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The One-Straw Revolution Revisited

Experiences with Natural Farming by Masanobu Fukuoka

by Paul W. Syltie, Ph.D.

Many of us may recall a book published in the late 1970's called *The One-Straw Revolution* by Rodale Press. This intensely rich book by self-taught Japanese farmer-philosopher Masanobu Fukuoka ["Foo-kyou-o-ka"] reintroduced many of the concepts of natural farming held dear by Sir Albert Howard some decades earlier. In particular, Fukuoka condemned the fragmentation of knowledge into specialized disciplines such as our universities do today. Rather, he desired to pursue his subject in its wholeness, including what he did and did not know, for "Nature as grasped by scientific knowledge is a nature which has been destroyed; it is a ghost possessing a skeleton, but no soul."

It would do all of us much good to review some of Mr. Fukuoka's ideas and experiences from his mountainside farm on an island in southern Japan. There he taught many farm students on an intern basis the essentials of not just crop farming, but livestock husbandry, building construction, food preparation, and general living. He had his students live in a semi-primitive manner, as he himself lived, so they could develop the sensitivity necessary to farm by his natural methods.

The farmer/philosopher Masanobu Fukuoka not only theorized a way to a better agriculture; he lived it, along with many other farm apprentices, in southern Japan. We would do well to emulate his revolutionary ideas.

Mr. Fukuoka initially left his rural home for the city to pursue a career as a microbiologist. He became a specialist in plant disease and worked as an agricultural customs inspector until age 25, when an idea dawned on him that demanded testing. That idea caused him to leave his job and return to his own farm.

"The basic idea came to him one day as he happened to pass an old field which had been left unused and unplowed for many years. There he saw healthy rice seedlings sprouting through a tangle of grasses and weeds. From that time on, he stopped flooding his field in order to grow rice. He stopped sowing rice seed in the spring and, instead, put the seed out in the autumn, sowing it

See Do-Nothing Agriculture, page 2

The Nuances of Nitrogen

by Neal Kinsey
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Charleston, Missouri,
Reprinted with permission from* Acres U.S.A., *P.O. Box 8800, Metairie, Louisiana 70011 [(504) 889-2100]. This article is abridged from Chapter 5 of* Hands-On Agronomy, *by Neal Kinsey and Charles Walters.

On the average, a plant contains 2 to 6% nitrogen. We can get large quantities of nitrogen from the nodulation on legumes. In an excellent situation, 70% of the nitrogen comes from the microbes. Under medium growing conditions, you only get about 50% from that source. Under poor conditions, you get about 25%. As far as I am concerned, the better we can influence the chemistry and the physical structure of the soil, the more efficient we make those microbes....

Nitrogen is essential for plant growth and is a part of every living cell. There are three major forms of soil nitrogen. Organic nitrogen is a part of organic matter, or humus, and it is not readily available. It makes up 97 to 98% of total soil nitrogen, and it is held there, albeit in the wrong form; thus the plant cannot use it. When we measure manures, we measure organic nitrogen. When you measure organic nitrogen in manures, you have to cut in half the amount it contains before calculating the nitrogen you are counting on for the crop that year. Ammonium nitrogen is another form of nitrogen in the soil held by the soil col-

A cheap source of on-farm nitrogen is a direct conversion of atmospheric N to plant-usable N from rhizobium bacteria of nodulating legumes.

See Chlorophyll Needs, page 3

Do-Nothing Agriculture Really Works!

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directly into the surface of the field when it would naturally have fallen to the ground. Instead of plowing the soil to get

rid of weeds, he learned to control them by a more or less permanent ground cover of white clover and a mulch of rice and barley straw. Once he has seen to it that conditions have been tilted in favor of his crops, Mr. Fukuoka interferes as little as possible with the plant and animal communities in his fields" (Fukuoka, *The One-Straw Revolution*, Rodale Press, 1978).

