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Soil and Civilization

The Nation That Abuses Its Soil Risks Annihilation

By Paul W. Syltie, Ph.D.

Perhaps no other topic has aroused such varied and vociferous responses and counter-responses as the causes for the rise and fall of empires. Many historians have vehemently defended their claims that political intrigues or weaknesses are the principle causes this demise.

One major disciple of history, Edward Gibbons, outlined eight essential reasons why the Roman Empire collapsed. These he set down in his six-volume monumental work *The Decline and Fall of the Roman Empire*[1], but in general he touted the fact that luxury of the populace was the crowning blow that brought down the regime.

1 **Decline in Morals and Values.** The dramatic increase of divorce undermined the institution of the family. Crimes of violence made the streets of the larger cities unsafe, prostitution thrived, and gladiator sports and personal pleasure were exalted.

2 **Public Health.** Many of the wealthy had water brought to their homes through lead pipes, so the death rate of the wealthy was very high. Those who lived on the streets were in continuous contact with others citizens, allowing for an uninterrupted spread of disease. The Roman Empire had extended so far that diseases from other lands could easily reach Rome.

This desert in Israel was once a productive pastureland, but after centuries of overgrazing and neglect it is barren and wasted.

3 **Political Corruption.** The Romans never created an effective system to determine how new emperors would be selected. In 100 years, Rome had 37 different emperors, 25 of whom were removed from office by assassination. People lost their faith, both religiously and in their government. The efficient Roman Government gave way to chaos and disintegration.

4 **Unemployment.** During the latter years of the empire farming was done on large estates called *latifundia* that were owned by wealthy men who used slave labor. A farmer who had to pay workmen could not produce goods as cheaply. Many farmers could not compete with these low prices and lost or sold their farms and moved to the cities, where unemployment and crime were rampant.

5 **Inflation.** High taxes due to lavish government programs and a reduction in the flow of gold from fewer newly conquered nations led to inflation.

6 **Urban decay.** Wealthy Romans lived in a *domus*, or house, with marble walls, floors with intricate colored tiles, and windows made of small panes of glass. Most Romans, however, were not rich, They lived in small, smelly rooms in apartment houses with six or more stories called

See Parity Pricing Would Help, page 2

Opioids in the Milk We Drink!

The Opioid Epidemic Has Spread to the Humble Cow

By Keith Woodford

[Professor of Farm Management and Agribusiness at Lincoln University in New Zealand, and author of *Devil in the Milk, Illness, Health, and the Politics of A1 and A2 Milk* (Chelsea Green Publishing Company, White River Junction, Vermont, 2007)]

This book is about the effects on human health of a tiny protein fragment called beta-casomorphin-7, or BCM7 for short. This fragment is implicated in the genesis of heart disease, Type 1 diabetes, autism, and schizophrenia.

BCM7 is unquestionably a powerful opioid and hence a narcotic. It is also an oxidant. It is formed by digestion of a particular type of milk protein produced by some cows. This milk protein is called A1 beta-casein.

The BCM7 that is released from A1 beta-casein has been implicated in many illnesses, including heart disease, Type 1 diabetes, and autism. And there is increasing evidence that it is associated with milk intolerance and an additional

She is a fine looking animal, highly productive innocent-looking, but her milk is likely to contain BCM7, and that is a problem.

See Devil in the Milk, page 3

Soil Degradation—a Worldwide Plague

Continued from page 1

islands, or on the dangerous streets.

7 **Inferior Technology.** The Romans built marvelous roads, bridges, and aqueducts. They established the first system of medicine for the benefit of the poor, but since the Romans relied so much on human and animal labor they failed to invent many new machines or find new technology to produce goods more efficiently.

8 **Military Spending.** Maintaining an army to defend the border of the Empire from barbarian attacks was a constant drain on the government.

These eight factors of Rome's destruction sound hauntingly familiar to conditions in modern-day America and other Western nations. Yet, one factor that Gibbons did not list was perhaps the most important of all: the lack of proper attention to the soils upon which the Empire depended for its food, feed, and fiber.

