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"Biorational" Substances in Agricultural Programs — A New Approach

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[This article is condensed from the original. For the full article and references, please contact Vital Earth Resources.]

Pests and diseases are still taking a large chunk of the world's food supply despite the farmer's annual expenditure of about $25 billion on chemical pesticides. Moreover, many global pests have evolved resistance to certain major groups of pesticides. In spite of the adverse effects of the massive use of these

IPM = Integrated Pest Management

toxic chemicals, their use still exceeds that of any other pest control method.

Understandably, farmers are reluctant to change their ways. They see in pesticides at the least the illusion of a guarantee which they can never get from other technologies. One the other hand, natural enemies, as biological control agents, can play a big role in controlling pests, but their development and deployment are proceeding slowly. It is questionable whether they can provide a suitable level of control alone. Most farmers, therefore, rely on conventional pesticides because they act more quickly than biological control agents.

Nematodes cause untold billions of dollars of damage to major food crops as well as to horticultural crops. They can be suppressed by new botanical products and proven soil and crop management techniques.

It is about time to give high priority to searching for ecologically sound plant protection technologies that can be orchestrated with an integrated management approach towards sustainable practices. It is, therefore, imperative to look into IPM as a holistic interdisciplinary

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Harmony with Natural Laws

An Impossible Task for Agriculture and Horticulture?

by Paul W. Syltie, Ph.D.

A few short decades ago the thought of farmers and horticulturalists returning to their "organic roots", as it were, was somewhat of a pipe dream, for our entire generation has been conditioned to viewing soils and plant growth through chemical eyes. Universities, the agricultural extension service, farm and grower magazines, and advertising induced nearly everyone to use the new methods: commercial fertilizers, insecticides, herbicides, nematicides, miticides, and a plethora of other treatments that too often spelled trouble for the health of farm and nursery workers, the purity of ground and surface waters, and usually the pocket book.

We should not respond too harshly, however, against all of these new chemical practices. Some are reasonably innocuous, but some are downright dangerous, even when used according to label directions. Witness the recent case of Costa Rican banana workers whose reproductive lives were ended due to EDB, a potent nematicide that eventually was banned ... but not before untold damage had been thrust upon unsuspecting human

See Nature's, page 3

Modern banana production is highly integrated with a wide array of agricultural chemicals that spur production but threaten workers and consumers.

OUR SOIL PROBLEM

Countless bushels of corn fill the bins of American's heartland, but is our time running out for bumper crops as our soil organic matter levels are being depleted?

Continued from the last issue of *The Vital Earth News, Agricultural Edition.*

by Eric Eweson

Today's agricultural experts are too much concerned with the, as yet, largely unknown mysteries of plant nutrition. Therefore, their thinking is along the deceptive lines of feeding the plants directly as if they were an isolated manifestation of life, instead of a transient stage in the continuous cycle of life, with no real beginning and real end. Feed the soil so as to sustain its incalculable billions of inhabitants, which is comparatively simple, and the plants will then take care of themselves.

It is true that for a limited time fair-sized crops can be grown in humus-deficient soil by the addition of increasing quantities of chemical fertilizers. The actual length of time during which chemical fertilizers appear to be successful for raising crops depends on how long the humus in the soil will last. However, even at best, such crops will be deficient in proteins, vitamins, and minerals, which has been proven over and over by comparative analysis of grains, vegetables, eggs, milk, and other products derived from naturally fertile soil and those from chemically fertilized soil. (It is important to realize that excesses in the mineral content of plants are now very common, and often more dangerous than the deficiencies.) Plants grown in humus-deficient soil also lack resistance to pests and parasites and have a tendency to lose their powers of reproduction. Disease can be traced from deficient soil, via deficient plants, to deficiency manifestations and declining health in the higher forms of life.

Chemical fertilizers must not be confused with natural rock materials like ground-up limestone, phosphate and potash rocks, which are not harmful to soil life; moreover, to be utilized by plants they require breakdown by microbial activities, and their effectiveness depends, therefore, on the presence of humus.

AGRICULTURE TODAY

In this light let us now examine some of our modern agricultural practices.

Chemical fertilizers are like shots in the arm to the soil. They accelerate the consumption of humus, but do not replace it. This leads ultimately to the soil's exhaustion and to erosion, floods, and dustbowl conditions. Intensive agriculture gives high yields but consumes much humus. So it must be balanced with intensive decay—that is, formation of new humus—to prevent loss and gradual

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Biorational Pesticides Are Safe and Effective!

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approach to pest management that takes advantage of the full range of technologies in an economicallly and environmentally sound manner.

Resurgence of interest in natural products in agriculture among scientists is not surprising. Synthetics are likely to soon be gone and a return to nature seems imminent for the sake of food, soil and water safety. One possibility is to look into the production of natural substances that can be derived from the plant kingdom. Such biorational plant extracts include neem, nicotine, and the pyrethrins. Until recently, preparations with nicotine and pyrethrins in public opinion passed for excellent and harmless natural pesticides. Today, the application of these preparations is severely restricted or even banned by organic farmers. The principal reason for the slow takeoff of safer botanical extracts has been the complex translation of a sound scientific approach into manageable services and programs at the field level.

SAFER BOTANICAL EXTRACTS

Producing quality, high-yielding cauliflower becomes possible even without toxic pesticides if the tools of modern biorational pest control are used.