The core idea of Fukuoka's approach to farming is "do-nothing". By that he does not mean work is not needed for success, but rather so many traditional labor-intensive practices are unnecessary. Modern agribusiness generally adds more and more products and complicated procedures to crop cultivation, but his new method prescribed, "How about *not* doing this?... I ultimately reached the conclusion that there was no need to plow, no need to apply fertilizer, no need to make compost, no need to use insecticides. When you get right down to it, there are few agricultural practices that are really necessary."

Fukuoka came to view man's "improved" techniques as necessary only because the natural balance has been so badly upset that the land has become dependent on them. Along that same line of reasoning, medical science has become necessary because people have created a sickly environment. Formal schooling likewise has become necessary since humans have created conditions requiring "educators" to survive within the system.

See Laws of "Do Nothing", page 6

Root Regeneration After Damage

A major factor in determining crop yield

By Paul W. Syltie, Ph.D.

The ability of a root to grow additional roots after being damaged from any of a number of causes -- root insects, nematodes, root fungi or bacteria, cultivation pruning, and so forth -- has been found to be a major determinant of overall crop yield. A root system's population of *Meloidogyne* spp. (root knot) nematodes, or number of *Diabrotica* (corn rootworms) is thus not as important as the ability of the plant to overcome the assault by regrowing new roots to feed and support it.

The ability to regrow roots varies substantially with species and environmental conditions. For instance, an aggressive, open-pollinated corn plant such as Reid's Yellow Dent will likely regrow roots faster than a highly inbred Pioneer single-cross hybrid. Plants growing on well-structured soils will grow new roots after nematode or fungal damage much faster than if grown on soil containing a hardpan; oxygen and water restrictions and composition will severely limit root extension. In like manner, fertile soils will encourage new root development better than infertile soils. According to Riedell and coworkers (*Agronomy Journal* 88:27-32; 1996), "plowing, seedbed preparation, fertilizer application, weed control, insect control, residue managment, and crop plant populations are important components of the crop production system that must be optimized to assure a healthy root system environment conducive to crop root growth and optimum grain yield production."

While corn tolerance to rootworm larval feeding damage is related to size

Root development can be improved dramatically by the use of Vitazyme biostimulant to aid root regeneration.

of the root system at the time of attack, the plant's ability to grow new roots after feeding damage is highly important, according to Hills and Peters (*Journal of Economic Entomology* 67:748-750; 1971) and Riedell (*Cereal Research Communications* 22:327-335; 1994). Tolerant plants sustain as much damage as susceptible plants, but are able to continue growing and producing high yields in spite of the damage. It is a matter of getting up quickly after being knocked down.

These facts point towards the need to give the plant every possible benefit to not only grow an extensive, vigorous root system as soon as possible, but to also regrow roots after damage has occurred. Prevention of damage should be foremost in anyone's managment system, such as utilizing crop rotations (to break pathogen cycles), encouraging natural soil predators and parasites of pathogens, and planting naturally vigorous varities. To encourage a vigorous root regrowth once damage has occurred, do the following. ■

1 **Maintain excellent soil structure and tilth.**

2 **Build high organic matter levels.**

3 **Balance soil minerals, and eliminate deficiencies.**

4 **Limit tillage.**

5 **Eliminate soil erosion.**

6 **Recycle nutrients on-farm.**

7 **Utilize rhizosphere biostimulants such as Vitazyme.**

Chlorophyl Needs More Than Nitrogen!

Continued from page 1

loids. The NH_4 attaches to the clay particle and is less available than nitrate. Less than 1% of the total soil nitrogen is generally in the form of ammonia in a natural system. Nitrate nitrogen and other soluble compounds are also available in the soil as 1 to 2% of the total soil nitrogen....

Nitrogen deficiency in corn is manifested by yellowing beginning at the leaf tip lowest on the stalk, and running up the midrib and expanding toward the edges. The deficiency moves progressively up the leaves from the bottom of the stalk.

