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Diluting Our Health Nutrient Dilution Is Robbing Our Bodies of Elements

By Cheryl Long

The commercially grown vegetables, fruits, and grains that we are eating today have significantly lower nutritional content than these foods had 100 years ago, or even just 30 years ago. We now have solid, scientific evidence of this troubling trend. For example, in wheat and barley, protein concentrations declined by 30 to 50 percent between the years 1938 and 1990.

Likewise, a study of 45 corn varieties developed from 1920 to 2001, grown side by side, found that the concentrations of protein, oil, and three amino acids have all declined in the newer varieties.

Six minerals have declined by 22 to 39 percent in 14 widely grown wheat varieties developed over the past 100 years (see the graph on page 2).

Official U.S. Department of Agriculture (USDA) nutrient data shows that the calcium content of broccoli averaged 12.9 milligrams per gram of dry weight in 1950, but only 4.4 mg/g dry weight in 2003 (see the graph, page 2).

All of this evidence has been assembled and rigorously reviewed by Dr. Donald R. Davis, a now retired chemist from the University of Texas.

So what's causing these declines? The evidence indicates there are at least two forces at work. The first is what agriculture researchers call the environmental "dilution effect." Davis notes that researchers have known since the 1940s that yield increases produced by fertilization, irrigation, and other environmental means used in industrial farming tend to decrease the concentrations of minerals in those plants. These techniques give growers higher yields, and consumers get less expensive food. But now it appears there's a hidden long-term cost: food quality.

For example, a study of phosphorous fertilizer on raspberries found that applying high levels of phosphorus caused the yield to double and concentrations of phosphorus to increase in the plants, but meanwhile levels of eight





Plant breeding for high yields (top) and heavy fertilization, especially with nitrogen (bottom), has resulted in higher crop yields that contain much starch, diluting nutrients. See A Great Loss in Nutrient Values, page 2

Good Progress Being Made in Organic Agriculture

By Paul W. Syltie, Ph.D.

The memory of so many people tends to be short-lived. This includes readers of the 1989 report by the National Research Council (NRC) entitled *Alternative Agriculture*. This 448-page report concluded, "Wellmanaged alternative farming systems nearly always use less synthetic chemical pesticides, fertilizers, and antibiotics per unit of production than comparable conventional farms. Reduced use of these inputs lowers production costs and lessens agriculture's potential for adverse environmental and health effects without necessarily decreasing—and in some cases increasing—per acre crop yields and the productivity of livestock management systems."



These discoveries are achieved in spite of the fact that many federal policies discourage the adoption of alternative practices and systems by economi-

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cally penalizing those who adopt rotations, apply certain soil conservation systems, or attempt to reduce pesticide applications. On the other hand, as the NRC report pointed out. federal programs often tolerate and sometimes encourage unrealistically high yield goals, inefficient fertilizer and pesticide use, and unsustainable use of land and water. These approaches lead to environmental degradation and reductions in food quality, as the lead article of this newsletter issue points out.

Even so, in 1971 then US Secretary of Agriculture Earl Butz uttered these

See The Future of Agriculture Is, page 7

A Great Loss in Nutrient Values

Continued from page 1 other minerals declined by 20 to 55 percent!

The other force at work is what Davis calls the genetic dilution effect — the decline in nutrient concentration that results when plant breeders develop high-yielding varieties without a primary focus on broad nutrient content. That's what the studies of wheat, corn, and broccoli confirm.

In fruits, vegetables, and grains, usually 80 to 90 percent of the dry weight yield is carbohydrates sugars and starches (the last things

we need more of in the American *****Sig** diet). Davis says that when breeders (and growers) specifically choose varieties for high yields, they are selecting mostly for the highest amounts of

carbohydrates. "These studies suggest to me that genetic dilution effects may be common when selective breeding successfully increases crop yield," Davis says. USDA data indicate that yields have increased

Dilution Effects of Phosphate Fertilizer At 44 ppm With Red Raspberries



Dilution Effect of Elements in Kansas Wheat Varieties Introduced from 1873 to 1995



sugars and starches (the last things [A negative correlation means that as yields increased the element content went down. we need more of in the American ***Significant statistically at P=0.05. *Significant statistically at P=0.001.]

> an average of 1.8 fold for 24 vegetables and 1.3 fold for six fruits over the past 30 years.

