



The Vital Earth News

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How to Rebuild Soil Fertility

by Neal Kinsey
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[This is the third in a series of articles aimed at helping farmers improve their crops by improving the productivity of the soil. Neal is the author of Hands On Agronomy, available from Acres U.S.A., P.O. Box 91299, Austin, Texas 78709.]

What kind of soil fertility should the average farmer or grower expect to have? Most farmers have land that has been in production for many years. A sizeable portion of the land will have received only N-P-K and lime over those years. But many who make their living in agriculture tell us that in spite of new seed varieties and good management practices, their yields have either stagnated or begun to drop. When it comes to production and/or quality, this is the case in spite of using as much or even more fertilizer than before. A large number of clients tell us at the start of using our program that they just want to achieve

what they used to achieve in terms of the crop production.

Follow the program to get results

We have clients who sample every different type of soil in every field every year, and strive to do all that the soil test



The development of highly productive soils is a critical issue that should be addressed by all farmers, and should be based on a strong scientific foundation together with in-field experience.

indicates needs to be done. And for "high dollar" crops this may be followed by several leaf tests per year. Clients

have been amazed at the increased productivity of their "good soils" after three years of following our recommendations for improving those good soils. For yields to reach an appropriately high level we find there is more to bringing them up in fertility than just adding nitrogen, phosphate and potassium. The higher the yields have been the more one must closely evaluate fertility needs. Soils do not have an endless supply of the required range of nutrients in forms that are available for plant use, other than what is supplied with typical N-P-K fertilization.

Assessing the cost

Most growers will not be so blessed to have soils that can be built up or restored to excellent fertility levels on the same fertilizer budget they have been using. The exceptional growers would be those who have maintained an excellent liming program and/or have been successfully using higher amounts of phosphate and potassium. If you are working with large acreage, just expect that in the

See Consider the Albrecht, page 2

Vitazyme for Mexico Sales continue to increase

By Robert Hudak, President
Ag Biotech, Lakeville, NY

The Cortes brothers — Tito, Francisco, and Alberto — along with the help of Ing. Antonio Munes, have been marketing Vitazyme in Baja California for the past two years through the company Partes y Servicios Agricolas. The first year they conducted trials and saw very quickly how Vitazyme could benefit Mexican agriculture. Then it was simply a matter of telling their customers about it.

Vitazyme was used on onions, tomatoes, peppers, lettuce, strawberries, and pasture grasses. The next year sales quadrupled as Mexican farmers learned how they could boost their productivity and profits with Vitazyme. This year sales have expanded to include growers in Sinaloa and Jalisco Provinces.

Vitazyme is typically applied through drip irrigation at the rate of 13 oz/acre (1 liter/hectare). Most long-season vegetable crops benefit from three applications. Vitazyme is applied with the first irrigation



Pictured here at the World Ag Expo at Tulare, California, in February of 2002 are (L to R) Scott Hammer, president of Vital Earth, Alberto Cortes of Partes y Servicios Agricolas and Robert Hudak, president of Ag Biotech.

See Success in Mexico, page 7

Consider the Albrecht Model

Continued from page 1

beginning it may cost you more than a “sensible” budget will allow. That is, until you verify on some of your own land that these expenditures will truly pay for themselves.

Where to start

If a soil fertility building program appeals to you, but you wish to limit your budget, consider sampling perhaps 10% of the acreage to learn what is needed. Do not just sample the worst 10%; that will generally be the most expensive soil to correct. Send some good soils, some average areas, and some problem soils for testing. This will give an idea of what amendments will be needed in all of these various situations, and provide an opportunity to see what nutrients are in your better soils as compared to the poor ones.

Next, determine to set aside enough of your fertilizer budget for at least a field or two so you can follow through on the program each year for the next three years. Make the acreage large enough so you can buy materials in economical quantities, and small enough to not cause economic hardship for your overall operation. You do not have to test the entire acreage, but test enough to validate whether the benefits of fully implementing the program will justify the fertilizer costs.

The Soil Test

The Albrecht Model of Soil Analysis and Recommendations is a soil management program designed to help the grower achieve excellent results. The soil analysis measures the nutrients available to the plant through specific laboratory methods. Such measurements effectively reflect the soil’s ability to provide the elements in the form the plants require for both top production and top quality. The soil test results in most instances will show balanced soil nutrient levels in areas of high crop yields.

