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Record Fertilizer Prices Driving Farmers to Microbes

By Patrick Thomas and Amrith Ramkumar
[*The Wall Street Journal*, April 30, 2022]

Startups marketing alternative crop fertilizers said they are gaining traction among U.S. farmers and investors, pitching themselves as a potentially cheaper option as prices for traditional fertilizers surge.

Companies such as Pivot Bio, Kula Bio, and Anuvia are pushing development of farm fertilizers by harnessing microbes or plant-based products to deliver nutrients that corn and other crops need. They aim to replace traditional fertilizers produced from natural gas or mined underground, prices of which have hit records this year due to supply-chain constraints and Russia's war on Ukraine.

While some farmers have been skeptical of trading in tried-and-true fertilizers for still-nascent alternatives, startup executives and investors said that escalating prices for traditional nitrogen, potash, and phosphorous-based fertilizers are giving farmers extra incentive to test drive the new products. Such startups, which pitch their products as more environmentally friendly than conventional fertilizers, have attracted roughly $1 billion since early last year, according to research AgFunder.

The practice of spraying bacteria, algae, and other microbes to the soil and leaves is becoming a more common practice to improve yields and soil health.

Dan Hansen, a fifth-generation farmer in Avoca, Iowa, said he is saving money by using Pivot microbes instead of conventional fertilizers. Mr. Hansen, who has been applying the startup's products to his roughly 700 acres for several years, said he has cut his nitrogen fertilizer use by about 25% over that period and that his corn yields have been bigger, too.

Mr. Hansen said Pivot Bio's microbial products are currently cheaper than nitrogen fertilizer and have increased his corn crop yields.

The high price of nitrogen fertilizers could prompt more skeptical farmers to look at new products like Pivot, he said. Nitrogen fertilizer costs him about 90

A Food Crisis a Real Possibility, page 2

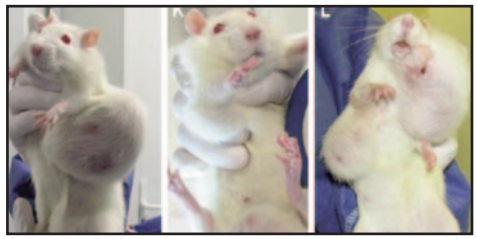
The Other Side of GMOs

Farmers Rely On Them, But There Are Drawbacks

By Paul W. Syltie, Ph.D.

As we all know, there are two sides to a story, and the wise person will look at both sides before making a judgement on a matter. It is implied in Proverbs 18:7 that in everyday life we need to examine both sides of an issue. You cannot wholly support an issue unless you iunderstand both sides.

The same applies to GMO crops. This is a highly relevant issue for today, since in 2019 more than 18 million farmers in 29 countries planted over 190 million hectares (469.5 million acres) of GMO crops. Even the countries of Europe, which ban the growing of GMOs, import



Laboratory rats fed GMO corn developed tumors and other problems due to the toxins found in the grain.

30 million tons of corn and soybean animal feeds every year.[1]

Between 1985 and September 2013, the USDA approved over 17,000 different GMO crops for field trials, including varieties of corn, soybean, potato, tomato, wheat, canola, and rice, with various genetic modifications such as herbicide tolerance, insect, fungal, and drought resistance, and flavor or nutrition enhancement. As of January 10, 2022, the USDA listed 12 bioengineered products available in the US: alfalfa, Arctic apples, canola, corn, cotton, eggplant, disease-resistant varieties of papaya, pink flesh varieties of pineapple, potato, salmon, soybean, summer squash, and sugarbeet.[2]

The major claims both for and against the use of GMOs are shown in the boxes. What is most noticable concerning the

See The Solar Corridor Captures, page 3

Use of Microbial Products Is Growing

Continued from page 1

cents a pound, while Pivot's product amounts to about 60 cents a pound, he said.

"When fertilizers are cheap, guys are more willing to do what they do," Mr. Hansen said. "It's in these situations when there's supply issues that we're pushed to step out of our comfort zone a bit."

