The Vital Earth News
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The Rapidly Aging U.S. Farmer

Who Will Grow Our Food During the Next Years?

By Danielle Kurtzleben

Everyone knows American workers are aging, but farmers are longer in the tooth than workers in almost any other occupation. According to the Labor Department, the median age for farmers and ranchers is 55.9 years, second among tracked occupations only to "motor vehicle operators, other," who have a median age of 59.2.

It's not just that farmers are among America's oldest workers – their average age also has been growing rapidly for about 30 years, according to the U.S. Department of Agriculture's Census of Agriculture, which recently released new data. This census, which is published every five years, shows that during the last 30 years, the average age of U.S. farmers has grown by nearly eight years, from 50.5 years to 58.3 years. [Note: The USDA implemented a new methodology in 1997, meaning there could be some inconsistencies between data before and after that year.]

It's important to remember that this figure includes only principal operators, meaning any large farms that have one farmer at the helm but other, younger farmers helping out will only have that one farmer at the top represented. Still, the increase reflects that for many years, new, young farmers were tough to come by, one expert says.

The average age of the American farmer was about 60 years old in 2012, and is even greater today. [Sandra Cunningham, fineartamerica.com]

From about 1982 through the 2007 census, "folks just really weren't getting into farming that much," says Bob Young, chief economist with the American Farm Bureau Federation.

However, he says the fact that the average age in the 2012 census jumped by another 1.2 years surprised him.

"I was a little surprised by the result for this year based on what I'm seeing in the countryside," Young says. "It seems to me that the age demographic is dropping noticeably in the farm meetings I'm attending."

One thing that might keep some young people out of farming could be the barriers to entry – land prices skyrocketed in recent years, and some equipment, like tractors and combines, can cost hundreds of thousands of dollars.

"There are ways that folks can get into it. You can lease some land, you can end up borrowing equipment from somebody," Young says.

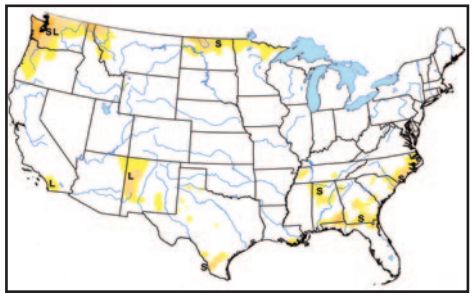
See Farm Lenders Are Also Aging, page 2

Rapid Turnaround in Precipitation

Famine to Feast: America's Weather in Flux

By Paul W. Syltie, Ph.D.

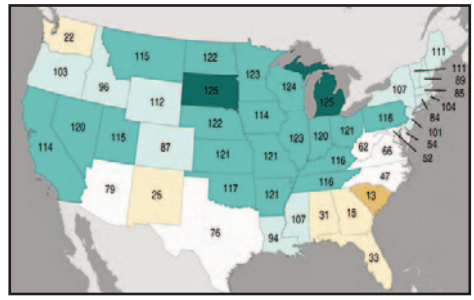
The Summer 2018 issue (Volume IV, Number 1) of *The Vital Earth News* had an article in this very position of the newsletter, touting the worries that 2018 might herald the beginning of a return to the Dust Bowl days of the 1930s. The drought monitor map of the country showed widespread areas of severe to exceptional drought over a wide area of the Southwest and western Plains, stretching from central Kansas through southern Arizona.



Since that time the precipitation pattern across the lower 48 states has turned around dramatically, to the point that very few areas of the country show signs of drought. Note the drought monitor map on the left for July of 2019.

Compare this map with the NOAA map below, showing state-by-state precipitation percentages from January to September, 2019, compared to the aver-

See From Famine to Feast, page 7



Farm Lenders Are Also Aging

Continued from page 1

Young also adds that being counted in the census does not require heavy investment – an operation need only have the potential to produce $1,000 worth of agricultural goods in a year to count as a "farm."

Not only are farmers getting older, but the ones that have been around their current farms the longest appeared to hold on in 2012 while the short-timers dropped off sharply. The number of principal operators who had been on their present farms for less than 10 years fell off by nearly 20 percent between 2007 and 2012. Meanwhile, the number of farmers who had been on their farms for a decade or more grew by nearly 1.2 percent.