Yield variations will map to soil nutrient balance variations. To test this

relationship, some clients have produced a yield monitor map showing yield variations across a field, and asked us to tell them from the soil samples of that field where the good and bad yields will be! The areas of “good yield” will usually be the same areas shown by the soil test to be closest to the ideal nutrient balance, and areas of “poor yield” are most likely to be shown as most lacking in essential nutrients which affect that crop. The Albrecht model of testing is that accurate — if the soil sampling is done as prescribed, and the nutrient analyses are interpreted correctly.

The accuracy of the soil analysis is further verified by the fact that for every

its own set of measurements, generally very different from those used with the Albrecht Model of testing. For example, we express levels of trace elements such as zinc, copper, and manganese in different terms than do other soil testing laboratories. As a rule, our soil test numbers will be much higher. This may cause alarm to some consultants and fertilizer dealers who are not trained in what our numbers actually represent! And these people may say (incorrectly), after seeing our numbers, that soil nutrient levels are already too high, when actually the levels may still be quite deficient.

The important thing to know, though, is how well the soil test numbers can be

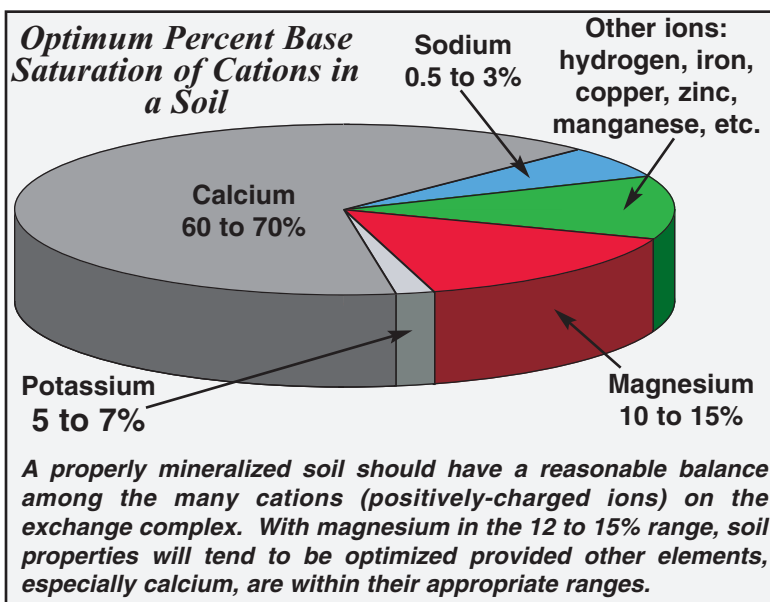
used to determine how a sampled area performs, what the crop potential is when the proper nutrient levels are achieved, and what materials are needed to achieve those levels. Is the soil test accurate enough, and does the person who uses it, provide experienced advice to determine the good production areas from the bad? Does the consultant explain how the soil test report levels will be affected by the materials and recommendations he suggests?

Test your soil tester; that includes us too if you wish!

More on Albrecht Model Concepts

There are several concepts related to the Albrecht Model of soil testing which can be verified by using the test itself, along with observing field conditions. Some of those concepts will be briefly mentioned here.

First is the concept of soil balance. Some professionals say there is no such possibility as balancing soil minerals. But by testing the soil and measuring nutrient levels, and noting the fate of added nutrients, it is possible to document how increasing the availability of one element in the soil will reduce the availability of one or more of the others. In other words, when adding a nutrient element to the soil and holding it there



pound of plant-available fertilizer material applied, the soil test will accurately detect this addition as long as the soil pH is not excessively high. The soil test for micronutrients also picks up additions of those elements to the soil, pound for pound. This is true as long as the micronutrients are properly applied, and adequate time is allowed for the minerals to show up as available on the soil test. Even with a very high soil pH you can generally build the mineral levels, though more time and material may be required. From our experience, many growers with excellent yields are still losing out in both yield and quality because trace elements are so limiting in their soils.

Understand the Numbers!

