# The Vital Earth News

## Agricultural Edition

Volume XVII, Number 2 | Vital Earth Resources • Gladewater, Texas | Summer, 2011


# The Future Is Organic!

## ... but it's more than organic

**By E. Ann Clark, Ph.D.**

*[The following article is abridged from a paper given at the Annual Guelph Organic Seminar Series, 14 January 2010.]*

Organic will be the conventional agriculture of the future, not because of wishful thinking or because it is the right thing to do,... You don't need to be a utopian to see the agricultural landscape of the future dominated by organic practitioners — whether in the city or in the country — if you stop to ask yourself ... why are we not organic now? ....

How did we evolve an agri-food system so centered on specialization, consolidation, and globalization? What drove us to an agri-food system that reportedly consumes 19% of the national energy budget — but only 7 of the 19% are used on the farm, with the remaining 12% incurred by post-farmgate transport, processing, packaging, distribution, and meal preparation?

This paper will present the argument that the future is organic because the design drivers that have shaped and molded the current agri-food system are changing, demanding a wholly new, and largely organic, approach to agriculture. Efforts to make the current model less bad — more sustainable — are counterproductive because they dilute and deflect the creative energy and commitment that are urgently needed to craft productive, ecologically sound systems driven by current solar energy. Although time does not permit coverage, post-oil design drivers will also necessarily demand not just organics, but novel agri-food systems emphasizing

- local/decentralized food production, and
- seasonal consumption expectations,
- from minimally processed foods.

*A petroleum based agricultural system has powered farmers for decades, but is this system sustainable for many more years?*

[O]rganic is not enough, however. Ecological soundness will require a de-emphasis on annual cropping coupled with re-integration of livestock, both to mimic the principles that sustain Nature and to dramatically reduce dependence on fossil fuels.

### Agriculture Was Not Designed to Be Sustainable

So what was agriculture designed to do? Agriculture here in the colonies was designed primarily for one thing: to export vast quantities of undifferentiated, raw commodities back to the Mother Country. We do the same thing today, but the recipient is ADM, Cargill, Smithfield, and Tyson. Arguably, agriculture performed other services as well: sustenance, a good place to raise a family,

*See Live By Current, page 2*

# Organic Matter: Making Soils Work

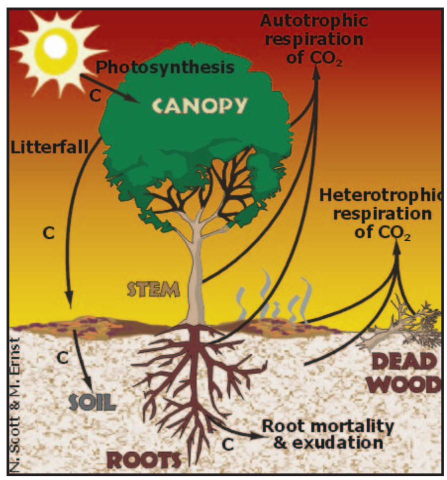
## The "Black Gold" That Drives Civilizations

**by Paul W. Syltie, Ph.D.**

All nations and civilizations depend upon the soil and its fertility for their existence. No informed person will deny the essentiality of farmers producing the food, fuel, and fiber for food and raw materials necessary to feed, clothe, and shelter the millions that populate communities across the land. Moreover, few will argue with the fact that all new wealth originates from the soil, and the plants which grow upon it.[1]

It is unfortunate that so few people draw a connection between soil organic matter and that existence of civilization. Yet, the heartbeat of soil fertility is its organic matter content, placing the emphasis of our very existence on that soil fraction which darkens the land beneath our feet, and performs so many wonderful processes. Steve Peters of Seeds of Change has stated, "The most important component for sustaining a healthy, living soil is organic matter."[2] Eddie Funderburg at the Noble Foundation relates, "Of all the components of soil, organic matter is probably

*See Radish Roots Punch, page 3*



# Live By Current, Not Stored Energy

*Continued from page 1*

and a way to make a living.

But those seeking to ensure food production in a post-oil future must first explicitly acknowledge that agriculture was never designed to be sustainable — not ecologically, not economically, and not socially sustainable, at least for primary producers.... Thus, efforts to adjust, refine, or otherwise tweak contemporary agriculture to sustain productivity are ***starting from a flawed design***....

***The issue is design***. The question is whether the current flawed design can be refined to enable sustained food production in the post-oil era, or not. And if not, then what to replace it with?....

