Clinical Toxicology of Agricultural Chemicals

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by

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CLINICAL TOXICOLOGY OF AGRICULTURAL CHEMICALS

Foreword

The clinical toxicology of agricultural chemicals and the environmental issues which have arisen as a result of the use of these chemicals are presented in this book. The subject is viewed from the social, economic, and scientific standpoints.

Agricultural chemicals—pesticides, herbicides, and other related chemicals—play a key role in maintaining the strength of the U.S. economy, since agriculture is a major U.S. industry and the U.S. is a prime exporter of food and foodstuffs. These facts underscore the continuing need for agricultural research. However, this need for new and effective chemicals must be balanced against the possible long-term detrimental effects to the environment. The issues are complex, and the book presents an overview of the problem, with the major thrust on scientific background and practical clinical toxicology.

The book is divided into two parts. Part I provides background information on the extensive use of agricultural chemicals and discusses some of the major environmental issues which have arisen as a result of their use. Understanding some of the basic concepts of this field may give the reader insight into the scope of the problems in determining possible genetic defects from exposure to any number of possible genetic insults, including chemicals. Laboratory methods and tests are described, and the role of regulatory agencies is discussed. Part II deals with the basic and clinical toxicology of selected agricultural chemicals, which have been classified according to chemical structure. Where possible, the discussion has included sections on basic chemistry, basic toxicology, molecular biology issues (teratogenicity, mutagenicity, carcinogenicity), environmental fate, potential human exposure, symptoms and signs of intoxication, and diagnosis and treatment.

The information in the book is from *Clinical Toxicology of Agricultural Chemicals* (PNRC Report 841-9) by Sheldon L. Wagner, M.D., of the Environmental Health Sciences Center, Oregon State University, prepared for the Pacific Northwest Regional Commission, August 1981.

The extensive table of contents provides easy access to the information contained in the book. An alphabetical list of the chemicals discussed is included, and the book is indexed.

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Preface

This book, written from a sense of perceived need, is offered in the hope that it will be useful to people of various interests and different training. Agricultural chemicals are a fact of life in this world and their universality has become controversial. There are many issues: social, economic, scientific and others. They are never addressed together yet the undertones of each are always present in any open meeting on any aspect of the subject. The issues, of course, are all complex but such complexity does not mean that they cannot, nor should not, be addressed even though the emotions may be intense and labile. It is hoped that this book will present a part of all aspects although it is not an in-depth analysis of each issue and the major thrust is the background and the practical clinical toxicology of these chemicals. For those interested in further reading, the chapters are followed by key references but are not meant to be complete bibliographies. Other sources of information are also listed. Although the book is written particularly for physicians, I believe that it should be useful to the understanding of various viewpoints by other disciplines and by the public at large. If such furthering of mutual understanding leading to increased communication occurs, the book will have, in my mind, achieved one of its major objectives.

Many thoughts and kind words of consideration are due to many people. I have learned much from many colleagues at Oregon State University, and in particular, I wish to thank Drs. Virgil Freed, Frank Dost and James Witt who have been, and always are, a great help in understanding this subject. I am also indebted to the following for their helpful review and comments on the rough draft of this material: Jack Allard, Eric Deck, Richard Ellerby, William Kosesan, Hershell Pendell, Nancy Stouffer, and Warren Westgarth.

Most significantly, I am indebted to, and this book would not have been possible without, the untiring efforts and enthusiasm of Carol McLaren. In addition to her multiple hours of hard work in helping at every level, her optimism, encouragement and even-keeled temperament will always be appreciated.

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March 1981

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Part I
Scientific Background

Introduction

A common misconception held by the public is that the United States' major strength in the field of industry is related in some way to mechanization. The United States is known historically as the founder of the industrial and mechanical revolution and the conception of many people is that this reliance upon mechanics is the principal source of economic strength in this country. The following statements made by Press (1978) may therefore be rather surprising: 1) agriculture is this country's largest industry, with assets of over $531 billion; 2) the food and fiber industries are the nation's biggest employers, with between 14 and 17 million people working in some phase of them from growth to sales; 3) since 1971, U.S. agricultural exports have tripled to a record $24 billion in 1977 resulting in a net contribution of $10 billion to our balance of payments; 4) the United States supplies about half of the grain that moves in world trade and three-fourths of the soybeans. It produces about 70% of all the food aid to the world.

Conversely, again from Press, most nations in this world are chronic importers of food and the situation is growing worse. In 1950, some 45 nations exported food or were self sufficient but by 1974, only 19 nations did so. Only four countries, including the United States, accounted for more than 90% of the exports. The demand for food in 80% of the entire Third World's population is in excess of its supply.

These facts underscore the importance of agriculture not only to this nation but to other nations of the world. The need for continued agricultural research in order to increase the yield of food available is of major importance for the future. Agricultural chemicals,

including pest and weed control types, as well as other related chemicals, play an important role in maintaining the strength of this part of our economy. There is no question that many of these chemicals have a significant level of toxicity, particularly when applied or used incorrectly or inappropriately. Everyone is, therefore, aware of the necessity of balancing the need for chemicals against the possible long-term detrimental effects to our environment. The magnitude of assessing toxicity of all chemicals is a continuing and impossible job. If one recognizes that all chemicals are toxic given in inappropriate dose, route, and so on, then when one considers that there are now over four million known chemicals with the number growing at approximately six thousand per week and that there are now approximately 63 thousand chemicals which are in common use, one can appreciate the magnitude of the problem.

Recognizing that environmental factors probably play a major role in the state of human health, the continued surveillance and investigation into the relationship of chemicals to health remains a major priority. A principal controversy with many agricultural chemicals has been with respect to their long-term accumulation in the environment, such as with DDT, and their potential as possible agents to cause delayed health effects such as birth defects, cancer, or genetic changes of future generations. We should recognize, however, that during the past 25 years, certain diseases have decreased considerably in spite of, or perhaps because of, the introduction of chemicals into our environment. For example, during the past 25 years, heart disease, our major killer, has decreased by more than 24%; stroke has dropped 32.5%; deaths due to hardening of the arteries have decreased 53%. Other improvements could be cited. The above statistics are not meant to minimize the importance of chemically related health problems but simply cited to note that a number of health parameters in addition to life expectancy are continuing at this time to improve. Furthermore, many problems of health could be significantly decreased if the public took on more of its own share of responsibility in attempting to reduce actual self-inflicted diseases such as those associated with cigarette smoking, alcohol, and other drugs.

Part I of this book is intended to provide readers with information about the extensive and wide use of agricultural chemicals and to discuss some of the major environmental issues which have arisen as the result of