Every soil testing company will have

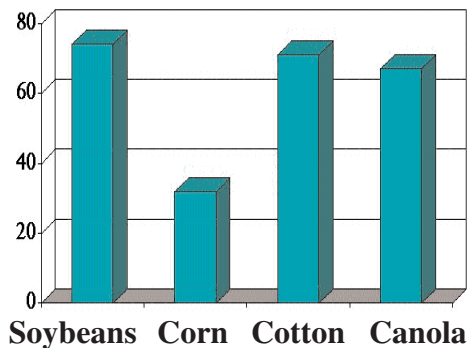
See Correct Deficiencies, page 3

Genetic Engineering of Crops Continues

By Paul W. Syltje, Ph.D.

The biotech industry has continued its push to increase the acres of genetically engineered crops across the nation and the world. In January of 2002 the industry claimed an

Percentage of Crops Planted with GE Seeds — 2002



18% increase in global acreage of such crops, although much of this supposed increase is a result of U.S. government subsidizing and below market cost dumping of Monsanto's Roundup ready soybean seed in Argentina (*Biodemocracy News*, No. 39, May 9, 2002). In March of this year, the United States Department of Agriculture estimated that genetically engineered crops planted in the U.S. would comprise 74% of all soybeans, 32% of corn, 71% of cotton, and 67% of canola.

A major problem, however, has occurred in some areas with the cross-pollination of these genetically altered varieties crops and non-engineered crops

in the same areas. This problem becomes especially serious when the altered genes are introduced to areas of genetic origin of certain crops, like corn in Mexico.

In the November, 2001, issue of the prestigious scientific journal *Nature*, two University of California scientists showed that genetically engineered corn, despite a government ban on its introduction, had polluted non-engineered corn varieties in over a dozen communities in southern Mexico. The biotech industry and pro-biotech scientists forced *Nature* to print a retraction of the article, but the executive secretary of the Mexican biodiversity commission later reported that the degree of genetic contamination in many areas of Mexico was "... far worse than originally reported" (*The London Guardian*, April 19, 2002).

According to *The London Guardian*, up to 95% of all corn plots were contaminated by gene-altered DNA. In one field, 35% of all plants were contaminated, and 8% of all kernels were contaminated. The Mexican executive secretary was forced to admit, "[Genetic pollution has occurred] at a speed never before predicted. This is the world's worst case of contamination by genetically modified material because it happened in the place of origin of a major crop. It is confirmed. There is no doubt about it."

Many biotech disasters or near-disasters have occurred over the past decade because the biotech firms have not adequately evaluated their seeds. For instance, Y-1 tobacco was developed to produce a super-high level of nicotine,

and was surreptitiously placed in the tobacco of several popular brands of cigarettes. Such a high level of the addictive nicotine made it extremely hard for smokers to quit, and even made the farmers dizzy when they handled it (*Biodemocracy News*, No. 39). Most people know of the Starlink fiasco, when in September of 2000 it was discovered that this allergenic variety had contaminated nearly 10% of the U.S. corn harvest. The herbicides sprayed on these herbicide-tolerant crops, of course, are toxic to the human body. Bromoxynil, for instance, is sprayed on genetically engineered cotton and can cause liver tumors, spinal and skull defects, reduced fetal weight, and fetal development disorders.

"The genetically engineered crops now being grown represent a massive uncontrolled experiment whose outcome is inherently unpredictable. The results could be catastrophic." Dr. Barry Commoner

A return to selection of open-pollinated crop varieties is the way out of the genetic manipulation Armageddon that is facing mankind. Once foreign genomes are introduced into the environment they cannot be brought back. Let us hope that those ever released by our crop scientists will not mean disaster to our land and its people instead of a cornucopia of healthful foods. □

Correct Deficiencies to Control Excesses

Continued from page 2

until the plant can use it, it is imperative that another element be displaced from the soil colloid to make room for it.

The Albrecht Model is based on this concept of element replacement. The process of achieving soil mineral balance is an extremely important principle to understand, especially as to how it relates to soil productivity. The soil nutrient balancing program is built upon the understanding that every time a deficient element is added, it will reduce any

other element that is excessive in that soil. In other words, having too little of one nutrient in the soil means having too much of others. Supplying what is lacking is the primary approach to controlling any nutrient excess in the soil. This is the meaning of soil balancing using the Albrecht Model.

