PESTICIDE PROBLEMS IN MEXICO AND NICARAGUA:

A TIME FOR CHANGE

by

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The unregulated use of pesticides in the export-oriented agriculture of Northern Mexico is hazardous to humans and the environment. Agricultural laborers working to produce Mexican crops for export are the mixers, applicators, and often the victims of chemical pesticides. The consumers of these crops are also at risk due to persistent pesticide residues. Historical factors shaping Mexican agricultural development policy link Mexican labor, the environment, and U.S. consumers in a dangerous relationship. Nicaragua is an example of a developing country that has broken from a tradition of pesticide abuse through a successful integrated pest management (IPM) program. The appropriateness of pesticides in Mexican export-agriculture is questionable for significant human and ecological safety reasons.

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CHAPTER I: INTRODUCTION

Pesticides are a serious problem in Mexican agriculture with many international implications, involving consumers here in the United States. Pesticides are chemicals produced to increase crop production through the control of weeds, parasites, insects, fungi, or any other persistent pest. The problems in Mexico present themselves in human, ecological, economic, and social terms. Before addressing the problems of pesticides in Mexico, this paper begins by briefly explaining some of the reasons for pesticide use in the developing world and some of the general costs involved.

Land, Food, and Scarcity in the Third World

The multifarious connections of environmental protection and economic development goals in LDCs are easily witnessed in the pressures placed upon the land by a burgeoning population. Population growth, especially in rural areas, places a strain on available lands for both income and food. The "health" of the land (i.e. the soil nutrients, the available clean groundwater for irrigation, the amount of top soil) will inevitably be reflected in the health of the people dependent upon its productivity for nutrition and employment. Unfortunately, the pressures placed upon the land in LDCs are

often too great and ecological degradation occurs. This degradation results in an even greater strain placed upon the remaining available land, thus creating a dangerous cycle of poverty and environmental deterioration. Poor land can often equal poor people.

The world population growth numbers for the future are, by themselves, staggering. The figures for the Third World paint an even bleaker picture. Population projections estimate an increase in global population from 4.8 billion in 1985 to 6.1 billion by 2000, and to 8.2 billion by 2025. More than 90 percent of this increase is expected in developing countries.[1] In a world where already 13 to 18 million die each year as a result of hunger and starvation[2], the additional nutritional demands of this dramatic population increase represents an unprecedented food production challenge to the world's farmers.

Population pressure is already forcing farmers in the less developed countries of the world to work harder, often on shrinking farms and marginal land, just to maintain household income and feed themselves.[3] In Africa and Asia, rural population nearly doubled between 1950 and 1985, with a

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[1] World Commission on Environment and Development (WCED), Our Common Future (Oxford: Oxford UP, 1987) 101.

[2] Hugh Thomas, A History of the World (New York: Harper and Row, 1979) 49.

[3] WCED 97.

relative corresponding decline in land availability.[4] Soil erosion, nutrient depletion (through intensive land use), and salinization constrain the prospects for Third World agricultural development. Historically, falling soil productivity has led to the decline of civilizations and the emigration of people to new lands.[5] Today, this latter option has all but disappeared. In the developing world, only 15 percent of people live in countries with abundant land resources that might be able to accomodate farmers displaced from unproductive soils.[6] In Asia, nearly 80 percent of the arable land is already cultivated.[7] Even where large areas of land remain, it is often worthless for agriculture due to low soil fertility or because the prevalence of disease prevents human settlement. The Food and Agriculture Organization (FAO) of the United Nations estimates that agricultural expansion into new land, in the developing world, can account for only one-quarter of the growth in food output

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[4] Department of International Economic and Social Affairs (DIESA), World Population Prospects: Estimates and Projections as Assessed in 1984 (New York: UN, 1986).

[5] Walter V. Reid, James N. Barnes, and Brent Blackwelder, Bankrolling Successes: A Portfolio of Sustainable Development Projects (Washington D.C.: Environmental Policy Institute, 1988) 4.

[6] World Resources Institute, World Resources 1986 (New York: Basic Books, Inc., 1986) 44.