It is important to realize that in natural soil environments the levels of nutritional elements are adequate for optimum plant growth. The root zone contains a dizzying array of all types and variations of microbes. Heavy inputs of synthetic fertilizers and pesticides to such natural environments will upset the soil-plant balancing systems, and hence nature's own possibilities of pest control. For a sustainable agriculture system we should think about means and ways of bringing the soil-plant system into balance. The first cause of the entire sequence leading to good crop health is the encouragement of expression of the plant's and soil's native potential. The long-term solutions to pest problems lie in the normalization of soil fertility, water management, and plant nutritional/hormonal balance. This integrated manage-

See Natural, page 5

— Nature's Seven Immutable Laws —

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beings. Few would argue against an approach that, if workable, would permit farmers, nurserymen, and homeowners to worry little about the material they use, and instead free up their creativity to solve other management problems.

I was fortunate to have grown up on a Minnesota dairy farm where my family used nothing but organic methods. That was the system most farmers in the northwestern Corn Belt used to grow corn, wheat, soybeans, flax, oats, and alfalfa during the 1950's and 1960's. With mixed farming the rule, we would spread manure onto our fields on a rotational basis every few years, thereby recycling the minerals and organic matter back to the soil. Crop yields were less than present levels, since varieties were less productive and less responsive to fertilizer inputs as are today's types. Even so, the nutritional value of the grain was high, soil conditions were maintained at acceptable levels, yields were consistent year-by-year, and chemical bills were nil. Most people farmed that way in our part of the world. Few farmers could be accused of pushing their soils beyond their natural limitations, since most owner-operators truly believed in stewardship: leaving the land for their children as good as, or better than, they found it.

How things have changed! The cultivator has been largely replaced by herbicides, organic manures by commercial fertilizers, and natural pest control (predaceous insects, resistant plants, etc.) by pesticides. In a very real sense our soils have become addicted to chemicals as an addict has to drugs. Yet, natural laws do not change. Some farmers and nurserymen are rediscovering these laws of nature and using them to great advantage, much like growers have for millennia ... despite the trend toward bigness and efficiency (meaning replacing people with machines or chemicals).

Perhaps it is wise and just to examine briefly the views of one of modern history's most ardent proponents of mankind's returning to natural laws in growing things. This proponent is Sir Albert Howard, who was knighted by the Queen of England for his work in agriculture. An ardent promoter of composting in the first half of the Twentieth Century, Howard was the friend of J. I. Rodale (former editor of *Organic Gardening*), Lady Eve Balfour (British author of *The Living Soil*[1]), and many other prominent promoters of biological soil and cropping systems of that generation. Eric Eweson, the inventor of the Eweson Digester, was also a friend of Sir Albert Howard. His digester forms the heart of the Bedminster technology for transforming municipal solid waste and sludge into valuable, nutrient-rich compost.

In one of his books, *An Agricultural Testament*[2], Sir Albert asked the question, "Can mankind regulate its affairs so that its chief possesion—the fertility of the soil—is preserved? ... On the answer to this question the future of civilization lies." He shunned conventional forms of agricultural research in favor of practical, on-farm testing, and was opposed to research by teams of specialists, each working on a fragment of the whole ... each contributing an isolated splinter of knowledge. Sir Albert revealed how using compost will build soil fertility independently, as he illustrated in 25 years of practical experimentation in India. He and other farmers in India who eschewed chemical fertilizers and used natural manures had the best crops and healthiest animals.

Sir Albert Howard listed several "methods of soil management" which nature utilizes to conduct her affairs:[3]

1. Mixed farming is the rule; plants and animals are always found together.
2. The soil is always protected from the direct action of sun, rain, and wind.
3. Rainfall is carefully preserved in surface layers and subsoil.
4. The forest manures itself , making its own humus and supplying its own minerals.
5. Mineral matter needed by trees and undergrowth is obtained from the soil.
6. The soil always carries a large fertility reserve.
7. Crops and livestock look after themselves, and maintain health due to internal vitality imparted by the soil.

In another book, entitled *The Soil and Health*[4], Sir Albert Howard showed that disease is the awful consequence of abusing the soil. As he put it, "This [disease] is the punishment meted out by Mother Earth for adopting methods of agriculture which are not in accordance with Nature's law of return. We can begin to reverse this adverse verdict and transform disease into health by the proper use of the green carpet—by the faithful return to the soil of all available vegetable, animal, and human wastes."

He further emphasized that "... the problems of the farm and garden are biological rather than chemical." It is to this end that Eric Eweson, the developer of Bedminster's and Vital Earth's foundational technology for composting, directed his efforts.

To help return the organic by-products of our towns and cities back to the land which originally grew these food and fiber crops, Bedminster Biotechnology has been utilizing the rotating three-chambered drum process to produce compost in three days from raw starting materials such as sawdust, wood chips, chicken litter, paper, leaves, food waste, plastic

See Enhancing, page 4

Simulating natural principles of soil and crop management enabled this Canadian farmer to achieve a high yield of quality corn. Note the untreated control area of the field to the right.

Enhancing Soil Microbes Helps Optimize Soil Fertility

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bags, and sludge. The material—termed OrganagrO—must be further aged for several weeks at correct moisture and temperature levels, but in due time produces a premium grade, highly fertile, pathogen and weed-seed-free compost. Input levels of MSW and sludge at the Sevierville, Tennessee, facility (four drums) are about 350 tons per day, while the volume at the Marietta, Georgia, plant is nearly double that of the Tennessee facility. The original prototype digester at Big Sandy, Texas, is still operating after 26 years, producing about 45 tons per day of premium-grade compost for horticulture.

Bedminster's "sister company," Vital Earth Resources, seconds the Bedminster philosophy by producing compost which is used mostly in an array of horticulture soil and potting mixes. Besides, Vital Earth produces a line of "Earth-Safe" fertilizers and plant protection products, including a high quality biostimulant called Vitazyme that, when applied to agricultural or horticultural crops, speeds growth and development, increases yields and quality, improves crop appearance, and enhances soil characteristics such as structural strength. These effects are achieved not through direct fertilization of the soil but through the activation of bacteria, fungi, algae, cyanobacteria, and other microbes in the soil...especially within the rhizosphere [root-zone], where soil biological activity is multiplied intensively.