If we have a 5% organic matter soil, we already have roughly 100 pounds of nitrogen that is available for that year's crop. Put that 100 pounds along with the other 70%, and we now have to account for 35 pounds of nitrogen from somewhere else. This is not a tough job for the microbes as long as we give them the right environment. That is why it is so important to get the chemistry and the physical structure of the soil just right. By dead reckoning, a 150 bushel corn crop requires 200 pounds of nitrogen. Actually, it all depends on where the calcium/magnesium levels are. It depends on the soil's balance....

I have farmer/clients who are completely organic, and I have clients who are completely commercial. The people who really work with natural systems can come out ahead of the guy who is commercial, but some farmers just don't have the mind-set it takes to work with natural systems. There are some clients I simply instruct, "Under the situation you are operating in, you are not going to do well with biologicals." In terms of biologicals, the closer the chemistry in the soil is to being "right," the better they are going to work. If the chemistry is not right, then extra steps must be taken first to see that the basics are more perfectly in place....

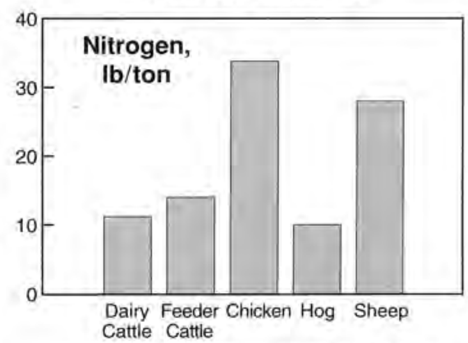
The first clue for a decent production level is calcium in the 60% range. If the soil colloid does not have a proper calcium level, nitrogen will not deliver a top yield. Once you have your basics in place -- 60 to 70% calcium, 10 to 20% magnesium -- then and only then do you start looking at nitrogen as a factor in growing high yield beans. There are very few farmers on my program who raise 60 bushels of beans without obtaining some extra nitrogen above the amount supplied by the soil and nodulation....

We say legumes can get nitrogen out of the air, but we have to add that they don't get it all from the air. At least 30% has to come from another source, and that 30% either has to be supplied by microbial activity in the soil or by a commercial source. The farmer can choose either one, but when the choice is made, he or she has to deal with the consequences.

If you choose commercial nitrogen, that act will start making that soil more and more reliant on commercial nitrogen. If biology is the choice, everything else has to be right and in place, else the biological activity will turn out to be the limiting factor. Before microbiology works, chemistry and physics have to be in place. Albrecht's percentages are what really make the microbes work. I have clients who do not know about microbial products and still can raise 60 bushels of beans without commercial fertilizer, but that is not the general rule.

Manures are an excellent source of nitrogen. I work with farmers who use a lot of manures in some areas, and I have other areas under consultation where there are no livestock for thousands and thousands of acres, and nothing organic is applied. A real saving factor in my area is a broiler production facility that generates 15,000 tons of manure a year. All of it is moved out to farmers....

Nitrogen Content of Various Manures



(From Tisdale, S.L., & Nelson, W.L. *Soil Fertility & Fertilizer.* The Macmillan Company, New York, 1966.)

See Nitrogen, page 6

Nobody likes to be wrong, especially a leader proud of his ability and position. But the fact is that he's going to be wrong now and then. When he is, he can't let foolish pride stand in the way of recognizing it promptly, admitting it, and correcting the situation as soon as possible .... Admitting his own fallibility doesn't hurt a man's image. It builds a reputation for courage, fair-mindedness, and progressive thinking.

[Confess your faults one to another ...." James 5:16] *Bits and pieces*, September, 1972

15-Minute Soils Course

Lesson 8:

Soil Structure, Part II

In the last issue we discussed the essential elements of *soil structure* ... the gross aggregation of soil particles. A strong, stable structure is very critical because the cleavage planes between structural units allow air and water to move into, through, and out of the soil.

