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Natural Farming Practices Work Today As They Always Have

By Paul W. Syltie, Ph.D

The major theme driving agriculture today was summed up so eloquently by Earl Butz, the United States Secretary of Agriculture from 1971 to 1976 under presidents Richard Nixon and Gerald Ford. He infamously stated at one point, "Get big or get out," a message to farmers to encourage their planting of commodity crops like corn "fencerow to fencerow."

Butz drastically changed federal agricultural policy and reengineered many New Deal-era farm support programs. For example, he abolished a program that paid corn farmers to not plant all their land, a program that unsuccessfully attempted to prevent a national oversupply of corn and low corn prices. These policy shifts coincided with the rise of major agribusiness corporations, and the declining financial stability of the small family farm.

These policies of the U.S. government accelerated the movement of potential young farmers off the land and into cities They also encouraged the mining of soil fertility at the expense of soil erosion and ever-expanding agrichemicals. The dream of living on the land was further eroded for countless young, aspiring farmers.

Yet, natural laws never die. They are as active today as the day The Creator made them, and they can be summarized as shown on the right, according to the pioneer of modern eco-agriculture, Sir Albert Howard. For a detailed explanation of these laws, see *The Vital Earth News*, Volume II (2), 1997.

Let's look at some examples of farmers who are implementing these laws, and are thriving.

Seven Sons Farms[1]

Near Roanoke, Indiana, the Hitzfield family farms 550 acres of perennial pasture, on which graze 220 head of cattle

Nature's Seven Laws

1. Mixed farming is the rule; plants and animals always grow together.

2. The soil is always protected from the direct action of sun, rain, and wind.

3. Rainfall is carefully preserved in surface layers and subsoil.

4. The forest manures itself, making its own humus and supplying its own minerals.

5. Mineral matter needed by trees and undergrowth is obtained from the soil.

6. The soil always carries a large fertility reserve.

7. Crops and livestock attend to themselves, and maintain health due to internal vitality imparted by the soil.

See Success Stories by Following, page 2

Hydrogen Powered Tractors?

Engines Have Already Been Developed and Used

By Paul W. Syltie, Ph.D.

There is a current push throughout the United States and much of the world for electric vehicles. This move away from petroleum powered internal combustion engines is supposed to help limit the increase in carbon dioxide emissions into the atmosphere, thus reducing the increase in temperatures that some models of climate change have predicted.

Although the core claims of those promoting the climate warming scenario have been debunked, there is still a strong move within governments and industry to move away from petroleum energy to more renewable types, such as wind and solar sources. There are, however, other sources of energy that many people may not be aware of, sources which are non-polluting and easily accessible, given a bit more time to develop and integrate into our highly technological, energy-intensive society.

This BMW diesel engine runs just like a conventional reciprocating diesel engine, except it is powered by hydrogen.

Enter Hydrogen Combustion

The issue of hydrogen engines has powerful implications for farmers across the United States and the entire world. Their use would be a direct answer to government standards that are becoming more and more strict in terms of CO_2 emissions. In short, hydrogen engines

See Hydrogen Power Is Coming, page 3

Success Stories By Following Nature

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and 14,000 hens that wander and peck. Besides, they allow 300 to 400 head of hogs to forage the farm's woodlands. They also raise bison and sheep.

The family is committed to raising free-range, grass-fed, non-GMO, antibiotic-free food products, and strives to maintain soil fertility, most of which is recycled as manure in the fields.

As Blaine Hitzfield says, "Regenerate soil by stopping tillage and chemical use, produce nutrient-dense foods, and make an exchange with the consumer, knowing that we are affecting their future health." The farm supports the seven sons of Lee and Beth Hitzfield, plus 35 full-time people, and feeds over 10,000 families a year through the farm's meat subscription service.

Things were not always that way. Working as a conventional row-crop farmer, things were not looking rosy for the family if the sons were to follow in Lee's footsteps. They were barely making ends meet. Besides, Beth became severely afflicted with rheumatoid arthritis. Then they met an agronomist named Ray Smith, who helped them transition to ecologically sound practices.