Fertilizer costs, one of growers' biggest expenses each year, tripled earlier this year due to supply constraints. Costs have gone even higher following a drop in supply from Russia, one of the world's largest exporters, due to sanctions that followed the Ukraine invasion. At the same time, skyrocketing prices for natural gas—another Russian export and a crucial ingredient in fertilizer-making—have prompted European fertilizer factories to scale back production.

Mounting pressures on the traditional fertilizer industry show the need to modernize the sector and develop U.S. sources of what some backers call clean fertilizer, investors said. Berkeley, California-based Pivot, founded in 2011, has raised more than $615 million, according to AgFunder, including $430 million last summer from investors including Bill Gates's Breakthrough Energy Ventures, Singapore's state investment firm Temasek Holdings Ltd., and the venture arm of grain trader Bunge Ltd.

Pivot develops microbes that can be applied to fertilize crops. Karsten Temme, its CEO, said he expects the company's products to be used on more than three million acres of land this year, three times last year's figure, and that they are often cheaper than conventional fertilizers.

"The biggest challenge is to convince people that now it's possible" to profitably use alternatives to conventional fertilizers, Mr. Temme said. The company is now expanding its sales force and labs.

Traditional fertilizer makers said microbe-based alternatives are promising but can't fully replace existing products. While emerging alternatives can offset some nitrogen-based fertilizers, they don't replicate others such as potash and phosphate, said a spokesman for Mosaic Co., which produces those two fertilizers. Mosaic has a commercial agreement to sell a biofertilizer product made by Anuvia, a Winter Park, Florida, startup that has raised about $170 million since early last year.

Fertilizer companies including Mosaic, Yara International ASA, and Nutrien Ltd. have made their own investments in researching and developing such biological products. A Nutrien spokeswoman said it has invested $1 billion in its effort over the past decade.

A variety of soil organisms can be cultured and sprayed on fields to enhance nutrient utilization, yield, plant protection, and soil health.

Bayer AG recently announced a partnership with synthetic-biology company Ginkgo Bioworks Holdings Inc., that includes evaluating biological fertilizer solutions. Robert Reiter, head of research and development for Bayer's crop science division, said the partnership is meant to engineer a product that is more effective than what's currently on the market.

Independent research on alternative fertilizers remains limited, said James Camberato, a professor of agronomy at Purdue University. Farmers should consider testing the products themselves before purchasing in bulk, he said.

In January, climate-focused Lowercarbon Capital and other investors put $50 million into Kula Bio, a Boston company co-founded by a Harvard University professor that is working to commercialize cost-competitive microbes that can store energy, stay alive longer, and boost crop growth. Kula has seen a surge in inquiries from farmers and now expects to start selling products to farmers by the end of 2022, several months earlier than it previously did, Chief Executive Bill Brady said.

Nitricity, a San Francisco company launched in 2018, is working to build reactors that replicate lightning's effect on the atmosphere, using electricity to break down nitrogen molecules in the air that are mixed with water to fertilize crops. The company raised $5 million in August from investors including Lowercarbon and Energy Impact Partners.

The company isn't yet selling its products to farmers. Still, Nico Pinkowski, Nitricity's chief executive, said he had to remove his phone number from the company's website early this year due to a surge in calls from farmers looking for lower-cost fertilizer options, and he said some farmers even showed up at the company's headquarters.

"We've been totally inundated with inquiries," Mr. Pinkowski said.

Some farmers said they aren't ready to gamble their harvests on unfamiliar products. Growers' livelihoods depend on their crops, and some venture capital-backed startups have struggled to gain traction.

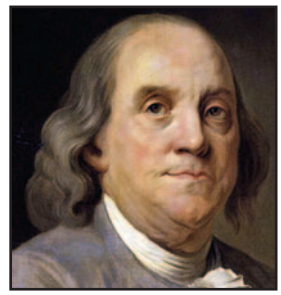
Stanton Stine, a fifth-generation corn and soybean farmer in Farina, Ill., said he needs more proof that biological fertilizers work before he buys them. He said the startup-backed fertilizers aren't cheap enough to justify the risks of cutting back on traditional fertilizer use and lack enough independent research to convince him that they will help his harvest. "I'm not on the bandwagon," he said. ❒

Benjamin Franklin a Farmer? Yes indeed!