### Historic Design Drivers

The inter-related drivers which have created today's model in the organic as in the conventional agri-food system were (a) cheap energy and (b) the pervasive externalization of costs, neither of which can persist for much longer....

Why was cheap oil such a pivotal design driver? Hindsight reveals that cheap energy was foundational to the transitory, apparent economic competitiveness of bigness, a premise which in turn facilitated the specialization, consolidation, and globalization which dominate our time.

You don't have a million head on feed in Feedlot Alley near Lethbridge, AB, to feed Lethbridge (population 85,500). You have a million head on feed because you fully expect to ship beef and be economically competitive with beef producers across the continent. You have every reason to expect this because the energy cost of transport has been tiny relative to the economies of scale you've captured (and because you are not obliged to cover the cost of the massive pollution and risk to human health that evolves from high density confinement)....

Specialized businesses tailored to producing vast quantities of bulk, homogenous product necessarily exclude or co-opt smaller scale operators by driving down prices, narrowing the profit margin, and forcing farmers to "get big or get out". Thus, the cheap energy that enables bigness is very much the driver for the specialization/consolidation/globalization trajectory that has so marked our recent past.

### Costs Externalized?

The historical willingness of society to allow or even encourage externalization of costs to the environment and to society as a whole also encouraged bigness, as in Feedlot Alley. When the price paid at the store does not reflect the true costs of production or processing, consumers are given a false perception of how cheap and easy it is to produce food, fly to Tahiti, or air condition our homes. And it is not necessarily a straightforward process to relate adverse externalized costs back to the original source....

The magnitude of costs externalized by contemporary agriculture is staggering. [One researcher] conservatively estimated that UK agriculture externalized £208/ha

***Soil erosion, a result of growing row-crops like corn and soybeans, is only part of agriculture's external damage.***

of arable and pasture land, equivalent to 89% of net farm income....

The wave of legislation and market-driven challenges to once common agricultural practices ... reflects growing societal alarm with costs externalized by agriculture. As the proverbial chickens come home to roost, whether in the form of hypoxic zones or pathogens, antibiotic-resistant bacteria, and other drug residues evolving from CAFOs, or birth defects from biocide use, society is awakening to the full meaning of "externalized costs".

Consider that:

- if every farmer had to absorb all of the costs routinely externalized on farms today, many common practices would be unimaginable because they would be prohibitively expensive, and
- if farmers were paid for all the downstream benefits society receives from ecologically sound management, such as clean air and water, robust and functional biodiversity, and food free of pharmaceuticals, antibiotic resistant bacteria, and human pathogens, many practices common on organic farms would be ubiquitous on conventional farms as well....

### Future Design Drivers

So what will drive the design of agriculture in the future? Arguably, the overriding design driver, from which everything else will follow, will be the displacement of systems dependent on stored fossil fuel with systems centering on current solar fuel (Pollan, 2008). In simplest terms, ***living on current rather than stored solar energy is an absolute prerequisite to inter-generational equity, enabling our children, and indeed all of the earth's children, to be sustained in the future***....

### Why Will Organic Go Mainstream?

Organic will predominate in the future because rising energy costs will preclude continued reliance upon energy-dependent inputs. Synthetic N alone currently accounts for about 40% of the energy budget of grain crops, encouraging a shift toward biological N fixation, but also toward less extreme levels of labile N.

The rising costs of "fixing symptoms" created by ecologically dysfunctional production systems will demand less intrusive, more ecologically sound approaches. For example, the weeds promoted by simple crop rotations will be viewed as a symptom of an unsound system, rather than as a problem. The solution then is not just to kill the weeds which will just reappear next year, but to strategically design rotations and other practices to narrow the weed niche....

### What About Organic Yields?

One argument often heard for rejecting organic approaches to food production is the perception that high yields depend integrally on resource-intensive inputs. We have become so entrained to the notion that fertilizers and biocides are essential to high crop yields that many reject even the notion of high organic yields.

When studied systematically, however, organic yields can be quite comparable to conventional yields, particularly after the 3-5 year transition interval.... After the transition interval, Pimentel et al. (2005) found no difference in corn yield or in soy yield between conventional and organic

*See Perennials Must Replace, page 6.*

# Organic Losses Must Be Reversed!

*Continued from page 1*

the most important and most misunderstood."[3] Finally, this author claims in *How Soils Work* that "The organic matter of the soil is a most critical component, since its effects are so pervasive."[4]

An early effort to assess the major effects of organic matter in soils is outlined in the classic text *The Nature and Properties of Soils,*[5] but since then many other benefits have been uncovered[6], most of which are summarized below.