This lesson emphasizes the critical nature of soil macro and microorganisms in building and maintaining a strong structure. Notice the illustration of a "typical" soil aggregate to the right (from D.M. Sylvia et.al., *Principles and Applications of Soil Microbiology*, Prentice-Hall, Inc., 1998; printed with permission). Soil organisms have everything to do with creating this beautifully ordered unit of soil.

Who Does the Work?

Notice each part of the system that is present to build this unit:

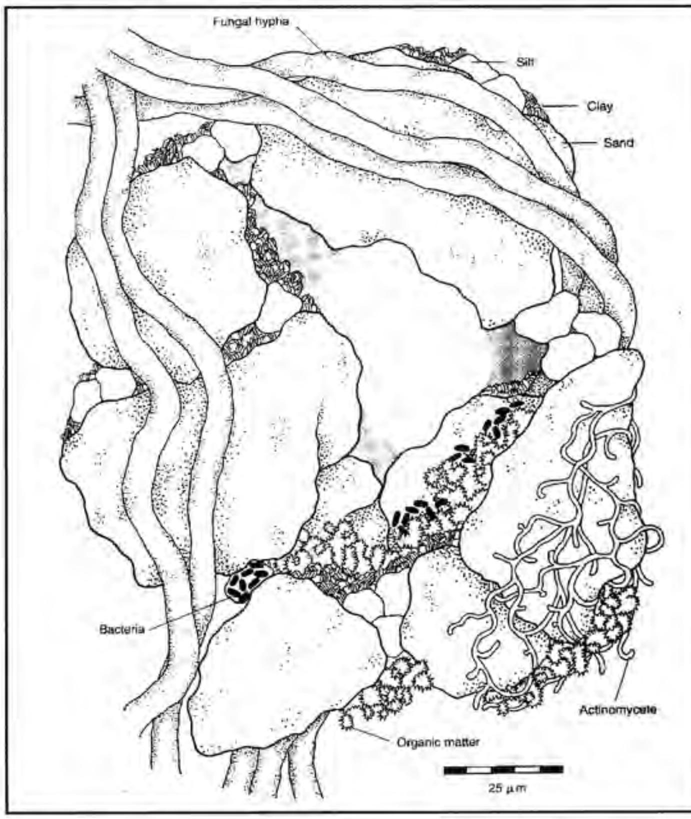
Bacteria live in the niches between mineral particles, and feed on organic residues. Their sticky polysaccharide by-products glue the minerals and organic matter together.

Fungi send out hyphae (thread-like filaments) that create a structural "fabric" that meshes together soil mineral and organic materials, holding them in sac-like configurations. Many of these filaments are symbiotic mycorrhizae in soil that lie within 1 cm of a root surface. Fungi can also produce glues and mucilages to bind particles together.

Actinomycetes act like fungi, but are smaller. They further net together the soil particles, especially smaller silt, and clay particles.

Not shown in this illustration are *plant roots* and *root hairs* that produce cleavage planes and pores through the soil mass as they grow. When they die, the organic remains serve as food for myriads of bacteria, fungi, actinomycetes, and other soil creatures.

Also not shown are *earthworms* and other small creatures such as *ants, springtails, mites, millipedes*, and many other soil animals that bur-



row through the soil mass, leaving channels and pores behind them.

