



Your Living Environment

Vol. III No.3

March, 1972

NOURISHING FOOD -- FROM SOIL NUTRIENTS!

"One of the general observations regarding diet and human health is that man frequently gives evidence of being least well nourished where and when his food supply is most ample, and as a corollary primitive peoples, as a whole, show the fewest evidences of constitutional diseases, except when they come in contact with civilization" (Our Plundered Planet, Fairfield Osborne, p.79).

This is a most interesting observation, especially in view of our recent look at the effects of the Agro-chemical Industry on Britain. Though levels of food production are high, we saw that there are losses running in MULTIPLE MILLIONS of pounds. These are in the form of soil, plant, animal and human sickness. Therefore much of our so-called profitability must go to off-set these losses. This makes that proportion purely illusory!

Then we saw that the "Green Revolution" is nothing more and nothing less than the problem-ridden Western system of agriculture exported to the under-developed areas. Which simply means that these nations can look forward to the same kind of problems now besetting Britain and other Western countries.

That which we looked at last time is a man-devised system. In this issue we are going to have a close look at certain vital aspects of the one our Creator God devised. It has existed for almost 6,000 years, though man has seldom attempted to develop its full potential. But as we might expect -- IT DOES WORK!! You are going to see that God's system of producing food of both quality and quantity is so successful that it makes man's efforts apart from God seem incredibly stupid.

Our God-given Soil Environment

Before focusing on the life that has its existence in dynamic relationship with the soil, let us get a true perspective. The diagram that follows will give a percentage breakdown of each of the

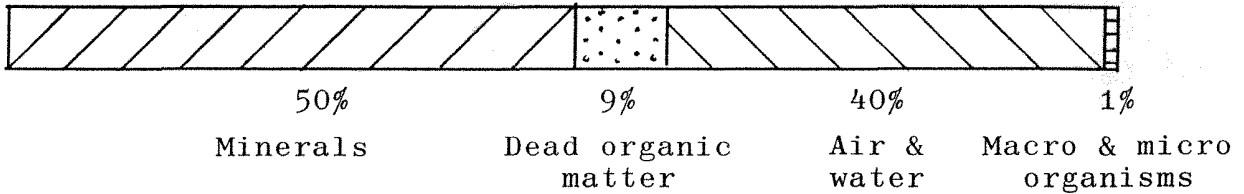
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major components of the total soil mass:

Total Soil Mass



Micro-organic life is such a small part of even a healthy soil that it does not show on the above diagram. Added together, micro and macro-organisms form a narrow 1% column on the right of the diagram above (just the width of a pen stroke, that's all)!

Ultimately, the supply of plant and animal nutrients for man depends on that vital 1% of the total soil mass. These tiny living forms are an integral part of our God-designed eco-system. Man, along with every other link down the food chain, is affected. All are consumers and all are affected.

This Research News is called "Your Living Environment" and there is no more vital part of it than that with which we are dealing right now. The reader might reflect that most previous issues have focused the need to halt deterioration in some form of LIFE. But all these other forms of life, including man himself, are precariously balanced on that which is in the soil. That's just the way God has designed the system and we will do well to recognise it!

Seeing The Unseen

If so much hinges on this invisible 1% of the total soil mass, how could man hope to succeed in environmental management and food production? After all, it has been only in very recent times that man has actually SEEN micro-organic life. Must we then see bacteria in order to appreciate their role in soil fertility? In other words, was effective agriculture impossible before the advent of the microscope and soil microbiology?

Notice what God says to man on this problem: "...the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made..." (Rom.1:20)

Obviously, microscopic life is one of "the invisible things". And its effect is most "clearly seen" -- IF MAN CHOOSES TO SEE! It is most plainly revealed in plant nutrition, (or the lack of it). But, as the first chapter of Romans points out -- there are many things that man has usually chosen NOT to see.

We don't know the range of Adam's knowledge. We don't need to. We don't know if any other civilization had the microscope. They did

not need it. Ancient Rome certainly did not have this tool, but it is interesting that some at that time recognised at least the effects of rhizobium bacteria on soil fertility!