Enhancing beneficial rhizosphere [root-zone] organisms through the addition of the biostimulant Vitazyme encourages the development of a more vigorous root system that is better able to take up nutrients, and thus boost yields.

Results with a wide variety of agricultural and horticultural crops attest to the fact that microbial inoculants are usually not needed with this biostimulant. Microbes are generally present in soils in great numbers, and it simply remains the grower's job to provide the correct environment (moisture, temperature, fertility, and aeration) for an appropriately adjusted population to proliferate.

Working with biological systems is a gentle blend of art and science, one that requires greater patience and a higher degree of management skill than with the use of chemicals alone.[5] While pesticides destroy the unwanted pests—insects, mites, nematodes, fungi, or weeds—biological materials such as compost, manure, cottonseed and other high-protein by-products, plant residues, or biostimulants encourage the buildup of beneficial insects, nematodes, bacteria, and fungi over time, thus controlling the pests through living systems. In the process, man and the environment are not tainted by toxic chemistry.

The same may be said of fertilizer.

See We Can Harmonize, page 11

What Do You See Here?

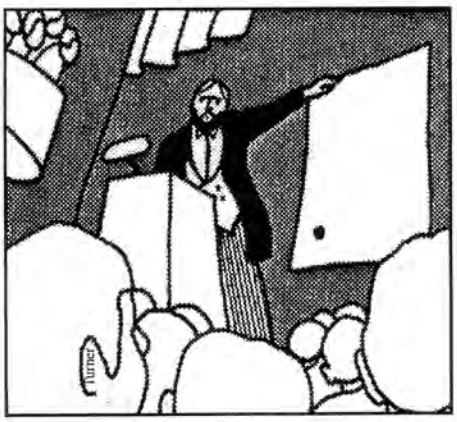
A prominent psychologist used to start his lectures this way. He would appear on the platform with a large piece of white cardboard with a small black dot in the lower left-hand corner, then ask someone in the audience what they saw.

Back came the usual answer. They saw a small black dot in the lower left-hand corner.

"What you saw is what you chose to see," the psychologist would then say. "You could have said that what you saw was a large empty white space — enough in which to copy Lincoln's Gettysburg Address, the Ten Commandments, or the Bill of Rights."

The point, of course, he was leading up to is that it is not what happens to us that is so important as the way we see it. And the choice is ours. ■

Land O'Lakes Mirror, January 1987



Garbage Generation

- In a lifetime, the average American will throw away 600 times his adult weight in garbage. A 150-pound American will leave a legacy of 90,000 pounds of trash.
- On average, each office employee is estimated to generate 0.5 pounds of paper each day.
- Since 1960, the amount of packaging in our garbage has increased by 80%. Packaging, by weight, represents a third of what we throw away.
- The average family of four pays $1 in packaging for every $11 spent for groceries.

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Natural Botanicals Are the Future for Pest Control

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ment strategy can be achieved through the incorporation of safer plant extractives into the system.

I. Active Ingredients

Safer botanical extracts are usually composed of a mixture of natural organic and inorganical compounds. This mixture is a sort of soup that contains multiple ingredients. They are not, by all means, biochemical pesticides but simply activators that improve crop health. The following is a partial list of common active natural ingredients that constitute the so-called safer biorational plant extracts:

- Aldehydic acids
- Nucleic acids and related compounds
- Lipophiles
- Natural fatty acids
- Naturally occuring cytokinins
- Vitamins, especially B1, B2, B6, C, and E
- Other organic acids
- Traces of mineral ions

Since all of the ingredients are natural substances, the advantages of the employment of such safer plant extracts are many. However, the following two merits are of importance:

Botanical biostimulants such as Vitazyme (treated on the right) can encourage beneficial bacteria and fungi to overpower root pathogens such as Fusarium and Pythium fungal species that wreak havoc on millions of acres of crops every year.

First, their actions are rooted in the porphyrin biosynthetic pathway; they can be totally biodegradable and hence do not accumulate or persist in the environment. Second, as a mixture of natural compounds they have multiple active ingredients and hence multiple modes of action that make it nearly impossible for pests and pathogens to develop effective resistance against them.

II. Modes of Action

So far as available knowledge exists, safer botanical extractives have a positive impact on soil-plant-pest interactions in the following manner:

A. Normalization of Soil Fertility and Nutritional Balance of Growing Plants

Components of the extracts trigger various metabolic responses within the root

See As Chemicals, page 6

Exhausted Soils Require More Pesticides

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exhaustion of soil fertility.

Contour plowing, terracing, crop rotation, cover cropping, sheet composting, mulching, and reforestation are sound and essential practices, but limited in their effect. Contour plowing, for example, will reduce erosion and permit soil rehabilitation but will not prevent subsequent exhaustion of the soil. Cover cropping is likewise no panacea and its success depends entirely on the soil's ability to decompose the crop through the presence of humus. With exhausted soil, cover crops will remain undecomposed for long periods.

Contour strip-cropping is an excellent means to help control erosion, but cannot grant long-term success unless organic matter and fertility are maintained at high levels.

High yields are always of questionable value when attained at the cost of depleting the soil's content of humus. They represent "mining" of the soil, or spending of our soil capital. If conditions exist that justify such practices temporarily, then we should at least realize what we are doing.