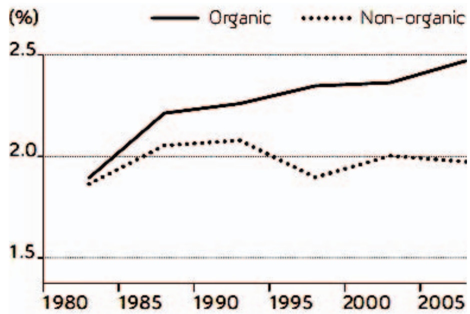
It has been found that a high soil organic content, especially with annual fresh additions, allows soil fungi, bacteria, crickets, beetles, and other organisms to consume weed seeds.[6] An aggressive microbe population also plays havoc with root pathogens, which tend to be less competitive than beneficial microbes, and helps release nutrients for plant uptake. Most of this microbial activity occurs within the rhizosphere (root zone), where the roots excrete carbohydrates and other compounds which feed the bacteria, fungi, and other organisms so critical for nutrient release and root protection.

According to the Network for Sustainable Agriculture, the entire issue of soil quality — its suitability for crops — is based on soil organic matter. "It is important to soil structure and tilth, it provides energy for soil microorganisms, improves water infiltration and water holding capacity, reduces erosion potential, and is an important element in the nutrient and carbon cycles ... the adhesive of the soil, binding together the soil components into stable aggregates."[7]

***The continuum of soil organic matter as it improves soil fertility, to crop productivity and quality, and to the health and wealth of civilizations is a truism like no other.*** It is a connection that every leader in government around the world should hang around his neck. Only by increasing to optimum levels this "black gold" for soils worldwide will mankind be able to reap his potential, individually and nationally.

To optimize this critical soil fraction we must adopt farming practices that increase its production while limiting its degradation. Tillage, the most important destroyer of the organic fraction, must be minimized, and annual returns of crop residues and animal manures must be universal. Recycling minerals and organic residues can emulate natural created laws. Our civilization, our health, and our prosperity depend upon it. Will we be equal to the task?

**TOTAL SOIL CARBON CONTENT**




***At the Rodale Institute in Pennsylvania, organic matter was diminished by conventional methods, but greatly enhanced by organic systems of crop production.***

### Bibliography


1. Wilken, Carl, *All New Wealth Comes from the Soil,* Raw Materials National Council, Washington, D.C., 1957.
2. Peters, Steve, Soil fertility basics: organic matter, Seeds of Change, Rancho Dominguez, California, 2010.
3. Funderburg, Eddie, What does organic matter do in soil? The Samuel Roberts Noble Foundation, Ardmore, Oklahoma, 2011.
4. Syltie, Paul, *How Soils Work*, Xulon Press, Fairfax, Virginia, 2002.
5. Buckman, Harry, and Brady, Nyle, *The Nature and Properties of Soils*, The Macmillan Company, New York, 1969.
6. Anonymous, The importance of organic matter to soil fertility and crop health, Midwest Organic and Sustainable Education Service, Spring Valley, Wisconsin, 2009.
7. Anonymous, Module 2: Principles and concepts of soil fertility, *Integrated Soil Fertility Management*, Network for Sustainable Agriculture, 2011. □


## Effects of Organic Matter

### Influence on physical properties

- Improves structural strength, especially water-stable aggregates
- Reduces plasticity and cohesion
- Increases water-holding capacity
- Improves infiltration and percolation of water
- Reduces rainfall runoff and soil erosion

### Influence on chemical properties

- Increases cation-absorption capacity, two to 30 times as great as mineral colloids (accounts for 30 to 90% of the adsorbing power of mineral soils)
- A storehouse of essential plant nutrients held in organic form, and are released slowly
- Contains easily replaceable cations
- Aids in the extraction of elements from minerals by acidic humus
- Buffers the soil against rapid chemical changes.[4]

### Influence on biological properties

- Provides food for microbes that release plant nutrients and combat plant pathogens.
- Reduces crop attractiveness to insect pests[6]
- Suppresses common soil-borne crop diseases[6]
- Decreases weed competition[6]