By Paul W. Syltie, Ph.D.

I wrote last month the fact that our founding fathers were avid promoters of agriculture, and were themselves farmers. In this issue I want to focus on one of those founders—Benjamin Franklin—whom many historians might say was an exception to that rule.

But, he was not an exception! Though unquestionably a confirmed city-dweller, Benjamin Franklin bought a New Jersey farm after he retired from the printing business in 1748. According to historian Earle Ross, "Apparently he turned his farm into a sort of miniature experiment station, carrying on projects in drainage, in crop rotation, and especially in the utilization of the newer grasses and liming and fertilization. With Jared Eliot he exchanged seeds and plants and compared the experiences of sandy Jersey with those of rocky New England."[1]



America's foremost scientist and inventor described his efforts to cultivate part of his three-hundred-acre spread in a letter to a friend. "This meadow had been ditched and planted with Indian corn, of which it produced about sixty bushels per acre. I first scoured up my ditches and drains, and took off all the weeds; then I ploughed it and sowed it with oats in the last of May [1748].... On the 23d of August, I sowed nearly thirty acres with red clover and herd-grass, allowing six quarts of herd-grass and four pounds of red clover to an acre in most parts of it."[2]

The management of Franklin's farm

See Benjamin Franklin, the Farmer, page 7

There Are Alternatives to GMOs

Continued from page 1

claims in favor of GMO crops is that they neglect to truthfully support many of those claims. As a soil scientist who is above all concerned about the effect of these crops on human health, I am especially aware of studies performed with laboratory animals that reveal their danger to health and reproduction. Toxins in the grain are not innocuous, and are known to cause allergic reactions, abdominal pain, diarrhea, skin rashes, and tumors. The kidneys and livers of test animals are especially affected.[3]

Ken Roseboro of the Organic and Non-GMO Report states that nearly 30 years ago proponents of genetically engineered food crops boldly claimed that lab-created foods would "feed the world," create more nutritious food, increase crop yields, and reduce pesticide us. Thirty years later all of those claims remain unfulfilled.[4]

- The two most common GMO crops—glyphosate-tolerant soybeans and insect resistant corn—are not more nutritious than their non-GMO counterparts.
- The use of pesticides, including herbicides like glyphosate, has increased by about 404 million pounds during these 30 years.
- The majority of the GMO corn and soybeans is used for animal feed, so these crops are not feeding the world.

The synthetic biology company Ginkgo Bioworks claims to be working towards a future where genetic engineering can help make foods that are sustainable, delicious and accessible to everyone. However, in an SEC filing the company disclosed the risks of this technology by stating, "We work with biological and chemical materials that could be hazardous to human, animal, or plant health and safety or the environment.... In addition, we cannot eliminate the risk to (a) accidental or intentional injury or (b) release, or contamination from these materials or wastes, which could expose us to liability."[5]

An article in *Nature* (June 25, 2020) describes how the use of CRISPR gene editing in human embryonic cells causes "chromosomal mayhem."[6] Thus, we see that manipulating the DNA of living systems through genetic engineering, synthetic biology, or gene editing is risky. We do not know the long-term effects on human and animal health and the environment.

New crop varieties are currently being developed using non-GMO and traditional plant breeding techniques that offer safer and more viable options.

We need to face the fact that GMO crops are used primarily to save labor for the farmer, and enable him to grow hundreds or thousands of acres of row crops without having to cultivate, a time-consuming and expensive operation. In the end, it is important to put the health of people and the environment first, and not let profitability be our sole consideration when framing the future of our families and nation. ❐

Claims in favor of GMOs[7]

1. They have been proven safe through testing and use, and can even increase the safety of foods.
2. They lower the price of food and increase nutritional content, helping alleviate world hunger.
3. They lead to environmental benefits such as reduced pesticide use, less water waste, and lower carbon emissions.