Destruction of crops by pests and parasites is nowadays worrying farmers and gardeners more than anything else. Spraying to check the growth of parasites has in a comparatively few yours become standard practice, increasing in intensity year by year as "new" pests develop and the old ones acquire greater resistance to the sprays. For certain crops as many as ten applications of sprays per season are not unusual, clearly indicating that we are simply fostering tougher and tougher breeds of pests. The final outcome of this battle is at best doubtful, but meantime the higher forms of life, humans and animals, are deprived of the protection provided by nature's censoring scavenger forces, and as a result suffer from deficient and sometimes even poisoned food, inferior in taste, nutrition, and keeping quality.

One law of nature is that pests and par-

See Complete, page 7

As Chemicals Are Banned, Biologicals Will Fill the Gap!

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zone of the plant. Within this zone are countless organisms, most of them beneficial to the health and nourishment of the actively growing roots and other plant tissues: nitrogen-fixing organisms, mycorrhizal fungi, bacteria, and others.

Further stimulation of root zone activities occurs through the triggering of the "oxygen-ethylene exchange" that takes place along root hairs. Ethylene gas, an anaesthetic to microbes, slows them down to prevent runaway activity.

Soil structure is improved due to the stimulation of microbe-produced polysaccharides and humic acids. This approach of promoting the rhizosphere dynamics is likely to gain momentum because of the increasing interest in exploring alternative practices for controlling soil pests. The current serious problem of having few effective means to control pathogenic nematodes is an example of what happens when there is over-reliance on one approach to control a pest.

The current serious problem of having few effective means to control pathogenic nematodes is an example of what happens when there is an over-reliance on one approach to control a pest.

When plants are growing normally, the supply of N-compounds from the soil is adjusted to plant needs. No excess will occur, but the supply of protein building blocks (amino acids) is immediately incorporated into proteins in the leaf cells. Accumulation of excessive amino acids in plant tissues can occur when plants receive heavy N-fertilization, are short on certain minerals, have pesticide applications, or get old.

These plant pests are able to "home-in" on plants containing these high amino acid levels. Agronomic practices that help to optimize plant nutritional balance, promoting plant health and reducing free amino acids levels, are keys to crop health. Biorational substances, especially botanical extractives (cytokinin, triacontanol, and others), can adjust the free amino acid balance in the plant tissues and thus discourage pests to feed on plants.

B. Strengthening Plant Defense Systems

We have learned that plants have a complex defense system with as many different components as the immune system in mammals. Plants can be immunized using harmless pests, or treating the plants by naturally occurring chemical substances that are capable of releasing signals in plants.

The technique of using minor pests or diseases to immunize plants against more serious pests and diseases is unlikely to become commonplace because of the difficulty to produce, distribute, and apply living organisms to crops. On the other hand, spraying plants or treating seeds or drenching soils with naturally occurring botanical extracts is more feasible.

The antennae of insects allow them to home-in on females, or on certain plants that radiate frequencies which indicate they are ready food for the moth.

Levels of natural defense compounds can be increased by immunization. The natural chemical signals for systemic immunization have not been identified, though chemicals which release such signals have been.

C. Disruption of Pest Biological Activities

Non-toxic botanical extracts can induce various biological abnormalities in target pests and pathogens through the following mechanisms:

- *Antioxidant effect*
- *Interference with normal growth and development*
- *Chelation of certain metallic ions necessary for pest survival*

Prospects

We have a responsibility towards nature and human society to look into new products that are safe in the environment—on and off the farm—and safe for human health. Methodologies of evaluating new biorational substances and biocontrol agents are rapidly developing, and support for this area of research is likely to increase in the years ahead. These environmentally and ecologically safe techniques are, however, not well articulated, are underused, and are in need of quantitative research. Recognizing the potential of integrating botanical extracts into our pest management systems, more knowledge, however, is needed regarding protocols that will ensure consistent results in farmers' fields.

Long-term field experiments will provide a vehicle for scientific investigations of structure-function relationships that govern the long-term viability of a specific pest management system.

Evidence is overwhelming that biora-

See Strong, page 8

Root hairs (RH) and mucigel (M) on a wheat root are being overrun by a pathogen called Gaeumannomyces. Such infections are more difficult when the crop is grown in fertile, highly organic soil and when biological pest control is employed.

Complete Proteins Build Strong, Healthy People

A girl from north Australia, with excellent facial bone and tooth development due to a wholesome protein and nutrient intake, without modern chemical-raised foods.

This man from the high Andes has excellent bone and tooth development from a native, non-refined diet. [Weston Price, Nutrition and Physical Degeneration, Price-Pottenger Nutrition Foundation, 1945]

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asites shall provide for the elimination of deficient plant life—that is, plants which are unfit to reproduce their species and unfit as food for higher forms of life. Only in this manner can the species improve and degeneration be prevented. The normal function of pests is the destruction of deficient plant life, so it may return to the soil for decay and restart the cycle of life.

Plants grown in fertile soil do not succumb en masse to such destruction. This may appear as a rash statement, but it is a fact which has been proved conclusively, and which can be proved by anybody who has a few square feet of garden. If it were not so only scant plant life would now survive on the earth. With the abundance of deficient plant life, pests have become the normal if not the dominant factor in agriculture. This development parallels our declining soil fertility and the increasing use of chemical fertilizers.

Weeds also have a purpose in the order of nature. Some appear when the soil becomes too acid, others when it is too alkaline, too rich or too poor in potassium, iron, calcium, etc. But the most significant fact about weeds is that if left to their own devices (which of course is not recommended), most of them will in their good time correct the very deficiency which brought them about. Daisies, for instance, thrive in calcium-deficient soil but are comparatively rich in calcium because they have the ability to accumulate this element from higher potencies of dilution than other plants. So, as they die and revert to soil, the calcium deficiency is gradually corrected.