Over several years the family struggled to survive, but they followed their vision by coverting to perennial pasture and natural livestock principles. They soon learned that modern agriculture rewards quantity of production, not quality.

Thus, to survive by raising nutrient-dense, chemical-free food they would need to find consumers who shared this interest to sell directly to. They started small with people driving out to their farm to purchase eggs. Then they expanded to beef and hog sales. Direct marketing to the consumer was a great boon for the family.

As Lee stated, "Our soil today holds three times as much water as it did 20 years ago. We don't need to fear drought. Our soil has so much biology in it; we're raising healthier grass. And so our animals are healthier."

Plus, Beth has fully recovered from her arthritis by consuming the nutritious fare of the farm. As the Hitzfield's say, "God designed forgiveness through soil biology."

High Ground Organics[2]

Near Watsonville, California, Jeanne Byrne and Stephen Pederson operate High Ground Organics, a unique organic operation that rotates more than 30 crops—numerous species of leafy greens, other vegetables, and strawberries—on 17 acres of their property that are sold at farmers markets and to members of their Community Supported Agriculture (CSA).

"For us, farming organically isn't just about not using toxic chemicals. It's an ethic—of working with the natural environment, not against it. Farming shouldn't mean doing combat with nature."

Before they even purchased the farm, Jeanne and Stephen walked the property with Natural Resource Conservation District people and initiated plans to establish a vegetative buffer, called a filter strip, between the farm and slough, to slow down and filter any runoff.

The Hitzfield sons of Seven Sons Farms pose in front of their hen houses, shelter for thousands of grazing hens.

They have implemented more than a dozen conservation practices, including installing filter strips and hedge rows, planting cover crops, establishing a riparian buffer, using rotational grazing and crop rotations, improving irrigation efficiency, and controlling erosion. They now have a mature 15-year- old strip of flowering bushes and perennials that has provided pollination, natural insect control, erosion control, wildlife food and habitat, and a buffer against wind for over a decade. They have an incredible array of birds and animals around the slough, including a bald eagle pair.

As to their legacy, Jeanne says simply: "We want to leave the land better than we found it. Of course we never intend to leave it," Jeanne adds, smiling.

A-Frame Farm[3]

Luke and Ali Peterson became partners in A-Frame Farm in 2016 with farming mentors, Carmen and Sally Fernholz in Madison, Minnesota. Today they farm 500 certified organic acres, employing practices such as cover cropping, minimal tillage, and crop-livestock rotation with the goal of becoming self-sustaining and truly regenerative.

"We use a lot of regenerative practices, but...we [still] import fertility from off the farm. I think the main thing is supplying your own fertility. It forces you to do a lot more intense soil health practices...."

Diversification is the name of the game for Luke, and he is constantly looking for new opportunities. The relationships he's set up with local bakers to sell his small grains provide the income that allows him to incorporate soil health practices like cover cropping and diverse crop rotations, introducing perennials like Kernza and alfalfa.

"We eliminated all tillage in the fall, and the only tillage we do is to terminate a perennial that's been in the soil for three years or more because we either have to use tillage or a chemical."

When it comes to building soil health, Luke says the changes they've made have yielded impressive results. Soil structure has improved dramatically. His soil has become much more alive and forgiving. Farmers think that tilling allows the soil to warm up and dry out faster in the spring, but Luke has found that he gets out in the fields as soon as his neighbors who are deep tilling.

These are just three stories of farmers striving to follow the laws of nature. This adventure takes work and faith, but these laws are active and give success if we use wisdom to apply them, even today. ❒

Bibliography

1. H. Atkins, How a once-struggling Indiana farm found success, and hope, when they embraced farming practices that nurture the soil, *Time*, 1/14/23.

2. A. Brown, Taking the high ground and farming with nature, Natural Resources Conservation Service, *www.nrcs.maps.arcgis.com*.

3. Organic Farming Research Foundation, A-Frame Farm, August 6, 2020, *www.ofrf.org*,

Hydrogen Power Is Coming Soon!

Continued from page 1

would reduce CO_2 emissions to zero. Yes, you heard that right: zero! This is not saying that such a reduction is beneficial, since more CO_2 in the atmosphere means greater crop production and less hunger, and is not linked to atmospheric warming.