Just keep in mind that it is always best to FIRST correct deficiencies; this will help remedy any excesses. The problem may not be completely solved, but this approach is always the best and most

efficient beginning. Extreme elemental excesses may require the continued use of high amounts of another element to help completely eliminate the excess, and thus remedy the resulting problems. An excess is always a problem for growers because too much of one element in the soil means there is not enough of something else. In that regard, balancing soil nutrients, one against all others measured, is extremely important to soil fertility management, and to yields and quality of production. □

15-Minute Soils Course

Lesson 15:

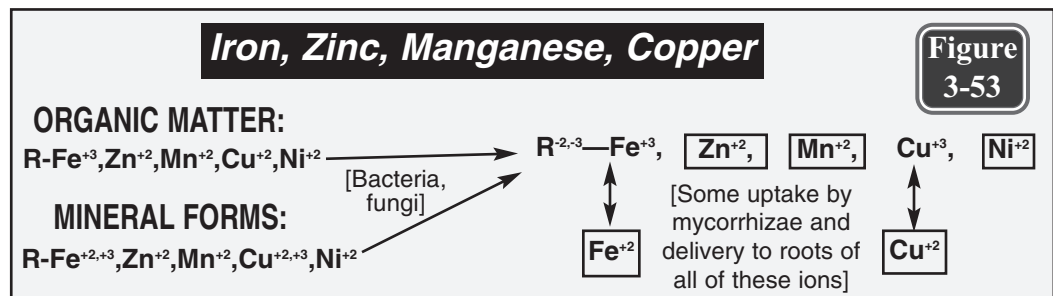
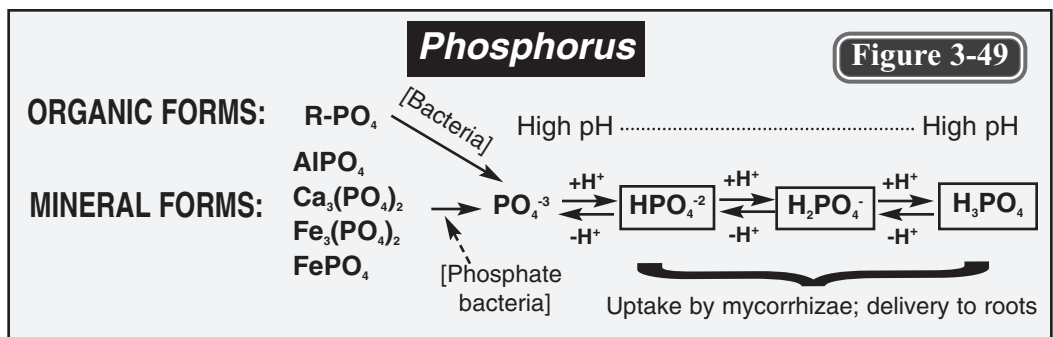
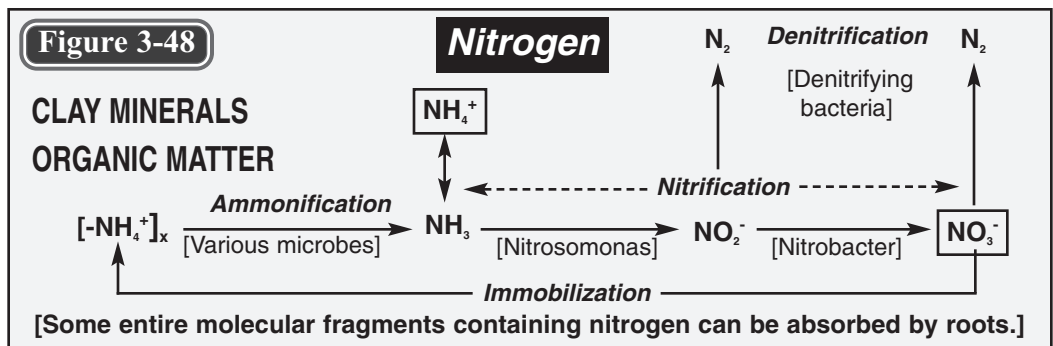
How Microbes Make Plant Nutrients Available

Soil microorganisms and some macroorganisms, such as earthworms, are highly important — in many cases essential — in making plant nutrients available. This is not to say that strictly chemical processes do not operate in making nutrients available, but rather that the chemical processes are caught up with microbial activities. For example, soil phosphate compounds release phosphorus very slowly, but the VA mycorrhiza dramatically assist the plant in collecting this and other immobile elements through its extensive hyphal network.