Many deep-rooted "weeds" like dandelions thrive even in poor, dry, hardpacked soil; their deep roots penetrate the topsoil for moisture and mineral nutrients in the subsoil, thereby breaking up and after their decay enriching the topsoil so that other and more demanding plants can establish themselves. It was the "weed" type of plants—notably mosses and lichens—that prepared the earth for its present green carpet. Deep-rooted "weeds" like chicory, cocksfoot, kidney vetch, and burnet could play extremely important roles in soil rehabilitation and modern soil management if their possibilities were properly understood, and not as now only utilized by a few exceptional farmers.

Chemical sprays and weed controls may well be compared to aspirin: they affect the symptoms but never the cause of the trouble.

SOIL AND NATIONAL HEALTH

Medical authorities have often expressed the opinion that malnutrition—with stress on quality rather then quantity—is our only major disease. I believe, more specifically, that deficiencies in the composition of the proteins, which include the vitamins, hormones, and enzymes, are at the root of our declining national health. The proteins, also carriers of the important trace minerals and the building blocks of all living substances, are still a deep secret in respect to their detailed molecular structure. The hope expressed by some chemists that thanks to our rapid progress in analytical methods the mystery of the proteins can be solved "within the next ten or twenty years" is, in my opinion, much too optimistic. Be this as it may, the great danger is the presently accepted practice of raising our food, of which the proteins are by far the most important component, with a few fertilizer chemicals, water and air. Modern agricultural science thus still seems to regard the proteins as simple compounds that can be built up in the plants from half a dozen elements, while in reality the proteins are as complex as life itself and composed of a great many times that number of elements and factors. It is illogical to assume that such utter disregard for nature's complicated and largely unknown life processes can fail to affect out health adversely. I firmly believe that disease begins with poor soil and the deficient build-up of plant proteins, which are consumed by humans and animals, who themselves cannot produce proteins. Disease in man, beast, and plant is fundamentally one and the same problem, a carry-over of deficient proteins from our abused and sick soil, a logical but as yet sadly neglected field for medical research, notably on cancer.

A distinguished English investigator, J. E. R. McDonaugh, long ago advanced the theory that protein molecules "overexpand" from improper nourishment, which causes portions of the protein to break off, such broken-off pieces forming the dreaded virus. A "heart chart" issued by the American Heart Association shows that cardiac mortality is increased more alarmingly in those states which have been farmed the longest. Consider also the recruiting records from the last war: an average of over 50 per cent and in some states 70 per cent of our young men were rejected as unfit for military service. Analysis will show that the regions having the highest percentage of rejections where those where the soil is most exhausted.

THE POLLUTION PROBLEM

Closely allied to the problem of soil deterioration is the almost equally severe one of disposal of municipal and industrial wastes which should be, but are not, returned to the soil to aid in the regeneration process.

We are proud of our progress in sanitation, but we have as yet no better ways to dispose of the waste matter than by burning or dumping in nearby waters or dumping grounds. In fact, many of our cities are well on the road to polluting themselves

See Nature, page 8

Strong, Healthy, Plants Resist Disease!

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tional substances, especially plant extracts, applied at very low concentrations increase the yield, improve health, and enhance quality of a diverse group of crop species.

The prospects of biorational substances as newly developed biotechnology for integration into IPM programs are quite promising. Legislation for their deployment, however, requires registration procedures for their use in plant protection. The future will see the restrictions on pesticide use and a great reliance on highly integrated control tactics involving biological agents, biorational substances, immunization technology, genetic engineering, and classical plant breeding. ■

Nematode-infected roots in this squash have led to green, inedible fruit. The plant is using its energy to build new roots.

Healthy root systems produce excellent fruit as seen in this squash plant, grown a short distance from the plant in the other picture. Biorational approaches can create an improvement such as this.

Nature Does Not Waste... She Recycles

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out of existence. Even where sewage-treatment plants exist the resulting sludge residue usually ends up on unsightly dumps, as does most of the garbage, creating favorable breeding grounds for flies and rats.

Just as bad is the resulting pollution of the underlying water table, spreading to larger and larger areas every year. Today few municipal water supplies are safe without heavy chlorination. No one knows how long we can continue to consume the steadily increasing proportions of chlorine needed to sterilize our drinking water without the intake of chlorine becoming a menace to public health. Pollution by industrial waste is also a serious problem, as is obviously the dumping of raw sewage, with no treatment at all, into our waterways.

Even more important than the pollution, however, is the fact that all of these organic wastes are sorely needed to restore the land. Actually the word "waste" is incorrect, because these are the by-products from the life process, not to be wasted but necessary to maintain proper balance between growth and decay for high soil fertility and a vigorous life cycle.

In this process of decay remarkable precautions are provided by nature to prevent transfer of disease from higher forms of life via lower back again to higher—that is, from man via soil and plant back to man. Penicillin and streptomycin are both products of soil microbes which abound in humus and exemplify nature's delicate yet powerful protective devices. Compare these so-called antibiotics with man-made sulfa drugs, which until the discovery of penicillin we hailed as wonderful antiseptics, but which are now in comparative discard because of the violence of their effects. It is a profound lesson on the results obtainable by working in harmony with nature instead of against nature. Penicillin versus sulfa drugs offers an enlightening parallel to compost versus chemical fertilizers. Let us hope that the present trend towards more and more synthetics in the manufacture of these antibiotics is reversed before they lose their natural characteristics and become as harsh and violent as the sulfa drugs.

Another safeguard against the transfer of disease through municipal wastes is the high temperature developed by the microbes in a proper composting process—temperatures of 160 to 175 degrees F. This is a most reassuring margin of safety when we consider that the cysts causing amoebic dysentery, more resistant to heat than any other pathogenic organism, are completely destroyed at 122 degrees F.