That claim of zero CO_2 emissions is also proudly championed by the makers of electric engines, but whose environmental impacts are notoriously large. For instance, an electric vehicle requires six times the mineral inputs than does a comparable internal combustion engine; this includes nickel, lithium, cobalt, and copper. The impact on the environment and health in countries like Australia, Canada, Indonesia, Russia, and the Philippines of mining for these elements is large.[1] Besides, the electricity to charge electric vehicles comes mostly from coal and natural gas generating plants.

The Hydrogen Engine

While there are different ways to utilize hydrogen to power vehicles, such as with a hydrogen fuel cell that generates electricity to power an electric motor, the engine type I am focusing on here is nearly identical to the typical gasoline or diesel powered internal combustion engine.

In fact, one of the very first internal combustion engines ran on a mixture of hydrogen and oxygen, and used an electric spark ignition mechanism. Its inventor, a former Swiss artillery officer named François Isaac de Rivaz, used it to build a vehicle that could carry heavy loads over short distances.[2]

Cummins, Inc., is investing heavily into this type of hydrogen engine. If you saw one of these engines, you might think it was a standard diesel motor. Four-stroke hydrogen internal combustion engines (Hydrogen ICE) operate on the same cycle as regular gas engines and have almost the same components: engine block, crank, cylinder heads, ignition system, installation parts, and so on. Because of these commonalities between hydrogen and standard internal combustion gas or diesel engines, the engineering required to build these hydrogen types is already essentially in place.[3]

There are also differences between hydrogen engines and other spark ignited

Hydrogen fuel cells can also power diesel engines, as this Toyota truck model has proven at the Port of Los Angeles.

engines. Differences in the physical properties of hydrogen and petroleum fuels impacts how fuel and air are metered and injected. Pre-ignition is a greater problem for hydrogen engines than for gasoline engines because hydrogen is much easier to ignite. Direct injection is one way to overcome pre-ignition issues. Direct injection systems introduce fuel directly into the cylinders, rather than into the intake manifold or ports. If the injection takes place at a time when the inlet valve is closed, backfire conditions are avoided.[4]

Toyota of Japan has been investing considerably for years on the hydrogen internal combustion engine, and Honda and General Motors are not far behind.[5]

Overcoming Nitrogen Pollution

Hydrogen powered engines will also reduce atmospheric pollution from nitrogen oxides, the gas that produces the brownish haze over some cities during the summer. When hydrogen burns in the presence of plenty of oxygen, there are very few nitrogen oxides produced. Hydrogen engines needs about twice as much air in the combustion mixture to remove excess nitrogen oxides.

Cummins researchers have discovered that hydrogen engines work well in medium and heavy duty trucks and buses. They would thus work very well in farm tractors and machines, and other agricultural applications. They are also friendly to mechanics and maintenance personnel, since these engines are similar to traditional internal combustion engines.[6]

Hydrogen engines look, sound and work like the internal combustion engines that every mechanic in the world is used to. Their reliability and durability are equal to that of diesel engines. Once the fuel becomes widely available, the world will have another major energy source at its fingertips. ❒

Bibliography

1. M. Heberling,The environmental downside of electric vehicles, www.fee.org, 4/7/22.
2. De Rivaz engine, *www.wikipedia. org*.
3, 4, 6. J. Nebergall, How do hydrogen engines work?, *www.cummins.com*, 1/26/22.
5. Y. Kageyama, Toyota debuts hydrogen-fueled Corolla race car, *www.abcnews.go.com*, 6/1/23.

