Sericulture has in this way shifted repeatedly from one side to another. From natural farming it moved to scientific farming, then appeared to move a step back in the direction of natural farming. However, once scientific farming begins to get under way, it does not regress or turn back but rushes madly onward along a path that takes it away from nature.

The intertwining of natural farming and scientific farming can be depicted as shown in Fig. 3.3. Narrowly defined natural farming, which includes organic farming, proceeds centripetally inward toward a state of "nothingness" (Mu) by the elimination of human labor; it compresses and freezes time and space. Modern scientific farming, on the other hand, seeks to appropriate time and space through complex and diverse means; it proceeds centrifugally outward toward "somethingness," expanding and developing as it goes. Both can be understood as existing in a relative relationship in the same dimension or plane. But although the two may appear identical at a given point, they move in opposite directions, the one headed for zero and the other for infinity.

Thus, seen relatively and discriminatively, the two readily appear to be in opposition, yet intimately intertwined, neither approaching nor moving away from one another, advancing together and complementarily through time. However, because natural farming condenses inward, seeking ultimately a return to the true world of nature that transcends the world of relativity, it is in irreconcilable conflict with scientific farming, which expands forever in the relative world.

2. The Four Principles of Natural Farming

I have already shown how natural farming is clearly and undeniably superior to scientific farming, both in theory and in practice. And I have shown that scientific farming requires human labor and large expenditures, compounds chaos and confusion, and leads eventually to destruction.

Yet man is a strange creature. He creates one troublesome condition after another and wears himself down observing each. But take all these artificial conditions away and he suddenly becomes very uneasy. Even though he may agree that the natural way of farming is legitimate, he seems to think that it takes extraordinary resolve to exercise the principle of "doing nothing."

It is to allay this feeling of unease that I recount my own experiences. Today, my method of natural farming has approached the point of "doing nothing." I will admit that I have had my share of failures during the forty years that I have been at it. But because I was headed in basically the right direction, I now have yields that are at least equal to or better than those of crops grown scientifically in every respect. And most importantly: 1) my method succeeds at only a tiny fraction of the labor and costs of scientific farming, and my goal is to bring this down to zero; 2) at no point in the process of cultivation or in my crops is there any element that generates the slightest pollution, in addition to which my soil remains eternally fertile.

There can be no mistaking these results, as I have achieved them now for a good many years. Moreover, I guarantee that anyone can farm this way. This method of "do-nothing" farming is based on four major principles:

1. No cultivation
2. No fertilizer
3. No weeding
4. No pesticides

No Cultivation

Plowing a field is hard work for the farmer and usually one of the most important activities in farming operations. In fact, to many people, being a farmer is synonymous with turning the soil with plow or hoe. If working the soil is unnecessary then, the image and reality of the farmer change drastically. Let us look at why plowing is thought to be essential and what effect it actually has.

Plowing Ruins the Soil: Knowing that the roots of crops penetrate deep into the earth in search of air, water, and nutrients, people reason that making larger amounts of these ingredients available to the plants will speed crop growth. So they clear the field of weeds and turn the soil from time to time, believing that this loosens and aerates the soil, increases the amount of available nitrogen by encouraging nitrification, and introduces fertilizer into the soil where it can be absorbed by the crops.

Of course, plowing under chemical fertilizers scattered over the surface of a field will probably increase fertilizer effectiveness. But this is true only for cleanly plowed and weeded fields on which fertilizer is applied. Grassed fields and no-fertilizer cultivation are a different matter altogether. We therefore have to examine the necessity of plowing from a different perspective. As for the argument that this helps increase available nitrogen through nitrification, this is analogous to wasting one's body for some temporary gain.

Plowing is supposed to loosen the soil and improve the penetration of air, but does not this in fact have the opposite effect of compacting the soil and decreasing air porosity? When a farmer plows his fields and turns the soil with a hoe, this appears to create air spaces in the soil and soften the dirt. But the effect is the same as kneading bread: by turning the soil, the farmer breaks it up into smaller and smaller particles which acquire an increasingly regular physical arrangement with smaller interstitial spaces. The result is a harder, denser soil.

The only effective way to soften up the soil is to apply compost and work it into the ground by plowing. But this is just a short-lived measure. In fields that have been weeded clean and carefully plowed and re-plowed, the natural aggregation of the soil into larger particles is disturbed; soil particles become finer and finer, hardening the ground.

Wet paddy fields are normally supposed to be tilled five, six, or even seven times during the growing season. The more zealous farmers have even competed with each other to increase the number of plowings. Everyone thought this softened the soil in the paddy and let more air into the soil. That is the way it looked to most people for a long time, until after World War II, when herbicides became available. Then farmers discovered that when they sprayed their fields with herbicides and reduced the frequency of plowing, their yields improved. This demonstrated that intertillage had been effective as a weeding process but had been worthless as a means for loosening the soil.

To say that tilling the soil is worthless is not the same as claiming that it is unnecessary to loosen the soil and increase its porosity. No, in fact I would like to stress, more than anyone else, just how important an abundance of air and water are to the soil. It is in the nature of soil to swell and grow more porous with each passing year. This is absolutely essential for microorganisms to multiply in the earth, for the soil to grow more fertile, and for the roots of large trees to penetrate deep into the ground. Only I believe that, far from being the answer, working the soil with plow and hoe actually interferes with these processes. If man leaves the soil to itself, the forces of nature will enrich and loosen.