# Nitrogen Forms and Losses

**The main available forms of nitrogen are nitrate and ammonium.**

**Nitrate $[NO^{3-}]$**. ● Not readily absorbed by the soil, and free to move with water

- Can be denitrified by microorganisms in waterlogged or compacted soils, and lost to the air as nitrogen gas
- The form used by plants in the largest quantity

**Ammonium $[NH^{4+}]$**. ● Adsorbed by soil; only traces leached away

- Converted to nitrate rapidly above 50º F
- Can be fixed and unavailable in some minerals
- Under high pH conditions, can form ammonia and be lost to the air

**WANT TO BE HAPPY? ACCOMPLISH SOMETHING!**

**If you observe a really happy man you will find him building a boat, writing a symphony, educating his son, growing double dahlias in his garden, or looking for dinosaur eggs in the Gobi desert. He will not be searching for happiness as if it were a collar button that has rolled under the radiator. He will have become aware that he is happy in the course of living twenty-four crowded hours of the day.**

**Dr. W. Beran Wolfe, *Bits and Pieces*, August, 1972.**

# 15-Minute Soils Course

## Lesson 33:

# Iron (Fe): a Crucial Micronutrient

In some soils iron is so abundant that it should be considered a micronutrient — over 10% in some soils — but normally it averages about 2.5% (25,000 pm). Along with aluminum and silicate clays, iron can be solubilized and move down and accumulate in the B-horizon. It is an element that is essential for many plant functions, and seldom is deficient.

| | |
|---|---|
| 26 | 55.847 |
| Iron | |
| 1535 | 2750 |
| Fe | |

Iron is normally taken up and used by the plant in the $Fe^{++}$ or $Fe^{+++}$ ionic forms following the breakdown of hematite or other iron compounds. The element is essential for several functions (see the box), not the least of which is chlorophyll synthesis. Iron forms the "template" for the heme core of the molecule, which is then replaced by magnesium so it can capture sunlight energy. The similarities between chlorophyll in leaves and hemoglobin in blood are remarkable; see the structures above.

### Functions of Iron in Plants

1. **Chlorophyll development and function**
2. **Energy transfer within the plant**
3. **Activator of some enzymes and proteins**
4. **Plant respiration and metabolism**
5. **Nitrogen fixation enhancement**
6. **Lignin formation**

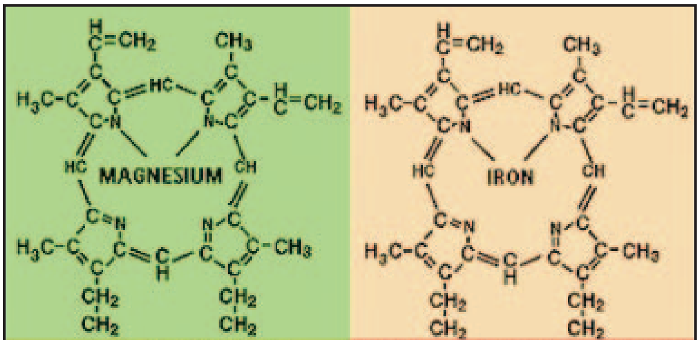
### Factors Affecting Iron Availability

Though iron is seldom limiting, it is affected by various situations.

● **High soil pH** (above 7.5), especially under good drainage, can give deficiencies; conversely, very low pH soils that are poorly drained can give toxic levels of Fe, as with Mn.

● **Low organic matter** can give deficiencies, since organic matter itself supplies iron, and the humic substances can complex iron and improve availability.

● **Water saturation, poor aeration, and compaction** reduce oxidation and increase iron availability. More of the iron is reduced to the soluble $Fe^{++}$ oxidation state.




PLANT CHLOROPHYLL MAGNESIUM AT THE CENTER

HUMAN BLOOD HEMOGLOBIN IRON AT THE CENTER

● **Nutrient interactions** are important in affecting iron availability:

***High soil P***: inhibits Fe uptake

***High fertilizer $NO_3^-$*** (nitrate): inhibits Fe uptake

***Low soil Zn***: increases Fe uptake, and vice-versa

***Low soil Mn***: increases Fe uptake, and vice-versa

***Low soil K***: may in some cases increase Fe uptake

***High soil Mo***: inhibits Fe uptake

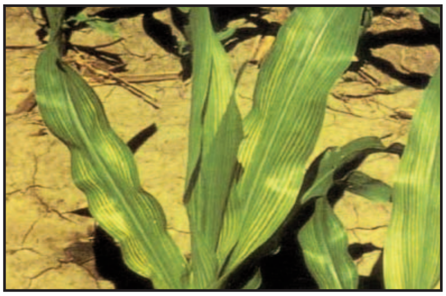
***$HCO_3^-$*** (bicarbonate): inhibits Fe uptake, in saline and alkaline soils