Sustainable vs. Regenerative Agriculture

Despite both sustainable and regenerative agriculture trying to respect the natural processes, and their practices often overlap, the main goal of ***sustainable agriculture*** is to maintain the soil's conditions and not worsen them. ***Regenerative agriculture*** goes one step further, as it tries to improve the quality of soil, and it has the potential to rebuild natural systems with minimum tillage, cover crops, etc. Regenerative agriculture tries to mimic the natural processes in ecosystems and revitalize the environment for future generations. Its main focus is to improve the biodiversity of the soil. Increased biological diversity of communities provides higher resilience during environmental stress periods, such as drought or intensive rains. ❒ [From *www.earth.org*]

15-Minute Soils Course

Lesson 57: Antibiotics in Soils

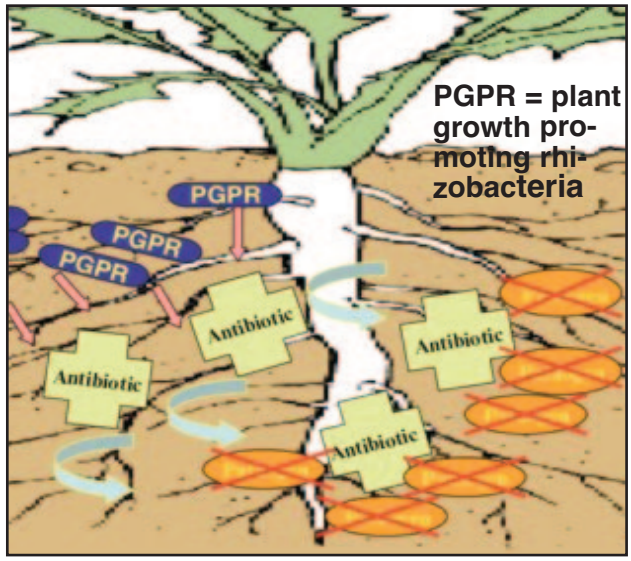
The soil is an amazingly rich and highly versatile body, comprised of mineral matter, organic matter, air spaces, structural units, water, and an array of macro and microorganisms that boggles the mind. It is in this area of soil microorganisms that we will focus in this lesson.

A Short History of Antibiotics

The use of antibiotic-producing microbes to prevent or treat disease goes back thousands of years. Over 2,000 years ago, moldy bread was used to treat open wounds in Serbia, China, Greece, and Egypt. The Eber's papyrus from 1550 B.C. is the oldest preserved medical document, and it includes moldy bread and medicinal soil among its list of remedies. In fact, an old microbial recipe from the Anglo-Saxons of 1000 years ago has been shown to kill MRSA (methicillin-resistant *Staphylococcus aureus*).

In more modern times, the use of antibiotics to treat diseases followed the discovery that arsenic-based compounds could treat syphilis, and sulfa drugs became commonly used on the battlefields of World War I to help prevent infections of the wounded. Then came the accidental discovery by Alexander Fleming in 1928 of the ability of a soil bacterium to kill other organisms on a contaminated Petri dish. The responsible compound was called penicillin, which was later purified and used widely, even to the present day. This compound was used to treat the wounds and infection of troops during World War II, and became known as a "wonder drug."

Selman Waksman, an inventor and microbiologist, in the late 1930s introduced the Golden Age of antibiotic discovery by doing a systematic study as microbes as producers of antimicrobial compounds. He defined an ***antibiotic*** as "a compound made by a microbe to destroy other microbes." He helped identify the soil-dwelling filamentous actinomycetes as prolific producers of antimicrobial compounds. Among the several antibiotics that these actinomycetes produced were neomycin and streptomycin. Waksman identified the genus *Streptomyces* as prolific producers of secondary metabolites. These are compounds that are not needed for normal growth and development of the microbe, but were found to be active against various bacteria, fungi, viruses, nematodes, cyanobacteria, and even insects, and also were active against cancer cells.



Plant roots excrete a considerable amount of mucigel, containing carbohydrates, amino acids, and other compounds that feed actinomycetes and bacteria, which in turn produce antibiotics that kill pathogenic microbes and allow beneficial bacteria to prosper and feed the plant.

How Antibiotics Work

Antibiosis, or the ability of one microbe to kill another, was known well before the discovery of penicillin. It is for this reason that certain microbes in the soil use this ability for purposes of survival in the midst of the massive interaction amongst rhizosphere microbes. Those producing compounds that inhibit or kill nearby competing microbes have a distinct advantage in surviving amongst the countless species of bacteria, fungi, actinmycetes, cyanobacteria, protozoa, and other microbes.