Farmers usually plow the soil to a depth of about four to eight inches, whereas the roots of grasses and green manure crops work the soil down to twelve inches, fifteen inches, or more. When these roots reach down deep into the earth, air and water penetrate into the soil together with the roots. As these wither and die, many types of microorganisms proliferate. These organisms die and are replaced by others, increasing the amount of humus and softening the soil. Earthworms eventually appear where there is humus, and as the number of earthworms increases, moles begin burrowing through the soil.

The Soil Works Itself: The soil lives of its own accord and plows itself. It needs no help from man. Farmers often talk of "taming the soil" and of a field becoming "mature," but why is it that trees in mountain forests grow to such magnificent heights without the benefit of hoe or fertilizer, while the farmer's fields can grow only puny crops?

Has the farmer ever given any careful thought to what plowing is? Has he not trained all his attention on a thin surface layer and neglected to consider what lies below that?

Trees seem to grow almost haphazardly in the mountains and forests, but the cedar grows where it can thrive to its great size, mixed woods rise up where mixed woods must, and pine trees germinate and grow in places suited for pine trees. One does not see pines growing at the bottom of a valley or cedar seedlings taking root on mountain tops. One type of fern grows on infertile land and another in areas of deep soil. Plants that normally grow along the water's edge are not found on mountain tops, and terrestrial plants do not thrive in the water. Although apparently without intent or purpose, these plants know exactly where they can and should grow.

Man talks of "the right crop for the right land," and does studies to determine which crops grow well where. Yet research has hardly touched upon such topics as the type of parent rock and soil structure suited to mandarin orange trees, or the physical, chemical, and biological soil structures in which persimmon trees grow well. People plant trees and sow seed without having the faintest idea of what the parent rock on their land is and without knowing anything about the structure of the soil. It is no wonder then that farmers worry about how their crops are going to turn out.

In the mountain forests, however, concerns over the physical and chemical compositions of the topsoil and deeper strata are nonexistent; without the least help from man, nature creates the soil conditions sufficient to support dense stands of towering trees. In nature, the very grasses and trees, and the earthworms and moles in the ground, have acted the part of plowhorse and oxen, completely rearranging and renewing the soil. What can be more desirable to the farmer than being able to work the fields without pulling a plow or swinging a hoe? Let the grasses plow the topsoil and the trees work the deeper layers. Everywhere I look, I am reminded of how much wiser it is to entrust soil improvement to the soil and plant growth to the inherent powers of plants.

People transplant saplings without giving a thought as to what they are doing. They graft a scion to the stock of another species or clip the roots of a fruit sapling and transplant it. From this point on, the roots cease to grow straight and lose the ability to penetrate hard rock. During transplanting, even a slight entanglement of the tree's roots interferes with the normal growth of the first generation of roots and weakens the tree's ability to send roots deep into the soil. Applying chemical fertilizers encourages the tree to grow a shallow root structure that extends along the topsoil. Fertilizer application and weeding bring a halt to the normal aggregation and enrichment of topsoil. Clearing new land for agriculture by pulling up trees and bushes robs the deeper layers of the soil of a source of humus, halting the active proliferation of soil microbes. These very actions are what make plowing and turning the soil necessary in the first place.

There is no need to plow or improve a soil because nature has been working at it with its own methods for thousands of years. Man has restrained the hand of nature and taken up the plow himself. But this is just man imitating nature. All he has really gained from this is a mastery at scientific exposition.

No amount of research can teach man everything there is to know about the soil, and he will certainly never create soils more perfect than those of nature. Because nature itself is perfect. If anything, advances in scientific research teach man just how perfect and complete a handful of soil is, and how incomplete human knowledge.

We can either choose to see the soil as imperfect and take hoe in hand, or trust the soil and leave the business of working it to nature.

No Fertilizer

Crops Depend on the Soil: When we look directly at how and why crops grow on the earth, we realize that they do so independently of human knowledge and action. This means that they have no need basically for such things as fertilizers and nutrients. Crops depend on the soil for growth.

I have experimented with fruit trees and with rice and winter grain to determine whether these can be cultivated without fertilizers. Of course crops can be grown without fertilizer. Nor does this yield the poor harvests people generally believe. In fact, I have been able to show that by taking full advantage of the inherent powers of nature, one can obtain yields equal to those that can be had with heavy fertilization. But before getting into a discussion of why it is possible to farm without using fertilizers and whether the results are good or bad, I would like to look first at the road scientific farming has taken.

Long ago, people saw crops growing in the wild and called this "growth." Applying discriminating knowledge, they proceeded from the notion of wild plant growth to plant cultivation.

For example, scientists typically begin by analyzing rice and barley plants and identifying the various nutrients. They then speculate that these nutrients promote the growth of rice and barley. Next they apply the nutrients as fertilizer, and observing that the plants grow as expected, they conclude that the fertilizer is what makes the crops grow. The moment they compare crops grown with and without fertilizer and conclude that fertilizer application results in taller, better yielding plants, people cease to doubt the value of fertilizers.

Are Fertilizers Really Necessary?: The same is true when one delves into the reasons why fertilizers are thought to be essential to fruit trees. Pomologists normally begin with an analysis of the trunk, leaves, and fruit of the tree. From this they learn what the nitrogen, phosphorus, and potassium contents are and how much of these components are consumed per unit of annual growth or of fruit produced. Based on the results of such analyses, fertilization schedules for fruit trees in mature orchards will typically set the amount of nitrogen components at 90 pounds, say, and the amount of phosphates and potassium at 70 pounds each. Researchers will apply fertilizer to trees grown in test plots or earthen pots, and examining the growth of the tree and the amount and quality of fruit it bears, will claim to have demonstrated the indispensability of fertilizer.