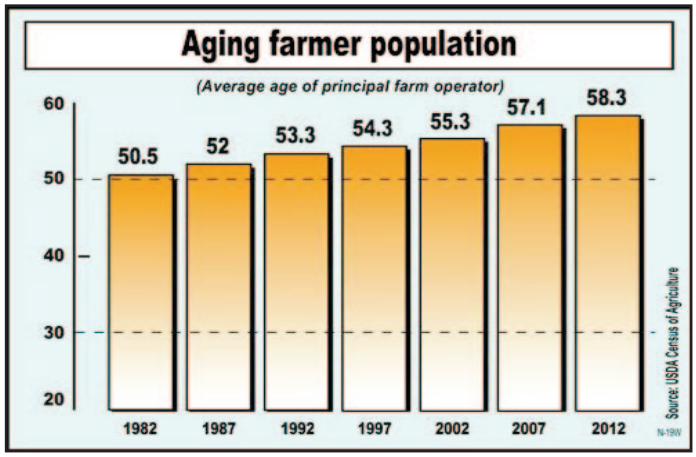
Of course, because the number of farmers who have been at their current operations for less than a decade is relatively small, those figures can experience steeper percentage drop-offs. But the degree to which long-tenured farmers outnumber new farmers is itself striking.

As to what may have driven these changes, one USDA statistician says that the decline in beginning farmers has been an ongoing trend, but that the department is still exploring the reasons behind it. For his part, Young says the fact that the census took place in 2012 is significant here.

"One thing we probably ought to keep in mind is this report is based on what happened in 2012, and that was one of the worst drought years we've had in a long time," he says. Once the USDA comes out with more extensive data on 2012, he says, that could better show why farmer tenure continued to grow. February 14, 2014.

[From *https://www.usnews.com/news/blogs/data-mine/2014/02/24/us-farmers-are-old-and-getting-much-older*.]

To add to the aging scenario of farmers themselves, **Daniel Grant** adds information about aging ag lenders in an article entitled, **A Third of Ag Lenders On "Borrowed Time:" Turnover Imminent,** in the following article.



Many ag lenders have done business with the same farmers for decades. But that likely will change in the near future as farmers and ag bankers exit the industry.

The aging farm population remains a well-documented trend as the average age of a principal U.S. farm operator was 58.3 years as of the 2012 Ag Census. That continues a 30-year uptrend.

A similar but generally less publicized trend continues at ag lending institutions, and could have a significant impact on the industry in the years ahead. "Like producers, agricultural lenders are aging," said Brittany Kleinpaste, director of economic policy and research for the American Bankers Association (ABA). Moreover, fewer farmers expected to turn a profit this year, according to ag lenders survey.

Nearly half of respondents to a recent survey of ag lenders, conducted by ABA and Farmer Mac, reported they have just one to three dedicated ag lenders on staff with an average of nearly 20 years of experience each. However, lenders anticipate a whopping one-third of ag lending staffs around the country will turn over in the next five years.

"It is a concern," Kleinpaste said. "They have valuable institutional knowledge and experience that will be hard to replace, which must be transferred to the next generation of ag lenders."

On the bright side, it appears there will be opportunities to enter ag banking, along with ag production, as the generational transfer plays out for years to come.

"Opportunities to educate and inspire the rising workforce are vital to ensuring new lenders have the knowledge to understand the unique characteristics of the ag sector," Kleinpaste added.

[From *www.farmweeknow.com*, May 5, 2017.]

Thomas Jefferson's Views on Cities Versus Farms

The City: "I view great cities as pestilential to the morals, the health and the liberties of man. True, they nourish some of the elegant arts; but the useful ones can thrive elsewhere; and less perfection in the others, with more health, virtue and freedom, would be my choice."

The Farm: "Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous, and they are tied to their country and wedded to its liberty and interests by the most lasting bonds. As long, therefore, as they can find employment in this line, I would not convert them into mariners, artisans, or anything else." –Thomas Jefferson

Organic Agriculture Can Feed the World

By Andre Leu

[Andre Leu is the author of *The Myth of Safe Pesticides* (ACRES USA, 2014), This is a beginning excerpt and the conclusion of an article published in ACRES USA in the January 2004 issue.]