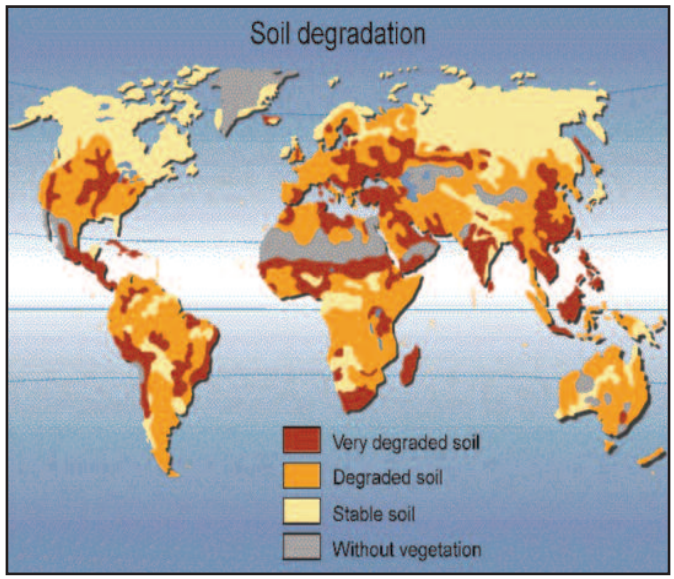
Soil, the Foundation of Civilization

Certain prophets of the modern era have pointed towards the loss of soil productivity through erosion, and soil health in general, as the major cause for the fall of empires throughout history. During the Dust Bowl days of the 1930s in the United States, a growing awareness of the importance of soil conservation to stave off the incredible loss of topsoil due to wind erosion began to take shape, and led to the creation of the Soil Conservation Service (SCS). An awareness of even greater losses due to water erosion also reared its head and motivated the head of the SCS, Hugh H. Bennett, to crusade for the preservation of the nation's most critical resource.

In 1938 and 1939, W. C. Lowdermilk, assistant chief of the SCS at that time, made an 18-month foray into western Europe, North Africa, and the Middle East to study soil erosion and land use in those areas. In 1948 he published a scathing indictment of the history of mankind in abusing the soils upon which he lives in *Conquest of the Land Through Seven Thousand Years*[2].

During tours through England, Holland, France, Italy, Algeria, Tunisia, Egypt, and several countries of the Middle East, his tour cut short by WWII, he saw firsthand the ravages of mankind's abuse of the soil. At the site of ancient Carthage he stated, "Over a large portion of the ancient granary of Rome we found the soil washed off of bedrock and the hills seriously gullied from overgrazing. The valley floors are usually still cultivated but are still eroding in great gullies fed by accelerated storm runoff from barren slopes. This was an area that once supported many great cities in Roman times."

This scene was repeated all over areas of North Africa, the Middle East, and the Balkans, oftentimes where goats had grazed off all available vegetation, leaving nothing to protect the soil when rains arrived. Relics of many Roman cities were apparent over many areas. In Syria, the topsoil had been entirely removed from some areas where once had stood thriving cities and great populations.



The 1950s witnessed continuing indictments of the failure of many farmers to adequately protect their land from water and wind erosion. Vernon Gill Carter and Tom Dale authored *Topsoil and Civilization*[3], which reiterated many of the same concerns that Lowdermilk had a decade earlier. They pointed out how only three civilizations in the world had not ruined their soil resources in time: those in the Nile Delta, in Mesopotamia, and in the Indus Valley. Elsewhere, historical records reveal that, over the millennia of earth's history, civilized man, with few exceptions, was never able to continue a progressive civilization in one locality for more than 800 to 2,000 years.

Civilized man's dominion over the land in one locale usually lasted only a few generations, and after the culture flourished for a time it began to decline, and eventually disappear. Interestingly, the more brilliant the culture the shorter its lifespan.

Edward Hyams in *Soil and Civilization*[4] carried the issue even further when he characterized man as a parasite and disease organism feeding upon the soil. "But when a people at a very high technical level intrude upon a virgin soil community, or upon an old artificial soil community, they possess the means to impose their will: they will offer no terms, make no adjustments in their native practices, concede little or nothing to the invaded soil. They will probably introduce their own native practices at that level of efficiency which they have reached at home, and which, perhaps, their own soil has been adapted to during hundreds, even thousands of years. Or they may, by their scientists, devise intellectually, new practices, with an insufficient understanding of the conditions in which these practices are to be applied."