Learning that nitrogenous components are present in the leaves and branches of citrus trees and that these are absorbed from the ground by the roots, man hits upon the idea of administering fertilizer as a nutrient source. If this succeeds in supplying the nutrient needs of the leaves and branches, man immediately jumps to the conclusion that applying fertilizer to citrus trees is both necessary and effective.

If one works from the assumption that fruit trees must "be grown," the absorption of fertilizer by the roots becomes the cause, and the full growth of the leaves and branches the effect. This leads quite naturally to the conclusion that applying fertilizer is necessary.

However, if we take as our starting point the view that a tree grows of its own accord, the uptake of nutrients by the tree's roots is no longer a cause but, in the eyes of nature, just a small effect. One could say that the tree grew as a result of the absorption of nutrients by the roots, but one could also claim that the absorption of nutrients was caused by something else, which had the effect of making the tree grow. The buds on a tree are made for budding and so this is what they do; the roots, with their powers of elongation, spread and extend throughout the earth. A tree has a shape perfectly adapted to the natural environment. With this, it guards the providence of nature and obeys nature's laws, growing neither too fast nor too slow, but in total harmony with the great cycles of nature.

The Countless Evils of Fertilizer: What happens when the farmer arrives in the middle of all this and spreads his fields and orchards with fertilizer? Dazzled and led astray by the rapid growth he hears of, he applies fertilizer to his trees without giving any thought to the influence this has on the natural order.

As long as he cannot know what effects scattering a handful of fertilizer has on the natural world, man is not qualified to speak of the effectiveness of fertilizer application. Determining whether fertilizer does a tree or soil good or harm is not something that can be decided overnight.

The more scientists learn, the more they realize just how awesome is the complexity and mystery of nature. They find this to be a world filled with boundless, inscrutable riddles. The amount of research material that lies hidden in a single gram of soil, a single particle, is mind-boggling.

People call the soil mineral matter, but some one hundred million bacteria, yeasts, molds, diatoms, and other microbes live in just one gram of ordinary topsoil. Far from being dead and inanimate, the soil is teeming with life. These microorganisms do not exist without reason. Each lives for a purpose, struggling, cooperating, and carrying on the cycles of nature.

Into this soil, man throws powerful chemical fertilizers. It would take years of research to determine how the fertilizer components combine and react with air, water, and many other substances in nonliving mineral matter, what changes they undergo, and what relationships should be maintained between these components and the various microorganisms in order to guard a harmonious balance.

Very little, if any, research has been done yet on the relationship between fertilizers and soil microbes. In fact, most experiments totally ignore this. At agricultural research stations, scientists place soil in pots and run tests, but more likely as not, most of the soil microbes in these pots die off. Clearly, results obtained from tests conducted under fixed conditions and within a limited experimental framework cannot be applied to situations under natural conditions.

Yet, just because a fertilizer slightly accelerates crop growth in such tests, it is praised lavishly and widely reported to be effective. Only the efficacy of the fertilizer is stressed; almost nothing is said about its adverse effects, which are innumerable. Here is just a sampling:

1. Fertilizers speed up the growth of crops, but this is only a temporary and local effect that does not offset the inevitable weakening of the crops. This is similar to the rapid acceleration of plant growth by hormones.

2. Plants weakened by fertilizers have a lowered resistance to diseases and pests, and are less able to overcome other obstacles to growth and development.

3. Fertilizer applied to soil usually is not as effective as in laboratory experiments. For example, it was recently learned that some thirty percent of the nitrogenous component of ammonium sulfate applied to paddy fields is denitrified by microorganisms in the soil and escapes into the atmosphere. That this came out after decades of use is an unspeakable injury and injustice to countless farmers that cannot be laughed off as just an innocent mistake. Such nonsense will occur again and again. Recent reports say that phosphate fertilizers applied to fields only penetrate two inches into the soil surface. So it turns out that those mountains of phosphates that farmers religiously spread on their fields year after year were useless and were essentially being "dumped" on the topsoil.

4. Damage caused directly by fertilizers is also enormous. More than seventy percent of the "big three"—ammonium sulfate, superphosphate, and potassium sulfate—is concentrated sulfuric acid which acidifies the soil, causing great harm to it, both directly and indirectly. Each year, some 1.8 million tons of sulfuric acid are dumped onto the farmlands of Japan in the form of fertilizer. This acidic fertilizer suppresses and kills soil microorganisms, disrupting and damaging the soil in a way that may one day spell disaster for Japanese agriculture.

5. One major problem with fertilizer use is the deficiency of trace components. Not only have we killed the soil by relying too heavily on chemical fertilizers, our production of crops from a small number of nutrients has led to a deficiency in many trace elements essential to the crops. Recently, this problem has risen to alarming proportions in fruit trees, and has also surfaced as one cause of low rice harvests.

The effects and interactions of the various components of fertilizers in orchard soil are unspeakably complex. Nitrogen and phosphate uptake is poor in iodine-deficient soils. When the soil is acidic or turns alkaline through heavy applications of lime, deficiencies of zinc, manganese, boron, iodine, and other elements develop because these become less soluble in water. Too much potassium blocks iodine uptake and reduces the absorption of boron as well. The greater the amount of nitrogen, phosphate, and potassium administered to the soil, the higher the resulting deficiency of zinc and boron. On the other hand, higher levels of nitrogen and phosphate result in a lower manganese deficiency.