The use of raw, undecomposed city wastes to fertilize land is an indefensible practice. Warnings against the consumption, especially of uncooked vegetables grown in this manner, are well founded, for such vegetables may transmit dysentery and typhoid. Although organic waste matter will slowly decompose when added to the soil, only proper composting will produce the safeguard of high temperatues.

Why then has composting, a practice many thousands of years old, failed to be universally re-adopted? Up to now there have been many stumbling blocks: it takes too much time, requires too much labor and demands considerable skill. But above all there has been a lack of understanding for the vital importance of the humus content in soil.

Except for the latter these obstacles have now been overcome, and I am confident that composting of municipal and industrial wastes of organic origin can be accomplished by a new process in as many days as it requires months to produce compost by old methods. It can be done on a large scale industrial basis, with a minimum of manual labor, at low cost and with no offensive odors. The end product is a finely granular, blackish compost, in appearance and odor like rich, fertile topsoil.

THE EWESON COMPOSTING PROCESS

This process for the manufacture of compost is briefly as follows: The organic raw materials and a quantity of acclimatized culture of soil microorganisms are mixed, shredded, and deposited in a "digester" of novel design. This is a decomposition chamber of some 5,000 cu. ft. capacity, equipped for the supply

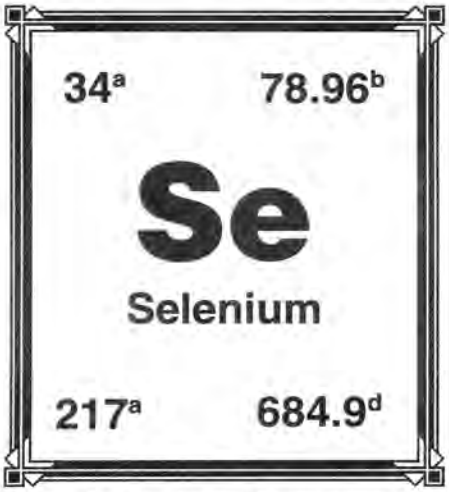
See Compost, page 10

Selenium — Best Kept Secret

by Barry Blessing, Inorganics Supervisor

Selenium is perhaps the best kept secret in trace element nutrition. Until studies showed selenium may provide some protection against heart attacks and cancer, it had received little press in human diet studies. While selenium acts as an antioxidant (much like Vitamins C and E), its benefits to humans are not yet clear—and it has the potential to be toxic at levels significantly above the RDA of 70 mg. So, while it's not a bad idea for your multi-vitamin/mineral to include selenium at reasonable levels, "mega dosing" could be dangerous.

Human and animal nutrition are only part of the selenium story. It is one of the acitve ingredients in dandruff shampoos. The greatest amount of selenium is used in the eletronics industry ... in photocells, as a semi-conductor, and in copy machines. It is also widely used as a coloring agent in plastics, paints, pigments, ceramics, and glass. ■



[a]Atomic number; [b]atomic weight; [c]melting point (°C); [d]boiling point (°C).

Midwest Laboratories Newsletter. **Vol. 17, No. 1, 1997.**

Less N, Same Yield

Pennsylvania farmers collectively reduced N fertilizer purchases by 38 percent between 1981 and 1986—from 92,500 tons to 57,400 tons, according to the Tennessee Valley Authority. Did corn yields plummet? Did the state's farmers lose out on windfall profits, and shirk their responsibility to feed the world's hungry?

Hardly. Pennsylvania corn production barely changed at all during that period. It totaled 134 million bushels in 1981 and 128 million bushels in 1986, less than a 5-percent drop.

"We're not seeing farmers growing less corn," says Richard Fox, a soil scientist at Pennsylvania State University (PSU). "We're seeing them grow as much as, or more than, they have in the past, but using nitrogen fertilizer more efficiently."

***The New Farm*, Vol. 10, No. 6.**

Strive for Perfection.....OR ELSE!

If 99 percent is good enough, then...

- Two million documents will be lost by the IRS this year.
- 811, 000 faulty rolls of 35 mm film will be loaded this year.
- 22,000 checks will be deducted from the wrong bank accounts in the next 60 minutes.
- 1,314 phone calls will be misplaced by telecommunication services every minute.
- 12 babies will be given the wrong parent each day.
- 268,500 defective tires will be shipped this year.
- 14,208 defective personal computers will be shipped this year.
- 103,260 income tax returns will be processed incorrectly this year.
- 2,488,200 books will be shipped in the next 12 months with the wrong cover.
- Two plane landings daily at O'Hare International Airport in Chicago will be unsafe.
- 3,056 copies of tomorrow's *Wall Street Journal* will be missing one of the three sections.
- 18,322 pieces of mail will be mishandled in the next hour.
- 291 pacemaker operations will be performed incorrectly this year.
- 20,000 incorrect drug prescriptions will be written in the next 12 months.
- $761,900 will be spent in the next 12 months on tapes and compact discs that won't play.
- 107 incorrect medical procedures will be performed by the end of the day today.

Texas Association of Landscape Contractors, Texas Chapter, Tyler. February, 1997.

Compost: a Dynamic Catalyst for Improving Soils

Continued from page 8

and withdrawal of air in closely controlled, variable quantities. Too much air must be avoided as carefully as too little air, the exact quantities depending on the intensity and stage of decomposition.

It is important also that in the parts of the digester where maximum microbial activity is desired the air supply consists not of fresh air from the atmosphere but of air similar to the kind found in fertile soil, which is saturated with moisture and contains from 10 to 50 times as much carbon dioxide as does atmospheric air. Such air becomes available in the process through microbial activities and can be distributed as required. With moisture the carbon dioxide forms carbonic acid, which aids in rendering the organic wastes assimilable to the microorganisms in the decomposing mass, just as happens in fertile soil.