Claims against GMOs[8]

1. They have not been proven safe for human consumption through human clinical trials.
2. Tinkering with the genetic make-up of plants may result in changes to the food supply that introduce toxins or trigger allergic reactions.
3. Certain GMO crops harm the environment through the use of toxic herbicides and pesticides.

1, 2, 4, 7, 8.Anonymous, GMOs—Top 3 pros and cons, January 10, 2022, www.*britannicaprocon.org*.
3. C. Sarich, Study links GMOs to over 22 different diseases, December 14, 2021, *www.naturalsociety.com*.
5. K. Roseboro, Editor's note, *The Organic and Non-GMO Report,* September/October 2022.
6. H. Ledford, CRISPR gene editing in human embryos wreaks chromosomal mayhem, June 25, 2020, *www.nature.com*.

15-Minute Soils Course

Lesson 56: Our All-Important Approach to Soils

This lesson in soils will be more of a philosophical approach to the topic of soils, because it is critical to have a correct view of the soils under our feet in order to properly treat them. We learned in Lesson 55 in the Summer 2022 issue of *The Vital Earth News* that the success or failure of a nation is directly related to how the farmers of that nation treat its most precious possession ... its soil resources, for from that resource comes the food, feed, and fiber upon which the people and livestock survive. The quality of that production, as much as the quantity, contributes to the nutritional status of the population, and relates directly to the judgement and morality of the people living upon that production. The mind is affected as dramatically as is the body by the intake of plant nutrients that come directly from the soil.

Soil scientists and agronomists have for decades understood there are two basic approaches to soils.

1. The pedological approach. Coming from the Greek πέδον, pedon, "soil," and λόγος, logos, "study," this approach looks upon the soil purely as a biochemically weathered product of nature, consisting of certain minerals which vary depending upon the parent material inherited from bedrock, glacial till, stream alluvium, lake bottoms, or volcanic deposits. These minerals are affected by climate (the temperature and rainfall regime), topography, vegetation growing on the land and the organisms associated with this vegetation, and the length of time these factors have exerted their influence. Hans Jenny codified these five factors in his book *Factors of Soil Formation* (McGraw-Hill Book Company, 1941).

Factors of Soil Formation

1. **Parent material**
2. **Climate**
3. **Topography**
4. **Vegetation/Microbes**
5. **Time**

2. The edaphological approach. This term comes from the Greek ἔδαφος, edaphos, "ground," and λόγος, logos, "study," and is concerned with the influence of soils on living beings, particularly plants. It considers the various properties of soils as they relate to plant production. The edaphologist is a practical person who has in mind the production of food, feed, and fiber as his ultimate goal, so he must take into account all aspects of the soil, not only the pedological aspects but especially the means by which farmers treat the land to produce their crops.

Soil: ***"A natural body synthesized in profile form from a varied mixture of broken and weathered minerals and decaying organic matter, which covers the earth in a thin layer and which supplies, when containing the proper amounts of air and water, mechanical support and, in part, sustenance for plants."***

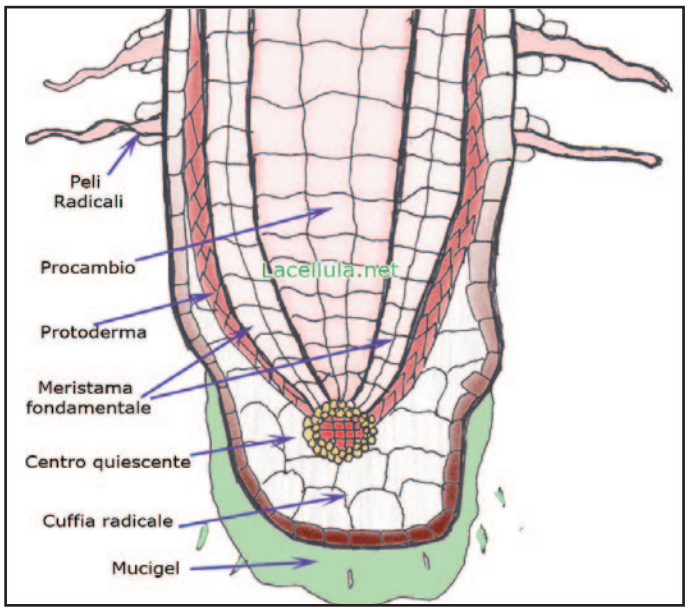
Thus, a good definition of soils from an edaphological perspective might be, "a natural body synthesized in profile form from a varied mixture of broken and weathered minerals and decaying organic matter, which covers the earth in a thin layer and which supplies, when containing the proper amounts of air and water, mechanical support and, in part, sustenance for plants" (Buckman and Brady, *The Nature and Properties of Soils*, Macmillan Company, 1969).

