The Vital Earth News
RESOURCES
Agricultural Edition
Volume XX, Number 2 Vital Earth Resources • Gladewater, Texas Summer, 2014

# Commercial Nitrogen Shown to Reduce Soil Organic Matter

**By Tom Philpott**

***"Fertilizer is good for the father and bad for the sons"*** - Dutch saying

For all of its ecological baggage, synthetic nitrogen does one good deed for the environment: it helps build carbon in soil. At least, that's what scientists have assumed for decades.

If that were true, it would count as a major environmental benefit of synthetic N use.... Moreover, carbon-rich soils store nutrients and have the potential to remain fertile over time—a boon for future generations.

The case for synthetic N as a climate stabilizer goes like this. Dousing farm fields with synthetic nitrogen makes plants grow bigger and faster. As plants grow, they pull carbon dioxide from the air. Some of the plant is harvested as crop, but the rest—the residue—stays in the field and ultimately becomes soil. In this way, some of the carbon gobbled up by those N-enhanced plants stays in the ground and out of the atmosphere.

Well, that logic has come under fierce challenge from a team of University of Illinois researchers led by professors Richard Mulvaney, Saeed Khan, and Tim Ellsworth. In two recent papers the trio argues that the net effect of synthetic nitrogen use is to reduce soil's organic matter content. Why? Because, they posit, nitrogen fertilizer stimulates soil microbes, which feast on organic matter. Over time, the impact of this enhanced microbial appetite outweighs the benefits of more crop residues. *[This does not occur when normal root exudation stimulates microbial populations, as with Vitazyme application—Ed.]*

And their analysis gets more alarming. Synthetic nitrogen use, they argue, creates a kind of treadmill effect. As organic matter dissipates, soil's ability to store organic nitrogen declines. A large amount of nitrogen then leaches away, fouling ground water in the form of nitrates, and entering the atmosphere as nitrous oxide ($N_2O$), a greenhouse gas with some 300 times the heat-trapping power of carbon dioxide. In turn, with its ability to store organic nitrogen compromised, only one thing can help heavily fertilized farmland keep cranking out monster yields: more additions of synthetic N.

*See The Morrow Plots, page 2*

# The Livestock Pandemic You May Not Have Heard About

**By Paul W. Syltie, PhD.**

I don't often write about livestock issue in *The Vital Earth News*, but a matter has come up that is really affecting me, as it is virtually every hog producer in the country. It is an issue that has been virtually blacked out by the major news media for some odd reason.

The matter I am referring to is Porcine Epidemic Diarrhea Virus, better known as PEDV. This issue is important whether you consume pork or not, because it is indicative of some deeper problems within the food industry of the United States. First, let us cover a bit of history concerning this disease.

***Pigs are being threatened by a highly virulent virus called PEDV. Is the epidemic related to feeding GMOs?***

The PEDV was first recognized in the United States in May od 2013, and since has infected farms in over 27 states. According to veterinary researchers at Virginia Tech, the virus strain most likely originated from Anhui Province in China. The incubation time is only two to four days, and it kills nearly 100% on infected young piglets within a few days of contracting the virus. The disease is spread primarily through consuming the

*See PEDV Tied to GMO Soy, page 3*

# The Morrow Plots Have Their Say!

*Continued from page 1*

The loss of organic matter has other ill effects, the researchers say. Injured soil becomes prone to compaction, which makes it vulnerable to runoff and erosion and limits the growth of stabilizing plant roots. Worse yet, soil has a harder time holding water, making it ever more reliant on irrigation. As water becomes scarcer, this consequence of widespread synthetic N use will become more and more challenging.

In short, "the soil is bleeding," Mulvaney told me in an interview.

If the Illinois team is correct, synthetic nitrogen's effect on carbon sequestration swings from being an important ecological advantage to perhaps its gravest liability. Not only would nitrogen fertilizer be contributing to climate change in a way not previously taken into account, but it would also be undermining the long-term productivity of the soil.