[7] P. Crosson, "Agricultural development--looking to the future," Sustainable Development of the Biosphere, ed. W.C. Clark and R.E. Munn (Cambridge: Cambridge UP, 1987) 123.

from 1975 to 2000.[8]

Farmers in the developing world are faced with the challenge of increasing the productivity of available arable lands and simultaneously safeguarding against their ecological degradation so that future generations might also benefit from their use. This same FAO report, entitled "Agriculture: Toward 2000," makes the following suggestion:

> A sustained higher growth of production can come only by a modernization of the production process, i.e., purchased inputs must be increased and resources used more intensively in conjunction with an expansion of the land base...
>
> The rapidly rising demands for agricultural products in the face of limited natural resources call for an increasing reliance on science and technology. The agriculture of the future in developing countries must become more science-based...as has been the case with the agriculture of developed countries.[9]

Many LDCs already have a strong reliance on science-based agriculture, a reliance brought to them through the agricultural development policies of the "Green Revolution."

The Green Revolution

The very spirit of the Green Revolution, that modern technologies are an effective means to alleviate hunger, was encapsulated in Harry S. Truman's "Point Four" address:

> More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of

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[8] Food and Agriculture Organization (FAO) of the United Nations, Agriculture: Toward 2000 (Rome: UN Publ., 1981) vii.

[9] FAO xv, xvi.

> disease. Their economic life is primitive and stagnant. Their poverty is a handicap and a threat both to them and to more prosperous areas...
>
> I believe that we should make available to peace-loving peoples the benefits of our store of technical knowledge in order to help them realize their aspirations for a better life...
>
> Greater production is the key to prosperity and peace. And the key to greater production is a wider and more vigorous application of modern scientific and technical knowledge.[10]

The Rockefeller Foundation gave birth to agricultural research, started in Mexico in the 1940s, that sought food output increases through gains in the productivity of certain grains (wheat, rice, and others). Aimed at helping Third World nations increase their agricultural production through technological and biological advances, the "Green Revolution" refers to any package of modern agricultural technologies (high-yielding varieties of seeds, fertilizers, irrigation systems, pesticides) introduced into the developing world. New plant varieties constitute the foundation of the Green Revolution, but these varieties require careful management and relatively high and regular amounts of fertilizers, pesticides, and water.[11] For precisely this reason, the success of these varieties, and the Green Revolution in general, has been in serious question. The plants' dependence

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[10] Harry S. Truman, "The Faith by Which We Live," Inaugural Address, Washington D.C., January 20, 1949, Vital Speeches of the Day 15, no. 8 (February 1, 1949): 227, 228.

[11] The Hunger Project, Ending Hunger: An Idea Whose Time Has Come (New York: Praeger, 1985) 111.

on chemical inputs and large-scale investment has often meant that their proliferation into developing countries comes at the expense of both the small farmer who cannot afford these expensive inputs and the environment that must absorb the effects of the use, and often the abuse, of these chemicals. Reliance on "science-based" agriculture (the hybrid seeds) breeds further reliance (on their requisite chemical inputs).

Pesticides: Appropriate Technology in Third World Agriculture?

The use of one of these chemical inputs, pesticides, has become a cornerstone of the scientific approach to increasing agricultural production. Pesticides (a broad range of chemicals including herbicides, insecticides, fungicides, and rodenticides) boost crop yields by attacking pest populations. Norman Borlaug, winner of the 1970 Nobel Peace Prize for his work in agricultural research, argues that the use of pesticides and other modern agricultural technologies has increased productivity and simultaneously decreased environmental degradation. His argument is based on evidence ranging from global rice productivity increases since 1950 to the successful U.S. experience in increasing crop yields per acre:

> To produce food for ourselves and other nations, we required 290 million acres of farmland last year. To get the same yield while relying on the technology we used 30 years ago...we would have required nearly 600 million acres, or twice the amount used last year. This would have resulted in a huge loss of forest and grass lands which not only would

> have further crowded some animal species into extinction but would have caused other problems as well.[12]

The benefits of pesticide use, here, are appropriate to the needs of the developing world farmer with finite land and growing demands on agricultural output.

The costs of pesticide use in developing countries have in many cases been overwhelming. While many advocates of pesticides cite the significance of the malaria problem in LDCs as a justification for intensified use, the "pesticide treadmill" may exacerbate vector-borne diseases. As pesticides are used more and more around the world, insects, plant pathogens and weeds become increasingly resistant to them and pass this resistance on to their offspring, thus requiring even greater pesticide use in the future. A treadmill of pesticide addiction then emerges. Researchers at the World Health Organization (WHO) have found that new malaria cases, at about 7.5 million a year (double the rate of 10 years ago), are directly linked to the problem of pesticide resistance in insects.