What can we do? Vegetables and fruits are our richest sources of many vitamins and minerals. It seems likely that those of us who grow food gardens (or shop at farmers markets) will get more nutrient-dense foods if we grow (or pay a premium for) older, lower-yielding heirloom varieties. Odds are good that heirloom varieties may be more nutritious than current supermarket fare. Plus, using organic methods such as moderate amounts of slow-release fertilizers should help us get maximum nutrition from our homegrown produce. And most important of all, Davis points out that the

nutrient declines in processed foods are much deeper and broader than the declines in fresh, whole foods.

[From Industrially farmed foods have lower nutritional content, *Mother Earth News*, June/July, 2009, *https://www. motherearthnews.com/natureand-environment/nutrit i o n a l - c o n t e n t zmaz09jjzraw.*]

Calcium Trend in Broccoli over 63 Years (USDA Publications)



Our Founding Fathers Were Farmers!

"I think our governments will remain virtuous for many centuries; as long as they are chiefly agricultural." Thomas Jefferson

"I begin now to think all time lost that is not employed in farm-ing." John Adams





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

"I am hastening my preparations to become a fixture on my farm, where I anticipate many enjoyments; which, if not fully realized, will become a welcome exchange for the fatigues and anxieties of public life." James Madison

The Farm Crisis Deepens American Farmers Hope for the Best in 2019

By Paul W. Syltie, Ph.D.

am normally an optimistic person when it comes to the future of agriculture, perhaps because of my farm upbringing in western Minnesota, and acknowledgement of the simple fact that people need to eat to live. As has been covered in a feature article in the Summer 2017 issue of *The Vital Earth News*, fair prices paid to the farmer are essential for national wealth and security. Raw material values paid to farmers are multiplied by five times as they move through the economy; shortchange the farmer with low prices and the entire economy suffers.

What then is in store for farmers for the 2019 cropping year? Here in the Upper Midwest, as of mid-May it has been so cold and wet that very little land has been planted, not a very good beginning to the cropping year. Soybeans will be substituted for many corn acres, and options for substitute crops are limited as the days move along.

According to AgWeb in an article titled, Dilemma for U.S. Farmers: Which Crop Will Lose the Least Money?, *agweb.com*, February 24, 2019), "For farmers who grow some of the biggest U.S. crops, choosing what to plant this year has become a bet on which one will lose less money."

"For farmers who grow some of the biggest U.S. crops, choosing what to plant this year has become a bet on which one will lose less money."

A three-year plunge in prices has sent farm income to the lowest in more than a decade and left parts of the Midwest agricultural economy in recession. While growers probably would lose \$70 on every acre of corn or soybeans they sow -- the most since 1999 -- those crops offer the best chance at profit if yields are better than average, according to AgResource Co. So, even with record global surpluses, U.S. farmers are preparing to plant more corn and soybeans in 2016 and devote less land to wheat, a Bloomberg survey showed." Moreover, the USDA-ERS contends that, "If realized, inflation-adjusted net farm income in 2019 would be 49.0 percent below its highest level of \$136.1 billion in 2013 and below its historical average across 2000-17 (\$90.0 billion). Net cash farm income is forecast to increase \$4.3 billion (4.7 percent) to \$95.7 billion"

(www.ers.usda.govtopics/farm-economy/, March 7, 2019).

The only way for farmers to beat the current depressed agricultural economy is to (1) hope for better prices by some fluke in market forces, such a sudden opening of export potential to China and other needy countries, and (2) to reap an abundant harvest this year so net farm income will be boosted to its maximum.

Let us take a quick look at the first option: hope for higher prices. The price level of an agricultural commodity is influenced by a variety of market forces that can alter the current or expected balance between supply and demand. As explained by

Randy Schnepf of the Congressional Research Service (Price Determination in Agricultural Commodity Markets: A Primer, RL33204, January 6, 2006, www.nationalaglawcenter.org), "Many of these forces emanate from domestic food, feed, and industrial-use markets and include consumer preferences and the changing needs of end users; factors affecting the production processes (e.g., weather, input costs, pests, diseases, etc.); relative prices of crops that can substitute in either production or consumption; government policies; and factors affecting storage and transportation. International market conditions are also important depending on the "openness" of a country's domestic market to international

competition, and the degree to which a country engages in international trade."

Schnepf added that a distinguishing feature of U.S. commodity markets is the importance of futures markets. Unlike cash markets which deal with the immediate transfer of goods, a futures market is based on buying (or selling) commodity

Market and Inflation Adjusted Corn Prices, \$/MT, 1981-2015



Farm Debt (Billions of \$) and Debt-To-Asset Ratios, 1960-2018



1960 1970 1980 1990 2000 2005 2010 2015 2018

contracts at a fixed price for potential physical delivery at some future date.