Organic agriculture practices are often blamed for being unsustainable and not able to feed the world. In fact, several high-profile advocates of conventional agricultural production have stated that the world would starve if we all converted to organic agriculture. They have written articles for science journals and other publications saying that organic agriculture is not sustainable and produces yields that are significantly lower than conventional agriculture.

Thus, the push for genetically modified organisms, growth hormones, animal- feed antibiotics, food irradiation and toxic synthetic chemicals is being justified, in part, by the rationale that without these products the world will not be able to feed itself. Ever since Thomas Malthus wrote *An Essay on the Principle of Population* in 1798 and first raised the specter of overpopulation, various experts have been predicting the end of human civilization because of mass starvation.

The theme was popularized again by Paul Ehrlich in his 1968 book, *The Population Bomb*. According to Ehrlich's

logic, we should all be starving now that the 21st century has arrived: "The battle to feed all of humanity is over. In the 1970s the world will undergo famines; hundreds of millions of people are going to starve to death in spite of any crash programs embarked upon now."

The only famines that have occurred since 1968 have been in African countries saddled with corrupt governments, political turmoil, civil wars, and periodic droughts. The world had enough food for these people — it was political and logistical events that prevented them from producing adequate food or stopped aid from reaching them. Hundreds of millions of people did not starve to death.

The specter of mass starvation is being pushed again as the motive for justifying GMOs. In June 2003, President Bush stated at a biotechnology conference, "We should encourage the spread of safe, effective biotechnology to win the fight against global hunger."

We must now ask ourselves: Is global hunger due to a shortage of food production?

Most of our current production systems are price driven, with the need for economies of scale to reduce unit costs. The small profit margins of this economic

See Organic Can Indeed Feed, page 6

Roots Seek Nutrients in Low-N Soils

By Julia Gerlach

Our cultivated crops generally live in a relatively nutrient-rich environment. But, according to a recent paper published in the journal *Nature Communications*, plants have been shown to "forage" for nitrogen (N) in low-N conditions, growing longer primary and lateral roots in order to find nutrients in the surrounding area.

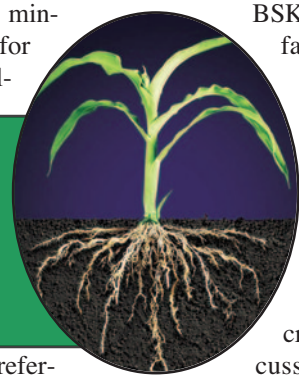
However, this foraging action has been the least understood N-dependent root response — until now.

The paper reveals findings from a study being done at the Leibniz Institute of Plant Genetics and Plant Research (IPK) in Gatersleben, Germany, led by professor N. von Wirén, that has identified the hormone pathway that regulates root foraging in low-nitrogen environments.

According to the summary of the study, "Plants sense changes in their nutritional status and respond to these by tailoring the growth and development of their roots. These responses express in an altered degree of branching, extension, placement, and growth direction of individual parts of the root system.

"Nitrogen is an essential mineral element and nutrient for plants. When nitrogen availability is low, plant roots preferentially grow into nitrogen-enriched soil patches by locally expanding their lateral roots. As soon as plants run into nitrogen deficiency, they immediately induce a foraging response, in which roots elongate to explore a larger soil volume."

As soon as plants run into nitrogen deficiency, they immediately induce a foraging response, in which roots elongate to explore a larger soil volume.



The researchers, studying the plant *Arabidopsis thaliana*, a brassica commonly known as thale cress, found a brassinosteroid called BSK3, in conjunction with the brassinosteroid co-receptor BAK1, work together to modulate root growth under low N. This suggests that naturally occurring variations in the BSK3 hormone can be selected to favor variants that promote a stronger foraging response.

This development could lead to the development of new crop varieties with root systems that better exploit the soil for nutrients, thereby requiring lower N inputs.

Nutrient placement for crops is a frequent topic of discussion among no-tillers, with some debate as to whether plants seek out nutrition or live in the presence of nutrition. Coupled with the conscientious farmers and researchers who are already improving their nutrient management systems, this research points to a promising path on the road to reducing inputs. ❐

[From *No-Till Farmer*, June 25, 2019. www.no-tillfarmer.com.]