### Dealing With Deficiencies and Toxicities

As seen in the photos of the corn and soybean plants on the next page, interveinal chlorosis of young leaves is the most common characteristic of deficient plants. Being an "immobile" element in plants, new tissues are affected first. In severe cases, the entire plant may progressively become yellowish, and tissues will die.

Iron toxicity is usually displayed by a defi-

# 15-Minute Soils Course



*Iron deficiency for corn displays interveinal chlorosis that is noted mostly on newly developing tissues.*

*Iron deficiency for soybeans reveals chlorosis predominantly between the veins of younger leaves.*

ciency of another nutrient, since the element interacts with other elements. Toxicity can also occur with a zinc deficiency, or with a wet or compacted soil. With iron toxicity, leaves will often turn dark, and growth will be stunted.

In the rare case when iron supplementation is needed, application of iron sulfate or iron ammonium sulfate can be made in the row, or iron chelates can be sprayed on the leaves at 1 to 2 lb/acre. Oftentimes the cost of treating iron deficiency is prohibitive, so try to correct a potential problem with soil supplementation before planting, or in the spring before the growing season. Once visual symptoms are noted the crop yield will already be seriously affected.

| Iron Fertilizer | Fe, % |
|---|---|
| **Ferric sulfate [$Fe_2(SO_4)_3 \cdot 4H_2O$]** | **23** |
| **Ferrous sulfate [$FeSO_4 \cdot 7H_2O$]** | **19** |
| **Ferrous ammonium sulfate [$(NH_4)_2SO_4FeSO_4 \cdot 6H_2O$]** | **14** |
| **Iron DTPA chelate [FeDPTA]** | **10** |
| **Iron HEDTA chelate [FeHEDTA]** | **5 - 12** |

Be cautious about interpreting iron critical levels in tissue tests because the leaf sample may have been contaminated, extra but on-functional iron may be present in the leaves, and the crop may still respond to foliar iron if there is a low Fe:Mn ratio.

As for all nutrients, the availability of iron is assured by maintaining high soil organic matter levels, unless the soil pH is excessively high. Soil organic matter forms the heart of soil fertility, and it provides many additional benefits to plants besides the release of nutrients.

### See How Much You Learned

1. Iron can be taken up by the plant as $Fe^{++}$ and $Fe^{+++}$. T or F
2. Low soil zinc, manganese, or potassium will tend to ___________ iron uptake by the plant.

| Crops Especially Responsive to Iron | | | |
|---|---|---|---|
| Alfalfa | Brussel sprouts | Oats | Spinach |
| Asparagus | Cabbage | Peanuts | Strawberries |
| Barley | Cauliflower | Rye | Sudangrass |
| Beans | Celery | Rice | Tomatoes |
| Beets | Citrus | Soybeans | Turfgrass |
| Broccoli | Grass | Sorghum | |

3. Which of the following things does iron do in the plant? a. aid in chlorophyll synthesis and function; b. help in energy transfer; c. assist in lignin formation; d. activate various enzymes and proteins.
4. If a foliar iron application is in order, a chelated form is probably the best choice to use. T or F.
5. It there is poor soil aeration due to waterlogging or compaction, then iron availability will ___________.
6. Iron may become deficient in alkaline soils. T or F.
7. Chlorophyll and hemoglobin are essentially the same molecule except that chlorophyll is coordinated with ______________ and hemoglobin is coordinated with ____________.

Answers: 1.T; 2. increase; 3. a, b, c, d; 4. T; 5. increase or be higher; 6. T; 7. magnesium, iron.

# Perennials Must Replace Annuals

systems in a 21-year trial conducted in PA. Similarly, over a 9 year interval in Iowa, Delate et al. (2008) showed no significant difference in yield for corn, for soy, or for wheat yields when grown in conventional versus organic systems.

