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JOHN'S CORNER:

NEWS FROM THE WONDERFUL WORLD OF SOIL AND PLANTS

by John Ferguson

A few times over the last couple weeks I have mentioned plants and their ability to help clean up problems or even mine elements out of soils and accumulate them. We have known for years that mercury (Hg) is toxic to many life forms and can accumulate in fish as one moves up the food chain where it may cause health issues.

Mercury is released into the atmosphere by burning of coal, mining, and other industrial processes. Researchers at the University of Massachusetts has found that plants absorb mercury from the atmosphere into their tissue. They found that 88% of mercury found in plants was absorbed from the atmosphere.

When the plants die, shed their leaves or roots, large amounts of mercury are transferred to the soil. This toxic metal is them leached into our waterways where it may affect wildlife. Nature Reviews Earth & Environment (2021).

A new study has found that artificial fertilizer utilization can have decades long negative lasting effects on soil biology. Soil microbiomes for soils with high fertility were insensitive to recent fertilizer usage. However, they found that previous land use had decades long lasting effects on soil microbial diversity.

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Soils without a history of artificial fertilizer usage exhibited higher soil microbial diversity. This study suggests that soils have an ecological memory and may take a long time to recover from chemical abuse. Applied Soil Ecology (2021)

Degradation of our soil is becoming a worldwide concern. A recent conference has defined soil health: "Soil health is the capacity of soil to function as a vital living system, within land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health." One of the tools used to measure soil health is the use of soil organisms as indicators of soil quality and health. Applied Soil Ecology (2021)

One of the best ways to improve soil health is to use cover crops (also known as Living Mulches). A study of 96 farms for a period of 3-5 years found that the use of cover crops significantly improved key soil health indicators. These include active carbon, soil organic matter, aggregate stability, available water capacity, respiration, and soil protein.

The effect and benefits of the cover crop increased with the amount of time cover crops had been used on a field. ATTRA (2021)
Other studies have found that the larger the diversity of species used in the cover crop also increases the benefits.

The importance of microbes in our lives whether in the soil, on our plants, or our bodies continues to increase almost every day. Most of these good-essential microbes come from the soil. As we garden and work the soil or mulch we are continuously exposed to these unseen good guys.

Citrus canker is a bacterial disease common to many types of citruses. Researchers have discovered the fatty acid called hexanoic acid is effective in controlling this disease without the need for toxic chemicals. Journal of Applied Microbiology (2021)

This fatty acid is used by some plants as part of their immune system and it has been found to help treat several plant diseases.

Some people do not like spiders. Scientists at Canada's Simon Fraser University have discovered that several species of spiders avoid areas where fire ants had recently conjugated.

The ants apparently left behind a chemical trail that several species of spiders like the venomous black widow avoided. They hope to isolate these chemicals to form an effective spider deterrent. Royal Society Open Science (2021)

Excess nitrogen from artificial fertilizers, factory farms, etc. in the form of nitrate causes many forms of pollution in the drainage water. This toxic pollution causes algae blooms, fish kills, and the dead zone in our oceans.

Researchers found that simply running the polluted water through a bed of wood chips (often referred to as a bioreactor) reduces the amount of nitrate from 20-40%. Bacteria convert the nitrate into harm less nitrogen gas using energy derived from the carbon in the wood chips. Transactions of the American Society of Agricultural and Biological Engineers (2021)

A study by Northern Arizona University has found that predatory bacteria (those that eat other bacteria) grow faster and consume more resources than non-predators. For gardeners these predators play an important part in determining where nutrients go. We have known for a long time that when resources like grass and shrubs are added to an ecosystem, predators at the top of the food chain like wolves' benefit as the food web gets healthier.

Similarly, predation is important for soil health (which provides plant health). They found that when the resource carbon (like a native mulch or good compost) was added to the soil, the predators grew 36% faster and took up more over 200% more carbon than non-predators.

As bacteria eat each other plant nutrients are cycled and released into the soil which helps us have healthier plants. Journal mBio (2021)

Researchers at New York University have found seeds from the previously extinct Judean date palms that lived 2,000 years ago. The seeds were recovered from archaeological sites in the Eastern Mediterranean.
They were able to germinate the 2,000 year old seeds (Phoenix dactylfera) and sequence their genome. Proceedings of the National Academy of Science (2021).

White rot fungi that gardeners frequently find in their gardens is very efficient in breaking down lignin found in plant material from grass to trees. All life in the soil needs energy and the primary source is from carbon atoms being combined with oxygen.

It was found that the white rot fungi can use energy from the carbon released as they biodegrade the lignin. In the process they store carbon in their bodies and in the soil. Proceedings of the National Academy of Sciences (2021)

Note: I used to grow a lot of ferns in hanging baskets. When I used an aged (composted) native mulch as a potting medium and the and the Microloife 6-2-4 organic fertilizer, my ferns went crazy and were 30-50% larger than those grown in a soil medium.

When I would examine the root zones it was often filled with white rot fungi. I am not sure of the cause or the effect, but I know the ferns loved it.

I recently finished reading a book titled "Compost Utilization in Production of Horticultural Crops", CRC Press 2021, ISBN: 978-0367691073. One of the items covered was the benefits of compost to turfgrass.

One item mentioned is the benefits of compost in clay soils that shrink-swell. Most likely over half the soils in our area are the black gumbo clay known as the Lake Charles or Beaumont clay that is notorious for its shrink swell properties and its stickiness when wet. This shrinking property damages grass roots often ripping them apart, which then stresses the plant (grass) making it more susceptible to insects (chinch bugs, web worms, etc.) and disease (brown path, take-all, etc.).

"When a good compost is used on clay soils it will improve the soil structure, reduce surface crusting and compaction, promote drainage and provide nutrients." Compost reduces the shrink-swell hence the damage to out lawns.