15-Minute Soils Course

Lesson 50: Composting

Compost. (noun) "A mixture of various decaying organic substances, as dead leaves or manure, used for fertilizing soil."

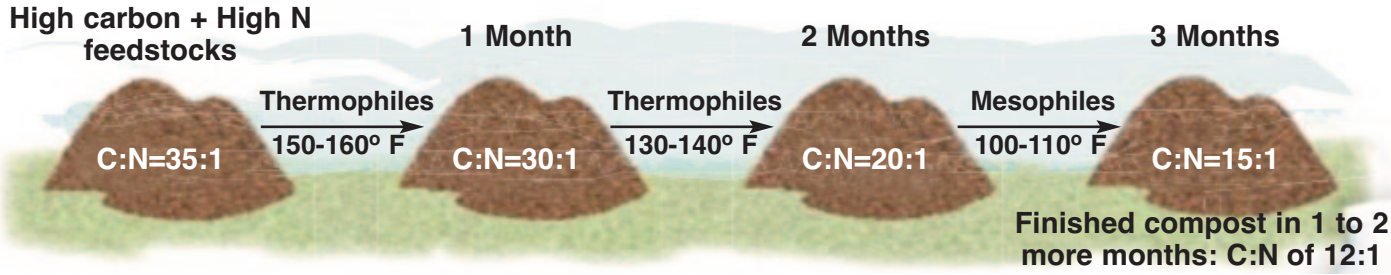
Compost and its production are extremely important in the world of soil fertility. The production of compost as most people understand it has been practiced for millennia, and was recorded by the Greeks and Romans since before the time of Christ.

There are different ways to classify the composting process; below is a common one.

In all cases the objective is to create an environment that is highly favorable to the growth of microorganisms—first fungi, and then bacteria—that will break down high carbon:nitrogen ratio compounds into stable low C:N humic substances which, when applied to the soil, will improve its physical, chemical, and biological properties to support vigorous plant growth.

The key to good composting is to provide feedstocks that complement one other: a high-carbon source (sawdust or straw), mixed with a high-nitrogen source (manure or soybean meal).

The **aerobic static pile** method involves mixing organic waste into a large pile at least four feet high, to maintain heat. To aerate the pile, layers of bulking agents, such as wood chips or shredded newspapers, are added so that air can pass from the bottom to the top of the pile. A network of pipes under the pile can deliver air into or draw air out of the pile.



Essential Elements for Composting

1. Proper feedstocks: **high carbon (like sawdust or straw) and high nitrogen sources**

2. Reasonable particle size: **chips, straw, or leaves that are large enough to allow air movement and not too small to create compact, anaerobic conditions**

3. Correct moisture content: **enough water content to allow for vigorous microbial growth, usually about 40 to 60%**

4. Good oxygen flow: **Enough air to supply oxygen to growing microbes while limiting anaerobic conditions, which produce toxic compounds like organic acids**

5. Correct temperature: **a large enough pile (at least five feet high) to allow temperatures to remain high and stimulate microbes to multiply**

Aerated windrow composting involves forming organic waste into long piles and aerating them periodically by turning the piles. The ideal pile height is between four and eight feet with a width of 14 to 16 feet. This size pile is large enough to generate enough heat and maintain high temperatures, yet is small enough to allow oxygen flow to the windrow's core. This method is suitable for large volumes of diverse wastes such as yard trimmings, grease, liquids, and animal byproducts.

1. **Aerated static pile composting**
2. **Aerated windrow composting**
3. **Vermicomposting**
4. **In-vessel composting**
5. **Sheet composting**

15-Minute Soils Course

Vermicomposting utilizes worms in bins that feed on food scraps, yard trimmings, and other organic matter to create compost. The worms, along with fungi and bacteria, break down this material into high quality compost. One pound of mature worms (approximately 800 to 1,000 worms) can eat up to half a pound of organic material per day, and it typically takes three to four months to produce usable castings.

In-vessel composting utilizes a cylindrical drum of some sort, ranging in size from about two to 15 feet in diameter, which can be over 100 feet long. The vessel rotates slowly to mix and aerate the organic materials, which can include manure, sawdust, meat and food scraps, or biosolids. This method produces compost in just a few days to a few weeks. Considerable heat can be generated, enough to eliminate all pathogens; a vessel can produce

The Vital Earth Resources rotary in-vessel digester at Big Sandy, Texas

Class A compost by maintaining 55° C for 72 hours. In some cases the vessel has different compartments with specific environments.