Modern Prophets

Wendell Berry, in *The Unsettling of America, Culture and Agriculture*[5], makes plain that the mistreating of our soils and the environment as a whole has created an ecological crisis, which is actually a crisis of character, a crisis of the type of agriculture that is used to work the land, and a crisis of the culture of these people. He challenges the moral underpinnings of mankind's entire approach to soil management, underpinnings tied to industrial economics and scientific innovations that assault natural laws and are driven by profit-maximizing economics.

The list goes on of scientists, farmers, some few legislators, and others who see through the thin facade of ill-conceived dogmas thrust upon the precious soil of earth, that thin layer of topsoil that sepa-

See An Eleventh Commandment, page 6

Zoopharmacognosy: Animals and Birds Eat Their Own Cures

By Paul W. Syltie, Ph.D.

It has long been known that living creatures have an inborn sense of utilizing plants and other substances to cure their ailments. Let us take a quick peek at a few of these cases to better appreciate the inborn wisdom of the created world.

Great apes often consume plants that have no nutritional value but which have beneficial effects on gut acidity or combat intestinal parasitic infection.

Chimpanzees swallow whole leaves of particular rough-leaved plants such as Aneilema aequinoctiale; these remove parasitic worms from their intestines.

African elephants apparently self-medicate to induce birth by chewing on the leaves of a particular tree from the family Boraginaceae.

Domestic cats and dogs often select and ingest plant material, apparently to induce vomiting.

Indian wild boars selectively dig up and eat the roots of pigweed which humans use as an anthelmintic. Mexican folklore indicates that **pigs** eat pomegranate roots because they contain an alkaloid that is toxic to tapeworms.

Many animals eat soil or clay, a behaviour known as geophagy. The clay may absorb toxins such as phenols and alkaloids, adjust the gut pH, act as an antidiarrhetic, add minerals to the diet, and counter parasites. **Cattle** in the tropics eat clay-rich termite mound soil to deactivate pathogens or fruit toxins.

Many parrot species in the Americas, Africa, and Papua New Guinea consume kaolin or clay, which releases minerals and absorbs toxic compounds from the gut.

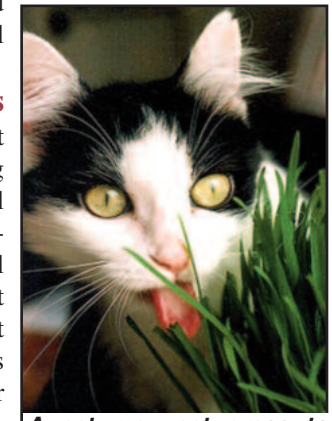
Woolly bear caterpillars [*Grammia incorrupta*] are sometimes lethally endoparasitised by tachinid flies, so the caterpillars ingest plant toxins called pyrrolizidine alkaloids, which improve the survival.

Tobacco hornworms ingest nicotine, which reduces colony growth and lethality of *Bacillus thuringiensis*.

North American brown bears make a paste of Osha roots [*Ligusticum porteri*] and saliva and rub it through their fur to repel insects or soothe bites.

Many songbird species perform "anting", either grasping ants in their bills and wiping them vigorously along the feathers, or roll in ant hills. The ants spray formic acid that kill lice.

Birds may select nesting material rich in antimicrobial agents that protect themselves and their young from harmful agents. ❐



A cat may eat grass to induce vomiting and the expulsion of worms.

Devil in the Milk and the Opioid Epidemic

Continued from page 1

range of auto-immune diseases. Metaphorically, it is "the devil in the milk."

The "milk devil" story is built upon more than a hundred scientific papers published in international journals, and on documents from milk marketing companies. It is a story that has never been brought together before.

The BCM7 protein fraction in A1 milk is a true opioid, and is linked to heart disease, Type 1 diabetes, autism, and schizophrenia.

There is strong evidence that the milk devil is produced only from the milk of cows that are of European origin, and then from only some of these cows. Asian and African breeds of cows are free of it (unless they have some hidden European ancestry). So are goats. And so (with a very minor but fascinating qualification) is human milk.