Many soil scientists today claim that nutrient absorption by plants is mostly chemical in nature, governed by mass flow of nutrients in soil water and by diffusion through the soil water, with direct interception by the extending root being limited except for immobile elements. Past estimates of uptake mechanisms minimized the importance of the mycorrhizae in moving immobile elements to root surfaces, or of bacteria and fungi first immobilizing nitrogen, and then releasing it through the grazing of protozoa, nematodes, microarthropods, and earthworms. Refer to Lesson 9 on the “Soil Foodweb” for

details concerning nitrogen release via protozoa, microarthropods, and other soil microbes.

Soil organisms play a highly important role in the nutrient uptake process. Roots indeed intercept nutrients as they extend through the soil, and a significant portion of some nutrients like calcium can be taken up by non-biotic root uptake mechanisms and the transpiration stream. Yet, the fact remains that the nutrients are brought into available form largely through microbial transformations. Thus, while nitrate is moved to the root in large part by mass flow, its



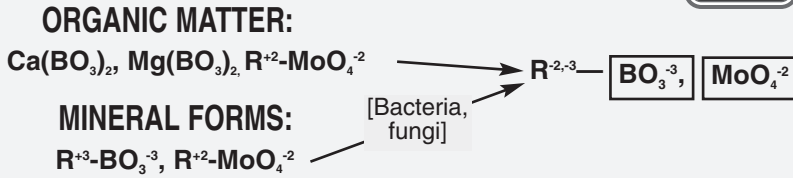
conversion to nitrate is mostly a biochemical, microbial process.

Note the accompanying figures which illustrate how each element is transformed by microorganisms to available forms. The plant-available nutrient forms are enclosed in boxes.

15-Minute Soils Course

Boron, Molybdenum

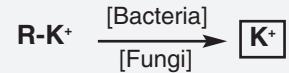
Figure 3-54



role. In all cases, however, the mutualism of soil microorganisms and earthworms as mediators

Potassium

MINERAL FORMS:



[Virtually all forms of potassium in soils are in mineral form.]

Figure 3-51

of the nutrient supply and transformation between the soil and the root is pervasive. In normal soil environments there is an absolute requirement for bacteria, algae, fungi, protozoa, nematodes, arthropods, actinomycetes, and other organisms to transform elements into the forms they are needed by plants.

See How Much You Learned

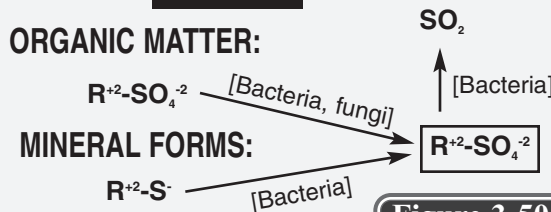
1. Soil microbes are needed to make all plant nutrients available. T or F
2. Vesicular-arbuscular _____ are very important in making plant nutrients available, and transporting them to the plant.

One phosphorus researcher has depicted microbial activity as a "wheel" that rotates in the soil, simultaneously consuming and releasing phosphorus to the soil solution¹⁷³.

It is clear throughout these nutrient transformations that soil microbes are extremely important in every case, whether release of the nutrients is

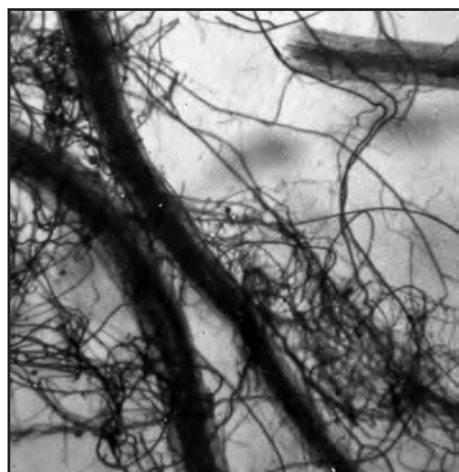
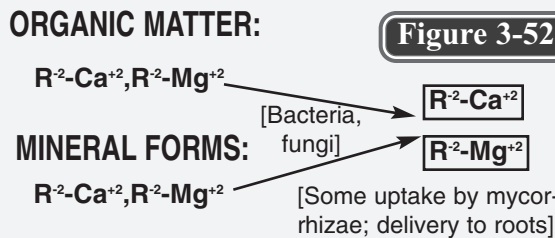
Sulfur