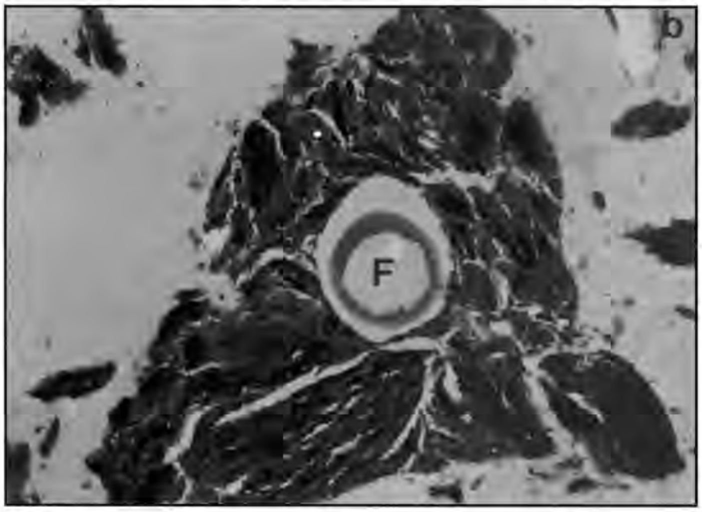
Notice how organic matter is located in niches between sand, silt, and clay particles. Bacteria, fungi, and other creatures feed upon organic materials, especially when they are fresh (such as recently dead roots, fungal mycelia, bacteria, and so forth) ... but as the breakdown process of the organic materials continues the remaining residue becomes blacker and more resistant to further degradation. Much of the humic material that is highly resistant to decomposition finds itself nestled within the interior of these soil "peds" [structural units], protected to a large degree from further consumption by microbes. Not only is it physically protected, but the interior of a strong ped is nearly sealed off to air exchange, restricting fur-

Continued on the next page

15-Minute Soils Course

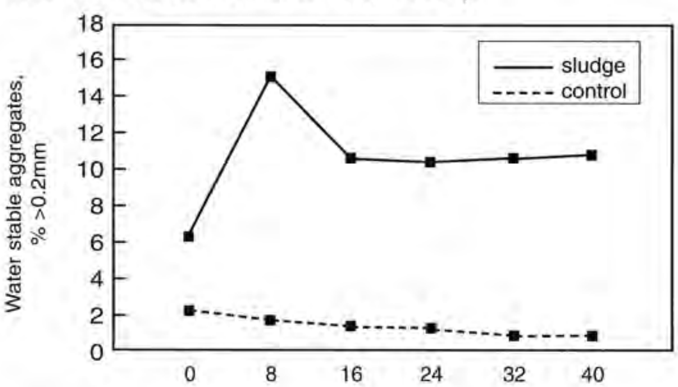
Continued from previous page

ther bacterial and fungal degradation of the organic materials therein to protect them over the long term. Much of the soil's nitrogen and mineral stores in a properly structured soil can be found within these peds. In some cases the core of a ped is actually filled with organic material, such as shown in the picture (F = fungal remains, which produce a sticky carbohydrate).



The Value of Organics in Stablizing Soil Structure

Any organic matter added to a soil -- compost, manure, leaves, cover crops, etc. -- provides food for microbes which in turn create the units. For example, plain sewage sludge can markedly improve the number of water stable aggregates in a soil (adapted from L. Metzger, et. al., *Soil Sci. Soc. Amer. J.* 48, 1984).



Soil structure is directly related to *porosity*, in particular to a high percentage of *macropores* ("large" pores, between 30 and 100 micrometers across), and thus to air and water movement within the soil mass. Many macropores means good air and water movement, and consequently good yields.

Tillage should be minimized so structural units, and thus soil pores, are not ruptured. Tilling of wet soils is especially harmful, since wet peds rupture much more easily than dry ones. Encourage microbial growth in the soil and you will be certain to build a stronger soil structure which will improve crop productivity, reduce soil erosion, and reduce energy requirements for tillage.

See How Much You Learned

1. Soil structure is a critical element in crop production. ____Yes ____No

2. Name three major groups of soil microorganisms that play a critical role in the development of a strong, stable soil structure.

_________________ _________________

____

3. What two plant-essential components of plant growth are encouraged to readily move through the soil when structure is optional?

_________________ _________________

4. A desirable soil structure gives rise to a high percentage of soil...
   a. millipores
   b. macropores
   c. micropores
   d. ionophores

5. Tilling soil when it is wet is especially destructive to soil structure because the peds are _______________.

6. The interiors of soil peds are good storage places for organic matter because they are low in _______________.

7. Earthworms and plant roots are important in developing good soil structure and porosity. _____ Yes _____No

1. Yes; 2. bacteria, fungi, actinomycetes; 3. water, air (or oxygen); 4. b; 5. broken, crushed, or ruptured; 6. oxygen or air; 7. yes.