Clearly, organic management is able to provide on-farm N and pest control comparable to what is purchased off-farm in conventional systems. However, it must be noted that the longer rotations typical of organic management mean corn may be grown once in 5 or 7 years, compared to in alternate years in a typical corn-soy rotation.... Thus, total corn production in 10 years time will be much less in an organic system....

### Organic Is Not Enough for Post-Oil Agriculture

So what would ecologically sound, post-oil agriculture look like? Organic? For sure. Of necessity. But organic according to contemporary North American organic standards is not enough. Humans have a long history of farming themselves to extinction, and long before GMOs or biocides or synthetic fertilizer were invented. So the issue of resolving the problem of ecologically unsound farming is more than replacing these inputs with rotations and composting. ... as practiced today, some (most) organic farms are still ecologically unsound.

Why? Several issues can be mentioned, not least the one-way nutrient movement embodied by export-oriented agriculture, but in the interests of time, we'll consider one. I would suggest that ***the over-reliance on large-seeded annuals in agriculture is the root cause of the unsustainability of agriculture, historically and today.***

What's wrong with large-seeded annuals?! If we accept:

- that Nature is the only true and certain model of ecological soundness
- that the type of vegetation adapted to much of North America is perennial - trees and grasses
- that agriculture is an inherently unnatural system, and
- that to approach ecological soundness, agriculture must emulate the principles that sustain Nature,

... then I put it to you that ecologically sound agriculture — including organic agriculture — will necessarily rely less on annuals and more on perennials, with a central role for grass-fed livestock....

Most of global nutrition today comes from barely a dozen crops, with large-seeded annuals like corn, rice, and wheat accounting for the lion's share. So what?

> **Prof. Clark's Conclusions**
>
> 1. The future, which is coming faster than most of us appreciate, will be organic.
> 2. Agriculture, as much of modern society, evolves in response to forces or drivers. Arguably, the dominant drivers in our recent past were cheap oil and the willingness of society to tolerate costs externalized by seemingly efficient mega-scale production and processing.
> 3. Drivers change, and the system they drive necessarily also changes. Post-oil realities will advantage small-scale, organic, locally-sourced, seasonal, and minimally processed food, just as cheap oil selected for bigness, resource-based production, globalization, and processing/packaging/refrigeration.
> 4. For much of North America, agriculture - including organic agriculture - is not ecologically sustainable, in part due to the absence of perennial forages, and hence, livestock to convert the forage into human-consumable food.
> 5. The sooner that academics and government policymakers acknowledge the implications of post-oil for the structure and function of agriculture ... the easier it will be to design and educate for the future.

***Annuals introduce periodicity into nutrient sinks***, leaving gaps early and late in the year that coincide with times when precipitation exceeds evapotranspiration and the net direction of water movement is downwards. Perennials more effectively cover off these leaky intervals with active nutrient sinks earlier and later in the year

***Annuals require bare soil***. Nature has evolved strategies ... to keep the ground covered. Keeping soil bare, apart from the sown crop, means perpetual war with Nature, whether through tillage or herbicides....

***Annuals are almost always sown in monocrops, impoverishing the plant biodiversity*** so vital to many of the functions that sustain natural ecosystems, including controlling pestiferous populations. Perennial grass swards, in contrast, quickly become biodiverse even if sown to just a few species, and are thus better able to sustain ecosystem functions.

***Annually re-setting a field back to the pioneer stage loses the accumulating advantages of succession***, which include building soil organic matter and nutrients, with follow-on benefits in water conservation, risk management, and disease/pest control. Again, perennials intrinsically capture these advantages, which is why withholding land from cultivation under a perennial grass sward actually builds and regenerates soil damaged by annual cropping....

I put it to you, then, that whether fruit and nut trees or grass swards, perennials will have to account for a much larger share of the agricultural landscape if our goal is ecologically sound agriculture....

Designing for the post-oil future means tailoring agricultural crops, practices, and expectations to the soil, climatic, and managerial constraints of each region. And for much of North America, that means a whole lot less annual — and especially grain — cropping. In other words, tailor the agriculture to fit the environment, rather than trying to shoehorn-in annual crops to an environment suited to perennials....

The exclusion of livestock from many farms, including many organic farms, challenges ecological rationality, exceeds the forgiveness limits of Nature. "... Earth never attempts to farm without live stock; she always raises mixed crops; great pains are taken to preserve the soil and prevent erosion; the mixed vegetable and animal wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility...." ☐

# How Glyphosate (Roundup) Works

**by Jeffrey Smith**

*[Jeffrey Smith is a world leader in understanding the dangers of GMOs.]*

The herbicide doesn't destroy plants directly. It rather cooks up a unique perfect storm of conditions that revs up disease-causing organisms in the soil, and at the same time wipes out plant defenses against those diseases. The mechanisms are well-documented but rarely cited.