From these definitions as to how we view and define soils comes our manner of treatment of this sustainer of civilization around the world. Yet, there should be an extension to this widely accepted edaphological approach to soils, beyond these two major ones widely accepted within the world of agronomy and soil science, which incorporates the parameters within which we treat this natural body. This approach may be called as follows.

15-Minute Soils Course

3. The edapho-moralistic approach. This view of soils includes the essential view of soils from an edaphological viewpoint—the soil being a natural body comprised of mineral matter that has been influenced by climate, topography, and biological activity over time—that takes into account the production of food, feed, and fiber and the methods used to produce those crops, but with an understanding of the moral responsibility the farmer has in this process.

Thus, the farmer, when managing his land, will picture the soil as a natural body that requires him to consider the consequences of what practices he invokes on the nutritional quality of the food produced from them, on the long-term health of the soil, and on the effects these practices will have upon his neighbors and the nation as a whole. This would include considerations such as follows.



The rhizosphere of plants involves highly complex interactions among soil microbes which feed on root exudates, which in turn feed the plants. This activity should be accounted for in our approach to soils.

- Effects of tillage on water and wind erosion
- Effects of herbicides and pesticides on soil health and the crops produced, such as effects on soil structure and biology, and food contamination
- Effects of crop type and variety on soil health, including GMOs which modify rhizosphere microbes

This third approach would require the farmer to view the practices he implements in his operations as a service to the Creator of the soils and plants with which he interacts. It would also cause him to carefully consider his responsibilities to his neighboring citizens of the earth.

The soil is much more than simply a biochemically weathered product of nature having a certain mineral and organic content upon which plants feed. The rhizosphere (root zone) contains a highly complex, interacting torrent of microbial activity interacting with both mineral and organic soil components; see Lesson 2 in the Spring 1996 issue of *The Vital Earth News* for a discussion on this topic. That reality should be incorporated into our all-important understandings of soils that guide us in our day-to-day management decisions. ❒

See How Much You Learned

1. The pedological approach to soils is the most comprehensive and useful approach. T or F.
2. The factors of soil formation include a. climate, b. time, c. topography, d. fertilizer.
3. An edaphologist in his practice considers the soil to be a producer of food, feed, and _____.
4. Mankind has a responsibility to the Creator to treat the soil with respect for the sake of future generations. T or F.
5. The_____must be considered in our approach to soils because the roots and soil closely interact in this zone.
6. An edaphologist is concerned with the influence of the soil on living beings. T or F
7. A more complete approach to soils should include the consideration of the following: a. crop variety, b. tillage, c. herbicide applications, d. concern for our neighbors.

Answers: 1. F; 2. a, b, c; 3. fiber; 4. T; 5. rhizosphere or root zone; 6. T; 7. a, b, c, d.

Fonio, an Ancient Grain for All Nations

By Jurrien Roossien
From *www.afonio.com*

Fonio is believed to be one of the oldest cereals in West Africa, where it is indigenous. Its cultivation extends back thousands of years. This forgotten grain has adapted to be perfect for the dry and harsh Saharan region.