Figure 3-50



Calcium and Magnesium

Figure 3-52



Mycorrhizal hyphae surrounding these roots help the plant draw many of the more immobile elements to the plant than the root hairs can themselves.

from organic matter or minerals. In some cases, as with nitrogen and sulfur, the intervention by microbes is essential, while with others such as potassium and molybdenum microbes play a less prominent

3. Which of the following forms of phosphorus are available to plants?
a. HPO_4^- ; b. H_2PO_4^- ; c. H_3PO_4 ; d. PO_4^-
4. Plants get nutrients from the soil from both _____ and _____ forms.
5. Earthworms help make nutrients in the soil more available. T or F
6. Microbes in most cases must transform nitrogen to _____ in order for plants to use it.
7. Which of these groups of microbes are involved in soil nutrient transformations?
a. Bacteria, b. Protozoa, c. Nematodes, d. Algae

Answers: 1. T; 2. mycorrhizae; 3. a, b, c; 4. organic, mineral; 5. T; 6. nitrate; 7. a, b, c, d.

Dry Aqua-Min Is Now Available!

An added convenience for livestock rations

By Paul W. Syltje, Ph.D.

Research began in 2001 to develop a dry form of Aqua-Min to replace the liquid form for use in dairy, beef, poultry, hog, and horse rations. Many farmers find it easier to add the dry form than the liquid; it can more easily be mixed with the total ration in many cases. Efficacy is the same on a volume basis: one gallon of liquid equals one gallon of dry Aqua-Min. On a weight basis, one pound of liquid equals only 5/8 pound of dry Aqua-Min because the carrier used for the dry form weighs less than water, the carrier for the liquid formulation.

On-farm use has provided some helpful hints for using the dry form of Aqua-Min. Because the active agents greatly stimulate microbial activity within the organic carrier, leaving the product open to the air under warm conditions leads to molding and caking. This hardening makes mixing with feed difficult and changes the characteristics of the product, although it will still function well as an internal metabolic stimulant.

To remedy the caking problem Aqua-Min is now supplied in 35 pound (net) sealed plastic pails, thus greatly reducing air contact and virtually eliminating cak-

ing. Once the pail is opened and partially used it should be covered again tightly until the next use. One pail will treat a total of 2,240 head of dairy cows per day, 8,960 head of sheep or goats, or 179,200 full-grown chickens per day.

Use rates for dry Aqua-Min are the same as for the liquid form on a per volume basis. These rates per day are shown in the following table.

Rates for Feeding Aqua-Min

Milk cows.....	8 ml
Feeder cattle.....	1 ml/100 lb
Horses.....	8 ml
Sheep and goats.....	2 ml
Chickens.....	0.1 ml
Turkeys.....	0.25 ml
Swine.....	3 ml
In general, feed 1 ml per 100 lb of body weight per day. For young stock, lower the rate according to weight.	

The active agents in Aqua-Min promote better health and feed utilization for all types of livestock. These facts were proven in two back-to-back replicated studies at a state-of-the-art dairy in Idaho, where it was discovered that Aqua-Min reduced the somatic cell

(white blood cell) count of the milk by 70%. This indicated fewer infections in the treated cows. The results of their reduced stress were improved milk output, more fat and protein in the milk, and a return per dollar of product invested of up to \$9.24.

Such positive results can be explained by the active agents multiplying microbial activity within the stomach and intestinal tract of the animal, resulting in better cellulose digestion of ruminants and improved feed breakdown and nutrient uptake for all types of livestock. Reduced stress in fighting infections allows more energy to be utilized in adding pounds of beef, poultry, or milk, or laying more eggs. Fewer veterinary bills and a lower death loss result as well, boosting profits. Some growers report a calmer disposition and sleeker coats of the animals. Besides, manure odor is significantly reduced for treated animals, such as dairy and beef cattle, because the undigested protein in the manure, which on breakdown causes the odors, is more thoroughly digested within the animal.

Livestock raisers are encouraged to try the new and easy-to-use dry Aqua-Min. It is a sure way to improve health and profitability of all animals. □

Thirteen Years Later: Chemicals Still Do Not Necessarily Increase Crop Yields

By Paul W. Syltje, Ph.D.

