SOIL

A Foundation of Health

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A MESSAGE TO YOUNG FOLKS:

The following pages point out the relation of soil to *your* health and the health of the nation. They indicate how much we still have to learn about the very dirt under our feet — and how important such knowledge may prove to be.

Present and past generations have developed the scientific instruments for obtaining this much-needed information. The task, and the *honor,* of employing such equipment and contributing a tremendous boon to the human race — improved health — is *yours.*

No other industry or profession offers you greater reward than does the application of available scientific technique and equipment to the problem of determining all you, and the rest of us, need to know about health and its dependence upon soil management.

As you plan your future education and career, don't overlook the immense possibilities for improvement in the science of nutrition and health.

Soil — A Foundation of Health*

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Do you know whether you are made of the "right stuff"?

Do you have the best material in your bones and muscles?

Does the gray matter of your brain contain all the elements that are necessary for a keen, alert mind?

Does your system contain the minerals needed to keep your teeth sound—your nerves steady?

These are "foolish questions." No one knows, *today*, what his body contains and what it lacks. *Tomorrow*, if the coming generation avails itself of current scientific knowledge and equipment, it seems probable that people will know definitely what they are made of. More important still, they should know just what they lack, and how to supply it, to maintain perfect health.

What We Are Made of

If your body could be placed in some apparatus, similar to a spectroscope, that would detect every different mineral or element present in your system, how many different elements would you expect it to show?

If you were in good health, the apparatus would indicate the following items as constituting the "stuff" you are made of. First, of course, would be the four elements:

calcium	
nitrogen (protein)	(N)
phosphorus	(P)
potassium	(K)

These four, together with water (hydrogen and oxygen) were for a long time believed to be the only materials composing our bodies, because early analyzing methods did not reveal any others. In addition, however, the modern analysis would show:

iron	——as ferrous (not ferric) sulphate
cobalt	——as cobalt sulphate
copper	——as copper sulphate
zinc	——as zinc sulphate
chlorine	——as the chloride of various minerals
sodium	——as sodium sulphate and sodium nitrate
magnesium	——as magnesium sulphate

**Based on an address before the Northwest Farm Managers Association.*

manganese ——as manganese sulphate
sulphur ——as the sulphate of various minerals
silver ——as silver sulphate and silver nitrate
boron ——as sodium tetraborate (borax)
nickel ——as nickel sulphate and nickel nitrate
aluminum ——as aluminum sulphate and aluminum nitrate
arsenic ——as the arsenate of various minerals
fluorine ——as the fluoride of various minerals
iodine ——as the iodide of various minerals
carbon ——as carbon dioxide and constituent of fat and carbohydrates

(Note that these elements are not in the ordinary forms in which you are accustomed to seeing them, but principally as salts, such as sulphates and nitrates.)

Also, there would be at least half a dozen vitamins, some of which are composed of several distinct factors, such as thiamin, riboflavin, niacin, pyrodoxine, pantothenic acid, folic acid, biotin, etc.

You perhaps never realized that your body was composed of such a complex formula of minerals and other elements. You are still less likely to have given much thought to the fact that the *absence* of some of the above items might lower your standard of health, or even cause sickness, just as surely as the *presence* of some poisonous element.

For example, if your body lacked iodine for any appreciable length of time, you would be likely to suffer from goiter. If it lacked iron, you would probably develop liver trouble, your skin and even your blood would become pale, your body would show emaciation, and your hair would become harsh and faded.

If your body contained no cobalt, the number of red corpuscles in your blood would be reduced, glandular activity would be lessened, and you would become listless.

The medical profession is rather generally agreed that a deficiency of copper will cause anemia; of phosphorus, deterioration of active body tissues; of silver, diseased tonsils; of magnesium, nervous disorders; of zinc, thyroid troubles; and so on.

Despite this knowledge of injurious effects of deficiencies of certain elements in our bodies, which has been developed largely in comparatively recent years, the average person seldom gives a thought to the supply of these elements for his body's requirements. At least, he seldom thinks about it until he becomes sick or indisposed. Then he may start buying vitamins or minerals from the drugstore, either as a result of reading advertisements or on a doctor's prescription.

We Buy Medicine to Meet Deficiencies

Sale of such anti-deficiency products is really "big business," running in the neighborhood of half a billion dollars annually. This is a

good indication of how widespread our national dietary deficiency is, and how readily we spend money to regain health when our lack of health becomes troublesome. The sum mentioned does not include the cost of treatment and medication involving special prescriptions; it covers only the sales of packaged vitamin and mineral preparations over drugstore counters.

Since your body is known to need all of the above-mentioned elements, and perhaps some more, just how are you to be sure you are obtaining enough of all these factors, major and minor, to be reasonably certain of avoiding the onset of deficiency or degenerative diseases?