- The glyphosate molecule grabs vital nutrients and doesn't let them go. This process is called chelation and was actually the original property for which glyphosate was patented in 1964. It was only 10 years later that it was patented as a herbicide. When applied to crops, it deprives them of vital minerals necessary for healthy plant function—especially for resisting serious soilborne diseases. The importance of minerals for protecting against disease is well established. In fact, mineral availability was the single most important measurement used by several famous plant breeders to identify disease-resistant varieties.
- Glyphosate annihilates beneficial soil organisms, such as Pseudomonas and Bacillus bacteria that live around the roots. Since they facilitate the uptake of plant nutrients and suppress disease-causing organisms, their untimely deaths mean the plant gets even weaker and the pathogens stronger.

***Pot A, glyphosate treated plant on sterile soil; Pot B, glyphosate treated plant on normal soil; Pot C, control.***

- The herbicide can interfere with photosynthesis, reduce water use efficiency, lower lignin, damage and shorten root systems, cause plants to release important sugars, and change soil pH—all of which damage crop health.
- Glyphosate itself is slightly toxic to plants. It also breaks down slowly in soil to form another chemical called AMPA (aminomethylphosphonic acid) which is also toxic. But even the combined toxic effects of glyphosate and AMPA are not sufficient on their own to kill plants. It has been demonstrated numerous times since 1984 that when glyphosate is applied in sterile soil, the plant may be slightly stunted, but it isn't killed. (See the photo on the left.)
- The actual plant assassins, according to Purdue weed scientists and others, are severe disease-causing organisms present in almost all soils. Glyphosate dramatically promotes these, which in turn overrun the weakened crops with deadly infections.

This is the herbicidal mode of action of glyphosate. It increases susceptibility to disease, suppresses natural disease controls such as beneficial organisms, and promotes virulence of soilborne pathogens at the same time. If you apply certain fungicides to weeds, it destroys the herbicidal activity of glyphosate!

By weakening plants and promoting disease, glyphosate opens the door for lots of problems in the field. There are more than 40 diseases of crop plants that are reported to increase with the use of glyphosate, and that number keeps growing as people recognize the association between glyphosate and disease. ☐

# Some Notes On Soil Testing

**by Paul W. Syltie, Ph.D.**

Soil testing is serious business. If you are going to test your soil, do it right or you will not gain much from your efforts. Follow these steps:

- **Use a probe if possible**, and collect at least 10 random subsamples to 7 inches depth for each uniform soil area having the same cropping history.
- **Send the sample to a reputable independent soil testing laboratory**.
- **Get expert consultation to interpret the results**. Soil test interpretation is an art as much as it is a science.

## True Morale

**Morale is when your heart and hands keep working, and your mind says it cannot be done.**

## 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* is a periodic publication of Vital Earth Resources to inform customers and other interested parties about our products and programs, and to educate our readership on critical issues facing growers today and in the future. If you would like to receive future issues of this newsletter or product information, simply fill out the form on the right and mail or Email it to us.

***Yes!* Send me a subscription to *The Vital Earth News* and/or product information!**

- ❑ *The Vital Earth News Agricultural Edition* (two issues per year)
- ❑ Carl Pool water soluble fertilizers
- ❑ Potting soils, mulches, and compost
- ❑ Vitazyme, Aqua-Min, and Odor-X
- ❑ I am a ( ) farmer or grower, ( ) retailer, ( ) other interested party.

Name _______________________________________

Address _____________________________________

City/State/Zip _______________________________

Telephone and/or fax (optional) ______________________

Mail to: **Vital Earth Resources, P.O. Box 1148, Gladewater, Texas 75647**

Email to: **pwsyltie@yahoo.com**

**Vitazyme** is being introduced in many countries around the world, improving yields and quality for crops of all types, and increasing farmers' profits. Here are three examples from across the Pacific.



**Philippines**. *An entire experimental farm is dedicated to Vitazyme trials.*

**Australia**. *Corn responded excellently to Vitazyme on seeds.*


**Viet Nam**. *A field day reveals Vitazyme success with rice.*