### An Old Idea Germinates Anew

While their research bucks decades of received wisdom, the Illinois researchers know they aren't breaking new ground here. "The fact is, the message we're delivering in our papers really is a rediscovery of a message that appeared in the '20s and '30s," Mulvaney says. In their latest paper, "Synthetic Nitrogen Fertilizers Deplete Soil Nitrogen: A Global Dilemma for Sustainable Cereal Production," which appeared last year in the *Journal of Environmental Quality*, the researchers point to two pre-war academic papers that, according to Mulvaney, "state clearly and simply that synthetic nitrogen fertilizers were promoting the loss of soil carbon and organic nitrogen."

That idea also appears prominently in *The Soil and Health* (1947), a founding text of modern organic agriculture. In that book, the British agronomist Sir Albert Howard stated the case clearly: "The use of artificial manure, particularly [synthetic nitrogen] … does untold harm. The presence of additional combined nitrogen in an easily assimilable form stimulates the growth of fungi and other organisms which, in the search for organic matter needed for energy and for building up microbial tissue, use up first the reserve of soil humus and then the more resistant organic matter which cements soil particles."

In other words, synthetic nitrogen degrades soil.

That conclusion has been current in organic-farming circles since Sir Albert's time. In an essay in the important 2002 anthology *Fatal Harvest Reader*, the California organic farmer Jason McKenney puts it like this: "Fertilizer application begins the destruction of soil biodiversity by diminishing the role of nitrogen-fixing bacteria and amplifying the role of everything that feeds on nitrogen. These feeders then speed up the decomposition of organic matter and humus. As organic matter decreases, the physical structure of soil changes. With less pore space and less of their sponge-like qualities, soils are less efficient at storing water and air. More irrigation is needed. Water leaches through soils, draining away nutrients that no longer have an effective substrate on which to cling. With less available oxygen the growth of soil microbiology slows, and the intricate ecosystem of biological exchanges breaks down."

> ***"We also know that their analysis is consistent with the founding principles of organic agriculture: that properly applied manure and nitrogen-fixing cover crops, not synthetic nitrogen, are key to long-term soil health and fertility."***

Although those ideas flourished in organic-ag circles, they withered to dust among soil scientists at the big research universities. Mulvaney told me that in his academic training—he holds a PhD in soil fertility and chemistry from the University of Illinois, where he is now a professor in the Department of Natural Resources and Environmental Sciences—he was never exposed to the idea that synthetic nitrogen degrades soil. "It was completely overlooked," he says. "I had never heard of it, personally, until we dug into the literature."

What sets the Illinois scientists apart from other critics of synthetic nitrogen is their provenance. Sir Albert's denouncement sits in a dusty old tome that's pretty obscure even within the organic-agriculture world; Jason McKenney is an organic farmer who operates near Berkeley—considered la-la land by mainstream soil scientists. Both can be—and, indeed have been—ignored by policymakers and large-scale farmers. By contrast, Mulvaney and his colleagues are living, credentialed scientists working at the premier research university in one of the nation's most prodigious corn-producing—and nitrogen-consuming—states.

### The Dirt on Nitrogen, Soil, and Carbon

To come to their conclusions, the researchers studied data from the Morrow plots on the University of Illinois' Urbana-Champaign campus, which comprise the "the world's oldest experimental site under continuous corn" cultivation. The Morrow plots were first planted in 1876.

Mulvaney and his collaborators analyzed annual soil-test data in test plots that were planted with three crop rotations: continuous corn, corn-soy, and corn-oats-hay. Some of the plots received moderate amounts of fertilizer application; some received high amounts; and some received no fertilizer at all. The crops in question, particularly corn, generate tremendous amounts of residue. Picture a[ Corn Belt] field in high summer, packed with towering corn plants. Only the cobs are harvested; the rest of the plant is left in the field. If synthetic nitrogen use

***Albert Howard, father of the modern organic movement, had a lot to say about synthetic nitrogen applications.***

*See Fertilizer N and Soil Carbon, page 7*

# PEDV Tied to GMO Soybean Products?

*Continued from page 1*

feces of infected animals.

