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JOHN'S CORNER: NEWS FROM THE WONDERFUL WORLD OF SOIL AND PLANTS

by John Ferguson

I hope everyone enjoyed the series on the elements (minerals) and how they affect all areas of our lives, from soils, microbes, and plants to animals and human health. Our modern food supply is extremely deficient in minerals that we need to be healthy; hence, more and more gardeners are growing their own fruits and vegetables.

A new study has found that 72% of early deaths are a result of dietary choices that cause cardiovascular events, type 2 diabetes, and cancer (Institute of Health Metrics and Evaluation). Researchers at Cornell University have found that adding a couple pounds of good compost to a bucket of water (no chlorine or other toxic chemicals) and let it sit for a few days to make a form of compost tea more correctly called compost leachate. The solution was filtered to remove the compost, and then the liquid was sprayed onto plants infected with pythium (pythium) root rot, where the tea suppressed the disease. Note: Good quality compost has repeatedly been shown effective against several dozen fungal and bacterial diseases. Cheap low quality compost does not work and can even stunt or kill the plants.

A study published in the Soil Science Society of America Journal found that Eastern Red Cedar (*Juniperus virginiana*) grows faster and stronger when colonized with arbuscular mycorrhizal fungi. The benefits that this partnership provides are why the Eastern Red Cedar has become invasive in many areas.

Scientists at the University of Birmingham have discovered a group of cells that act as a "brain" for plant embryos. These cells assess environmental information or conditions (moisture, temperature, light, microbial, etc.) and dictate when a seed will germinate.



I am often asked about global warming and how much carbon is captured or released by the soil. A recent article in the Journal of The National Academy of Sciences found that the microbes in soil life add between 44 and 77 Billion tons of carbon to the atmosphere each year (more than all the fossil fuels combined) through their respiration. As air and soil temperature warms, respiration tends to increase. Note: By changing how we farm and garden, and use the modern methods based on soil biology (organic), carbon is stored in the soil instead of being released to the air.

The Northeast Organic Farming Association has updated their publication "Organic Soil-Fertility and Weed Management". The focus is using weeds as diagnostic tools in farming and gardening. Certain weed species tell one a lot about soil conditions, for example, pig weed and lambs-quarters indicate a cultivated (poor soil structure) but rich soil. While horsetail (*Equisetum arvense*) likes soggy soil, which implies one has poor drainage.

A study in the Journal Neurobiology has found that children are harmed (lower attention control, reduced processing and motor skills) if they live nearby where organophosphates pesticides were applied.

We have known for years that plants communicate by airborne chemical signals and over fungal networks. It has been discovered that plants can also transfer defense signals over parasitic plants like "dodder", these defense signals can happen rapidly, and they can be transferred to different species of plants.

A paper in Phytotherapy Research has found that avocados contain many nutrients that promote health by helping our lipid profiles. They help with cholesterol, triglycerides, phospholipids, and in many other functions.

Research at the University of Rhode Island has found that maple syrup contains a complex carbohydrate, which is a type of fiber called "inulin". This chemical acts as a prebiotic and works to encourage beneficial bacteria in our guts.

Researchers at Cornell University have found another mechanism as to how biochar helps plants. Microorganisms need electrons (electrical energy) for everything they do. This energy



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moves through the soil via the carbon in the soil. Biochar promotes electrons (energy) moving through the soil efficiently. This spurs connectivity and growth of microorganisms and our plants.

A major health problem around the world is deficiencies of iron (Fe) and zinc (Zn) in the food supply. Researchers applied iron and zinc by foliar methods to newer and older varieties and found that older varieties of wheat which then had up to 78% more nutrients than the modern varieties. Journal of Agricultural and Food Chemistry.

Studies continue to come out that show organic foods are healthier for us. One of the reasons is the health benefiting phytochemicals that are in them. Researchers found that flavonoid levels and antioxidant levels in organic onions are much higher than conventional. Journal of Agricultural and Food Chemistry.

Along the same lines, a study published in the Food Research International Journal found that red onions contain powerful antioxidants that effectively kill cancer cells. Another study by Cornell University also found that Western yellow onions could kill colon cancer cells. They found that shallots and western yellow had many times more phenolic content than white onions.

Plants use sunlight to tell time. The protein *zeitlupe* forms and breaks in reaction to sunlight at varying rates. This tells the plant when to bloom, when to store energy, when to grow, when to flower, etc. Southern Methodist University.

Researchers at the University of Gothenburg and University of Jyvaskyla have identified another group of proteins called "phytochromes" that are light sensitive. They consist of thousands of atoms and function as tiny machines. They are found in the leaves of all plants and in many species of bacteria and fungi.

Over 30% of the "junk DNA" in our bodies and the resulting micro-RNA play a crucial role in regulating the 25,000 genes in our bodies come from microbes (bacteria and fungi) on our food. When we wash our food or use food grown with fungicides we lose this critical source of good microbes that works to keep us healthy.