Adding too much of one fertilizer renders another fertilizer ineffective. When there is a shortage of certain components, it does no good to add a generous amount of other components. When scientists get around to studying these relationships, they will realize just how complex the addition of fertilizers is. If we were prudent enough to apply fertilizers only when we were certain of the pros and cons, we could be sure of avoiding dangerous mistakes, but the benefits and dangers of fertilization are never likely to become perfectly clear.

And the problems go on multiplying. Very limited research is currently underway on several trace components, but an endless number of such components remain to be discovered. This will spawn infinite new areas of study, such as mutual interactions, leaching in the soil, fixation, and relationships with microbes. Still, in spite of such intimidating complexity, if a fertilizer happens to be effective in one narrowly designed experiment, scientists report this as being remarkably effective without having the vaguest idea of its true merits and drawbacks.

"Well yes," the farmer all too easily reasons. "Chemical fertilizers do cause some damage. But I've used fertilizers now for years and haven't had any big problems, so I suppose that I'm better off with them." The seeds of calamity have been sown. When we take note of the danger, it will be too late to do anything about it.

Consider also the fact that farmers have always had to struggle to scrape together enough to buy fertilizer. Why, to give one simple example, fertilizers currently account for thirty to fifty percent of the costs of running an orchard.

People claim that produce cannot be grown without fertilization, but is it really true that crops do not grow in the absence of fertilizer? Is the use of fertilizers economically advantageous? And have methods of farming with fertilizers made the lot of farmers easier?

Why the Absence of No-Fertilizer Tests?: Strange as it may seem, scientists hardly ever run experiments on no-fertilizer cultivation. In Japan, only a handful of reports have been published over the last few years on the cultivation of fruit trees without fertilizer in small concrete enclosures and earthen pots. Some tests have been done on rice and other grains, but only as controls. Actually, the reason why no-fertilizer tests are not performed is all too clear. Scientists work from the basic premise that crops are to be grown with fertilizer. "Why experiment with such an idiotic and dangerous method of cultivation?" they say. Why indeed.

The standard on which fertilizer experiments should be based is no-fertilizer tests, but three-element tests using nitrogen, phosphorus, and potassium are the standard actually used. Quoting the results of a very small number of insignificant experiments, scientists claim that a tree grows only about half as much without fertilizer as when various types of fertilizer are used, and the common belief is that yields are terrible—on the order of one-third that obtained with fertilizers. However, the conditions under which these no-fertilizer experiments were conducted have little in common with true natural farming.

When crops are planted in small earthenware pots or artificial enclosures, the soil in which they grow is dead soil. The growth of trees whose roots are boxed in by concrete is highly unnatural. It is unreasonable to claim that because plants grown without fertilizer in such an enclosure grow poorly, they cannot be grown without fertilizers.

No-fertilizer natural farming essentially means the natural cultivation of crops without fertilizers in a soil and environment under totally natural conditions. By totally natural cultivation I mean no-fertilizer tests under "condition-less" conditions. However such experiments are out of the reach of scientists, and indeed impossible to perform.

I am convinced that cultivation without fertilizers under natural circumstances is not only philosophically feasible, but is more beneficial than scientific, fertilizer-based agriculture, and preferable for the farmer. Yet, although cultivation without the use of chemical fertilizers is possible, crops cannot immediately be grown successfully without fertilizers on fields that are normally plowed and weeded.

It is imperative that farmers think seriously about what nature is and provide a growing environment that approaches at least one step closer to nature. But to farm in nature, one must first make an effort to return to that natural state which preceded the development of the farming methods used by man.

Take a Good Look at Nature: When trying to determine whether crops can be grown without fertilizers, one cannot tell anything by examining only the crops. One must begin by taking a good look at nature.

The trees of the mountain forests grow under nearly natural conditions. Although they receive no fertilizer by the hand of man, they grow very well year after year. Reforested cedars in a favorable area generally grow about forty tons per quarter-acre over a period of twenty years. These trees thus produce some two tons of new growth each year without fertilizer. This includes only that part of the tree that can be used as lumber, so if we take into account also small branches, leaves, and roots, then annual production is probably closer to double, or about four tons.

In the case of a fruit orchard, this would translate into two to four tons of fruit produced each year without fertilizers—about equal to standard production levels by fruit growers today.

After a certain period of time, the trees in a timber stand are felled, and the entire surface portion of the tree—including the branches, leaves, and trunk—is carried away. So not only are fertilizers not used, this is slash-and-burn agriculture. How then, and from where, are the fertilizer components for this production volume supplied each year to the growing trees? Plants do not need to be raised; they grow of their own accord. The mountain forests are living proof that trees are not raised with fertilizer but grow by themselves.

One might also point out that because the planted cedars are not virgin forest, they are not likely to be growing under the full powers of the natural soil and environment. The damage caused by repeated planting of the same species of tree, the felling and harvesting of the timber, and the burning of the mountainside take their toll. Anyone who sees black wattle planted in depleted soil on a mountainside and succeeded a number of years later with giant cedars many times their size will be amazed at the great productive powers of the soil. When black wattle is planted among cedar or cypress, these latter thrive with the help of the microbes present on the roots of the black wattle. If the forest is left to itself, the action of the wind and snow over the years weathers the rock, a layer of humus forms and deepens with the fall of leaves each year, microorganisms multiply in the soil— turning it a rich black, and the soil aggregates and softens, increasing water retention. There is no need for human intervention here. And the trees grow on and on.