This grain embodies great symbolic meaning for many African cultures spanning the Sahara Desert. In some cultures, Fonio symbolically represents the universe, as "from Fonio, life is born."

This tiny grain packs a punch in nutritional terms, providing more protein than most staple grains in modern agriculture. Annually, 3 to 4 million people are fed with Fonio in West Africa!

Fonio is drought-resistant and has the ability to grow on poor, shallow, sandy, or rocky soils, where other cereals cannot grow. Its roots help to secure topsoil to prevent the spread of deserts, and it is one of the world's fastest-maturing grains, completing its life cycle in 60 to 70 days.

Fonio is nicknamed the "lazy farmer's crop" because it is so easy to grow. Farmers simply scatter the seeds after the first rain and wait for harvest. This traditional method yields about 0.5 to 1.2 tonnes per hectare. However, up to two tonnes per hectare can be harvested using very good agronomic practices.

The seed germinates within a week after planting. Adult plants grow to about 50 cm tall, while flowers show about 6 to 8 weeks after emergence. The grain is ready to harvest between 60 and 120 days after emergence. The plants are usually harvested with a knife or a sickle, tied into sheaves, dried, and stored under cover before being dehulled.

The main challenge when cultivating

Although fonio grains are small and require dehulling before eating, the crop is highly nutritious and adaptable.

fonio is turning the grain into food. Fonio grains are as tiny as sand and each must have their inedible covers removed. Farmers may spend two hours threshing and dehulling the seeds, yielding only one kilo (2.2 pounds) of fonio. Thanks to a Senegalese mechanical engineer, a machine was invented capable of making this laborious procedure into an 8-minute task of dehulling five kilos (11 pounds) of fonio. This machine is promising because, unlike the traditional procedure, it can easily meet the high demands of food supply and it does not require water. Unfortunately, the miraculous machine is steps away from being distributed to all countries.

From Lake Chad to the savannah regions of Senegal and Guinea, fonio is an important food source across West Africa. It is one of the most nutritious of all grains, rich in important essential amino acids that are not found in wheat, rice, maize, or sorghum—such as methionine, leucine, valine, and cysteine.

This miraculous grain is beneficial for diabetics as it contains a low sugar content and low glycemic index. It is also rich in iron, with 8.5 mg per serving, meeting at least half of the daily requirement, not to mention that it is rich in zinc and magnesium.

Fonio can be used in salads, crackers, pastas, and even in baked goods. It can replace oats to make hot cereal, or be used in place of couscous or rice in any dish, and is delicious mixed with spices and olive oil as a side dish. It also can be used to brew beer. ❒

Organic Foods Going Mainstream

By Paul W. Syltie, Ph.D.

I remember very well the battle waged only a few decades ago between the forces of commercially grown and processed foods, and organic foods. I was working on my doctorate in soil fertility at North Dakota State University, and was attempting to show through field and laboratory research that how a crop is fertilized will affect the quality of the food from the cropping system used.

I was successful in that venture—wheat grown with improved soil fertility produced grain that led to superior growth of laboratory rats—following in the footsteps of Robert McCarrison, Sir Albert Howard, and Weston Price, among other pioneers in the field of organic nutrition. The results of my thesis were hardly noticed amidst the noise of the heavy advertising of multinational food corporations and the entrenched behavior of most people, who actually believed the advertising that Fruit Loops and Twinkies were good for you. The major scientific journals, coached and funded by big-ag, would not touch organic-oriented articles.

Compare those days with the present. The prestigious Mayo Clinic website proclaims some quite amazing information on its "Healthy lifestyle: Nutrition and healthy eating" web page. In an article for April 22, 2022, the Mayo Clinic staff defines the term *organic* in favorable terms, saying that organic farming practices improve soil and water quality, cut pollution, treat animals with dignity, and promote sustainable resource cycling on the land. The standards for organic acres do not allow commercial fertilizers, pesticides, irradiation of food crops, genetic engineering of plant varieties, and antibiotics or growth hormones for livestock.

Some of the health benefits of organically grown foods cited are given in the box below. These benefits have been extracted from published journal articles.