Sheet composting is a method that closely emulates natural soil-building processes that one finds in a native prairie or forest floor. In nature, carbon compounds in leaves and roots eventually die and are deposited on the soil surface or in top soil layers. A cover crop like millet or rye can be grown and tilled into the soil before it is mature, or manure, straw, hay, or other organic material can be spread and allowed to break down before a crop is planted. Bacteria, fungi, protozoa, mites, springtails, earthworms, and other soil inhabitants break down the organic compounds into humic substances over time, adding to and enriching the topsoil.

Benefits of Composting

1. Soil physical improvements: improved structure, porosity, and water holding capacity

2. Soil chemical improvements: a "complete" fertilizer containing all of the major and trace elements, and in good balance, required for plant growth in forms that can be delivered to the plant in a timed-release fashion by rhizosphere microbes; pH stabilization

3. Soil biological improvements: increased availability of plant nutrients, the production of glues and mucilages to create structure that improves soil aeration and permeability

4. Reductions on plant diseases due to greater nutrient availability and balance, and better water relations

5. Reduced water stress due to more organic matter, improved mycorrhizae populations, and increased root growth

See How Much You Learned

1. Methods of composting include a. sheet, b. aerated windrow, c. diffusion, d. vermicomposting.
2. It is very important to have good air flow and oxygen content within the compost pile. T or F
3. The maturity of compost is oftentimes rated by the relationship of_____and _____.
4. The size of a compost pile needs to be large enough to maintain the _____of the pile.
5. Maintaining a temperature of 30° C for 72 hours will kill all pathogens in the compost. T or F
6. Compost applied to the soil will a. improve soil chemistry, b. improve soil biology, c. reduce water stress, d. improve soil physical properties
7. Making compost involves mixing ingredients containing high amounts of _____ and high amounts of _____.
8. Compost has been used to maintain soil fertility

Answers: 1. a, b, d; 2. T. 3. carbon, nitrogen; 4. temperature or heat; 5. F; 6. a, b, c, d; 7. carbon, nitrogen; 8. T.

Organic Can Indeed Feed the World!

Continued from page 3

environment favor enterprises working in terms of large volume, and as a result the family farm is declining. Many areas of the United States and Australia have fewer farmers now than 100 years ago, and the small rural centers they support are disappearing. Hundreds of thousands of farmers have had to leave their farms in Argentina due to higher production costs and lower commodity prices. The sugar industry in Australia is on the verge of collapse for the same reason. Australian dairy farmers continue to leave the industry since deregulation forced down the prices they receive. Most of the major industrial countries are subsidizing their farmers so their agricultural sectors do not collapse.

Europe, North America, Australia and Brazil are in the process of converting a large percentage of their arable land from food production to biofuels such as ethanol in an effort to establish viable markets for their farmers. The latest push in GMO development is BioPharm, in which plants such as corn, sugarcane and tobacco are modified to produce new compounds such as hormones, vaccines, plastics, polymers and other nonfood compounds. All of these developments will mean that less food is grown on some of the world's most productive farmland.

Organic agriculture can be practiced anywhere in the world, with methods adapted to local climates, soils, and cultures to produce bumper yields of highly nutritious crops!

Grain farmers in India have protested cheap imports that are sending them deeper into poverty. Countries such as India and China, once considered as overpopulated basket cases, export large quantities of food. In fact, India, one of the world's most populated countries, is a net food exporter in most years.

The reality is that the world produces more than enough food to feed everyone and has more than enough suitable agricultural land to do it. Unfortunately, due to inefficient, unfair distribution systems and poor farming methods, millions of people do not receive adequate nutrition. ❒

[Don't miss the conclusion of this article on how organic agriculture can feed the world in the next issue of *The Vital Earth News*.]

Biopesticides Are in Our Future

By Paul W. Syltie, Ph.D.

There are many advantages of using biopesticides compared to toxic chemical pesticides. Take a look at a few of these advantages.