15-Minute Soils Course

These antibiotics also might send signals to close relatives for interactive purposes, or the compounds may signal insects or plants for various interactions.

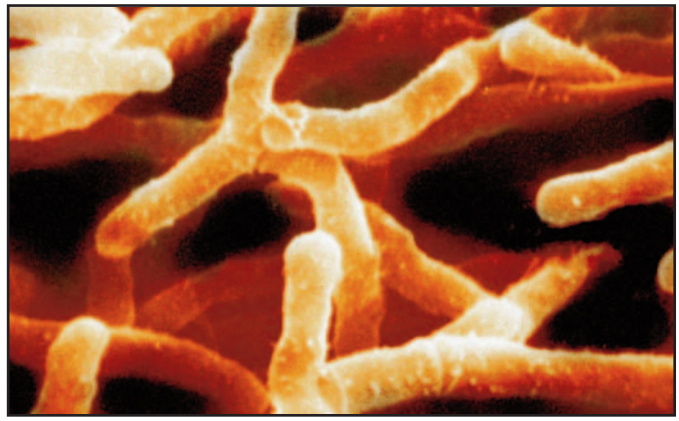
Because various bacterial pathogens can over time develop resistance to antibiotics through natural selection, the hunt has been on for different compounds that will attack these MRSA and other resistant bacteria. While many recent efforts to discover such effective antibiotics have been unsuccessful, a new National Institutes of Health push in this effort has led to the discovery of a new class of antibiotics called ***malacidins***. To find these effective agents, the DNA of the bacteria in thousands of soil samples has been examined, and compounds that are effective against MRSA have been identified.

It has been discovered that in the natural soil environment these antibiotic producing microbes will switch on various genes that they will not turn on in the laboratory environment. Within the wild battles among microbes in the rhizosphere, apparently various environmental cues from other organisms or from the plants themselves—even signals and various compounds excreted in the mucigel along the root surfaces—will trigger the genes that cause the synthesis of the compounds that are required by the microbes to survive and prosper.

There is a great number of antibiotics that have ben obtained from soil organisms, mostly actinomycetes, and have been or are currently being used in the fight against infections. The table here lists ten major classes of these compounds, which are grouped according to their similar chemical and pharmacological properties.Compounds within the same class may kill the same or related bacteria.

Classes of Antibiotics

1. **Penicillins**
2. **Tetracyclines**
3. **Cephalosporins**
4. **Quinolones**
5. **Lincomycins**
6. **Macrolides**
7. **Sulfonamides**
8. **Glycopeptides**
9. **Aminoglycosides**
10. **Carbapenems**



This is a typical actinomycete found in the soil, which group of microbes are the predominant producers of antibiotics. It posses properties of both bacteria and fungi.

We owe a great deal to this group of humble soil microbes. They may have even saved your life. We can truthfully say that not only does the soil grant us our food in due season, but also the means to heal our bodies directly through antibiotics! ❒

See How Much You Learned

1. Antibiotics are produced by a group of soil microorganisms called _____.
2. Pioneers in the study of antibiotics include a. Waksman, b. Wright, c. Fleming, d. Johnson.
3. Penicillin is the first antibiotic to be used in a major way. T or F.
4. _____is the ability of one organism to kill another organism..
5. Actinomycetes are the main microbial organisms from which antibiotics are obtained. T or F.
6. An antibiotic is a compound made by a microorganism that can kill a. bacteria, b. fungi, c. actinomycetes, d. cyanobacteria.
7. Moldy bread can contain antibiotic properties so it can be applied to an infection and help heal

Answers: actinomycetes; 2. a, c; 3. T; 4. antibiosis; 5. T; 6. a, b, c, d; 7. T.

Ethanol for Crops ... a Sober Reality

By Candace Cheung
[Abridged from *Courthouse News Service*, August 25, 2022]

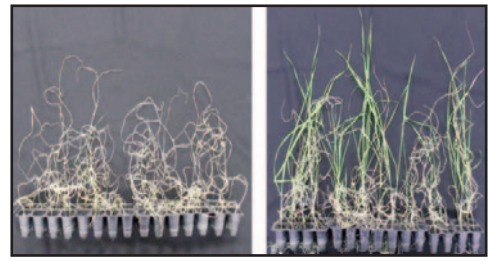
Researchers with Japan's RIKEN Center for Sustainable Resource Science have developed a simple, cost-effective ethanol soil treatment that could help crops thrive even throughout periods of drought. They published their findings Wednesday in the journal *Plant and Cell Physiology*.