Nature is not dead. It lives and it grows. All that man has to do is direct these vast hidden forces to the growth of fruit trees. But rather than using this great power, people choose to destroy it. Weeding and plowing the fields each year depletes the fertility of the soil, creates a deficiency of trace components, diminishes the soil's vitality, hardens the topsoil, kills off microbes, and turns rich, living, organic material into a dead, inanimate, yellowish-white mineral matter the only function of which is to physically support the crops.

Fertilizer Was Never Needed to Begin With: Let us consider the farmer as he clears a forest and plants fruit trees. He fells the trees in the forest and carries them off as logs, taking the branches and leaves as well. Then he digs deep into the earth, pulling up the roots of trees and grasses, which he burns. Next, he turns the soil over and over again to loosen it up. But in so doing, he destroys the physical structure of the soil. After pounding and kneading the soil again and again like bread dough, he drives out air and the humus so essential to microorganisms, reducing it to a yellow mineral matter barren of life. He then plants fruit saplings in the now lifeless soil, adds fertilizer, and attempts to grow fruit trees entirely through human forces.

At agricultural research centers, fertilizer is added to potted soil devoid of life and nutrients. The effect is like sprinkling water on dry soil: the trees thrive on the fertilizer nutrients. Naturally, researchers report this as evidence of the remarkable effectiveness of the fertilizer. The farmer simulates the laboratory procedure by carefully clearing the land of all plant matter and killing the soil in the field, then applying fertilizer. He too notes the same startling results and is pleased with what he sees.

The poor farmer has taken the long way around. Although I would not call fertilizers totally useless, the fact is that nature provides us with all the fertilizers we need. Crops grow very well without chemical fertilizers. Since ancient times, rock outcroppings on the earth have been battered by the elements, first into boulders and stones, then into sand and earth. As this gave rise to and nurtured microbes, grasses, and eventually great, towering trees, the land became buried under a mantle of rich soil.

Even though it is unclear how, when, and from where the nutrients essential to plant growth are formed and accumulate, each year the topsoil becomes darker and richer. Compare this with the soil in the fields farmed by man, which grows poorer and more barren each year, in spite of the large amounts of fertilizer constantly poured onto it.

The no-fertilizer principle does not say that fertilizers are worthless, but that there is no need to apply chemical fertilizers. Scientific technology for applying fertilizers is basically pointless for the same reason. Yet research on the preparation and use of organic composts, which are much closer to nature, appears at first glance to be of value.

When compost such as straw, grasses and trees, or seaweed is applied directly to a field, it takes a while for this to decompose and trigger a fertilizer response in the crops. This is because microbes help themselves to the available nitrogen in the soil, creating a temporary nitrogen deficiency that initially starves the crops of needed nitrogen. In organic farming, therefore, these materials are fermented and used as prepared compost, giving a safe, effective fertilizer.

All the trouble taken during preparation of the compost to speed up the rate of fertilizer response, such as frequent turning of the pile, methods for stimulating the growth of aerobic bacteria, the addition of water and nitrogenous fertilizers, lime, superphosphate, rice bran, manure, and so forth—all this trouble is taken just for a slight acceleration in response. Because the net effect of these efforts is to speed up decomposition by at most ten to twenty percent, this can hardly be called necessary, especially since there already was a method of applying straw that achieved outstanding results.

The logic that rejects grassed fields, green manure, and the direct application and plowing under of human wastes and livestock manure changes with time and circumstances. Given the right conditions, these may be effective. But no fertilizer method is absolute. The surest way to solve the problem is to apply a method that adapts to the circumstances and follows nature.

I firmly believe that, while compost itself is not without value, the composting of organic materials is fundamentally useless.

No Weeding

Nothing would be more welcome to the farmer than not having to weed his fields, for this is his greatest source of toil. Not having to weed or plow might sound like asking for too much, but if one stops to think about what repeatedly weeding and running a plow through a field actually means, it becomes clear that weeding is not as indispensable as we have been led to believe.

Is There Such a Thing as a Weed?: Does no one question the common view that weeds are a nuisance and harmful to the raising of crops?

The first step that those who distinguish between crops and weeds take is to decide whether to weed or not to weed. Like the many different microorganisms that struggle and cooperate in the soil, myriad grasses and trees live together on the soil surface. Is it right then to destroy this natural state, to pick out certain plants living in harmony among many plants and call these "crops," and to uproot all the others as "weeds"?

In nature, plants live and thrive together. But man sees things differently. He sees coexistence as competition; he thinks of one plant as hindering the growth of another and believes that to raise a crop, he must remove other grasses and herbs. Had man looked squarely at nature and placed his trust in its powers, would he not have raised crops in harmony with other plants? Ever since he chose to differentiate crop plants from other plants, he has felt compelled to raise crops through his own efforts. When man decides to raise one crop, the attention and devotion he focuses on raising that crop gives birth to a complementary sense of repulsion and hate that excludes all else.

The moment that the farmer started caring for and raising crops, he began to regard other herbs with disgust as weeds and has striven ever since to remove them. But because the growth of weeds is natural, there is no end to their variety or to the labors of those who work to remove them.

If one believes that crops grow with the aid of fertilizers, then the surrounding weeds must be removed because they rob the crop plants of fertilizer. But in natural farming, where plants grow of their own accord without relying on fertilizers, the surrounding weeds do not pose any problem at all. Nothing is more natural than to see grass growing at the foot of a tree; no one would ever think of that grass as interfering with the growth of the tree.

In nature, bushes and shrubs grow at the foot of large trees, grasses spread among the shrubs, and mosses flourish beneath the grasses. Instead of cut-throat competition for nutrients, this is a peaceful world of coexistence. Rather than seeing the grasses as stunting shrub growth, and the shrubs as slowing the growth of trees, one should feel instead a sense of wonder and amazement at the ability of these plants to grow together in this way.