Over 5 million pigs have died of the disease since May of 2013. In January of 2014 about 1.3 million pigs died. The sickness is spreading like wildfire across the country, and is a major topic of concern amongst farmers in most areas, Yet, few people on the streets of America's cities know about it, at least not yet. They will once the price of pork skyrockets due to supply shortages within a year. Thankfully PEDV is not communicable to humans.

PEDV affects only swine, It produces severe and profuse diarrhea and vomiting that rapidly transmits through all ages of hogs in a facility. Pre-weaned piglets under three weeks of age nearly always die from it, while older hogs are sickened but may recover within a few weeks. There is no vaccination or treatment yet known; all that can be done is to try and keep the animals hydrated and comfortable.

The virus is so virulent that, according to one source, a thimbleful of infected hog feces is all that would be needed to infect every single hog in the United States! One small hog farmer in western Pennsylvania lost 282 out of a group of 300 hogs to PEDV in just two days.

### A GMO Connection?

Of course, hog farmers nationwide are taking whatever steps they can to prevent the spread of this epidemic, such as by restricting entry of others into their facilities, avoiding contact with other pigs, sanitizing equipment and trailers, and quarantining affected herds. These practices may be helping, but the contagion keeps spreading at an alarming rate.

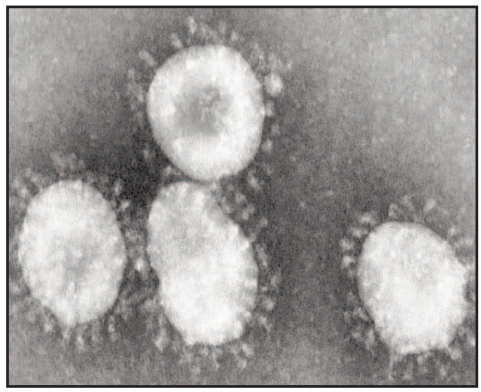
About the same time as PEDV has appeared on the scene, another story has surfaced that seriously thickens the plot. This story comes from Denmark, from a pig farmer named Ib Petersen. Ib raises hogs the way most other Danish hog farmers do, using the highest "factory farming" standards in the world which include the addition of GMO soybean products to the feed.

Mr. Petersen noted that a number of his piglets were being born with deformities, diarrhea was rampant within his operation, and his sows often suffered from bloat. He decided to try replacing the GMO soybean portion of his feed with non-GMO soybeans and fish meal, and within two days his troubles nearly disappeared. He noted the following results.

The non-GMO diet stopped the diarrhea and removed the need for antibiotics.

Since the dietary change, diarrhea has become less of a problem, whereas before he had lost about 30% of his pigs to diarrhea.

Now none of his animals has died



***Porcine epidemic diarrhea virus (PED virus or PEDV) is a coronavirus that infects the cells lining the small intestine of a pig, causing severe diarrhea.***

because of bloat or ulcers, versus 36 deaths from those causes the previous two years.

The number of piglets weaned per sow has doubled compared to before the feed change was made, and the piglets are stronger with fewer stillbirths.

Mr. Petersen's hours attending his operation have been trimmed by 20 to 30 hours per month due to less need for cleanup and veterinary attention.

Even with the higher cost of non-GMO feed, the savings have been so great that he has increased his income by $42,000 per year, or about $93 per sow.

To add to this story from Denmark, a long-term toxicology study in Australia involving pigs fed either mixed GMO soybean and GMO corn products, compared with an identical diet of non-GMO corn and soybean products, resulted in 25% heavier uteri for the GMO-fed animals. The GMO-fed pigs also had a higher rate of severe stomach inflammation, with male hogs affected more severely by a factor of four.

The possibility that there is a direct causal relationship between GMO feeds and PEDV in the United States is real. All that needs to be done to prove or disprove this theory is to compare the disease incidence of PEDV with and without GMO feed products.