No one can tell by looking at a cow whether or not she is a source of the milk devil. However, genetic testing is possible, and it is also possible to test the milk. Farmers can breed cows that are free of the problematic protein by using appropriately tested bulls and semen.

Anyone who buys ordinary milk at the supermarket can be sure that it will contain milk from many cows and therefore there will be lots of A1 beta-casein in it. However, the level varies between countries, and even between regions. Some countries such as Australia, New Zealand, Finland, the United States, and Great Britain have milk with high levels of this protein. The milk in others, such as Iceland, France, and the island of Guernsey has much lower levels.

We don't have to stop drinking cows' milk to avoid this devil. But we do have to drink milk from cows that have been tested and found to be free of what is called the A1 variant (or 'allele') of the beta-casein gene. Milk that is free of A1 beta-casein is known as A2 milk. All milk used to be A2 milk until a natural mutation affected some European cows long ago.

A2 milk is available in more than 1,000 Australian supermarkets and stores, although with a low market profile. It is also available in a very limited number of stores in New Zealand. In 2007 it became available for the first time in seven mid-western states of the USA. The reasons why A2 milk has had such a low market profile are a major part of the story.

Throughout this book I often refer to A1 milk. This is essentially a shorthand for milk that contains some A1 beta-casein, the source of the milk devil.

The story of A1 versus A2 milk may sound stranger than fiction. It is a story of how science works and doesn't work. It is also a story of how the forces of big business and the so-called 'health industry' work, and of how wishful thinking can get in the way of truth. ❐

15-Minute Soils Course

Lesson 46: Conservation Tillage

More and more farmers nowadays are seeing the wisdom of conserving the soil and optimizing soil biology through what is known as conservation tillage. This term encompasses a rather wide range of tillage practices, but they all have in common the idea of disturbing no more than 30% of the soil surface, leaving plants or crop residue to protect the soil.

Conservation tillage includes no-tillage, direct-drilling, minimum tillage, and/or ridge-tillage, to denote that the specific practice has a conservation goal of some nature. Because tillage is minimized, the horribly destructive effects of rupturing the soil mass are much reduced, and the natural laws governing soil health and soil fertility are optimized.

The Benefits of Conservation Tillage

Conservation tillage is based on the integrated management of soil, water, and agricultural resources in order to reach the objective of economically, ecologically, and socially sustainable agricultural production. It relies on three major principles:

1 **Minimal soil disturbance by directly planting through the soil cover without seedbed preparation**

2 **Maintenance of a permanent vegetative soil cover or mulch to protect the soil surface**

3 **Diversified crop rotations in the case of annual crops, or plant associations in the case of perennial crops**

The concept of conservation tillage has evolved from the zero tillage technique. In zero tillage, seed is placed into the soil without any soil disturbance through any kind of tillage activity, or only with minimal soil disturbance. Over time soil life takes over the functions of traditional soil tillage like loosening the soil and mixing

Strip Tillage. ***Only a limited strip is worked up for the seeds of row crops to be planted, on a flat planting surface.***

No-Till. ***The entire soil surface is left untilled except the track of the planter to insert the seed, thus leaving residues to cover the soil.***

Cover Crops. ***A legume or other crop is planted after the crop is harvested to reduce erosion, suppress weeds, and improve the soil.***

15-Minute Soils Course

the soil components, such as by earthworms and ants.

In addition, increased soil biological activity creates a stable soil structure through the accumulation of organic matter. Conversely, mechanical tillage disturbs this process. Mechanical tillage is avoided, which helps to maintain the existing interactions between soil flora and fauna, which are necessary to release plant nutrients. Seeds are directly put into the soil without any prior tillage or minimal tillage.

The biomass produced in the system is kept on the soil surface rather than incorporated into the soil or burned, which provides physical protection for the soil against agents of soil degradation, and also grants food for soil bacteria, fungi, algae, and other microbes. With crop residues retained on the soil surface, processes that lead to improved soil quality and reduced erosion are enhanced.

Ridge Tillage. *The seeds of row crops are planted in a raised ridge, and residues are concentrated between the rows.*

Because minimum tillage allows the farmer to pass through the field only once at planting, there is less fuel used and less compaction. In addition, time is saved so crops can be planted in a more timely manner.