A futures exchange provides the facilities for buyers and sellers to trade commodity futures contracts openly, and reports any market transactions to the public. Thus, the USDA in their reports and yield predictions plays a critical role in monitoring and disseminating agricultural market information that affects the futures markets in a big way for storable commodities such as corn, soybeans, wheat, and cotton.

Let us hope that the crop yields for 2019 are high, and the USDA does not sabotage futures markets so the hard working farmers of our land will reap reasonable rewards for their labors. \Box

15-Minute Soils Course

Lesson 49: Silicon (Si), Important and **Overlooked**

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Si	

Silicon is the secondmost abundant element on earth, comprising about 28% by weight of mineral soils; only oxygen is more prevalent. It is usually

found in combination with oxygen as SiO₂, known as silica, which comprises sand and the better portion of most rocks and clay minerals. Since clay minerals play such a central role in soil properties, the importance of silicon in soil fertility is profound.

Because silicon is next to carbon on the



Periodic Table (Group 14), is tetravalent (bonds to four other atoms), and comcan with bine

hydrogen,

and oxygen,

just as car-

The element silicon can be isolated cheminitrogen, cally to produce a lustrous gray metalloid, which is used extensively in computer electronics.

bon can, one would think that silicon could form the basis for life forms. Yet, it does not, though it does compose a significant portion of plants, animals, and man: plants contain from 0.1 to 10% silicon, which is as much as the other major elements like potassium and nitrogen.

Only recently has silicon become appreciated as an important component of plants, and perhaps even essential, such as it is for horsetail. Virtually all plants benefit from it, as H_4SiO_4 , the plant-available form.

Even though soils typically contain an abundance of silicon, plants still oftentimes respond



Clay minerals are comprised of silica tetrahedral and aluminum octahedral layers, some such as montmorillonite and illite with an expandible interlayer between them.

to applications of the element because the plantavailable form is always at an extremely low concentration.

Functions of Silicon in Plants

The mechanical strength of plants is maintained by silicon, and with that several protective functions, improving the plant's defense mechanisms to insects and pathogens due to these

The Role of Silicon in Plants

1. Improves mechanical strength: reduced lodging

2. Directly stimulates growth and yield

3. Counters the negative effects of excess nitrogen fertilization

4. Suppresses plant disease caused by fungi and bacteria, especially powdery mildew on cucumbers, pumpkins, wheat, and barley, and gray leaf spot on ryegrass 5. Suppresses insects such as stem borers, spider mites, and leafhoppers

- 6. Alleviates environmental stresses:
 - a. Drought
 - b. Temperature extremes
 - c. Ultraviolet radiation
 - d. Salts in soils
 - e. Heavy metals in soils
 - f. Nutrient imbalances of soils

15-Minute Soils Course

physical barriers in and around cells. In addition, silicon activates the plant's defense genes that lead to more lignin synthesis (to give stronger cells walls and vessel elements), more phenolic compounds and phytoalexins, and other plant resistance metabolites such as certain enzymes, hydroxyl radicals, and reactive oxygen.

Grasses in particular can profit from silicon

Cuticle

applications, even under favorable growing conditions and the absence of disease. Monocots may contain about 1% silicon, but Equisetum contains about 10%. Dicots (broadleaved plants) contain usually around 0.1%

silicon. A New Jersey study revealed concentrations of 1,530 to 11,750 ppm for wheat flag leaves, 4,200 to 7,200 ppm for Kentucky bluegrass leaves, and 1,300 to 3,300 ppm for corn stems.

There are several factors that influence silicon availability.

1. Soil texture. A fine, clayey texture provides more available silicon than a sandy soil, even though sand is almost entirely comprised of SiO_2 , but even a fine texture releases very little silicon as H_4SiO_4 , the plant-available form.

2. Degree of soil weathering. Highly weathered soils, such as Ultisols (common in tropical and high-rainfall areas), have a low availability of silicon.

3. Level of organic matter. Silicon levels in organic matter are low, so organic soils and potting mixes provide little of the element.

Fertilizing With Silicon

Crops can benefit from silicon applications due to better standability, reduced insect and pathogen pressure, and less stress due to temperature extremes, drought, soil salinity, and nutrient imbalances. Fertilizers can be either solid or liquid, and include the following:

- Manure and compost
- Calcium, magnesium, potassium, or sodium silicates
- Diatomaceous earth (the silicaceous skeletons of diatoms)

It is recommended that soil applications rather foliar applications be made for optimum utilization and effectiveness. Adding soluble silicates



to drip irrigation water is effective, as is mixing the silicate with liming materials.