Will Monsanto and other GMO promoters in the United States welcome this research, or will they resist uncovering a possible link, in the process helping to destroy an entire segment of the livestock industry? Time will soon tell. ❒

### Bibliography


J. Carman, et. al., A long-term toxicology study on pigs fed a combined genetically modified (GM) soy and GM maize diet, May 12, 2013, *www.offthegridnews.com/2013/12/18/farmer-blames-gmo-feed-for-pig-deformities-and-deaths/*.

K. Grossman, Granny Miller—a Journal of AgrarianLife and Skills, March 23, 2014, *www.granny-miller.com/porcine-epidemic-diarrhea-virus/*.

D. Jennings, Farmer blames GMO feed for pig deformities and deaths, *Off the Grid News*, December 18, 2013, *www.offthegridnews.com/2013/12/18/farmer-blames-gmo-feed-for-pig-deformities-and-deaths/*.

E. Main, Proof that GMOs really are unhealthy, *Rodale News, www.rodalenews.com/gmo-soy*.

Origin of U.S. PEDV strains tracked, *Feedstuffs*, October 22, 2013, *feedstuffs.com/story-origin-pedv-strains-tracked-45-103686*.


## Be a Doer!

When you think of a nice thing to do for someone, don't just think it. ***Do it.***

When you have a kind thought, express it. Bring it to life. ***Put it into action.***

If you admire something someone has said or done, ***speak up and say so.*** His life—and yours—will be the richer for it.

Never be content to think nice thoughts. ***Express them, and do them!***

*Bits and Pieces*, March 7, 1991.

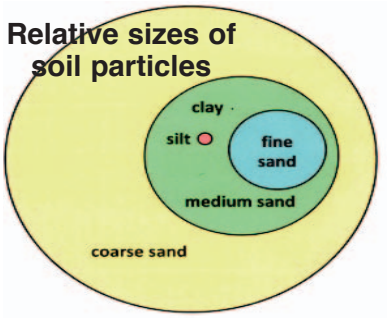
"For it is not the hearers of the Law who are just in the eyes of God, it is those who obey the Law who will be acquitted..." (Romans 2:13, *Moffatt Translation*).

# 15-Minute Soils Course

## Lesson 39:

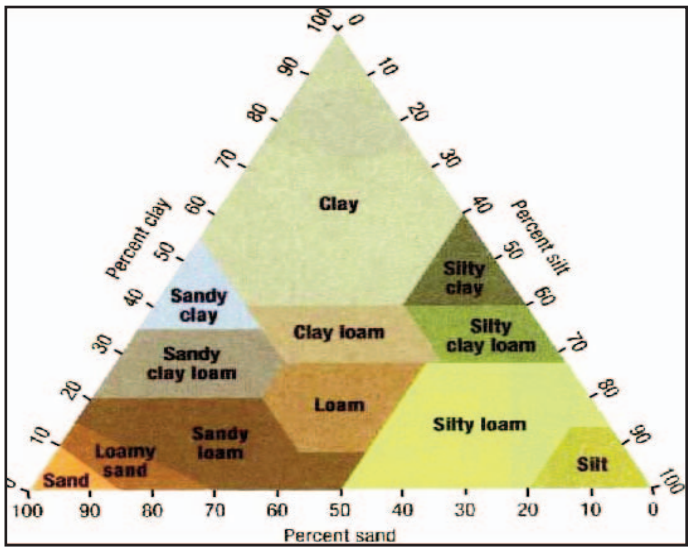
## That All-Important Soil Tilth

Soil tilth is a complex topic because it involves nearly every aspect of the soil: its composition, structure, and the management system applied to it. As a descriptor of soil, tilth combines the properties of particle size, moisture content, degree of aeration, rate of water infiltration, and drainage into abbreviated terms in order to more easily present the agricultural prospects of a piece of land.