Weeds Enrich the Soil: Instead of pulling weeds, people should give some thought to the significance of these plants. Having done so, they will agree that the farmer should let the weeds live and make use of their strength. Although I call this the "no-weeding" principle, it could also be known as the principle of "weed utility."

Long ago, when the earth began to cool and the surface of the earth's crust weathered, forming soil, the first forms of life to appear were bacteria and lower forms of plant life such as algae. All plants arose for a reason, and all plants live and thrive today for a reason. None is useless; each makes its own contribution to the development and enrichment of the biosphere. Such fertile soil would not have formed on the earth's surface had there been no microorganisms in the earth and grasses on the surface. Grasses and other plants do not grow without a purpose.

The deep penetration of grass roots into the earth loosens the soil. When the roots die, this adds to the humus, allowing soil microbes to proliferate and enrich the soil. Rainwater percolates through the soil and air is carried deep down, supporting earthworms, which eventually attract moles. Weeds and grasses are absolutely essential for a soil to remain organic and alive.

Without grasses growing over the surface of the ground, rainwater would wash away part of the topsoil each year. Even in gently sloping areas, this would result in the loss of from several tons to perhaps well over a hundred tons of soil per year. In twenty to thirty years, the topsoil would wash entirely away, reducing soil fertility to essentially zero. It would make more sense then for farmers to stop pulling weeds and begin making use of their considerable powers.

Of course, it is understandable when farmers say that weeds growing wild in rice and wheat fields or under fruit trees interfere with other work. Even in cases where cultivation with weeds appears to be possible and even beneficial in principle, monoculture is more convenient for the farmer. This is why, in practice, one must adopt a method that utilizes the strength of weeds but also takes into account the convenience of farming operations—a "weedless" method that allows the weeds to grow.

A Cover of Grass Is Beneficial: This method includes sod and green manure cultivation. In my citrus orchard, I first attempted cultivation under a cover of grass, then switched to green manure cultivation. Now I use a ground cover of clover and vegetables with no weeding, tillage, or fertilizer. When weeds are a problem, then it is wiser to remove weeds with weeds than to pull weeds by hand. The many different grasses and herbs in a natural meadow appear to grow and die in total confusion, but upon closer examination, there are laws and there is order here. Grasses meant to sprout do so. Plants that flourish do so for a reason; and if they weaken and die, there is a cause. Plants of the same species do not all grow in the same place and way; given types flourish, then fade in an ongoing succession. The cycles of coexistence, competition, and mutual benefit repeat themselves. Certain weeds grow as individuals, others grow in bunches, and yet others form colonies. Some grow sparsely, some densely, and some in clumps. Each has a different ecology: some rise up over their neighbors and overpower them, some wrap themselves around others in symbiosis, some weaken other plants, and some die—while others thrive—as undergrowth.

By studying and making use of the properties of weeds, one weed can be used to drive out a large number of other weeds. If the farmer were to grow grasses or green manure crops that take the place of undesirable weeds and are beneficial to him and his crops, then he would no longer have to weed. In addition, the green manure would enrich the soil and prevent its erosion. I have found that by "killing two birds with one stone" in this way, growing fruit trees and tending an orchard can be made easier and more advantageous than normal methods. In fact, from my experience, there is no question that weeding in orchards is not only useless, it is positively harmful.

What about in the case of crops such as rice or barley? I believe that the coexistence of surface plants is true to nature, and that the no-weeding principle applies also to rice and barley cultivation. But because the presence of weeds among the rice and barley interferes with harvesting, these weeds have to be replaced with some other herb.

I practice a form of rice-barley succession cropping in which I seed barley together with clover over the standing heads of rice, and scatter rice seed and green manure while the barley is up. This more nearly approaches nature and eliminates weeding. My reason for trying such a method was not that I was tired of weeding or wanted to prove that cultivation is possible without weeding. I did this out of dedication to my goals of understanding the true form of rice and barley and of achieving more vigorous growth and higher yields by cultivating these grains in as natural a way as possible.

What I found was that, like fruit trees, rice and barley too can be grown without weeding. I learned also that vegetables can be grown in a state that allows them to go wild, without fertilizer or weeding, and yet attain yields comparable to normal methods.

No Pesticides

Insect Pests Do Not Exist: The moment the problem of crop disease or insect damage arises, talk turns immediately to methods of control. But we should begin by examining whether crop disease or insect damage exist in the first place. A thousand plant diseases exist in nature, yet in truth there are none. It is the agricultural specialist who gets carried away with discussions on disease and pest damage. Although research is done on ways to reduce the number of country villages without doctors, no studies are ever run to find out how these villages have managed to get by without doctors. In the same way, when people spot signs of a plant disease or an insect pest, they immediately go about trying to get rid of it. The smart thing to do would be to stop treating insects as pests and find a way that eliminates the need for control measures altogether.

I would like to take a look now at the question of new pesticides, which has escalated into a major pollution problem. The problem exists because, very simply, there are no non-polluting new pesticides.

Most people seem to believe that the use of natural predators and pesticides of low toxicity will clear up the problem, but they are mistaken. Many feel reassured by the thought that the use of beneficial insect predators to control pests is a biological method of control without harmful repercussions, but to someone who understands the chain of being that links together the world of living organisms, there is no way of telling which organisms are beneficial predators and which are pests. By meddling with controls, all man accomplishes is destruction of the natural order. Although he may appear to be protecting the natural enemies and killing the pests, there is no way of knowing whether the pests will become beneficial and the predators pests. Many insects that are harmless in a direct sense are harmful indirectly. And when things get even more complex, as when one beneficial insect feeds on a pest that kills another beneficial insect which feeds on another pest, it is futile to try and draw sharp distinctions between these and apply pesticides selectively.