1. EFFECT ON NON-TARGET SPECIES

When a pesticide is applied to counter a specific pest, this pest is referred to as the target species. Biopesticide products usually fight their intended target pests while chemicals end up affecting non-target species as well, which include beneficial insects, birds and, mammals.

2. POLLUTION EFFECTS

Due to the toxic ingredients contained in the conventional pesticides, their pollution effects are quite substantial. These effects can be very serious to the environment, and include tainting of surface and groundwater, as well as the absorption into food plants and consequential harmful effects on humans and animals.

3. PRODUCT COSTS

Most biological pesticide products occur naturally which reduces the cost of production, resulting in relatively cheaper prices compared to chemical pesticides, whose manufacturing cost is high. This results in the consumer footing the bill at a relatively high price.

4. PEST RESISTANCE

Research has shown that pests tend to become resistance to conventional pesticides over time, thus proving that using chemical pesticides is not a long term solution. Such resistance seldom occurs when using organic pesticides.

5. MARKET

As the consumer has become more aware of the dangers posed by synthetic chemicals, demand for organically certified products has risen. This poses a potential risk for farmers using toxic chemicals, since they may lose market share and reap lower prices due to decreased demand. ❒

Three Major Biopesticide Groups

Microbes. Especially bacteria and fungi. They tend to be more targeted in their activity than conventional chemicals. For example, a certain fungus might control certain weeds, and another fungus might control certain insects. The most common microbial biopesticide is Bacillus thuringiensis (BT).

Substances Found in Nature. These include plant materials like corn gluten, garlic oil, and black pepper, and also insect hormones that regulate mating, molting, and food-finding behaviors. They tend to control pests without killing them. For example, they might repel pests, disrupt their mating, or stunt their growth.

Plant-Incorporated Protectants (PIPs). These are not natural biopesticides, but are toxins produced by plants through genetic engineering, when foreign genes are inserted into plants by genetic engineering, such as BT in corn.

From Famine to Feast: Precipitation Reverses

Continued from page 1

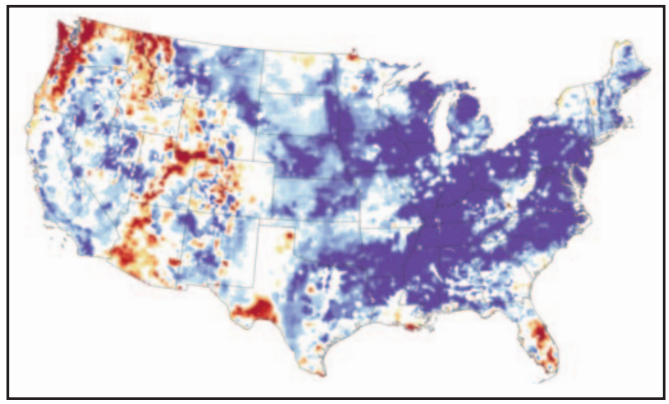
age precipitation from 1895 to 2019. Note that all of the Midwestern states show much-above average precipitation.

Wettest Twelve Months in History

According to the NASA Earth Observatory in a May, 2019 report (*www.earthobservatory. nasa.gov*), from May 1, 2018, to April 30, 2019, the lower 48 states collectively averaged 36.20 inches (919.48 millimeters) of precipitation, a full 6.25 inches (158.75 mm) above the mean. The previous record (April 2015 to March 2016) was 35.95 inches. According to the National Centers for Environmental Information, ten U.S. states had their wettest 12 months, and three others were in the top three. Many of them were clustered in the Mid-Atlantic and Midwest regions.

According to the May 21, 2019 report from the U.S. Drought Monitor, just 2.72 % of the contiguous U.S. was in drought, among the lowest levels in two decades of records. As recently as February 2018, one-third of the United States was in drought.

The map above shows how groundwater has responded to the unusually wet year. The colors depict the amount of groundwater on May 13, 2019, compared to all Mays from 1948 to 2012. Blue areas have more abundant groundwater than usual for the time of year, and orange and red areas have less. The map is based on multiple types of meteorological data (precipitation, temperature, etc.) integrated within an advanced computer model developed by scientists at NASA's Goddard Space Flight Center.



This map shows shallow groundwater wetness for mid-May, 2019, compared to the average for 1948 to 2012. Red indicates drier, and blue indicates wetter than average.