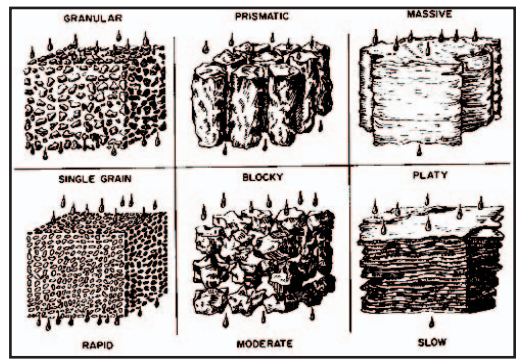

Put another way, the term soil tilth refers to the soil's general suitability to support plant growth, or more specifically to support root growth. Tilth is technically defined as the physical condition of soil as related to its ease of tillage, fitness of seedbed, and impedance to seedling emergence and root penetration.

Let's look closer at the soil properties that relate to soil tilth.




**Soil texture.** The soil is made up of particles of various sizes. Those that are from 0.05 to 2 mm in diameter are called sand, those from 0.002 to 0.05 mm are called silt, and those less than 0.002 mm in diameter are called clay. See the "Soil Texture Triangle" below.

A soil having approximately equal proportions of all three separates will be a loam, clay loam, or silty loam. These textures most easily build a good structure that will build an excellent tilth. High clay contents will tend to create compact soils, especially if tilled when wet, whereas sandy soils have trouble maintaining excellent structure and are often droughty.

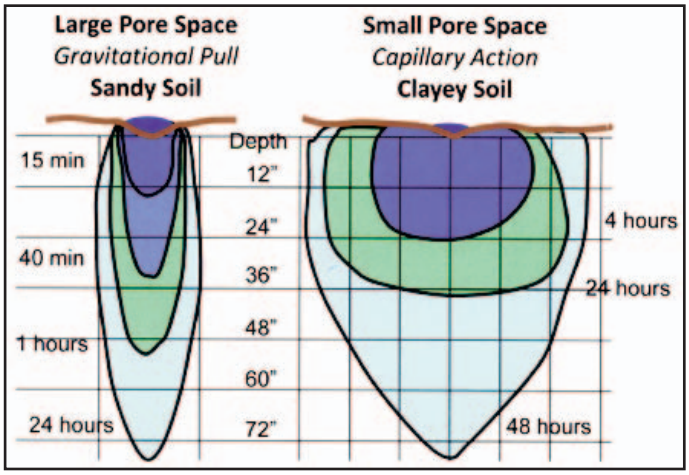



**Soil structure, aeration, and water percolation.** While it is not possible for the farmer to control the texture of his soil, he can affect the structure and have a profound effect on tilth. There are several types, as shown in the illustration above. These various "ped" types, as they are called, form through the action of soil microorganisms such as fungi, bacteria, algae, and also earthworms which produce mucilages and glues that stick particles together. Other forces such as wetting and drying, freezing and thawing, adsorbed cations, and tillage also play a part in structural development, but root action, mycorrhizal fungi, and other biology perform the main role of creating structure—and thus tilth.

Granular and blocky structures are preferred because they allow moderate water movement into the subsoil, and allow plant roots to grow unimpeded as long as there is no hardpan to penetrate. Massive structure, so detrimental to root growth, will result from heavy machine passage, especially during tillage under wet condi-

# 15-Minute Soils Course

tions, and even more so if the texture is clayey.




An excellent blocky or granular structure will also be optimal for air and water movement, as illustrated by the figure above. Note how the fine textured soil on the right with "micropores"— those about 0.08 mm or less— slows the movement of water through the profile, while the sandy soil on the left permits rapid water movement into the subsoil through "macropores", those larger than 0.08 mm. Ideally something between these two extremes is preferred, in a soil having good structure and little compaction.

Aeration, so critical for excellent root growth (roots cells breathe as do leaf cells), is optimal when macropores predominate. Air is pulled into the soil as rain or irrigation water moves down, and circulates freely between waterings when not impeded by small pores in compacted soils.