Thus, it is easy to see that zero or minimum tillage, and the maintenance of soil cover in the form of crop residues or cover crops, are important factors in improving soil health. At the same time, crop rotations, usually involving legumes, are important to manage pest and disease problems and improve soil quality through biological nitrogen fixation and organic matter additions.

Conventional Tillage. *The moldboard plow inverts the entire topsoil and leaves little trash on top, encouraging soils to erode.*

See How Much You Learned

1. Conservation tillage involves a. maintaining a permanent soil cover, b. using crops rotations, c. minimally disturbing the soil, d. compacting the soil.

2. Minimum tillage tends to improve soil structure. T or F

3. Working only a narrow strip of soil to plant the seeds is termed _____.

4. The following are terms used to describe conservation tillage: a. ridge tillage, b. no-till, c. flat-till, d. zero tillage.

5. Maintaining soil biology in the top layers of soil is a major goal of conservation tillage. T or F

6. Conservation tillage reduces the use of _____ because of fewer trips to prepare the seedbed.

7. The moldboard plow is a useful tool to improve soil conditions and reduce erosion. T or F

Answers: 1. a, b, c; 2. T; 3. strip tillage; 4. a, b, d; 5. T; 6. fuel or energy; 7. F.

An Eleventh Commandment for Soils

Continued from page 2

rates him from famine. That list includes F. H. King in *Farmers of Forty Centuries*[6], R. Neil Sampson in *Farmland or Wasteland*[7], John Hart in *The Land That Feeds Us*[8], and the list goes on.

Yet, somehow these prophetic platitudes foreshadowing civilization's precarious stroll along the cliff's edge are buried within the gallant efforts of farmers trying to simply stay alive within the economic pressure cooker of low prices and information overload. The necessity to protect the soil is acknowledged, but the practicality to implement solutions that favor such truth takes a back-row seat to the survival of well-intentioned farmers.

Perhaps the lessons of Rome's fall ought to be studied by everyone so we might change our ways and avoid the same fate. In any case it would be wise to consider what W. C. Lowdermilk suggested as what might be termed the "Eleventh Commandment." **"You shall inherit the land as a faithful steward, conserving its resources and productivity from generation to generation. You shall safeguard your fields from soil erosion, your living waters from drying up, your forests from desolation, and protect your hills from overgrazing, that your descendants may have abundance forever. If any shall fail in this stewardship of the land, your fruitful fields shall become sterile stony ground and wasting gullies, and your descendants shall decrease and live in poverty or perish from off the face of the earth."** ❐

1. E. Gibbon, *The Decline and Fall of the Roman Empire*, Allen Lane, New York, 1788.
2. W. C. Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, USDA—SCS, MP-32, Washington, D.C., 1948.
3. V. G. Carter and T. Dale, *Topsoil and Civilization*, Revised Edition, University of Oklahoma Press, Norman, Oklahoma, 1974.
4. E. Hyams, *Soil and Civilization*, Harper and Row, New York, 1952.
5. W. Berry, *The Unsettling of America, Culture and Agriculture*, Avon Books, New York, 1977.
6. F. H. King, *Farmers of Forty Centuries*, Rodale Books, Emmaus, Pennsylvania, 1911.
7. N. Sampson, *Farmland or Wasteland*, Rodale Books, Emmaus, Pennsylvania, 1981.
8. J. F. Hart, *The Land That Feeds Us*, W. W. Norton and Company, New York, 1991.