"...of the crops that I have mentioned, the same Saserna thinks that land is fertilized and improved by some, and, on the other hand, that it is burned out and wasted by others;... that it is fertilized by lupine, beans, vetch, bitter vetch, lentils, the small chickenpea and peas" (Columella on Agriculture, Book II. xii.9 - xiii.3).

Nitrogen For Nothing

Without available nitrogen, it is impossible for plants to grow and reproduce. An abundance of nitrogen in the soil means an abundance of plant growth. This fact has been responsible for the development of gigantic nitrogen fertilizer factories and vast systems for distribution and application of chemical nitrogen to the world's soils.

But God has provided mankind with a far more efficient and inexpensive system of manufacture, distribution and application of nitrogen to plants. This takes the form of soil bacteria, most notably the rhizobium species.

Rhizobia occur in the soil as small round dots and rods and are one of the smallest organisms. They penetrate the root hairs of leguminous plants (such as common pea, bean, clovers, etc). This causes the formation of nodules (tiny lumps visible to the naked eye) on these roots. The bacteria multiply rapidly to as many as 100 million in a single nodule. By living off food from the plant, the bacteria in these nodules are able to convert gaseous nitrogen (there are 34,500 tons of this element above every acre of soil) to a form the plant can use and assimilate.

Since the nodule bacteria can fix far more nitrogen than the legume plant requires, the excess is released to stimulate the growth of non-legume plants growing nearby. Alternatively it is held in the soil for subsequent crops.

A number of micro-organisms are capable of releasing "available" nitrogen to plants. But rhizobium bacteria are the most important. They operate a little differently to the other microbes, by fixing nitrogen from the atmosphere. It can be done only when these minute organisms, (10,000,000 \pm 1 cc) are in direct symbiotic association with leguminous plants.

This role of nitrogen fixation enforces a legume-based agriculture on a God oriented farming community. This is in direct contrast with (previously discussed) grain monoculture! In the past we have also seen how God's law of the Land Sabbath guides obedient men in the same direction. Notice how all these points dove-tail together!

Authorities differ on the total nitrogen that each legume can fix from the atmosphere, but the following table is a fairly representative guide:-

Legume	lbs of Nitrogen per acre fixed in the soil
LUCERNE	450
SWEET CLOVER	270
CLOVER	260
SOYBEANS	160
FIELD BEANS	70

("Soil Conditions and Plant Growth"
E.W. Russell, p.350)

"... clover is fixing 480 lbs of nitrogen per acre per year which is harvested in the grass and clover leaf and if, as T.W. Walker (J. Sci. Agric. 1956, pp.7, 66) suggests, as much as 50 percent of what appears in the tops is left behind in the soil, grass and clover must be fixing about 700 lbs of nitrogen per acre annually" (Ibid. p. 351).

The Rhizobium Riddle

The rhizobium story does not stop there. Consider that these tiny nitrogen factories have no problems with distribution and application. They do their manufacturing right on the very root itself -- from existing raw materials. And what is more, they accomplish it at ordinary temperatures and air pressures and without man's help!

The simplicity and beauty of the system is a true testimony of the marvellous mind of God. But the story does not stop there either. You might expect that man would copy such an efficient method, in the development and construction of his chemical fertilizer factories, but he CAN'T! Note the comment of one well known scientist:

"A technical hope of considerable interest, which is exercising research workers in several countries, is that we shall discover precisely how nitrogen-fixing bacteria do the trick. The syntheses of ammonia in chemical plants is at present carried out at high temperatures and high pressure, yet insignificant-seeming bacteria can accomplish nitrogen fixation on a cold English day from unpressurized English air" (The Environment Game, Nigel Calder, 1967, p.57).

Another comes to the conclusion that: "In spite of all technical advances, it remains true that bacterial fixation of nitrogen by legume-nodule bacteria in partnership with leguminous herbaceous plants is the CHIEF SOURCE OF PROTEIN FROM LAND FOR MAN AND ANIMALS" (Microbes & Man, Hugh Nicol, 1955, p.67).