"The discovery came from the process of searching for compounds that make plants resistant to stress," said Motoaki Seki, co-author of the study and leader of RIKEN's Plant Genomic Research Team, in an email interview. "In general, experiments on compounds use organic solvents such as ethanol, acetone, and methanol to dissolve insoluble substances. Our experiment used several kinds of organic solvents and obtained data that made us suspect that the organic solvents, not the compounds, could have a property that makes plants stress resistant."

Researchers emphasize their method is merely an extension of the plants' naturally occurring processes. This technique of ethanol application does not rely on controversial genetic modification, and is both economically and environmentally friendly. As a naturally occurring compound, ethanol can eliminate fears of dangerous chemically treated food. Although safe for consumption, researchers have other concerns.

"Higher concentrations of ethanol inhibit plant growth," Seki acknowledged. "So, optimization of ethanol treatment (concentration and treatment period, etc.) is important."

Seki's team found that the optimized application of ethanol to the soil boosts drought tolerance in rice, wheat, and *Arabidopsis thaliana*, a plant commonly used in biological plant research.



Wheat on the left received no ethanol treatment on the soil before being water stressed, while plants on the right did.

They conducted an experiment where plants, after several weeks of normal watering, were suddenly deprived of water. Some of these plants had their soil pretreated with ethanol, and by the next week there was a marked difference between treated and non-treated plants. Plants growing in the regular soil had withered and died, but 75% of the ethanol-treated plants survived — and even thrived — after rewatering.

Seki and his team found the ethanol not only helped plants retain water, but also triggered genes usually associated with drought tolerance even before the plants were deprived of water. According to the study, ethanol specifically affected the plants' stomata — pores on the leaves where carbon dioxide enters the plant and water vapor and oxygen exit. Ethanol caused the stomata to close, thereby trapping more water in their leaves than the untreated plants....

While analyzing the gene expression of the plants, researchers noticed that the genes normally seen with water deprivation were expressed even before the researchers paused in their watering,... During this same time the ethanol prompted the plants to create more sugars and engage in photosynthesis, further helping the plants to stay alive.

"As ethanol treatment shows the increased accumulation of several sugars, amino acids and glucosinolates, we hope that this would be beneficial effects for humans," he said. ❒

Cash Rents in Iowa Reach New High

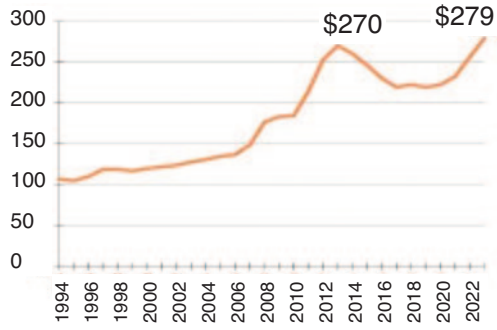
By Alejandro Plastina
Iowa State University, Ames, Iowa

Average cash rents in Iowa are the highest on record, according to the Cash Rental Rates for Iowa 2023 Survey conducted by Iowa State University Extension and Outreach.

The survey shows an increase of 9% in 2023, for a state average of $279 per acre. The new record is 3.3% higher than the previous record set in 2013, when rent was $270 per acre. The increase in rent since 2013 compares to a 2.8% increase in the non-inflation adjusted price of corn, and a 4.4% decrease in the soybean price.

Results of the survey are summarized in the May edition of Ag Decision Maker, in an article written by Alejandro Plastina, associate professor in economics and extension economist with ISU Extension and Outreach.

The survey is based on 1,306 usable responses about typical cash rental rates in Iowa counties for land producing corn and soybeans, hay, oats, and pasture. Of the responses, 42% came from farmers, 37% from landowners, 9% from professional farm managers and realtors, 7% from agricultural lenders, and 5% from other professions and respondents who chose not to report their status.