Organic farmers have a greater chance to benefit from silicon's benefits due to their use of organic fertiliz-

ers, which supply ample silicon. The element's ability to reduce both biotic and abiotic stresses is well worth the farmer's consideration when fertilizing his crops.

See How Much You Learned

1. Silicon is a major constituent of crops. T or F 2. Silicon increases yields due to a. increased stem strength, b. better resistance to pathogens, c. suppression of insects, d. greater cell turgor.

3. Stresses from high soil _____ and are alleviated by silicon in the plant.

4. Because silicon is so abundant in the soil, there should be no concern about its availability to the plant. T or F

5. The available form of silicon for plant use is thought to be _____.

6. Common silicon fertilizers include a. compost,

b. calcium silicate, c. diatomaceous earth, d. manure.

7. Grasses tend to be higher in silicon that broadleaved plants. T or F

8. The only element in the earth's crust more abundant than silicon is _____.

Н₄SiO₄. 6. а, b, c, d. 7. Т. 8. охудеп.

So You Think You Know Agriculture?

From *dailyprogress.com* [abridged], Virginia Cooperative Extension

o you know that, according to a Gallop Poll, most people think that oatmeal is made from wheat? Also, half of Americans do not know that most bread is made from wheat? Try this short quiz to test you agricultural knowledge. The answers follow the questions.

1. How much value from the corn in a bag of corn chips does the farmer get?

2. How big is an acre?

3. How many bags of corn chips can you get from an acre of corn?

4.Which weighs more, a gallon of whole milk, with 4% cream, or skim milk with no cream?

5. How much cream is in ice cream?

6. Which has more vitamin C, an orange or a bell pepper?

7. How many farmers are there in the U.S. today?

8. How many ears of corn are in a hamburger?

9. How many burgers do you get from one cow?

10. Why are dairy cows always black and white?

11. How much water is in watermelon?

Answers

1. Yes, corn chips are made of corn about 62% corn, 75% if they're tortillastyle. Yet, when you plunk down your \$2.49 for a 16-ounce bag, only about 25 cents goes back to the farmer. More goes to the folks who produced the oil they were fried in than the guy who grew the corn.

2. An acre is 43,560 square feet, or about the size of a football field minus the end zones.

3. About 5,600 16-ounce bags. The U.S. harvests 6.9 billion bushels of corn every year, enough to supply every man, woman and child an 8ounce bag of corn chips every day.

4. A gallon of skim milk actually weighs more than a gallon of whole milk because skim milk contains more non-fat solids, which weigh more than cream.

5. Ice cream has to contain at least 10% butterfat to merit that name; anything with less than that has be labeled ice milk, or some such thing. By the way, each of us eats an average of 14.3 quarts of ice cream each year, with our favorite flavors being vanilla, chocolate, butter pecan, and strawberry, in that order. 6. Believe it or not, the bell pepper has more vitamin C than the orange.

7. There are 2.1 million U.S. farms, and if you figure at least two people earning a living off of each of those farms, you'd have 4.2 million farmers, about the population of Louisiana. One farmer today grows enough food to feed 120 people. In 1957, one farmer grew enough for 27 people.

> 8. Wait a minute. You thought you knew for sure that hamburgers were made of beef. You're right, but beef cattle are fed on grain, and considering the conversion of corn to beef, there are about four ears of corn represented in just one burger.

9. About 1,600 quarter-pound hamburgers come from a steer weighing an average of 1,100 pounds.

10. It's not because they belong in old-time movies. The familiar white-with-black-splotches cows are members of the Holstein breed, the most popular for dairying because they give the most milk per cow, an average of 4.5 gallons per day.

11. About 90 percent of a typical watermelon is water. \Box

Do We Face An Udderless Future?

By Mike Mish Shedlock

S cientists believe they are on the cusp of a huge change in the way we produce milk in history. Cows won't be needed.

From Silicon Valley to Switzerland, hundreds of millions of dollars are being pumped into a new technology to produce "real milk" — containing identical casein and whey proteins to the genuine article — but without any humans, cows, or other animals involved at all.

There is a lot at stake. The global dairy industry was worth \$413 billion in 2017 while the market for infant formula is expected to top \$70 billion this year, according to Save the Children.

From animal cruelty on factory farms to deforestation and a rising portion of the emissions linked to climate change, raising cattle to produce milk is facing a growing reputational challenge. "If you see how cows are treated in the milking process ... from a moral standpoint it's appalling to most people," says Niccolo Manzoni, founding partner at Five Seasons Ventures, an agricultural technology fund based in Paris.

A study published by the World Health



Could we see laboratory-synthesized milk in the near future?