A healthy soil contains many types of organisms. These include -- other bacteria types, actinomycetes, fungi, algae and protozoa. The statement that a gram of soil contains a thousand million bacteria, a kilometre of fungal hyphae, plus hundreds of thousands of protozoa and algae conjures up a vision of Piccadilly in rush hour. Actually the microscope shows large areas of the soil apparently unoccupied and still available for colonization.

All have vitally important roles to play, mostly in the realm of nutrient re-cycling, by organic decomposition. But there are other types of bacteria which also release nitrogen in quantities significant to plant production. So, that fixed by rhizobium does not represent the grand total naturally available for plants.

The Eco-system

There are many parts to God's food production system and they operate collectively, cyclically and at the same time ecologically. It is misleading to think that one part is more important than another. But life in the soil, especially micro-organic life, is the most important, in the sense that it is unseen. It is therefore most likely to be forgotten! Have most of us not overlooked it in the past? Not only is micro-organic life unseen, but it also forms such an amazingly small part of the total soil mass.

God does say that He has "chosen the foolish things of the world to confound the wise; and ... the weak things of the world to confound the things which are mighty:

"And base things of the world, and things which are despised, hath God chosen, yea, and things which are not, to bring to nought things that are:

"That no flesh should glory in His presence" (I Cor. 1:27-29).

Elsewhere He caused King David to write: "Open thou mine eyes, that I may behold wondrous things out of thy law" (Psa. 119:18).

Those wondrous things must certainly include God's unbelievably fantastic ecological system. This He created for the specific purpose of supporting human life. Yet puny man has the effrontery, or is so blind (or both) that he worships his own crude system of food production and in most cases remains blind to God's creation.

Surprise! Surprise!

This should come as no surprise. We should know better, but even for us it is not always easy to adjust to the idea that man's methods of producing food are diametrically opposed to God's way. Many would consider that to be overstating it a bit! Did God not inspire His prophet Jeremiah to write:

"O Lord, I know that the way of man is not in himself: it is not in man that walketh to direct his steps" (Jer. 10:23).

Except in food production? No! The Bible doesn't say that!

Therefore apart from God, man looks somewhat hypnotically at the agro-chemical industry and it seems so big. It appears so scientific and complex and yet it operates so smoothly and it produces so much food. Even The Agricultural Show and The Field Experiment Station make it look so good! One is so glossy and the other so clinically precise, yet all these efforts of man apart from God can only be described as:

"Ever learning, and never coming to the knowledge of the truth"
(II Tim. 3:7).

Truth!

That is precisely what we must come to, if we are going to operate our God-given environment in harmony with His laws -- "the knowledge of the truth".

Artificial fertilizers, pesticides, fungicides, weedicides, the agricultural drug industry (and at times even irrigation) are merely weapons in the arsenal of man for the fight he continually wages against "Nature". Used in a right way, irrigation is not wrong and limited use of certain nutrients on plants will not collapse our ecosystem. But the point is -- where does man draw the line, where does he stop? Man rapidly comes to the point where he looks to fertilizer, water and drugs to produce food, instead of looking to God!

What is the truth? God tells us that His glory is the fulness of the whole earth, (Isa. 6:3) and that includes the LIFE He has created and placed in the soil. MAN, however, has consistently turned his back on the potential blessings with which God has surrounded him. This is exactly what we should expect, if we really believe such scriptures as Jer. 10:23, Rom. 8:7, and II Tim. 3:7.

Naturally there is much more to plant nutrition via soil fertility than atmospheric nitrogen fixation. Phosphate, potash, calcium, sodium etc. plus trace elements are all laid on in God's system. Many will argue to the contrary, but there is an acid test -- are high protein bread-making wheats, top quality seeds, or the world's best racehorses raised on impoverished soils? A very embarrassing question!!

Don't let anyone blame the "climate", or tell you that productivity is necessarily lower when food quality is high. Commercial levels of chemical fertilizer do not raise quantity on really fertile soils! Experts tell us that the world will starve if we stop relying on chemical fertilizers. But that depends on how we stop. And STOP we must! It is a withdrawal process which must be entered into cautiously and wisely to avoid calamity. The sooner we realize that no amount of chemical fertilizer will ever produce soil fertility, the sooner we will get started. Ambassador College has started and it feels GOOD!