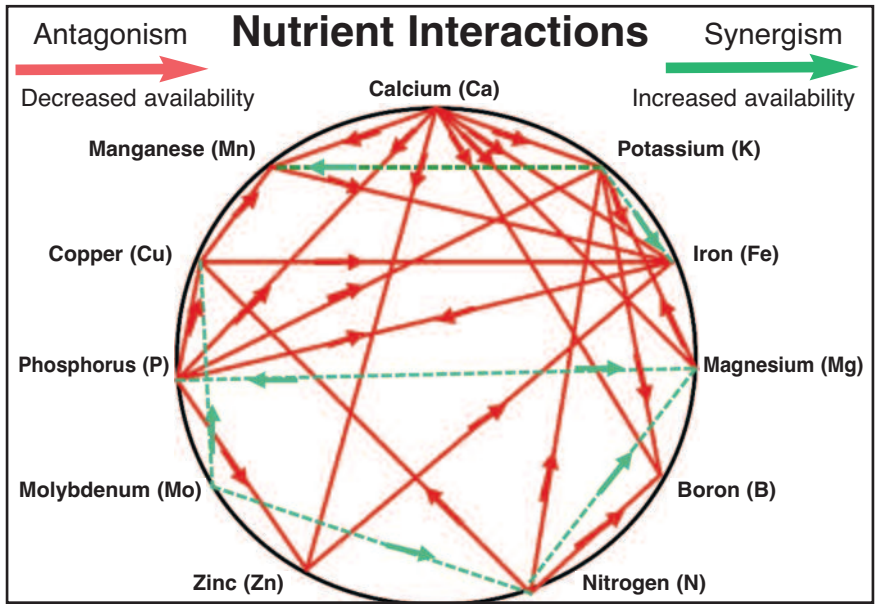
Plant Nutrient Interactions

By Paul W. Syltie, Ph.D.

The interaction of elements in plants and soils is an extremely important phenomenon that needs to be considered when fertilizing for high yields and quality. This process can be defined as "the interaction between nutrients in crop plants when the supply of one nutrient affects the absorption and utilization of other nutrients." This type of interaction is most common when one nutrient is in excess concentration in the soil, but can occur when there is a deficiency of nutrients.

The figure here shows some of the major synergisms and antagonisms that occur, but there are many more. It is also wise to understand that these are not hard and fast rules that occur in all instances, because they are influenced by a host of factors including plant species and variety, temperature and rainfall, sunlight, and cultural practices.

Some of the major interactions are as follows.



Antagonisms
(a high level of one element reduces the uptake of another element)

1. High nitrogen levels can reduce the availability of boron, potassium, and copper.

2. High phosphorus levels can influence the uptake of iron, calcium, potassium, copper, and zinc.

3. High potassium levels can reduce the availability of magnesium.

Synergisms

(a high level of one element increases the uptake of another element)

1. High nitrogen levels create a demand for more magnesium. In general, the more nitrogen that is applied the more of all elements that are taken up by the plant.

2. High potassium levels mean more manganese is required by the plant.

Health Consequences

There are nutritional consequences resulting from these interactions. For instance, high levels of molybdenum in the soil and herbage will reduce an animal's ability to absorb copper into the blood stream; ruminant animals grazing these areas must be fed or injected with copper to supplement their diet. Pastures that are fertilized heavily with potassium can cause magnesium levels in the grasses to drop greatly, leading to a disease caused hypomagnesemia (grass tetany), which symptoms are hyperexcitability, muscular spasms, convulsions, respiratory distress, collapse, and death, especially in adult lactating animals. ❐

The Disappearing Family Farm

By Dale L. Schurter

A class of society is being lost, and with it, iconic barns and sprawling rural landscapes are fading at an alarming rate. The concept of a small family farm—one that has been owned and operated by one family for possibly several generations—has been all but destroyed.

The ever-encroaching crush of urbanization plays a major part in the disappearance of the family farm. "According to the Census of Agriculture," a United States Department of Agriculture report revealed, "the number of U.S. farms fell sharply until the early 1970s after peaking at 6.8 million in 1935. By 2002, about 2.1 million farms remained."

"The American Farmland Trust estimates an acre of U.S. farmland goes into development every two minutes, while Environment Colorado estimates the state lost 1.26 million acres of agricultural land between 1997 and 2002," The *Denver Post* reported. "This loss averages 690 acres per day in Colorado, the third highest in the nation."

As the farming community ages, those within it and the land they own come under intense pressure. "Aging farmers and ranchers, whose average age has risen from 52 to 57 during the last 20 years, are often retiring without a younger family member willing to take over, thus too often removing multi-generation ranches and farms from production."

Statistics show that less than a third of farms have a designated successor in the family. Many young couples are unwilling to invest $500,000 in a business that requires them to work 12-16 hours per day throughout most of the year and then get a return that amounts to the equivalent of what a farmer's wages would have been 30 years ago.