Much of the East and Midwest had an extremely damp autumn in 2018 due to land-falling hurricanes and the effects of a mild El Niño. Yet, there is no single explanation for the extreme precipitation of the past year. It does, however, fit with long-term increases in overall precipitation and with heavy rainfall events that have been noted as the climate changes over time.

According to Ken Kunkel of the National Oceanic and Atmospheric Administration, "I do not have an explanation for the weather systems that caused the heavy precipitation, but sea surface temperatures in the western Atlantic and Gulf of Mexico have been generally well above normal over the past year. This has surely added to the atmospheric water vapor content available to the precipitating weather systems."

Many Acres Not Planted

Farmers could not plant crops on more than 19.4 million acres in 2019, according to the U.S. Department of Agriculture (USDA). This marks the most prevented plant acres reported since USDA's Farm Service Agency began releasing the report in 2007, and 17.49 million acres more than reported in 2018.

Of those prevented plant acres, more than 73 percent were in 12 Midwestern states, where heavy rainfall and flooding prevented many farmers from planting mostly corn, soybeans and wheat. We cannot outguess the progression of the weather, which changes continually. What might we expect in 2020? ❐

Statement of Purpose

Vital Earth Resources is a for-profit private corporation dedicated to the development, production, and sale of top-quality, ecologically sound horticultural and agricultural products. *The Vital Earth News* is a periodic publication of Vital Earth Resources to inform customers and other interested parties about our products and programs, and to educate our readership on critical issues facing growers today and in the future. If you would like to receive future issues of this newsletter or product information, simply fill out the form on the right and mail or Email it to us.

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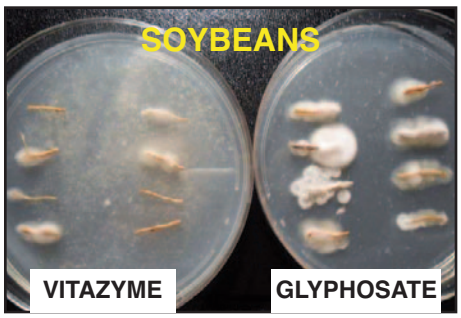
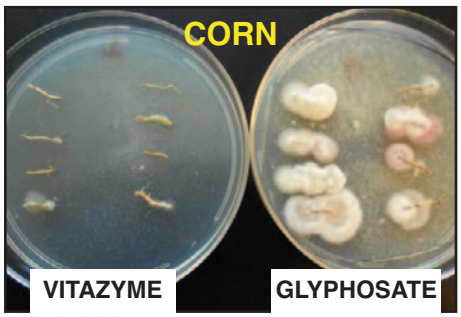
A Brassinosteroid-Based Biostimulant Improves Plant Growth, Soil Health, and Tolerance to Glyphosate Stress

A summary of a paper presented at the Fourth International Biostimulant Conference, Barcelona, Spain, November 18-21, 2019 by Manjula V. Nathan, Robert J. Kremer, Paul W. Syltie, Timothy M. Reinbott, Kelly A. Nelson, and Xiaowei Pan, Division of Plant Sciences, University of Missouri, Columbia, Missouri USA

A multi-year study with Vitazyme biostimulant on corn and soybeans in Missouri proved that the negative effects of glyphosate in soil-plant systems can be remediated. The study examined root growth, Fusarium infection, and the proliferation of beneficial microorganisms in response to (1) no products, (2) Vitazyme alone, (3) glyphosate alone, and (4) Vitazyme and glyphosate applied together. Findings include:





- Vitazyme supplements soil health functions and plant growth, as evaluated in root growth and soil and root microbiological effects with Vitazyme, which contains brassinosteroids.
- Multiple assessments of sensitive biological indicators of soil health successfully evaluated Vitazyme as a factor in suppressing effects of glyphosate on root growth and rhizosphere biology in transgenic cropping systems, and improving soil health.
- Soil microbial diversity (PLFA groups) was restored by Vitazyme in soils planted to maize and soybean treated with glyphosate. High soil microbial diversity is essential to maintain stable ecosystem and crop productivity.
- Biostimulants can be major management factors for addressing productivity problems and declining soil health associated with transgenic crops in current crop production systems.