**Drainage.** Excessive water in low-lying areas, or perched water tables above compact soil layers, will fill pore spaces with water, limit air movement, and restrict root growth. The benefits of tiling wet areas of fields are well known, and will improve tilth for all textures.

A soil with good tilth has large pore spaces for adequate air infiltration and water movement. (Roots only grow where the soil tilth allows for adequate levels of soil oxygen.) It also holds a reasonable supply of water and nutrients.

Soil tilth is a function of soil texture, structure, fertility, machinery activity, crop grown, and the interplay with organic content and the living soil organisms that compose the soil ecosystem. It is critical for the maintenance of optimum tilth, for any texture of soil, to maximize soil organic matter and limit tillage (zero tillage is best). An annual return of fresh organic residues is essential, to feed the variety of microbes and earthworms that generate the glues that hold soil particles together. Limit pesticide and herbicide applications as much as possible as well, since these compounds hamper microbial activity.


***Strip tillage is one way to limit damage to soil structure, microbes, and organic matter so tilth is enhanced.***

### See How Much You Learned

1. Soil tilth is closely related to a. soil texture, b. drainage, c. soil structure, d. aeration, e. all four

2. Lots of soil micropores (those less than o.08 mm) are beneficial to soil tilth. T or F

3. Perhaps the two best soil structures that give excellent tilth are_____and_____.

4. Characteristics of macropores: a. less than 0.08 mm, b. important for soil air movement, c. critical for soil water movement, d. all three

5. Sand, silt, and clay are designations of _____.

6. Tilth is technically defined as the physical condition of soil as related to its ease of tillage, fitness of seedbed, and impedance to seedling emergence and root penetration. T or F

7. The gums and mucilages that bind soil particles together are made by _____.

Answers: 1. e; 2. F; 3. granular, blocky; 4. b, c; 5. soil texture; 6. T; 7. soil microorganisms, bacteria, fungi, algae, earthworms (any of these).

# Sometimes Science Makes Mistakes, and the World Suffers

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

The idea that science makes mistakes is nothing new. After all, scientists are humans, and humans are prone to errors like everyone else.

However, as a scientist myself I oftentimes note the tendency to place this discipline on a pedestal and view it as little short of perfect, even god-like in nature. Look at what science has unleashed upon humankind in this age of enlightenment: rockets to Mars and Jupiter, cell phones, computers, supersonic travel, neutron bombs, nanotechnology, and chemotherapy, to name a few things.

Some of these things have indeed lightened the load upon everyday life—like tractors replacing oxen, and automobiles replacing foot travel—but some have made life much more complicated and perilous—like iphones and atom bombs. The many scientific innovations that have come together to make up these new items are mind-boggling, considering how few years it has taken to move from the pre-industrial age to the present.

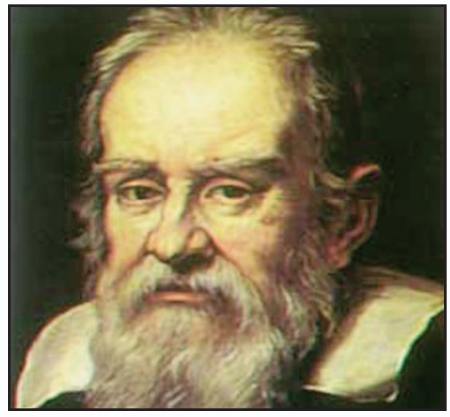
In the process of these innovations we find that a certain well-worn, familiar path is taken. That path is the one that profits those who gain control of and exploit that pathway, having little compassion for the truth, but instead upholding the status quo for the sake of continuing the paradigm that has been established, whether truthful or not. Whether for prestige and personal pride, or for financial gain, whole societies and the course of history have been, and are continuing to be, deflected along specific lines that may even bring about the death of the opposition. For example:

**1. Global warming.** The promotors of "global warming" claim it is "settled science" that mankind and the automobile are causing warming of the atmosphere and the catastrophic events that will shortly occur because of it... even though one single volcanic eruption may spew thousands of times more greenhouse gases into the atmosphere than have all automobiles for over 100 years. A scientist who dares to oppose global warming may lose his job, as did the Swedish climatologist Lennart Bengtsson.