Benefits of Organic Foods

- **Higher levels of nutrients, especially antioxidants and flavonoids**
- **Greater contents of omega-3 fatty acids in meat, dairy products, and eggs grown with grass and organic feeds**
- **Lower levels of toxic metals, such as cadmium in grains**
- **Very low levels of pesticides**

Finally the truth about the benefits of organic agriculture are being accepted and published to the general public, but coming to this point has required a battle by futuristic thinkers on many fronts. ❒

Benjamin Franklin the Farmer

Continued from page 3

reflected his meticulous, scientific side: "I would know every particular relating to this Matter [of a particular kind of hedge], as the best Thickness, Height, and slope of the Bank; the Manner of erecting it, the best Time for the Work, the best Way of planting the Hedge, the Price of the Work to Labourers per Rod or Perch...."[3]

Eventually, the farm would be turned over to Franklin's son, and later to his grandson. Ever-practical Franklin cherished the practical over the classical. Historian Earle D. Ross wrote that "Many years in advance of his time, Franklin advocated instruction in the science and practice of agriculture. In his proposal for the Philadelphia Academy in 1759 he included the often-quoted suggestion, 'While they are reading Natural History, might not a little Gardening, Planting, Grafting, Inoculating, etc., be taught and practiced; and now and then Excursions made to the neighbouring Plantations of the best Farmers, their methods observ'd and reason'd upon for the information of Youth?'"[4]

And as a diplomat, Franklin was an agricultural agent for American farmers. "The great business of the continent is agriculture," wrote Franklin later in life...." Yet, as early as 1751 Franklin had written, "Land being thus plenty in America, and so cheap as that a labouring man, that understands husbandry, can in a short time save money enough to purchase a piece of new land sufficient for a plantation, whereon he may subsist a family, such are not afraid to marry."[5]

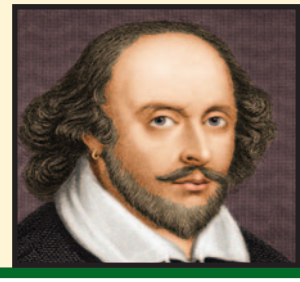
Clearly, Franklin appreciated the economic impact of agriculture. In 1769, Franklin wrote Henry Home, "There seem to be but three ways for a nation to acquire wealth. The first is by war, as the Romans did, in plundering their conquered neighbours. This is robbery. The second by commerce, which is generally cheating. The third by agriculture, the only honest way...wrought by the hand of God in his favour, as a reward for his innocent life and his virtuous industry."[6]

Biographer Carl Van Doren observed that "Franklin was one of the earliest Americans to perceive that the agricultural resources of the country should not be wasted, and that farming must be something of a business and a science as well as a way of life."[7] ❒

1, 4. Earle D. Ross, Benjamin Franklin as an Agricultural Leader, *The Journal of Political Economy*, February, 1929.
2, 7. Carl Van Doren, *Benjamin Franklin,* Viking Press, New York, 1938.
3.Letter from Benjamin Franklin to Jared Elliot, October 25, 1750.
5. Esmond Wright, editor, *Benjamin Franklin: His Life as He Wrote It*, Harvard University Press, 1996.
6. Forrest McDonald, Novus Ordo Seclorum: The Intellectual Origins of the Constitution, University Press of Kansas, 1985.

William Shakespeare (1564-1616) wrote nearly 10% of the most quoted lines ever written or spoken in English, and is the second-most quoted writer in the English language. Here are a few of his quotes.

❒ "When I got enough confidence, the stage was gone. When I was sure of losing, I won. When I needed people the most, they left me. When I learnt to dry my tears, I found a shoulder to cry on. And when I mastered the art of hating, somebody started loving me."
❒ "We suffer a lot the few things we lack, and we enjoy too little the many things we have."
❒ "In friendship, as in love, we are often happier through our ignorance than our knowledge."
❒ "Have more than you show, speak less than you know."
❒ "Laughing faces do not mean that there is absence of sorrow! But it means that they have the ability to deal with it."