The only logical way of supplying your body with them is to get them regularly in your customary diet. The body is continually eliminating these elements, if they are present, hence the supply should be just as constantly renewed.

A "Good Diet" Is Not Enough

If you are to obtain them from your food, they must be kept available in the soil from which that food is produced. Plants obtain nitrogen and carbon dioxide from the air but they must get minerals almost exclusively from the soil.

Suppose you follow religiously the recommended diet of some recognized authority—won't such a diet protect you against mineral deficiencies?

Unfortunately, the answer to this must almost always be "no."

Theoretically, such a diet should meet all your bodily requirements. Actually, however, it cannot meet these requirements unless the food has been produced on *completely fertile* soil, one that contains all the elements necessary for healthy plants and animals. Thus, a person could consume in excess of the recommended quantities of all the foods listed in such a "health diet" if they came from deficient soils and still fail by a wide margin of supplying all the minerals and vitamins which he requires for maintenance of health.

It was this fact that caused someone to coin the phrase: "starving to death on a full stomach."

Food Depends on Soil for Content

There is a very wide variation in the composition of fruits, vegetables, grain, and of meat, milk, and eggs, when produced on different soils in different sections of the country, or on different farms, or even different fields on the same farm.

Numerous laboratory tests have proved this fact, and the difference is often so pronounced that even a layman can notice it. For example, there are farmers in Illinois who refuse to buy corn from certain sections of their own state. Experience and observation have convinced these farmers that corn grown on "wornout" or poorly managed soil does not have the same feeding value as corn from land where the original mineral content has not been so depleted or has been replenished.

These farmers could not tell you what elements are lacking in this poor corn; but they do know that the animals do not put on weight as fast on such corn as when they are fed corn grown on better soil.

Testing Foods with Modern Instruments

The spectrograph would probably reveal the reason. Isn't it time some of our modern scientific tools were used to determine just what elements are lacking in such inferior feeds and soils, and what ones are found in the good feeds and soils?

The tremendous possibilities of uncovering invaluable information in this field have been barely scratched. If the health-giving qualities of feeds and foods depend not only upon the "major" elements they contain but also upon their content of "minor" or "trace" elements, as many people believe is the case, we should know what these contents are, at least so far as our facilities permit.

With the various adaptations of the principles of the spectrograph, it is possible to determine quickly and cheaply nearly every element in any sample of soil, food, feed, meat, manure, urine, or fertilizer. A complete knowledge of the elements present in healthy plants and animals as well as in unhealthy ones, should give us information never before available on how to keep plants and animals in perfect health.

Better yet, it should show how to produce and maintain health in people. Extensive use of such scientific knowledge and equipment was made throughout the war for the purpose of bringing about death and destruction. Surely, in peace, the human race is entitled to have such knowledge used for the improvement of national health and the restoration of one of our greatest national assets—the soil, since on the soil depends our personal and national health.

Despite all the progress we have made in processing and packaging foods for convenience in transportation, distribution, and home preparation, our knowledge of the actual constituents of various foods is far from complete. This is especially true with regard to the so-called "minor" or "trace" elements. While these may be "minor" in volume, they are often of "major" importance in their effects upon the health of the man or animal eating them.

Old Attitudes Prevail

The attitude of our present population toward these "minor" elements is much the same as the attitude of the public toward bacterially-borne diseases in Pasteur's day. Then, the average man of the street seemed to feel that any organism so small that it could not be seen with the naked eye need not be feared. The present attitude of the masses seems to be that elements which are needed by our bodies in such infinitesimally small quantities that the most delicate scientific instruments are required to detect their presence, cannot have much effect upon a person's health.

There is also the feeling on the part of many people that since the human race has for centuries eaten certain staple foods produced on our farm soils, and maintained a reasonably satisfactory state of health, it can do the same thing today. Those who hold this belief try to ascribe the growing rate of degenerative diseases, such as those of the heart, liver, teeth, bones, etc., to causes other than the quality of food.

Many others, however, have become alarmed at the increasing indications of a falling level of national health, and have embarked on extensive study of the situation. These men point out a much higher percentage of military rejections in World War II as compared to World War I; to a greatly increased percentage of hospitalization of the general public; and to a marked rise in the incidence of degenerative diseases. They have concluded that Dr. C. W. Cavanaugh, Cornell University, was right when he said:

> The fact is there is only one major disease, and that is malnutrition. All ailments and afflictions to which we may become heir are directly traceable to this major disease.

Dr. G. T. Wrench, of England, in his book, *The Wheel of Health*, makes a similar assertion:

> The inescapable conclusion is that in a very large number of diseases faulty food is the primary cause. The suspicion is that faulty food is the primary cause of such an overwhelming mass of disease that it may prove to be simply the primary cause of disease.