There was considerable variability across counties in year-to-year changes, as is typical of survey data, but 91 out of the 99 Iowa counties experienced increases in average rents for corn and soybeans. Only Des Moines, Jefferson, Lucas, Muscatine, Van Buren, Wapello, Warren, and Woodbury counties saw declines in their overall average cash rents. The complete 2023 summary by county, along with surveys from previous years, can be accessed on Ag Decision Maker.

Average cash rents increased proportionally more for higher quality lands. Low quality land experienced a 6% increase, from $217 per acre in 2022 to $230 in 2023. Medium quality land saw an 8.6% increase, from $255 per acre in 2022 to $277 in 2023. High quality land saw an 11.1% increase, from $297 per acre in 2022 to $330 in 2023. ❒

Farming Without Sight in Kansas

By Alice Mannette

[*Farm Forum*, Hutchinson, Kansas, 1/14/22]

It's not only in visual images that one remembers. Sometimes it's the smell of fresh-cut wheat, the sound of a well-tuned tractor or the feeling of calmness as you walk across your newly-planted soybean field.

For Plains farmer, Max Amerin, although now blind, the smells, sounds and feelings of his fields have not disappeared. Amerin lost his sight in 2010, due to a health complication. Since then, he has remained farming.

"I farmed all my life," he said. "

Amerin's son, Jake Amerin, 29, works closely with his father. But some chores, Amerin can still do on his own.

"I can still drive the tractor and combine," Amerin said.

But he admitted, he always has a sighted person in the seat next to him. Sometimes it's a friend, usually its Jake Amerin, sometimes it's his ex-wife, Ann Swank, or his other son Dalton Amerin.

"It's amazing what Max can do," Swank said.

Amerin is able to change a tire and fix a tractor by feel. He can also turn on the sprinklers, put gas in the tanks and air in the tires. For him, working to help his son on the farm is crucial to staying fit in both mind and body.

"It's fun," he said. "Dad was there for me, now I'm there for my son."

From a young age, Amerin helped his father with seeding and planting. Now he feels like all those years on the farm has helped him create a photographic memory.

"I've seen it before, but I feel it with my fingers," he said. "I can feel ball bearings."

Although he admits he's slowed down quite a bit, Amerin said his other senses have not left him. He still advises his son on what to do with their corn, milo and wheat fields.

"I can still smell the weeds, feel the corn and know how high it is," he said. "I can feel the wheat in my hand and know when to cut."

Max Amerin, a blind farmer who loves his work and counts blindness a blessing.

Amerin said he is not intimidated, but he understands there are tasks he cannot do. After being in a coma, he said his health could be worse.

"Blindness is kind of a blessing," Amerin said. "Sometimes God gives you gifts you don't realize you have until they're gone." ❒

It does us good to return to the mentality of our founding fathers, and how they viewed life and man's responsibilities on this precious earth that sustains us. Thus, let us ponder a simple comment by George Washington, the general of the armies that won our independence and the first U.S. president, and what he thought of farming and the care we need for our soils.

"I had rather be on my farm than be emperor of the world."

(Letter to James McHenry, 1798)

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.

For further information ...

Stay tuned to our website for the next edition of *The Vital Earth News*! You can find current and back issues at *vitalearth.com/vernews,* and keep up to date with the latest information, product news, and announcements at *vitalearth.com/newsandevents*. If you are interested in purchasing our products, or for other correspondence, please email us at *info@vitalearth.com*.