The decompostion, which is an aerobic fermentation process, proceeds continuously, the digester being charged with raw materials (canning, tobacco, sugar, cotton, feed mill, fish and packing house wastes; leaves, garbage, sewage sludge; farming and truck-garden wastes) at the top and the finished compost being discharged at the bottom. Ground limestone may be used to maintain neutral reaction during the process. In order to compensate for the mineral deficiencies which are likely to occur in our present organic waste materials, other ground rock materials may also be added. They will be acted upon by the carbonic acid and the microorganisms with the result that the minerals will be liberated and rendered available as plant food. But no chemicals are used either as food or as stimulants for the microorganisms.

Finished compost passes through a four to six-mesh screen, leaving about 10 per cent tailings which are used as culture and thus returned to the processing. The composting process is completed in a cycle of five to seven days. It is adaptable to high degrees of mechanization and automatic controls, and causes no objectionable odors.

THE FUTURE

The all-important task now before us is to re-examine soil exhaustion, pollution and national health objectively and without prejudice as the one integral problem which it is. If my observations and proposals for solving this problem are found to be right, then the resources of American enterprise must be mobilized for another big undertaking. It has been done before and it can be done again. The need and the urgency were never greater.

To the deplorable general lack of understanding for the vital importance of the organic factors in soil management we must ascribe the fact that under most of our state laws compost may not be labeled or sold as a "fertilizer". According to these laws a "fertilizer" must contain water-soluble (available) plant nutrients in stated quanitities and be so labeled.

"The all-important task now before us is to re-examine soil exhaustion, pollution and national health objectively and without prejudice as the one integral problem which it is."

Of course, only chemical fertilizers can meet these so-called N.P.K. requirements (for nitrogen, phosphorus, and potassium). But the real value of a fertilizer cannot be determined in such an over-simplified manner, or for that matter, even by the size of the crop grown. True tests must include effects on the soil, the health of the plants, their resistance to pests, their power to reproduce and their ability to sustain healthy life in men and animals, for all of which tests our conventional small-plot testing methods are utterly inadequate. The failure to recognize these facts in the past is at the root of our troubles today and must not be repeated.

Compost, which is dynamic and alive, much like seeds of plants, cannot be evaluated simply by its initial N.P.K. content, which is comparatively low and biologically limited. The value of compost as a fertilizer is many times greater because of its principal function—that of creating additional plant food in proper balance and variety from plant residue, inert rock particles in the soil, and from the atmosphere. Moreover, the plant nutrients in compost are not lost through leaching as is the case to a considerable extent with water-soluble chemical fertilizers. This does not mean that we can suddenly afford to dispense with chemicals as fertilizing agents. That might be fatal under existing conditions. Instead, we should begin intense biological research to determine if, and to what extent, compost can be fortified with chemicals without adverse effects.

As true pioneers on their own farms and gardens, hundreds of thousands of Americans have now become convinced about the superiority of compost for growing health-giving vegetables and luxuriant flowers, resistant to ravages by pests and parasites. This is why the movement has made and continues to make such astounding progress even in these times of predominant thinking along lines of synthetics in farming and gardening. As industrial compost becomes available it is to be hoped that this pioneering spirit will reach many more commercial tillers of the soil. They too will soon discover that their present "quick and easy" ways with synthetics are an economic illusion when all factors are considered. ■

Expect the Opposite!

We should learn to expect the opposite of what we see in the world... that is, if we are following eternal principles. We must give to receive, die to live, and serve to lead. Truly this world is an "upside-down kingdom."

- When fear comes, expect faith to rise up in you..
- When disease symptoms attack, expect healing power to raise you up.
- When sadness tries to submerge you, expect joy to flood your being.
- When shortages arise, expect abundance to flow in.
- When confusion comes, expect peace and order to overtake you.
- When darkeness tries to cover you, expect God's light to shine upon you.

We *Can* Harmonize with Natural Laws!

Continued from page 4

High analysis, water-soluble commercial fertilizers can quickly improve plant appearance, but the quick glut of nutrients can make plants susceptible to disease and insect attack. For instance, a high nitrogen diet produces tall, lush, good-looking plant that have thin cell walls and high free amino acid levels, and are thus susceptible to disease and weather damage. High carbon, complete fertilizers of organic origin allow a slow release of nutrients at the rate plants need them, since when moisture and temperature conditions are prime for optimum plant growth, the rhizosphere microorganisms are also operating at their maximum, releasing nutrients rapidly to roots as they break down organic amendments. Not to be slighted is the vast array of plant hormones, regulators, vitamins, antibiotics, and other growth stimulants produced by these microbes that feed on organic additions. As a result, internal plant characteristics such as mineral and vitamin concentration, protein level, the free amino acid pool, stem lignin and cellulose content, and digestability tend to improve as nutrients are supplied through the gentle art of biological soil and plant management.

These three great qualities of organic material—(1) timed-release, (2) complete fertility composition (including considerable organic carbon), and (3) the ability to stimulate a natural shield of plant protection (natural predators and parasites of pathogens, and internal plant protection)—cannot be matched by anything within the commercial chemical world's arsenal. While the biological approach takes longer to view results following treatment, the approach has staying power, and completes the logic that Sir Albert Howard so eloquently voiced: we can adopt the methods of nature and transform disease into health by faithfully returning to the soil all available vegetable, animal, and human wastes. The soil → plant → animal → man continuum is an inviolable principle which operates irrespective of our current paradigms of soil and crop management. Soils that produce high quality plants in terms of mineral, protein, carbohydrate, lipid, and vitamin content produce healthy, vital animals and people that consume them.