***Nitrogen*: Hard to Manage**

Continued from page 3

There are tremendous differences between poultry, cow and hog manures, and there is even a difference between layer and broiler manure. Layers are fed extra calcium to strengthen the egg shells. Broilers generally do not get this ration....

Every soil is different. You have to analyze what is going to happen to the several nutrients. When you analyze soils, you have to remember that just because a certain program works on one farm, that doesn't mean it is going to work on the farm down the road....

With reference to nitrogen, it is most difficult to properly recommend management because five things can happen to it....

1. It can be used by the crop, which is great.

2. It can become part of the soil complex, which means it can be *adsorbed* on the clay colloid or get incorporated into the humus. When it is on the clay colloid it is not too hard to get hold of, but when it is incorporated in the humus, microbial activity and chemical balance must attend its release.

3. It can leach down in the soil and be transported away from the production with drainage water.

4. It can be eroded away no matter what form it is in.

5. It can volatize and escape as a gas.

We do not want to see the visual effects of any nutrient on the plant leaves, not a trace element or whatever. Failure to see a nutrient deficiency in the leaves does not mean that crop is not short of a particular nutrient, because of what we call *hidden hunger*. It means that we do not have enough of a shortage to show up at visual inspection. Once you see the V [necrosis running from the tip down the midrib] it is too late to do anything for that specific leaf simply because it was short a long time before the V became evident....

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Laws of "Do-Nothing"

Continued from page 2

He came to understand that similar principles pervade all of creation. Trees ought not be pruned merely to make the fruit easier to harvest ... resulting in a grotesquely distorted, squat monstrosity. Pruning in this way requires yearly intervention to prevent a destructive tangle of branches that can lead to the tree's death. Rather, the natural form of the tree should be preserved. "To the extent that trees deviate from their natural form, pruning and insect extermination become necessary; to the extent that human society separates itself from a life close to nature, schooling becomes necessary."

Although Mr. Fukuoka realizes his pathway towards natural farming is strange, and a reaction against the reckless developments of science, he has pointed out that natural farming now in many ways is being unexpectedly viewed as far ahead of modern science. Agrichemical use, deep plowing, and other abuses of the land serve only to separate people from nature. As they spin out further and further from the center of their natural roots, a centripital, inward effect asserts itself and people desire to return to nature.

A major motivating factor that drives Mr. Fukuoka is his acknowledgement that nature's secrets lie beyond the reach of human intelligence. In this he admits to God's creation of all things. Yet, scientists think they *can* understand nature and thus investigate it and put it to work for them. Such a view has led mankind into great troubles, for scientists may view, say, a rice stalk as an insect specialist, or a nutrition specialist, or a fungus specialist. All view the same stalk but none consider the plant as a whole. "An object seen in isolation from the whole is not the real thing", says the philosopher farmer. "Science has served only to show how small human knowledge is".

Masanobu Fukuoka follows four main principles in his farming operations:

1 ***No cultivation.*** The earth cultivates itself naturally by means of plant roots, microganisms, small animals, and earthworms.

2 ***No chemical fertilizer or prepared compost.*** Soil left to itself maintains its fertility naturally, according to the orderly cycling of plant and animal life. Mr. Fukuoka uses a white cover crop, returns whole threshed straw to the fields, and adds a little poultry manure.

3 ***No weeding by tillage or herbicides.*** Weeds build soil fertility so should only be controlled, not eliminated. A straw mulch or a leguminous ground cover can serve well in controlling weeds.

4 ***No dependence on chemicals.*** Nature left alone will express a perfect balance. Harmful insects and plant diseases will always be present, but will never occur in great enough profusion to warrant the use of poisonous chemicals.