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 ...

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Please include the following in your request:

Name:

Location:

Message:

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

Organic Vitazyme Trials in Hungary Show Excellent Responses

A series of five trials was conducted in 2021 in Hungary to prove the efficacy of Organic Vitazyme in Csongrad-Csanad State.These results show the consistency of the program to improve yields for a variety of crops, and the superiority of the 1 and 2 liter/hectare rate (13 to 26 ounces/acre) under the trial conditions.

Strawberries

	Rate of application, four sprays			
	Control	0.5 liter/ha	1 liter/ha	2 liters/ha
Vigor[1]	88.3 b	97.3 a	98.2 a	98.2 a
Chlorophyll[2]	30.9 b	35.5 a	35.5 a	36.2 a
Fruit yield[3]	15.3 d	16.4 c	16.9 b	17.4 a
Fruit sugar[4]	9.2 b	10.4 a	10.5 a	10.7 a

[1] %; [2] SPAD units; [3] kg/plot; [4]Brix.
Means followed by the same letter are not significantly different at P=0.10 (Student-Newman-Keuls test).

Yield increase with Vitazyme: 7 to 14%

Cucumbers

	Rate of application, four sprays			
	Control	0.5 liter/ha	1 liter/ha	2 liters/ha
Vigor[1]	86.7 c	94.2 b	95.8 ab	97.5 a
Chlorophyll[2]	55.4 b	57.7 a	58.1 a	58.2 a
Yield[3]	11.2 d	13.2 c	15.8 b	17.4 a
Fruit/plot[4]	3.81 d	5.61 c	7.14 b	7.59 a

[1] %, July 4; [2] SPAD units; [3] kg/plot; [4]number/plot, July 27.
Means followed by the same letter are not significantly different at P=0.10 (Student-Newman-Keuls test).

Yield increase with Vitazyme: 17 to 55%

Tomatoes

	Rate of application, four sprays			
	Control	0.5 liter/ha	1 liter/ha	2 liters/ha
Vigor[1]	91.8 c	94.0 b	95.0 ab	96.0 a
Chlorophyll[2]	42.4 b	44.7 a	46.4 a	46.6 a
Fruit yield[3]	33.4 c	33.9 c	34.4 bc	36.2 a
Fruit/plot[4]	72.8 c	75.4 b	76.9 b	80.1 a

[1] %; [2] SPAD units; [3] kg/plot; [4] number/plot.
Means followed by the same letter are not significantly different at P=0.10 (Student-Newman-Keuls test).

Yield increase with Vitazyme: 2 to 8%

Grapes

	Rate of application, four sprays			
	Control	0.5 liter/ha	1 liter/ha	2 liters/ha
Bunches[1]	14.8 a	14.8 a	15.8 a	15.7 a
Chlorophyll[2]	33.4 b	34.4 a	34.6 a	34.6 a
Grape yield[3]	15.4 b	15.9 ab	16.1 ab	16.5 a
Unmarketable[4]	6.5 a	5.7 ab	6.0 ab	5.4 b

[1] number/plot; [2] SPAD units; [3] kg/plot; [4]unmarketable fruit,% of total.
Means followed by the same letter are not significantly different at P=0.10 (Student-Newman-Keuls test).

Yield increase with Vitazyme: 3 to 7%

Apples

	Rate of application, four sprays			
	Control	0.5 liter/ha	1 liter/ha	2 liters/ha
Vigor[1]	94.3 b	95.7 a	96.9 a	97.8 a
Chlorophyll[2]	47.3 c	47.5 b	47.7 ab	47.8 a
Fruit yield[3]	112.0 c	116.1 bc	120.0 a	122.6 a
Fruit sugar[4]	13.3 b	13.6 ab	13.6 ab	13.7 a

[1] %; [2] SPAD units; [3] kg/plot; [4] %.
Means followed by the same letter are not significantly different at P=0.10 (Student-Newman-Keuls test).

Yield increase with Vitazyme: 4 to 9%