Global warming legislation is clearly a means for governments to tax the people more heavily and attempt to reduce the world's population.

**2. Business cycles.** A Russian economic researcher named Nikolai Kondratiev developed a theory of capitalism that stated a boom-bust cycle occurs approximately every 50 years. He was executed in 1938 for stating that Communism was doomed to collapse.

**3. Cocaine mummies.** It has been recently been discovered that the mummies of ancient Egyptian, Persian, and other cultures contain significant concentrations of cocaine and nicotine, proving that there was trade between the Americas and Africa long before Columbus discovered America. Though no flaws in the research have been found, the findings are being routinely criticized.



***Galileo challenged the status quo 500 years ago, claiming the earth is a sphere. Similar challenges today often bring the same sort of coordinated resistance against genuine scientists.***

**4. The flat earth.** Galileo Galilei, a renowned astronomer of the late 1500s and early 1600s, and called the "Father of Science", challenged the flat earth concept and promoted heliocentrism. This delivered him to the Catholic Inquisition and house arrest until his death.

**5. GMOs.** Genetically modified corn, cotton, soybeans, canola, and other crops have been developed that tolerate glyphosate or other herbicides, or produce toxins that kill boring insects. Though these crops have been shown to cause diseases like cancer in test animals, scientists discovering and publishing such effects are routinely threatened, refused research grants, or fired from their positions. Moreover, Monsanto has a team of over 75 lawyers who investigate so-called "infringement" of their GMO rights by farmers, who can even be sued for having Monsanto pollen fertilize their crop across the road.

One can point to falsified or plagiarized research, which gets published sometimes despite the review process. That is bad enough, but when truthful, impeccable, repeatable results contradict long-held ideas—even when these traditional beliefs are patently false—and the author becomes an outcast or is arrested for his ideas, then science has made a horrible mistake—especially when these new findings might benefit the world.

Innovative scientists, like all innovators, tend to be discouraged in their pursuits. As Martin Armstrong said (*www.armstrongeconomics.com*), "Studies at the University of Chicago and the University of Minnesota have found that teachers smile on children with high IQs and frown upon those with creative minds. Intelligent but uncreative students accept conformity, never rebel, and complete their assignments with dispatch and to perfection. The creative child, on the other hand, is manipulative, imaginative, and intuitive. He is likely to harass the teacher. He is regarded as wild, naughty, silly, undependable, lacking in seriousness or even promise. His behavior is distracting; he doesn't seem to be trying; he gives unique answers to banal questions, touching off laughter among the other children. E. Paul Torrance of Minnesota found that 70 percent of pupils rated high in creativity were rejected by teachers picking a special class for the intellectually gifted. ***The Goertzels concluded that a Stanford study of genius, under which teachers selected bright children, would have excluded Churchill, Edison, Picasso, and Mark Twain just to mention a few*** (emphasis mine)."

Science can be an amazingly good force in the world, but when misdirected it can result in untold damage. Let's look forward to a day when science sides with Right, and not worship it today! ❐

# Fertilizer N and Soil Carbon Drop Together

*Continued from page 2*

really does promote carbon sequestration, you'd expect these fields to show clear gains in soil organic carbon over time.

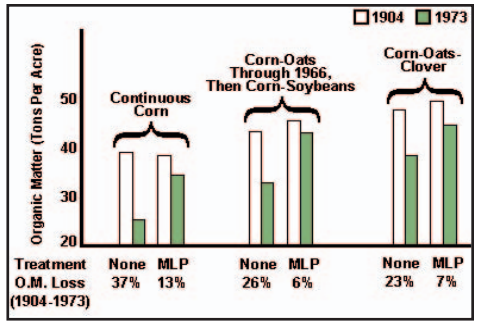
Instead, the researchers found, all three systems showed a "net decline occurred in soil [carbon] despite increasingly massive residue [carbon] incorporation." (They published their findings, "The Myth of Nitrogen Fertilization for Soil Carbon Sequestration," in the *Journal of Environmental Quality* in 2007.) In other words, synthetic nitrogen broke down organic matter faster than plant residue could create it.