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A new study has found that capsaicin the active ingredient found in hot and spicy peppers inhibits the growth of breast cancer cells (Journal Breast Cancer: Targets and Therapy). This is another reason to load up on salsa and jalapenos.

Research at Maryland's Department of Agriculture compared organic and conventional production of peaches and apples. They found significantly higher: active and total fungal biomass, flagellate and actinobacteria populations, and plant nutrients (phosphorus and copper) in plant tissues and organic matter (phosphorous and sulfur) in soils observed in organic compared to conventional practices, irrespective of crops or varieties.

The University of Georgia found in a three-year study converting a field to organic growing methods that by the end of the study period, onion, broccoli and lettuce had yields comparable to or greater than conventional methods.

Soils that have not been tilled, are found to have higher microbial biomass and enzymatic activity. These fields also hold more moisture, preserve organic matter, and provide a better habitat for beneficial microbes.

Healthy vigorous plants can adequately defend itself against attacks by insects or disease. Dr. Philip Callahan discovered that healthy vigorous plants emit wavelengths of energy that do not attract damaging insect species. However, unhealthy plants or plants under stress emit different wavelengths that do attract certain insect pests. Bugs that we call pests were created to eat these low energy sick unhealthy plants. Note: Refractometers can be used to measure the sugar content of a plants sap measured in degrees Brix, that will indicate the strength and health of a plant.

Researchers at Penn State University have found that the adjuvant Sylgard 309 (organosilicate) negatively hurts the health of honeybee's larva by increasing their susceptibility to the pathogen "Black Queen Cell Virus". This adjuvant has been found in pollen.



We have known for decades how important the vitamin B-12 is for human and animal health. Researchers at the Pacific Northwest National Laboratory have found that only a few species of microbes can produce this vitamin but almost all of the microbes require it. Microbes that produce B-12 wield great power in the soil microbial world. It helps shape microbial communities that in turn affect energy and food production. B-12 interacts with 41 different proteins in bacteria. It also changes the instructions it sends to genes depending if it is light or dark.

Research at Friedrich Schiller University has found that eating nuts have positive effect on health as they activate the body's own defenses for detoxifying reactive oxygen species that are known to cause cancer. Macadamia, hazelnuts, walnuts, almonds, and pistachios when digested, the digestion products induced cancer cell death.

The USGS and the University of Vermont have found 51 different drugs in wastewater from sewage treatment plants. This wastewater is then dumped into our streams and then used for our public water supply. As a result, pharmaceuticals are found in eighty percent of the surface waters tested. Many of these chemicals harm the microbes in the soil and our plants. This is another reason to invest in soil improvement so one does not have to use municipal water. The study did not include arsenic, cadmium, mercury, and many other toxic chemicals disposed of in our sanitary sewers.

Fresh citrus grown in our backyards organically not only tastes better but also has higher levels of vitamin-C. Numerous studies have now shown that those people, whom had higher levels of vitamin-C live longer, have fewer heart attacks as compared to those with lower levels. Mega doses of vitamin-C have been shown to be effective against many forms of cancer.

A study in the New Phytologist Journal has found that arbuscular mycorrhizal (AM) fungi obtain fats (lipids) which are the building blocks of cell membranes from their host plant. Plant cells that have AM fungi in them ramp up their lipid production by 3,000 %. Without this fat, the fungi cannot reproduce. Hence, it is no surprise this is why AM fungi work so hard to protect a plants roots.



Members of the cycad family can recognize its close relatives and plants that are not relatives. When the neighbor was a relative the plant reduced its competitive behavior, and if it was not a neighbor then the competitive behavior increased. This mechanism may explain why some plants grow quickly, and others poorly. Journal of Tropical Conservation Science.

The decline of wild bee populations continues across the world. Studies continue to link this decline to the use of neonicotinoid poisons. These are often applied to seeds before planting.

Research reported at the annual meeting of the American Headache Society in 2016 found that most headaches are related to nutritional deficiencies especially in younger people. The Diabetes Research and Clinical Practice Journal found that zinc supplements improved the ability of prediabetic men and women to handle glucose. Another study found that combining selenium with CoQ10 can drastically reduce cardiovascular mortality.

As was discussed in the mineral series over the last few months, our food supply is deficient in many minerals (elements). If the food is sprayed with glyphosate the body cannot absorb what few minerals are present. GMO foods have many times higher levels of glyphosate and is one of many reasons glyphosate (Round-Up) has been banned in dozens of countries.

A study by the University of Otago has found that bacteria boost their own immune system by talking (communicating) with each other, they collectively defend themselves against viral threats through a property known as "quorum sensing".

Researchers at the University of Delaware have found that a mixture of good bacteria will prevent rice from absorbing arsenic from the soil and protect the rice plant against the damaging fungal disease called "rice blast". By using these organic methods to protect the rice plant from the fungus, would produce enough rice that would have been lost to this disease, to feed 60 million people.