The careful use of straw is a major component of Fukuoka's management system. "... it [straw] is fundamental to my method of growing rice and winter grain. It is connected with everything, with fertility, with germination, with weeds, with keeping away sparrows, with water management." Spreading *uncut* straw is a key, since highest yields are obtained with this method. Compost is not needed in Fukuoka's system, not that it would not give excellent crop responses, but he does not need it -- and the hard work to make it -- with this system. Straw left lying on the field surface in the spring or fall, covered by a thin layer of chicken or duck manure, is completely decomposed in six months.

The fertility system Fukuoka uses encourages the growth of compact plants

See Science to Be Viewed, page 7

"No man is an island unto himself", wrote John Dunne. Yet, too many of us still fear the loss of self through serving others. Actually, it is the only way to "find" yourself!

Science to Be Viewed With Suspicion

Continued from page 6

with small heads, comforming to the natural potential of the variety. Neighboring fields using commercial fertilizers grow tall, leafy plants with large heads, but less energy will go into the grain than for his own fields. The rice fields, which are direct seeded and not transplanted, are flooded for only a week during the year, allowing for strong plants that are highly resistant to insects and diseases versus continually flooded and transplanted fields.

The novel methods of Fukuoka have led him to allow fruit trees to grow in their natural form. If such tree architecture is encouraged, then no pruning or spraying of any kind is required. "Growing fruit without pruning, fertilizing, or using chemical sprays is possibile only within a natural environment." Growing vegetables is an even simpler matter: seeds are tossed into a likely fertile area, and the weeds are cut back, not totally uprooted. He grows beans, cucurbits, brassicas, carrots, and other vegetables in this way, although not many places in North America would allow such success due to harsher climatic conditions.

Mr. Fukuoka views the scientific method with great suspicion, claiming that "Before researchers become researchers they should become philosophers. They should consider what the human goal is, what it is that humanity should create." Methods of cultivation should be developed that are *close to nature*. He has done this by whittling away unnecessary agricultural practices. Modern scientific agriculture, on the other hand, wanders aimlessly as each researcher views just one part of the infinite array of factors that affect harvest yields. "Scientific truth can never reach absolute truth, and philosophies, after all, are nothing more than interpretations of the world. Nature as grasped by scientific knowledge is a nature which has been destroyed; it is a ghost prossessing a skeleton, but no soul."

The culture of blemish-free, succulent-looking vegetables and fruits deceives consumers into thinking these items are best for them. They have now come to demand such produce, but in reality it is the wrinkled orange or the shriveled vegetable that is in a state whereby their food value is preserved.

As for diet and nutrition, Mr. Fukuoka speaks of the "diet of non-discrimination". This transcends the self-indulgent and scientifically fabricated diets, toward recognizing that the body must follow its own instinct, eating if something tastes good and abstaining if it does not. This selectivity of taste first requires the body, heart, and mind to become "... perfectly united within nature." No rules are adequate to guide this diet. He recommends living in a natural environment so sickness does not appear. "Doctors take care of sick people; healthy people are cared for by nature."

Man's arrogance has caused him to try and reorder nature, bending it to his own whims. He must cast aside his destructive ego and recognize he lives as an integral part of heaven and earth.

The peace and tranquility of the pastoral countryside of Japan -- and most everywhere else -- has been obliterated by engines of tillage, planting, and harvesting. The farmer does not realize he has merely become a factor in modern agrieuture's equation of increasing speed and efficiency.

Fukuoka lamented the incomprehensibility of Enstein's theory of relativity as a terrible intercession into the pleasant and peaceful world of nature. "His explanation is bewildering, however, and it caused people to think that the world is complex beyond all possible understanding. A citation for 'disturbing the peace of the human spirit' should have been awarded instead." By contrast, nature lives in undivided reality ... and to the extent that one lives in the relative world of the intellect, one loses sight of time that is beyond time and of space that is beyond space. Scientists have replaced the role of personal discrimination in people's minds.

These are just some of the main concepts of Masanobu Fukuoka concerning agriculture, economics, health, and philosopy. In this modern world of runaway technology his words deserve our carful rexamination. ■

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