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Title: **Pesticides & Health — Myths vs. Realities: A Position Paper of the American Council on Science and Health — Professor Allan S. Felsot, Washington State University**

Executive Summary

Will we avert a crisis of food supply shortage? This question continues to loom large although population growth rate has tempered considerably, compared to projections 30 years ago.

But several years ago, as food prices seemed to be on the verge of skyrocketing, owing to rapid increases in grain prices, we arguably got a taste of the future. When you consider uncertainty about climate variability and land use changes as well, we seem always on a precipice of doing with less rather than more. Fortunately, agricultural technology has thus far kept pace with a growing population. A crucial component of this toolbox has historically been a dynamic chemical technology, led by the availability of synthetic fertilizers and innovations in chemical pest control.

This report analyzes the myths surrounding pesticide science and corrects each with a realistic perspective of the technology: how it is possible to kill pests without harming other organisms, how the science is regulated with a precautionary perspective, and, finally, with an analysis of claims made about hazards and the probability that these pose credible risks to health. This report makes the case for the benefits of pesticides, ranging from the protection of crop yields to the protection of public health. Indeed, the benefits are abundant enough that one can simply state that the availability of pesticides has significantly improved human health.

Controversy surrounding pesticide use at first glance would seem to date back to the 1962 publication of Rachel Carson's Silent Spring. However, this superficial analysis ignores the long history of pesticide control statutes such as the Federal Food, Drug, and Cosmetic Act (FFDCA 1938) and the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA 1947).

One might argue about the effectiveness of these laws, but they have been amended many times, before and after Silent Spring, to address their weaknesses. Indeed, perhaps the most far-reaching modification was the Food Quality Protection Act of 1996 which, for the first time, oriented the main law, FIFRA, to consider risk to consumer health as the only basis for re-registering older chemicals and registering new products.

Veneration of Silent Spring by advocacy groups has overlooked the reams of data already in the public sector that Carson had been reading to inform her literary endeavor. And so, current pesticide laws have evolved and are arguably the most precautionary of all congressional mandates involving technology. Indeed, we assert that modern pesticide laws epitomize in action an otherwise vacuous precautionary principle that eschews risk assessment as a basis for risk management.

Risk assessment rightfully recognizes the too often ignored principles that all chemicals (whether plant-derived or cooked up by humans) are subject to the same physical laws of thermodynamics and the principles of kinetics. Such recognition explains how we humans can eat a myriad mixture of plant chemicals, many of which are recognized as toxins themselves, arising from an evolution of plant metabolism that aids their survival against voracious predators and the vagaries of weather.

In this background of survival, the principle of "reasonable certainty of no harm" guides decisions about releasing man-made pesticides to help in the battle to protect crop yields and food quality. Economic analyses prove how food supply would become precarious without the use of chemical technology. Epidemiological analyses prove how eliminating an effective surface-sprayed insecticide like DDT has fostered large outbreaks of malaria, the mosquito-borne scourge of 300 million humans a year.

Yet despite the proven benefits of pesticides, years of research have shown that these valuable tools cannot be used without proper management, and that, moreover, they should exhibit selectivity of pests over nontarget organisms so that they become complementary to natural biological control processes existing within all agricultural ecosystems.

Industry has responded to the goals and needs of a compatible pesticide technology with development of ever more selectively toxic chemicals that are used at comparatively low rates compared to the chemicals they are replacing in the marketplace. The recent generations of EPA-designated reduced-risk pesticides are in many cases tens to hundreds of times less toxic to fish, birds, and nontarget predators and parasitoids than chemicals that were introduced to farmers between the 1950s and 1970s.

However, the biochemical theory of ligand-receptor and enzymesubstrate kinetics, in combination with considerations of pharmacokinetics, is applied herein to show that some of the older chemicals actually present little risk of adverse effects in association with realistic environmental rates of use.

Following explications of toxicological mechanisms of selectivity and the importance of considering pharmacokinetic factors influencing pesticide disposition within the body, this report specifically examines the claims about four types of contemporary pesticides — atrazine, chlorpyrifos, pyrethroids, and glyphosate. In each case study, the published scholarly literature is used to show that the perception of adverse effects has arisen as a result of mistaking — either through ignorance or ideology — laboratory studies of toxicological mechanisms for analysis of risk based on consideration of how the chemicals are actually used.

One important point to consider in any analysis of pesticide technology is the evolution of a dynamic system of management. That is, any reports of adverse effects are dealt with by development and implementation of new testing requirements or by changes in permissible uses of a product. The system provides feedback to both regulatory agencies and manufacturers themselves.

The latter have historically responded by a focus on discovery of new products that meet the goals of a safer chemical technology. Unfortunately, public attitudes — fed by attention-seeking media scare stories — seem focused on the past and fail to see a comparatively rapid change in chemical technology and how it has been deployed.

Similarly, public attention is drawn to misinterpretations and half-analysis of stories of hazards. However, scrutiny of the published literature has failed to find evidence of a credible probability of adverse human health effects derived from the use of modern pesticides as occurs in the real world, not in the laboratory-generated environment.

Despite the headlines of hazard, modern chemical technology provides hope for continued improvement of human health, whether helping to make vegetables and fruits of high quality more abundant and cheaper, or to preserve (or indeed, enhance) the health of individuals and society at large.

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