> Many countries, which a few years ago were on the point of announcing the eradication of malaria, are struggling with an onslaught of pesticide resistant mosquitoes and drug-resistant parasites. In 1968, 38 species of the *Anopheles* mosquito, which carries the malaria parasite, were resistant to one or more types of commonly used pesticides. By 1975, however, the figure had risen to 42 and by 1980, 51 species including all the main

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[12] The Hunger Project, Ending Hunger: An Idea Whose Time Has Come (New York: Praeger, 1985) 141.

> malaria-carrying species. The intensive, and in many instances excessive and irrational, use of pesticides was responsible for the selection of pesticide resistant mosquitoes. Those which are resistant survive and go on to multiply.[13]

The pesticide treadmill has locked many developing countries into a spiral of economic, ecological, and human devastation.

Furthermore, at all stages of processing and use, pesticides pose dangers to those who are exposed to them and to the environment. This is especially true in developing countries where people applying pesticides are often unfamiliar with safe procedures for their use. For example:

> On this warm spring day, Jorge Munoz stands on a farm lane with several younger boys, smoking as he mixes buckets of canal water with poison dust from a plastic bin. The label on the product says "Sencor, Metribuzin." The product, a herbicide, is made by Bayer of Mexico.
>
> On the label are 13 warnings in Spanish.
>
> The first says, "Read instructions carefully."
>
> Jorge cannot read.
>
> "People under 18 should not apply this product," the label says. "Mexican law says it is illegal for growers to employ anyone under 16 to do hazardous work."
>
> Jorge is 16. His companions are 13, 14, and 15.
>
> Other instructions warn workers to keep the mixture away from skin, clothing, and food, to avoid spillages or mixing the poison near drinking water sources and to wear protective clothing. Within 10 minutes, the young workers have violated every warning and numerous labor laws as well...
>
> On any winter day, you can watch as crop dusters roar low over the valley, casually

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[13] WHO, Resistance of Vectors of Disease to Pesticides: Fifth Report of the Who Expert Committee on Vector Biology and Control, Technical Report Series 655 (Geneva: WHO, 1980) 19.

> dropping loads of poison mist that drift over workers in the fields and their families in ditch-bank labor camps. A *Times* photographer was sprayed as he took pictures of sick children in one squalid labor camp.
>
> You can see barehanded and barebacked men mix chemical cocktails and load them onto grower-owned crop dusters, wearing no masks and no gloves to protect their skin and lungs...
>
> One group of workers said someone in their camp dies every two or three days. Another group said they figure 150 workers have been given antidotes after being overcome by pesticides.[14]

This report, emanating from Mexico, highlights the negligent environment within which pesticide use occurs in many developing countries. Such cases of pesticide poisoning are increasingly common in LDCs. Information from WHO estimates that 500,000 people are poisoned each year in the Third World as a result of direct exposure to pesticides, about 5,000 fatally.[15]

Finally, because of the toxicity and persistence of pesticides in the environment, combined with insufficient knowledge of their side-effects, pesticide use can lead to environmental degradation. The continued application or misuse of pesticides depletes the fertility of the soil and, over time, reduces the overall quality of the land. Utilized for agricultural or disease control purposes, pesticides often contaminate the shrinking supplies of clean water for drinking

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[14] Laurie Becklund and Ronald Taylor, "Pesticide Use in Mexico-A Grim Harvest," Los Angeles Times, April 27, 1980, 1.

[15] Edith Kermit Roosevelt, "The Politics of Pesticides," Worldview April 1982: 7.

and bathing in the Third World.[16] Instead of aiding in the production of food, pesticides, through ecological damage, can harm fisheries through water contamination and contaminate meat supplies as grazing cattle feed on pesticide-ridden grain.[17]

The question then arises: Are pesticides an appropriate technology for Third World agriculture? The very nature of the pesticides themselves makes this question difficult to answer. Pesticides have a dual character. They are both helpful and harmful because they are lethal. A pesticide, then, cannot be regarded as being intrinsically hazardous or helpful to mankind. A clear and important distinction can be made between those costs to human health and safety and to the environment that are intrinsic to the chemical structure of a certain pesticide and those that arise from the circumstances in which they are used.[18] Thus, the terms of the debate over the costs and benefits of pesticide use in Third World countries are inherently complex since the circumstances of pesticide use are as divergent as the countries themselves.