Such men take serious exception to statements like the following which appeared in the column of a physician serving as health editor of a daily newspaper:

> If every day you drink a pint of milk, eat an egg, one serving of meat with several slices of whole wheat or enriched bread, 2 servings of vegetables, green or yellow, one potato, a citrus fruit and another fruit, then you can forget about vitamins and go merrily on your way with the joys of living.

This is typical of the "orthodox" attitude of many members of the medical profession, who apparently are not aware of how seriously depleted the mineral content of our soils has become. The realities will hardly justify such a Pollyanna view.

As already pointed out, theoretically, such a diet should keep a person completely supplied with all the elements of nutrition the body requires, if the various items were all the products of a completely fertile soil. By that is meant a soil containing all the major and minor elements essential for the production of healthy plants which in turn are capable of providing complete, healthful nutrition for human beings.

However, one pint of milk may be quite different from a pint of milk produced on another farm where a different soil management is practiced or where the cows receive a different kind of feed. An egg from a hen on a given farm may be decidedly different in composition from eggs produced on a neighboring farm with different soil or feeding

conditions. The same holds true concerning the meat, bread, vegetables, and fruit. Their mineral content is limited by the mineral contents of the soil.

Deficiency Diseases of Plants

Plants do perform some near-miracles, but they simply can't extract from a soil minerals which are no longer there. They will always do their best to grow and produce seed to perpetuate their species, but when the soil is exhausted of certain minerals the plant cannot enjoy real health. We know that some so-called plant "diseases" are really the effects of the absence of certain minerals. It seems probable that others may be found to be in the same class.

Some people think all such "diseases" are just the effects of deficiencies. They even claim insect damage is often due to the unhealthy condition caused by such deficiencies—that healthy plants are not so appetizing to bugs and that they can better withstand their attacks.

Others scoff at such beliefs, and much time and printer's ink have been wasted in arguing the case. We should not tolerate arguments and "opinions" on such important matters in this day and age, when the facilities are available to obtain the facts.

You may wonder why certain elements are missing in our farm soils today if they were once present. You will doubtless also wonder why something has not been done to replace these depleted elements if they are so important in maintaining the health of plants, animals, and human beings.

The explanation, if given in detail, would be a long one. A very brief one must suffice.

Our Soils Were Once Rich

The virgin soils in the United States, when it was first settled by white men, were not all alike so far as mineral content and other characteristics were concerned. But most of them probably contained adequate quantities of most of the minerals listed as being required for human health.

Some of these minerals came from the rocks from which the soils were formed. Many came from the water of the sea from which human life is believed to have evolved and which is known to contain at least 32 different elements. Birds and animals that lived upon fish and shellfish ranged inland and often died there, their bodies, rich in many of the minerals found in sea water and marine life, were incorporated into the soil. Ancient dust storms carried mineral-rich sand and dust from the seashore to the interior, and from one section to another.

Where Did the Minerals Go?

The story of how some of these minerals were removed from the soils to a point where their lack causes diseased and insect-ridden plants,

sickly animals, and menaces the health of the entire population, must also be limited to a few words.

For many generations crops and animals have been grown on our farm lands and shipped to the cities. With them, at first, went the minerals which nature intended they should contain. Each year's crop contained only small quantities of these "minor" elements, but in the one or two hundred years that our better soils have been farmed, some of these important "minor" elements have been depleted. Erosion and leaching have lent a strong hand in this process in many areas.

The minerals shipped to the cities never returned to the soil of the farms from which they were hauled. Instead, they went back to the sea as sewage or landed in inaccessible spots such as garbage dumps or ash heaps. While animal bones were ground into meal by the packing plants, this went largely to city lawns and not back to the farms where it was needed to produce health-giving food.

It is a fair question to ask why no one protested against this continued removal of these vital minerals from the farmlands without any effort being made to replace them. The answer is that a few people did realize what was going on and tried to warn the public. They protested against the waste of minerals through our methods of disposing of garbage and sewage. For the most part they were voices crying in the wilderness.

"NPK" and Lime

Most people, including our soil scientists, believed that so long as the calcium, nitrogen, phosphorus, and potash (the first four items in the list of body-building elements) were added to the soil we could continue to obtain good yields of crops. They took it for granted that good yields and high quality were synonymous. We are just learning this is not true.

It so happened that slightly over 100 years ago a famous chemist analyzed, to the best of his ability, a human body. He found calcium, nitrogen, phosphorus, and potash, in addition to water. His crude methods showed the same elements in plants and animals, and he concluded that so long as these elements were replaced in the soil in generous quantities neither plants nor people would suffer from malnutrition.

As is so often the case, the opinion of a noted scientist was accepted as gospel truth by scientists and laymen alike. For practically a century few people had the temerity to question his assumptions. His teachings still dominate practically every classroom where soil chemistry is taught.

