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Mini Review

Effects of Toxic Chemicals on Plants

E Ann Nalley[1]*, Sheila Youngblood[2] and Alimamy Fornah[3]

[1,2]*Department of Chemistry, Physics & Engineering, Cameron University, USA*

[3]*Department of Agriculture, Biology & Health Sciences, Cameron University, USA*

***Corresponding author:** E Ann Nalley, Department of Chemistry, Physics & Engineering, Cameron University, USA.

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Introduction

The Organisation for the Prohibition of Chemical Weapons (OPCW) recently announced a challenge to scientists from across its Member States to submit proposals that describe a method or system by which a specific type of vegetation could act as an indicator of exposure to chemicals, which are toxic to humans and/or animals. When I first learned about the OPCW Plants as Biomarkers Challenge, I thought it would be easy to do a search of the scientific literature and to identify the effects of toxic industrial chemicals on plants. After several days of searching, I learned that it would not be that easy.

The history of persistent bioaccumulative and toxic chemicals (PBT's) is traced from the 1825 synthesis of technical benzene hexachloride (BHC) by Faraday to international efforts to phase out 12 persistent organic pollutants (POPs) under the auspices of the United National Environmental Program (UNEP) in 2000. [1]. In the 1930's, new uses were sought for chlorine and this led to the discovery of a number of chlorinated chemicals which could be used as insecticides, including dichloro-diphenyl-trichloroethane (DDT). The discovery of DDT earned Muller the Nobel Prize in Medicine for its great success during and following WWII in controlling typus, malaria, typhoid fever and cholera. However, concerns about the environmental accumulation of DDT and other PBT's led to a number of studies of the effects of the pesticides on humans and other animals [2], and since that time as new pesticides have been developed there have been numerous studies of the effects of pesticides in the environment and their effects on the environment. Most of these have been on plants and animals but there are many on the uptake of these by plants and how they may interfere with plant growth.

Just like humans, plants too can be poisoned by exposure to toxic chemicals, although the chemicals that poison plants are not necessarily the same ones that poison humans or other animals (and vice versa) [3,4]. Highly lethal insecticides, for example, kill insects but leave plants unscathed. Other chemicals like fertilizers support plant growth and have a beneficial effects on plants the industrial age has brought millions of pounds of toxic contaminants into our environment. Pollution from industry and transportation, synthetic chemicals, pesticides, heavy metals and even chemicals from household products are now pervasive in our water, air and soil. This toxic legacy poisons wildlife and our future.

Widespread toxic contamination of ecosystems and exposure to wildlife is well documented. A 10-year government study revealed that more than 90 percent of the nation's tested waters and fish are contaminated with pesticides [5]. These chemicals also make their way into people's water supplies, significantly affecting our health. Independent research has found more than 200 chemicals, many of them known toxins, in the blood of newborns. In both humans and animals including the California condor, green sturgeon, Tehachapi slender salamander and polar bears.

Toxic chemicals increase cancer rates, cause reproductive problems and contribute to a wide range of other health problems. With the development of herbicides, chemicals designed to kill plants, came new problems. By virtue of their work as intended,

they will always have a toxic effect to plants and in many cases to animals and humans as well. Some herbicides are broad-spectrum and slaughter most plants when they are present at sufficient concentrations, while others are more specific and are targeted at only certain types of plants, such as weeds. 2,4-D and similar chemicals, for example, preferentially kill broadleaf plants. Other herbicides are "pre-emergence control" and intended to throttle weeds during germination; once the weeds are already established, these herbicides will not be as useful. This provided the opportunity for many scientists to conduct studies on the effects of these chemicals on both plants and animals and for studies on the effects on plants, which were not their intended target.

Heavy metals are toxic to many forms of life, and this is true for plants as well [6]. Elements like cadmium, mercury, lead and nickel can have deleterious effects for plants, especially at high concentrations. Not only can they directly affect plant physiology once they are taken up through the roots, they can also damage soil microbes that help provide nutrients for plants by breaking down organic matter. Some plants seem less afflicted by heavy metals than others, however, and some plants also display a surprising ability to take up heavy metals from the soil and sequester them- possibly offering scientists an interesting way to help clean up toxic waste.

There have been numerous studies of the effects of heavy metals on the growth and physiology of plants. With the increasing development and use of nanoparticles there have been many recent studies on nanoparticles on both their absorption by plants and their effect on the growth and physiology of plants [7,8]. Although there have been many studies on the effects of toxic chemicals dating back to the many studies conducted on those chemicals identified in chemical warfare [9], there are few studies which can serve as models for either the mode of action or the effects of toxic chemicals on plants [10]. There is a profound need to study the physical and chemical effects on plants following their exposure to toxic industrial chemicals.

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Conflict of Interest

No conflict of interest.

References

1. Lipnick (2000) Persistent, Bioaccumulative and Toxic Chemicals, ACS Symposium Series, American Chemical Society, Washington DC.
2. Brooks GT (1977) Chlorinated Insecticides: Retrospect and Prospect in Pesticides Chemistry of the 20th Century, Ed ACS Symposium Series 37, American Chemical Society, Washington DC.
3. Lichtenstein (1962) Effect of Various Insecticides on Growth and Respiration of Plants, Agriculture and Food Chemistry, Volume 10(3)
4. Buchel K (1983) Chemistry of the Pesticides, Wiley-Interscience, New York.
5. United States Environmental Protection Agency (2017) Overview of Risk Assessment in the Pesticide Program.
6. Kumar N (2016) Effect of Heavy Metals on Plants: An Overview, Environmental Science.
7. Wan J (2019) Comparative Physiological and Transcriptomic Analyses Reveal the Toxic Effects of ZnO Nanoparticles on Plant Growth, Environmental Sci Technol 53: 4235-4244.
8. Mohammad H (2013) Effects of Magnetite Nanoparticles on Soybean Chlorophyll, Environmental Sci Technol 47(18): 10645-10652.
9. Global Impact of Chemical Warfare Agents Used Before and After WWII.
10. Altenburger R (2006) On the mode of Action of N-Phenyl-2-naphylamine in Plants, Environmental Sci Technol 40(19): 6163-6189.