Bright city lights are another distraction. Today, farming is looked down upon while city-based, high-paying white-collar jobs are glamorized. Also, some farmers do not want their children to have to "work as hard as I do," and advise them to pursue a different profession.

Another reason for the disappearing family farm is the ever-increasing disparity between dwindling income and soaring expenses. Net farm income in 2000 dropped to $39.7 billion—the lowest since 1995. On the other hand, production expenses rose to $197.5 billion or 88 percent of gross cash income—the highest since 1980-1984.

While food prices have gone up substantially in supermarkets, the wages farmers are paid have been left out of the equation. Although private manufacturers can include all their costs plus a fair profit, government boards often set prices for what farmers receive for their products. Because of this, the United States Bureau of Labor Statistics projected that farmers will have the largest job loss of any occupation.

Giant agribusinesses are an additional factor. Even though 90 percent of all farms are still owned by families or individuals, more and more farms are becoming "corporations."

In this technologically advanced world, most are unaware that a prosperous society does not hinge on acquiring gadgets, vehicles or other luxury items. Rather, a significant indicator of a healthy society is the stability of the family unit. As small farms vanish from the countryside, with them disappears one of the best environments capable of producing strong, character-driven families. This—building strong character—is the most tragic loss as family farming dies out. ❐

[*Condensed from The Disappearing Family Farm,* The Real Truth, *www.rcg.org*.]

Acquiring Wealth

There seem to be but three ways for a nation to acquire wealth. The first is by war, as the Romans did, in plundering their conquered neighbors. This is robbery. The second by commerce, which is generally cheating. The third by agriculture, the only honest way, wherein man receives a real increase of the seed thrown into the ground, in a kind of continual miracle, wrought by the hand of God in his favor, as a reward for his innocent life and his virtuous industry.

Benjamin Franklin

Statement of Purpose

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A Study in Mexico Shows the Powerful Effect of Vitazyme to Protect Against Gray Mold

Induction or Resistance to Gray Mold [*Botrytis Cinerea*] in Strawberry With Vitazyme

By Agr. Lucero Berenice Fernández Alejándrez, a study for the International Masters in Protected Agriculture degree, University of Guanajuato, Mexico, and the University of Almeria, Spain. Below is the summary of the study.

A small-plot, replicated experiment was conducted in Irapuato, Guanajuato, México, in order to study the possible induction of resistance to Gray Mold [*Botrytis* sp.] in strawberries [*Fragaria* sp.], var. Fortuna, by a mixture of brassinosteroids + triacontanol + B-vitamins (Vitazyme) and with the fungicide iprodione (Rovral WP 50), alone and combined.

Treatment	Vitazyme	Rovral
1	0	0
2	1 L/ha	0
3	0	1.5 kg/ha
4	1 L/ha	1.5 kg/ha
5	0	1 kg/ha
6	1 L/ha	1 kg/ha
7	0.5 L/ha	0
8	1.5 L/ha	0

Vitazyme, at the dosage rates of 1 L/ha and 1.5 L/ha, and Rovral fungicide, at rates of 1 and 1.5 kg/ha, in three fortnightly (15 day) foliar sprays, reduced significantly the incidence and the severity of Gray Mold, and conversely increased significantly yields, incomes and net profits, both when applied alone, as well as when applied in combination in the same sprays and plots, and in the latter case (applied in combination, at 1 L/ha + 1 kg/ha, respectively) showed the lowest incidences and severities of the disease and the highest yields, incomes, and net profits, i.e., their effects were additive or synergistic. Vitazyme also had a more persistent effect on the disease than Rovral fungicide over the three weekly application-to-evaluation intervals. In Vitazyme, the lower than recommended rate of 0.5 L/ha did not show significant effects over the untreated control, while in Rovral there were no differences in any case between the recommended rates of 1 and 1.5 kg/ha. On the other hand, Vitazyme, in the rates of 1 L/ha and 1.5 L/ha showed significant and marked increases in quality parameters: brix or soluble solids percentage and thus sweetness of juice and in fruit firmness or consistency, in Newtons, as well as a much higher yield of fruit harvested for packaging (better appearance and consequent higher price), while Rovral fungicide had no effect on any quality parameter in any dosage rate.