Organization just last week involving almost 30,000 children across 16 countries suggested breast-feeding has a "protective effect" in staving off fat tissue. Bottle-fed babies, the study found, are 25% more likely to end up obese.

Corporate giants such as US-based DowDuPont, BASF, Nestle, as well as start-ups such as Sugarlogix, Gnubiotics Sciences, and Jennewein Biotechnologie are busy pouring money into lab research. They are developing products that are very similar to human milk, a complex hybrid of over 1,000 proteins and a unique ingredient called human milk oligosaccharide (HMO).

An udderless future is eventually in the cards. But even if scientists perfect the technology, how far off is public acceptance? Farmers will push to ban it. That's for sure. What about labeling? Using the term "milk" for such products will likely be restricted. Would you drink bioengineered milk?

From *Mish Talk*: Global Economic Trend Analysis, *https://moneymaven.io/mishtalk/*.

The Future of Agriculture is Sustainable

Continued from page 1

unsympathetic words: "Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry." What an insult to the wisdom and ingenuity of farmers to say such a thing without the knowledge of organic agriculture's potential. Of course, we know he was trying to protect the megacorporations that were profiting from the current agribusiness model.

Attempts to Impugn Organics

Even today there are some advocates of high-input commercial agriculture that keep trying to convince farmers and the public that organic, and other low-input farming systems, are not practical, or even dangerous when trying to feed a burgeoning world population that is projected to reach 9.8 billion by 2050. For instance, *Farm Progress (www.farmprogress.com/node/314077)* quoted a recent study that claimed "Organic agriculture can't feed the world." The study concluded, "Our results show that organic yields of individual crops are on average 80 percent of conventional yields."

The study, written by Tomek de Ponti, Bert Rijk, and Matin K. van Ittersum of Wageningen University in the Netherlands, in the latest issue of *Agricultural Systems*, examined 362 studies that compared organic and conventional crop yields.

Because the writers of the article can-

Statement of Purpose

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not deny the healthy, rapid growth of the organic food sector due to food preferences of people educated on food safety and quality issues, they relegate organics as a food production sector that will remain a "perpetual, healthy sub-sector" of the total food production system. To say otherwise would deny the financial and philosophical underpinnings of Wageningen University and most other agricultural universities across the world—especially in Western nations that wholeheartedly support the agricultural-industrial complex of fertilizers,



herbicides, pesticides, hybrid and GMO seeds, and sophisticated machinery.

The *Farm Progress* authors believe that the way forward is to improve conventional farming practices and utilize every technology available, including biotechnology, to increase yields. They cite the fact that farmers are doing this right now, with almost 17 million of them planting GM crops.

The Truth About Organics

Let us look at just a few examples of how organic agriculture has improved crop yields and promoted the health of individuals and communities (*www.regenerationinternational.org*).

• 223,000 farmers in southern Brazil using green manures and cover crops of legumes and livestock integration have doubled yields of maize and wheat to 4-5 tons/hectare.

• 45,000 farmers in Guatemala and Honduras used regenerative technologies to triple maize yields to 2-2.5 tons/ha and diversify their upland farms, which has led to local economic growth that has in turn encouraged remigration back from the cities.

• 200,000 farmers across Kenya as part of sustainable agriculture programs have more than doubled their maize yields to about 2.5 to 3.3 tons/ha and substantially improved vegetable production through the dry seasons.

• 100,000 small coffee farmers in Mexico have adopted fully organic production and increased yields by half.

• A million wetland rice farmers in Bangladesh, China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand, and Vietnam have shifted to sustainable agriculture, where groupbased farmer schools have enabled farmers to learn alternatives to pesticides and increase their yields by about 10 percent.

The future is organics, my friends. Let's support this approach, and join them when and where we can. \Box

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A Strawberry Trial in California With Vitazyme + Bio Seed

replicated study by Holden Research and Consulting at Silent Springs Farms, Oxnard, California, in 2018 proved that Vitazyme, together with Bio Seed, a microbial array of beneficial bacteria and fungi, greatly enhanced the production of strawberries, while improving quality as well.

The Program

(1) 16 oz/acre of Vitazyme as a soil drench at planting on July 16, along with 50 grams/acre of Bio Seed

(2) Vitazyme at 16 oz/acre five times as a foliar spray every three weeks, from August 15 to October 29

The Results

Berry yield increase: 28%

Berry income increase: \$2,716/acre

Marketable yield was increased in most cases. Vitazyme and Bio Seed worked together to produce an excellent return on investment of **35:1**!







8 / The Vital Earth News - Agricultural Edition / Summer 2019