Tracing chemicals over time

Whether we are weekend gardeners in the suburbs or farmers from Maine to California and Florida to Washington state we spread a lot of chemicals on our yards and fields and the only questions we ask ourselves are: “Did they work? Are our flowers bigger? Are our yields higher? Are the weeds dead? Are the pests gone?”

An article in the May/June 2019 issue of National Geographic History, “Investigation: Otzi,” examined what scientists have recently learned about the 5,300-year-old body of a man found in a melting glacier in the Alps in 1991. In that article they were able to identify “the presence of the bacteria *Borrelia bugendorfi* in his blood [that] shows that he suffered from Lyme disease.” In addition, “Among the objects found near his body was a fungus, *Fomitopsis betulina,* known for its antibacterial properties. Traces of bracken fern were also found in his stomach, which was used to treat intestinal parasites.” Additionally, scientists identified the grain found with him as coming from the valley below the discovery site.

In the Middle East, archaeologists use flotation tanks to separate ancient pollen from soil particles. They then can examine the pollen to identify the crops and plants that were growing in the area more than 3,500 years ago. Similar techniques are used in the examination of the debris layers of caves where human or pre-human bones have been found in order to identify the diet of the people who lived there in much earlier periods.

In both cases we are talking about areas where decomposition takes place at a much slower pace than the temperate climates where most of us live, garden, and farm. But that got us thinking about the afterlife of the yard and farm chemicals we use. Will some scientist 5,300 years from now, or even 100 years from now be able to look at the soil from our yards and farms and determine the powders and sprays that we spread with little thought of what happens to them after they have fertilized the plant or obliterated the pest?

Though we give little thought to the afterlife of the chemicals we use, maybe we should. Certainly, the atoms and molecules don’t just vanish like a coin in a magician’s hand. And if they persist, what impact do they have on the microbiome of the soil beneath our feet and tractor tires?

Neither of us are soil scientists, so perhaps chemists and soil scientists already have the answers to these and other questions that nag us. Other questions such as: How persistent are the original chemicals **and** their metabolized counterparts in the soils of lawns, gardens, and farm fields? To what extent do the original chemicals and their metabolized counterparts filter into aquifers and streams? What is their impact on the microbiome at 1 inch or 1 foot or lower? What is their impact after 1 year of use or 5 years of use or 50 years of continuous use? Do they build up in the soil? How do the various chemicals and metabolized counterparts interact with each other in the soil?

Perhaps decades-long, longitudinal measurements from test plots at the state agricultural experiment stations and federal agricultural research centers are available that go a long way to toward answering such questions. If that information is available, it is important that it be communicated to us all. If information is lacking, the USDA should provide funds to the network of state and federal experiment stations to research these issues.

When a skeptical public asks about the chemicals we use, we should be able to give them definitive answers based on scientific research from independent sources. It is not enough to say “trust us” the chemicals are safe. We need to be able to trace the original chemicals and their metabolites throughout the system and be able to explain those processes in ways that everyone

can understand. Consumers are increasingly demanding more information about the food complex. It is always better to be proactive than defensively reactive.

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