It has been 13 years since the landmark publication *Alternative Agriculture* was issued by The National Academy of Sciences. This book was intended to help sway Congress into accepting the notion that government ought to encourage farmers to adopt less orthodox practices of farming that were more "organic" and less harsh to the environment and to people's health.

In that book it was shown that farmers who apply few or no chemicals to crops are usually as productive as those who use pesticides and synthetic fertilizers. The brave agricultural scientists who drafted the document were trying to

turn the focus of agricultural policies that have for decades increased farm production through the heavy use of pesticides, drugs, and synthetic fertilizers towards natural farming techniques.

What has been the legacy of that NAS study? There has been a slow but relentless move by many farmers towards organic and sustainable systems. An estimated 1.35 million acres of land were certified organic in 1997, and certified organic livestock were grown in nearly half of the states. From 1997 to 1999 the organic acreage in California increased by 38%, while the organic acreage in Washington increased by 150%. Farm Verified Organic, a certifying agency, increased their certified acres by 55%

over these same two years. Only a very small percentage of the country's grain and bean acreage is organically certified, but nearly a third of the buckwheat, herbs, and mixed vegetables produced today are grown on certified organic acres. Besides, the acres under zero or minimum tillage practices has skyrocketed over the last two decades ... and all through this period yields have not suffered. □

The real measure of your wealth is how much you would be worth if you lost all your money.

Bits and Pieces, February 7, 1991.

Success in Mexico With Vitazyme

Continued from page 1

to activate the rhizosphere and get the crop off to a good start. Follow-up applications are made every 3 to 4 weeks. Substantial reductions in conventional fertilizer applications have been made with Vitazyme usage. The savings in fertilizer, combined with the increase in yield, have put Vitazyme in strong demand. "Everybody likes it", says Tito.

"... the exact mechanism for pink root suppression ... may be due to the plant's ability to outgrow the damage ..."

"Vitazyme is very suitable to use on onions in fields infested with pink root", says Francisco Cortes. "We have a customer who could not grow onions last year without using Vitazyme because otherwise the crop would be lost to pink root. Without Vitazyme we got no crop at all! With Vitazyme we got a good crop. Vitazyme produces a lot more roots on the onion plant."

While the exact mechanism for pink root suppression has not been studied, it may be due to the plant's ability to outgrow the damage, as well as to the increased competition for rhizosphere resources by beneficial organisms that keep the pink root organisms in check.

Francisco also notes the success that transplanted crops experience when Vitazyme is applied just before transplanting, as either a dip or a spray, or as they are set out in the field. "Vitazyme reduces stress on the plants, and they recover very fast after transplanting." Partes Servicios Agricolas has sold Vitazyme this spring for watermelon production for the first time.

Many Mexican soils develop salt stress due to a buildup of salts from high salt fertilizers under constant irrigation. Vitazyme mitigates salt damage and allows the plant to thrive even under these adverse

conditions. Production and quality improvements are often dramatic when Vitazyme is used in a well-balanced fertility program.

This year Vitazyme sales are projected to increase by 20 to 30% over last year's phenomenal growth. This product and its associated program will be paying big dividends on into the future for the farmers of Mexico. □



These Vitazyme treated onions grown in New York are typical of those grown in Mexico through the consultation of Robert Hudak of Ag Biotech.

The Power of Enthusiasm!

As you walk or ride or drive to work in the morning, or as you begin the day's housekeeping or start another day in school, force yourself to become enthusiastic about the tasks ahead of you. Determine deliberately in your mind and heart that the day's duties will not only deserve and receive your very best, but that you will approach them enthusiastically. A surprising thing will take place ...: if you act enthusiastic, very shortly you will find yourself *becoming* and *being* enthusiastic.

Arthur DeMoss and David Enlow, *How to Change Your World in 12 Weeks*, Fleming H. Revell Company, Old Tappan, NJ, 1969.

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 it to us.

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- 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 an () individual, () retailer, () grower

Name _____

Address _____

City/State/Zip _____

Telephone and/or fax (optional) _____

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

Vitazyme improves not only the yield, but also the feeding value of silage corn. In a New York study in 2001, silage tonnage increased by 14%, and milk income/acre increased by \$285 when Vitazyme was directly incorporated into fertilizer.



Vitazyme was applied at 13 oz/acre directly into the dry fertilizer, in a 2x2 inch placement beside and below the seeds.



P.O. BOX 1148 · Gladewater, Texas 75647