The value of calcium (usually applied as quick lime, marl, or shells) in improving soil tilth and yields and quality of crops had long been known. The present wide use of fertilizers containing nitrogen (N), phosphorus (P), and potash (K, from kainite), is a direct result of the teachings of the chemist referred to above.

Some people still praise him as a benefactor of the human race. Others say that his teachings have been and still are responsible for

untold sufferings of millions of people whose health has been ruined by deficiencies of minerals in their food, and also for other millions reaching early graves from the same cause.

His declaration was one of those dangerous "partial truths." Calcium and NPK are essential, as he claimed, but they are not the whole story. Often, when the application of this dogmatic formula has failed to produce results on a depleted soil, much valuable time has been lost in seeking the explanation in the "balance" between these four elements, instead of in the absence of other elements.

It now seems clear that, instead of pointing the way down the highway leading to improvement in health of plants, animals, and people, he guided us into a dangerously narrow by-path from which we are just beginning to emerge.

Progress on "Trace" Elements

Regardless of which opinion of him is correct, it is interesting to contrast his four elements of plants—calcium, nitrogen, phosphorus, and potash—with the results of analyses of plants made with modern equipment. All the samples contained:

sodium	phosphorus
potassium	iron
calcium	boron
magnesium	manganese
copper	barium
zinc	strontium
aluminum	lead
silicon	

Many of the samples also showed the presence of:

tin	nickel
cobalt	molybdenum
silver	chromium

Readings on iodine, sulphur, and selenium were not made.

This listing shows, better than words can express, how far we have progressed in the past hundred years in developing methods and equipment for analyzing materials. Our scientists deserve great credit on this score.

Yet the utilization of this new technique, which shows almost instantly the composition of any grain, fruit, meat, or other food, has been tragically small so far as improving human health is concerned.

It is to be hoped the next generation will make far better use of these facilities which seemingly offer such stupendous opportunities for benefiting the human race.

For example, consider the case of the medical scientist in India who fed large numbers of white rats on diets similar in every respect to those of various groups of natives. This exhaustive experiment showed conclusively that diets which caused deficiency diseases in human

beings also caused similar diseases in rats. On the other hand, diets on which human beings enjoyed excellent health also kept rats in equally good health. Foodstuffs grown by the Hunzas, one of the healthiest races known, maintained rats in exceptionally good condition.

That was fine, so far as it went. But if the work had only included complete analyses of all the diets, so that we knew what elements were contained in the foods of the healthiest people, and the healthiest rats, and just how they differed from those producing diseased people and rats, it should go a long way toward solving the problem of maintaining health through adequate nutrition. Also, if we knew the exact mineral content of the soil on which the most healthful food was grown, we doubtless could duplicate it at will.

This is just one of thousands of cases where careful and extensive research was limited in its value because the actual composition of foods, feeds, animals, or soils was only partially determined.

Let us hope they are a thing of the past.

For years, not only in this country but in others, there have been farmers and scientists who recognized the shortcomings of the NPK formula. Their own observations and experience convinced them that really nutritious food or feed cannot be produced from deficient soils, even though they might be liberally supplied with calcium, nitrogen, phosphorus and potash.

Such men have made various attempts to improve the health-giving qualities of soil products. Some rely upon adding bacteria-rich humus formed by composting. Others depend upon the addition of numerous minerals. Building up the earthworm population is believed by many to release more minerals from soil particles. Bio-dynamic farming, which might be termed an advanced form of composting, has received considerable publicity in some sections.

The people who are practicing these "unorthodox" methods of soil treatment seem to be, without exception, enthusiastic about the results they are obtaining. They boast of the better quality and flavor of their crops, and of the improvement in health of animals and humans consuming them. They even make claims of "cures" of degenerative heart troubles and other "deficiency" diseases by diets of these healthful, mineralized foods.

We Need the Facts

The "orthodox" group pooh-pooh all such methods and claims. The argument has been bitter and long drawn out, as arguments with few facts on either side usually are.

It is time more facts were definitely known and the argument ended. If the "fad" farmers are right, it is of the utmost importance to every man, woman, and child, and to the nation as a whole, that this be established. It is equally important to know if they are wrong.

Two billion dollars is said to have been spent on atomic research aimed at destruction. One tenth of one percent of this amount spent on

research into the effects of soil "atoms" on human health would not seem too much to ask. Yet that is far more than has been used for this purpose in several years.

The little that has been spent has resulted in discovering some soil atoms that are called "invaluable" in the treatment of diseases.

Wouldn't it be even better if we could learn how soil atoms might maintain HEALTH?

Additional copies of this booklet may be obtained on request from Consumer Relations Department, International Harvester Company, 180 North Michigan Ave., Chicago 1, Illinois.

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