A particularly stark set of graphs traces soil organic carbon (SOC) in the surface layer of soil in the Morrow plots from 1904 to 2005. SOC rises steadily over the first several decades, when the fields were fertilized with livestock manure. After 1967, when synthetic nitrogen became the fertilizer of choice, SOC steadily drops.

In their other major paper, "Synthetic Nitrogen Fertilizers Deplete Soil Nitrogen: A Global Dilemma for Sustainable Cereal Production" (2009), the authors looked at nitrogen retention in the soil. Given that the test plots received annual lashings of synthetic nitrogen, conventional ag science would predict a buildup of nitrogen. Sure, some nitrogen would be removed with the harvesting of crops, and some would be lost to runoff. But healthy, fertile soil should be capable of storing nitrogen.

In fact, the researchers found just the opposite. "Instead of accumulating," they wrote, "soil nitrogen declined significantly in every subplot sampled." The only explanation, they conclude, is that the loss of organic matter depleted the soil's ability to store nitrogen. The practice of year-after-year fertilization had pushed the Morrow plots onto the chemical treadmill: unable to efficiently store nitrogen, they became reliant on the next fix.

The researchers found similar data from other test plots. "Such evidence is common in the scientific literature but has seldom been acknowledged, perhaps because N fertilizer practices have been predicated largely on short-term economic gain rather than long-term sustainability," they write, citing some two dozen other studies which mirrored the patterns of the Morrow plots.




***Research at the Morrow Plots, on the University of Illinois campus, reveals that fertilizer N reduces soil organic matter.***

The most recent bit of evidence for the Mulvaney team's nitrogen thesis comes from a team of researchers at Iowa State University and the USDA. In a 2009 paper, this group looked at data from two long-term experimental sites in Iowa. And they, too, found that soil carbon had declined after decades of synthetic nitrogen applications. They write: "Increases in decay rates with N fertilization apparently offset gains in carbon inputs to the soil in such a way that soil C sequestration was virtually nil in 78% of the systems studied, despite up to 48 years of N additions...."

In the modern era of intensified agriculture, soils are generally managed as a commodity to maximize short-term economic gain. Unfortunately, this concept entirely ignores the consequences for a vast array of biotic and abiotic soil processes that affect air and water quality and most important, the soil itself.

So who's right? For now, we know that the Illinois team has presented a robust cache of evidence that turns 50 years of conventional soil science on its head—and an analysis that conventional soil scientists acknowledge is "sensational" and "incredibly important" if true. We also know that their analysis is consistent with the founding principles of organic agriculture: that properly applied manure and nitrogen-fixing cover crops, not synthetic nitrogen, are key to long-term soil health and fertility.

The subject demands more study and fierce debate. But if Mulvaney and his team are correct, the future health of our farmland hinges on a dramatic shift away from reliance on synthetic N fertilizer. ❐ [From **Third World Network**, with edits; *www.twnside.org.sg*.]

## 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**

**At South Dakota State University in 2013, replicated trials using four fertilizer nitrogen levels proved that Vitazyme can significantly improve grain yield by up 8.2 bu/acre (9%). The average yield enhancement at all nitrogen levels was about 5%. At the same time the copper, iron, manganese, sulfur, and calcium levels in the grain improved as the N levels rose. Vitazyme with corn for years has proven to be a consistent yield, quality, and profit enhancer!**



*Corn at South Dakota State University yielded 5.5 to 8.2 bu/acre more with Vitazyme at 0, 75, and 100% of optimal nitrogen.*