High carbon, complete fertilizers of organic origin allow a slow release of nutrients at the rate plants need.

The matter of soil conservation and soil quality should be touched upon at least briefly, since the soil is a nation's most valuable resource. Any practice that benefits soil structure should be encouraged, since structure dictates the rate of rainfall infiltration and percolation, and thus runoff and that terrible nemesis of soil erosion. There remains no doubt that soil microbial activity and the abundance of polysaccharides, humic acids, and other glues and mucilages produced by bacteria, fungi, and algae are responsible for deterring soil erosion and degradation.[6] Recycling of organic residues to the soil is once more seen as not just a viable option, but a necessity in order to preserve our most important natural resource... the soil.

The task of improving plant growth and soil conditions of our agricultural and horticultural world cannot be achieved without conforming to the natural laws which first built the fertile soil of our land. These laws require the recycling of organic and mineral matter back to the soils that first produced our food, feed, and fiber. This challenge has been faced head-on by Bedminster Bioconversion and Vital Earth. Returning the organic residues from our cities back to the soil—not to landfills or to other useless corners of our world—will have a great impact on the overall health and productivity of this nation ... or of any other nation that determines the soil is really more precious than gold ... and organic matter is the "heartbeat," as it were, of the soil.[7] Harmonizing with natural laws to build our soil resources is not an impossible task. It only takes a commitment, a will to do what is right.

Bibliography and Notes

1. Balfour, E. B. 1975. *The Living Soil and the Haughley Experiment*. Universe Books, New York, New York.
2. Howard, A. 1943. *An Agricultural Testament*. Oxford University Press, London, England.
3. See reference 2.
4. Howard, A. 1972. *The Soil and Health, a Study of Organic Agriculture*. Schocken Books, New York, New York.

5. The term "biological agriculture," though widely used, may be substituted by the term "nature assisted agriculture," which Larry Finn of Bedminster Bioconversion Corporation has termed as "...the thrust of Vital Earth Resources" (*The Vital Earth News—Agricultural Edition*, Gladewater, Texas, Vol. 1, No. 1, Summer, 1996).

6. For example, as little as 0.02% of added polysaccharides from proliferating soil bacteria and fungi can markedly stabilize soil clay aggregates (R. C. Foster, "Polysaccharides in Soil Fabrics," *Science*, Vol. 214, November, 1981).

7. For an excellent discussion on the importance of soil organic matter for soil integrity, see *Crop Land or Waste Land* (R. Neil Sampson, 1981, Rodale Press, Emmaus, Pennsylvania). ■

Millions in U.S. Allergic to Pesticides

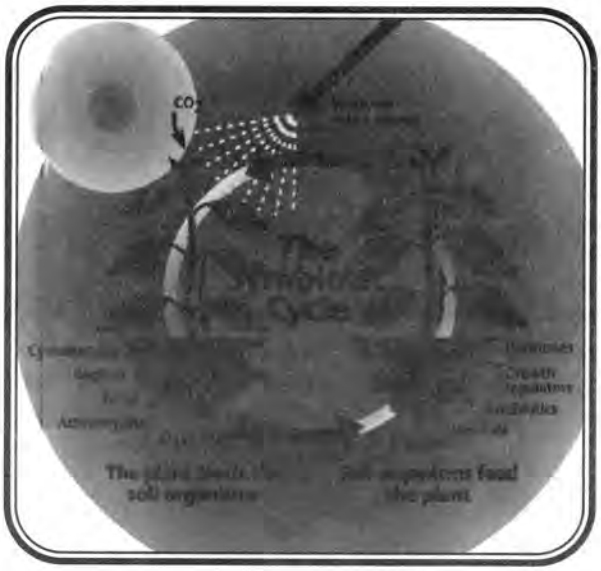
A study done by Serammune Physicians Lab in Reston, Va. states that about 16 million Americans have allergic reactions to pesticides; 5 million of them are highly allergic. The medical reactions range from sniffles in mild cases to shock and even death in severe cases. The "study shows clearly that even small amounts of pesticides are dangerous to sensitive people." The study was compiled from tests on 8,000 people over a five-year period.

— *San Francisco Chronicle*. April 2, 1990.

Statement of Purpose

Vital Earth Resources is a for-profit private corporation dedicated to the development, production, and sale of top-quality, ecologically sound horticultural and agricultural products. *The Vital Earth News, Agricultural Edition* is a periodic publication of Vital Earth Resources to inform primarily our agricultural customers and other interested parties about agricultural products and programs, and to educate our readership on the critical issues facing today's and tomorrow's food production. If you would like to receive future editions of this newsletter, please write Vital Earth Resources, P.O. Box 1148, Gladewater, Texas, 75647.

Vitazyme... a Sustainable Approach



Vitazyme, used within the context of common-sense management, will help the farmer overcome many of his production problems. While not a "magic bullet," it helps the entire system work better . . . greasing the wheels of his cropping system. Besides, the material is nontoxic and environmentally safe. Vitazyme enables the farmer to . . .

- **Increase Crop Yields and Profits**
- **Improve Crop Quality**
- **Reduce Fertilizer Nitrogen Inputs**
- **Hasten Germination and Maturity**
- **Improve Soil Structure and Infiltration**

Agriculture in the future must emphasize the use of biological systems—not strictly chemical approaches—to achieve long-term soil productivity. The promotion of life by conforming with natural laws will prevail . . . for instance, encouraging natural predators to control insect and nematode pests, or promoting more intensive biological nitrogen fixation. Stewardship of soil and plant resources must become the prime concern of the farmer, wherein Vitazyme can play an integral role.

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