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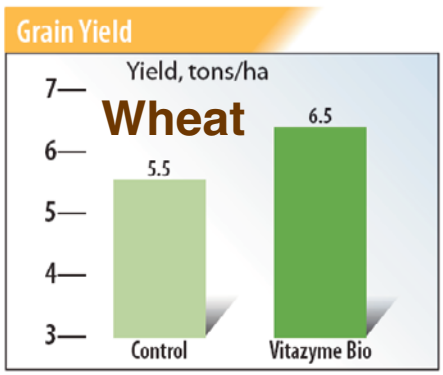
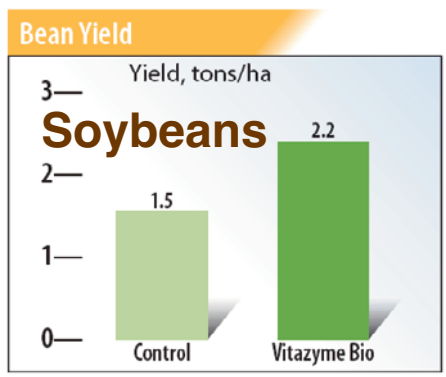
Thank you! The Team at Vital Earth Resources, Inc.

In Spite of the War, Vitazyme Trials Continue in Ukraine

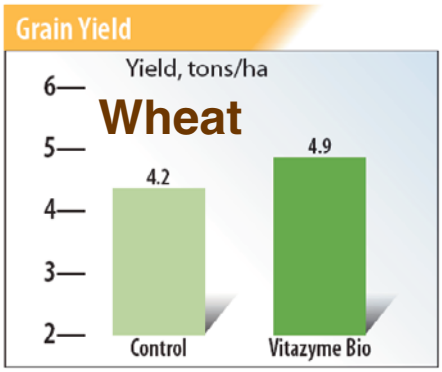
Despite Russian incursions into Ukraine and the ongoing war in the east and south of the country, researchers have continued their work in other parts of the country, proving the efficacy of Vitazyme for a number of crops. Here are the results of some of that work from 2022.



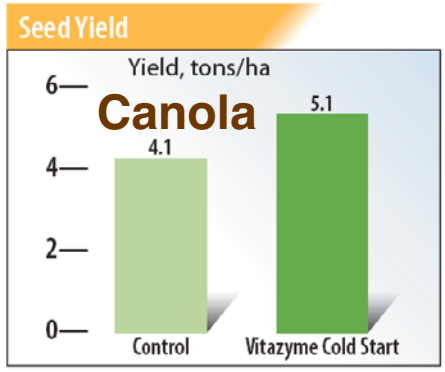
Yield increase with Vitazyme Bio: 18%



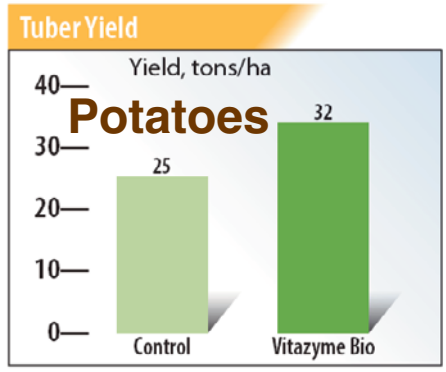
Yield increase with Vitazyme Bio: 47%



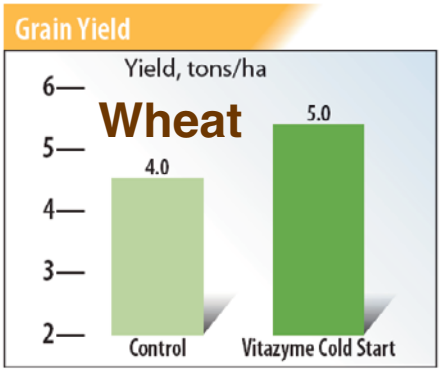
Yield increase with Vitazyme Bio: 17%



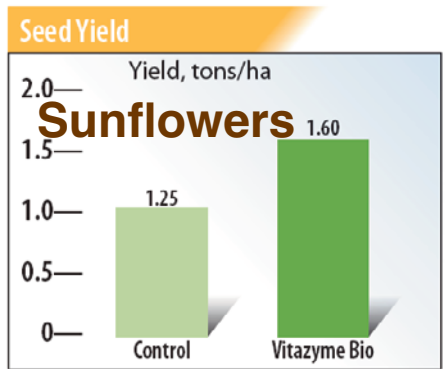
Yield increase with Vitazyme Cold Start: 24%



Yield increase with Vitazyme Bio: 28%



Yield increase with Vitazyme Cold Start: 25%



Yield increase with Vitazyme Bio: 28%