

Elements of Gardening

by Dr. H. Marc Cathey

EVER SINCE humans turned from gatherers to farmers, they have used chemicals of one form or another to improve the productivity of the plants they grow. Rapid advances in scientific research and industrial techniques in the last century provided farmers and gardeners with the tools to create, control, and destroy plants in the garden. As the world's population has grown, the development of chemical fertilizers, growth regulators, and pesticides has been critical to our ability to reliably raise many kinds of plants in quantities sufficient to serve millions of consumers.

But our success in growing healthy plants has always been overshadowed by the potential harm that readily available horticultural and agricultural chemicals can inflict upon our bodies and the environment around us. I learned more than 60 years ago that even the most essential chemicals in gardening can be highly damaging if not used properly.

WHEN GOOD CAN BECAME BAD

Take, for instance, something as simple as nitrogen, one of the basic nutrients required for plant health. Nitrogen—identified by the symbol “N” in the Periodic Table of the elements—is the basis for many essential plant cellular compounds including amino acids, amides, DNA, and coenzymes. It can be administered to plants in many chemical forms, including as urea, ammonia, and nitrates. Technological innovations over the years have led to many kinds of delivery systems for



Nitrogen is essential to the growth of plants, but applying excessive amounts in the form of fertilizers can damage aquatic ecosystems.

nitrogen. These include drip, hydroponic, or foliar solutions; or direct application of quick-release or encapsulated timed-release forms. The effective rate of nitrogen application can be determined by various post-application tests, including analysis of chloroplast content, fresh or dry matter, tissue uptake analysis, and direct observation of the overall productivity of the plants.

Unfortunately, nitrogen-containing compounds, including fertilizers, are also a major contributor, through leaching and runoff, to pollution in our lakes and waterways. In aquatic systems, excess nitrogen can cause massive algal blooms that deprive fish and other aquatic creatures of oxygen.

NOT-SO-ESSENTIAL CHEMICALS

Essential garden chemicals, such as nitrogen compounds, have become pollutants because of overuse or poor delivery systems, but some truly toxic elements have made their way into our soils as an incidental byproduct of pesticides,

paints, chemically treated landscaping timbers, and mining operations.

The most prevalent of these is arsenic, an element that is in the same group as nitrogen in the Periodic Table. Arsenic was a component in lead arsenate, an insecticide widely applied to tobacco and tree fruits in America in the 1950s. Arsenic does not biodegrade (neither does lead, of course) and it is readily released into ground and wastewater. It was also a standard component of a wood preservative that for decades was commonly applied to lumber used for outdoor building projects. Last year, the wood preservative industry, under scrutiny from regulatory agencies, stopped production and sales of arsenic-based wood preservative.

There are, fortunately, ways of removing arsenic and other toxins from the environment. Some of the most exciting developments are in the field of phytoremediation, in which certain plants have been shown to selectively absorb toxic soil contaminants. The toxins accumulate in the plants' stems and foliage, which can then be harvested and disposed of safely.

As described in an article in the November/December 2002 issue of *The American Gardener*, one very promising technique for arsenic removal was first identified by researchers at the University of Florida and is now being commercially licensed by Edenspace Systems Corporation, a company headquartered in Northern Virginia.

There are many other plants out there that have similar potential to remove toxic chemicals from the soil. Horticultural researchers in the 21st century will have to face up to these challenges and identify ways to restore the health and vitality of our landscapes. We must ensure that future generations can enjoy gardening as much as we do.

Dr. H. Marc Cathey is president emeritus of The American Horticultural Society.