

RISKS AND BENEFITS OF AGRICULTURAL PESTICIDES IN THE GLOBAL PERSPECTIVE

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World-wide sales of agricultural pesticides have exceeded at least \$20 billion per year since the 1990's. Herbicides account for half of the pesticides used. North America, Europe and Asia each use about 25% of the pesticides and about 25% is used by the rest of the world combined. Industrialized countries use most of the herbicides whereas developing countries use about half of the insecticides and fungicides. Human health risks for pesticides or any chemicals depend on the toxicity of the chemicals and our exposure to them. In industrialized countries, more sophisticated equipment and training programs have minimized exposures and health risks for applicators. However, more training programs and improved equipment are needed in developing countries where the use of hand-held equipment is still very common. Environmental risks of pesticides depend on the persistence and mobility of the chemicals, their toxicity to non-target organisms and their overall volume of use. Early in the pesticide era, during the 1960's, environmental concerns were largely focused on the bioaccumulation of persistent, lipid soluble insecticides. Pesticides with those properties have been discontinued and today, the environmental focus is largely on herbicide injury to non-target plants either by spray drift or by soil residue carry-over to injure subsequent crops. A study at Rothamstead in England does illustrate that intensive pesticide use in agriculture does not have impacts that are irreversible. When pesticide use was terminated on plots that had been treated with at least five different pesticides, each year, for more than 20 years., 17 months later, there were no detectable residues in the soil, microbial activity was not-altered and there were no difference in barley yields compared to un-treated plots [1]. Economic benefits of pesticides: In the late 1990's, growers in the USA could expect a \$4 return for each \$1 they spent on agricultural pesticides [2]. In that same era, Pimentel et.al. [3] agreed that the \$6.5 billion spent on pesticides resulted in a \$26 billion return to the growers. However, when all the indirect costs for pesticide regulation etc. were considered, there was only a \$2 return to society at large for each \$1 that growers spent on pesticides. Research costs have made today's pesticides so expensive that economic benefits might not be realized if growers were not minimizing pesticide use with sophisticated IPM programs for their crops. Pesticides save energy, especially human energy: By the late 1940's tractor powered plowing and cultivation made it possible for one farm worker in the USA to produce enough food for eight other people. Since the late 1980's, use of herbicides and other pesticides have made it possible for one farm worker in the USA to produce enough food for fifty other people. Thus, in the USA, only one person in fifty is involved in food production. In Mexico and Brazil, it is about one in five, world-wide it is one of every two and in parts of Africa, two of every three must work in growing food. In fact, most African women spend half of their waking hours planting, weeding or harvesting food crops [4]. Benefits for world food production: Increased agricultural pesticide use nearly doubled food crop harvests from 42% of the theoretical world-wide yield in 1965 to 70% of the theoretical yield by 1990 [5]. Unfortunately, 30% of the theoretical yield was still being lost because our use of effective pest management methods was not applied uniformly around the world and it still isn't. Pesticides can improve food safety: When crop plants are stressed by insect or disease damage, levels of natural pesticides can be increased to toxic levels. For example, potatoes harvested from plants defoliated by beetles can have solanine and chaconine levels that are 50% higher than in potatoes from non-defoliated plants and these chemicals are known to be natural insecticides, and fungicides as well as teratogenic and fetal toxic in chickens and frogs [6]. Similarly, use of fungicides can prevent the development of corn

ear mold that would produce carcinogenic aflatoxins. Pesticides save land: If agricultural pesticides had not been used since 1950, we would have already lost half of the forested land that we have today to food production [7]. Feeding our world population in 2050 or 2100. Today's world population is about 6.8 billion. It is expected to increase to 9 or 10 billion by the middle of this century. The population of South America is expected to reach 500 million by 2050. Fortunately, these numbers are far lower than what was predicted a few decades ago. It is hard to predict what our population will be at the end of this century. With an aging population, populations in most countries could plateau at the middle of this century and begin to decline. However, it will be a major challenge for politicians and economists to accept a non-growing human population. Governments in various countries are already trying to encourage women to have larger families. Regardless, we will have 50% more people to feed for the second half of this century – a problem that our grandchildren will have to deal with. If more arable land is used to produce bio-fuels and fibres, how will we grow enough food to nearly double world food production on less land than we have today? If birth rates continue to decline and bring the world population back down to 6 or 7 billion by 2100, future generations may have the choice to adopt organic farming world-wide or they may choose to reduce the amount of land devoted to food production. I do not think we have that choice today. Our goal for this century should be to prevent world hunger without irreversible harm to the world environment. It is my conclusion that this will be much easier to achieve with new crop genetics and with the best methods of integrated pest management than with a world-wide adoption of organic agriculture.

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