Pollution by New Pesticides: With the problem of pesticide pollution, many await the development of new pesticides that:

1. have no adverse effects on animal cells and act by inhibiting enzymes specific to given insects, microorganisms, pathogens, plants, or whatever;

2. are degradable under the action of sunlight and microorganisms, and are totally non-polluting, leaving no residues.

The antibiotics blasticidin S and kasugamycin were released onto the market as new pesticides that meet these conditions, and used widely as preventive measures against rice blast disease amid great clamor and publicity. Another recent area of investigation in which many are placing much hope is pesticides prepared from biological components already present in nature, such as amino acids, fatty acids, and nucleic acids. Such pesticides, it is generally surmised, are not likely to leave residues.

One other new type of pesticide discovered recently and reported as possibly non-polluting is a chemical that suppresses metamorphosis-regulating hormones in insects. Insects secrete hormones that control the various stages of metamorphosis, from the egg to the larva, the pupa, and finally the adult. A substance extracted from the bay tree apparently inhibits secretion of these hormones.

Because these substances work selectively on only certain types of insects, they are thought to have no effects on other animals and plants. But this is incorrect and short-sighted. Animal cells, plant cells, and microorganisms are basically all quite similar. When a pesticide that works on some insect or pathogen is said to be harmless to plants and animals, this is merely a word game that plays on a very minor difference in resistance to that substance.

A substance that is effective on insects and microorganisms also acts, to a greater or lesser degree, on plants and animals. A pesticidal or bactericidal effect is referred to as phytotoxicity in plants and pollution in animals and man.

It is unreasonable to expect a substance to work only on specific insects and microbes. To claim that something does not cause pesticide damage or pollution is to make small distinctions based on minor differences in action. Moreover, there is no knowing when these minor differences will change or turn against us. Yet, in spite of this constant danger, people are satisfied if a substance poses no immediate threat of damage or pollution and do not bother to consider the greater repercussions of its effects. This attitude of ready acceptance complicates the problem and aggravates the dangers.

The same is true as well of microorganisms employed as biological pesticides. Many different types of bacteria, viruses, and molds are sold and used in a variety of applications, but what effect are these having on the biosphere? One hears a lot lately about pheromones. These are chemicals produced by organisms in minute quantities that trigger very profound physiological changes or specific behavioral reactions in other individuals. They may be used, for example, to attract the males or females of a given insect pest. Even the use of chemosterilants together with such attractants and excitants is conceivable.

Sterilization can be achieved by a number of methods, such as destruction of the reproductive function by irradiation with gamma rays, the use of chemosterilants, and interspecific mating. But no evidence exists to support the claim that the effects of sterilization are limited to just the insect pest. If, for instance, one insect pest were entirely eliminated, there is no knowing what might arise in its place. No one has any idea what effects a given sterilant used on one type of insect will have on other insects, plants, animals, or man for that matter. An action as cruel as ruining and annihilating a family of organisms will surely invite retribution.

The aerial spraying of mountain forests with herbicides, pesticides, and chemical fertilizers is considered a success if a given weed or insect pest is selectively killed, or the growth of trees improved. But this is a grave error that can prove most dangerous. Natural conservationists have already recognized such practices as polluting.

Spraying herbicides such as PCP does more than just kill weeds. This acts also as a bactericide and fungicide, killing both black spot on living plants and the many putrefactive fungi and bacteria on fallen leaves. Lack of leaf decomposition seriously affects the habitats of earthworms and ground beetles, on top of which PCP also destroys microorganisms in the ground.

Treating the soil with chloropicrin will temporarily alleviate bacterial soft rot in Chinese cabbage and the *daikon* radish, but the disease breaks out again two years later and gets completely out of hand. This germicide halts the soft rot, but at the same time it also kills other bacteria that moderate the severity of the disease, leaving the field open to the soft rot bacteria. Chloropicrin also works against fusarium fungi and sclerotium fungi that attack young seedlings, but one cannot overlook the fact that these fungi kill other important pathogens. Is it really possible to restore the balance of nature by spraying an array of bactericides and fungicides like this into a soil populated with such a large variety of microbes?

Instead of trying to bring nature around to his own designs with pesticides, man would be much wiser to step out of the way and let nature carry on its affairs without his interference.

Man is also kidding himself if he thinks that he can clear up the problem of weeds with herbicides. He only makes things harder on himself because this leaves hardy weeds resistant to herbicides or results in the emergence of totally unmanageable new strains of weed. Somebody has come up with the bright idea of killing off herbicide-resistant weeds such as Kentucky bluegrass that are spreading from road embankments by importing an insect pest which attacks the weeds. When this insect begins to attack crops, a new pesticide will have to be developed, setting into motion another vicious cycle.

To illustrate just how complex the interrelationships between insects, microorganisms, and plants are, let us take a look at the pine rot epidemic spreading throughout Japan.

The Root Cause of Pine Rot: Contrary to the generally accepted view, I do not think that the primary cause of the red pine disease that has afflicted so many forested areas of Japan is the pinewood nematode. Recently a group of pesticide researchers at the Institute of Physical and Chemical Research pointed to a new type of *aohen-kin* ("blue change mold") as the real villain, but the situation is more complicated than this. I have made a number of observations that throw some light on the true cause.

1. On cutting down a healthy-looking pine in an infected forest, new pathogenic fungi can be isolated from pure cultures of some forty percent of the trunk tissue. The isolated fungi include molds such as *kurohen-kin* ("black change mold") and three types of *aohen-kin,* all of them new, undocumented pathogens foreign to the area.

2. Nematode infestation can be observed under a microscope only after a pine is a quarter- or half-withered. Actually, the new pathogenic fungi arrived before the nematodes, and it is on them that the nematodes are feeding, not the tree.

3. The new pathogenic fungi are not strongly parasitic, attacking only weakened or physiologically abnormal trees.

4. Wilting and physiological abnormalities of the red pines are caused by decay and blackening of the roots, the onset of which has been observed to coincide with the death of the *matsutake* mushroom, a symbiont that lives on the roots of red pines.

5. The direct cause of the death of *matsutake* mushrooms was the proliferation of *kurosen-kin* ("black bristle mold"), a contributing factor for which was the increasing acidity of the soil.

That red pine disease is not caused by just one organism became clear to me from 1) the results of experiments I conducted on healthy trees in which I inoculated nematodes directly into pines and placed long-horned beetles on the trees under a netting, all without ill effect, and 2) the observation that even when all insect pests are kept off the tree, the roots continue to rot, causing the tree to die. *Matsutake* mushrooms die when small potted pine saplings are subjected to conditions of extreme dryness and high temperature, and perish when exposed to a temperature of 30°C for one hour in a hothouse. On the other hand, they do not die in alkaline soil by the shore with fresh water nearby, or on high ground at low temperature.

On the assumption that red pine disease is triggered by acidification of the soil and dying of the *matsutake* mushroom, followed first by parasitic attack by *kurohen-kin* and other mold fungi, then by nematode infestation, I tried the following methods of control.

1. Application of lime to reduce soil acidification; in the garden, this can be done by spraying with water containing bleaching powder.

2. Spraying of soil germicides; in gardens, the use of hydrogen peroxide solution and alcohol chloropicrin disinfection is also okay.

3. Inoculation *of matsutake* spores grown in pure culture to promote root development.

These are the bare bones of my method of fighting pine disease, but what most troubles me now is that, although we may feel confident of our ability to restore garden trees and cultivate *matsutake* artificially, we are powerless to rehabilitate an ecosystem that has been disturbed.

It is no exaggeration to say that Japan is turning into a barren desert. The loss of the small autumn *matsutake* means more than just the perishing of a mushroom; it is a solemn warning that something is amiss in the world of soil microbes. The first telltale sign of a global change in weather patterns will probably appear in microorganisms. Nor would it be surprising if the first shock wave occurred in the soil where all types of microorganisms are concentrated, or even in mycorrhiza such as *matsutake,* which form a highly developed biological community with very organic interactions.

Essentially, the inevitable happened where it was meant to happen. Red pine is a hardy plant capable of growing even in deserts and on sandy beaches. At the same time, it is an extremely sensitive species that grows under the protection of a very delicate fungus. Man's ability to control and prevent red pine disease may be a litmus test of his capacity to halt the global loss of vegetation.

3. How Should Nature Be Perceived?

Seeing Nature as Wholistic

The central truth of natural farming is that nothing need be done to grow crops. I have learned this because non-discriminating knowledge has enabled me to confirm that nature is complete and crops more than capable of growing by themselves. This is not the theoretical hypothesis of a scholar in his study or the wishful thinking of an idler with an aversion to work; it is based on a total, intuitive understanding of the reality about self and nature wrested from the depths of doubt and skepticism in a deeply earnest struggle over the meaning of life. This is the source of my insistence that nature not be analyzed.

Examining the Parts Never Gives a Complete Picture: This principle is extremely important, but since it is somewhat abstract, I will illustrate with an example.

A scientist who wishes to know Mt. Fuji will climb the mountain and examine the rocks and wildlife. After having conducted geological, biological, and meteorological research, he will conclude that he now has a full picture of Fuji. But if we were to ask whether it is the scientist who has spent his life studying the details of the mountain who knows it best, the answer would have to be no. When one seeks total understanding and comprehensive judgment, analytic research is instead a hindrance. If a lifetime of study leads to the conclusion that Fuji consists mostly of rocks and trees, then it would have been better not to have climbed it in the first place.

One can know Fuji by looking at it from afar. One must see it and yet not examine it, and in not examining it, know it.

Yet the scientist will think: "Well, gazing at Mt. Fuji from a distance is useful for knowing it abstractly and conceptually, but is no help in learning something about the actual features of the mountain. Even if we concede that anayltic research is of no use in knowing and understanding the truth about Fuji, learning something about the trees and rocks on the mountain is not totally meaningless. And moreover, isn't the only way to learn something to go and examine it directly?"

To be sure, I can say that analyzing nature and appending to these observations one's conclusions is a meaningless exercise, but unless those who listen understand why this is worthless and unrelated to the truth, they will not be convinced.

What more can I say if, when I mention that the artist Hokusai who captured faraway images of Fuji in his paintings understood it better than those who climbed it and found it an ugly mountain, I am told that this is just a subjective difference, a mere difference in viewpoint or opinion.

The most common view is that one can best know the true nature of Fuji by both listening to the ecologist speak of his research on its fauna and flora and looking at the abstracted form of Fuji in Hokusai's paintings. But this is just like the hunter who chases two rabbits and catches none. Such a person neither climbs the mountain nor paints. Those who say Fuji is the same whether we look at it lying