The aim of this thesis is to present the case study of pesticide problems in Mexican and Nicaraguan agriculture within the broad context of each country's

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[16] David Bull, A Growing Problem, chapter 6, "Pesticides and the Third World Environment," (Oxford: OXFAM, 1982).

[17] Ibid.

[18] Robert Boardman, Pesticides in World Agriculture (London: Macmillan Press Ltd., 1986) 4-9.

agricultural development model. In the Mexican case, the connection of Mexican agriculture to the international capitalist market economy in the export-oriented regions of northern Mexico determines the context within which pesticide use and abuse occurs. In the Nicaraguan case, the success of their integrated pest management (IPM) program is analyzed within the context of wide socio-economic changes brought on by post-Revolutionary agrarian reform. Through comparing and contrasting these two cases, some specific solutions to Mexico's pesticide problems can be drawn out and general conclusions be made about the agro-ecological sustainability of pesticide use in developed and developing world agriculture.

CHAPTER II: PESTICIDES IN MEXICAN AGRICULTURE

In Search of the Perfect Tomato

> Culiacan, Mexico--Modern greenhouses with purified water systems have been erected to nurture tomato seedlings, while workers are crowded into dirt-floored tar-paper coops with no drinking water.
>
> "The seedlings are more important than people," one U.S.-born grower said casually when asked why a new purified water system built to irrigate young tomato plants did not provide drinking water to workers in a camp a few hundred yards away.
>
> Tomatoes grown here are grown for Americans--blemished seconds are sold in Mexico. Combining the latest U.S. technology with vast supplies of migrant laborers, Mexico's agribusinessmen produce a $500-million-a-year crop.[1]

The lives of Mexican workers, when the hazards of pesticides are added to the social context described above, are imperilled in the pursuit of the perfect tomato. This is yet another proof that truth is often stranger than fiction. The tomato grower is paid for the tomatoes that he sells. The tomatoes that sell for the highest price are the ones exported to the United States. The tomatoes that are accepted best by U.S. consumers are those that have no blemishes upon them. Nature, despite her eons of work in helping shape the course

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[1] Becklund and Taylor 3, 1.

of species selection and adaptation, is not flawless. Tomatoes are not easily grown without blemishes caused by pests, disease or other natural causes. Lawrie Mott and Karen Snyder point out in their 1987 book Pesticide Alert that many pesticides are used solely to enhance the cosmetic appearance of fruits and vegetables, and that farmers defend the use of pesticides because of consumer preferences for a blemish-free product.[2]

The price that is paid for a perfect tomato is not solely monetary in nature. For example, from 1983 to 1985 the Food and Drug Administration (FDA), the regulatory arm of the United States' government that deals with pesticide residues in foodstuffs, took samples from the over three billion pounds of tomatoes imported into the U.S. Imports made up 80% of these samples and 70% of these had measurable pesticide residues. What are these pesticides and what hazards do they present? Chlorothalinol, found in the fungicide *Bravo*, is the third most common pesticide detected in tomatoes and is a probable human carcinogen, and evidence suggests that chronic health effects include kidney, thyroid and liver damage. The insecticide Methamidophos, the most commonly detected residue found in tomatoes, is still under review by the Environmental Protection Agency (EPA) for carcinogenecity, mutagenic effects

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[2] Lawrie Mott and Karen Snyder, Pesticide Alert (San Francisco: Sierra Club Books, 1987) 25.

and birth defects, although it was registered for use in 1972.[3]

A blemish-free tomato, in this case a Mexican tomato grown in the Culiacan Valley, is grown in a labor and capital intensive manner. Although the American marketplace is some distance away, the cheap labor available in Mexico gives Mexican growers a significant advantage over American growers. The warm climate of the Culiacan Valley also creates a seasonal advantage in that production can continue through the winter months. Thus, it is no surprise to see the great number of large-scale farming operations making this valley their home.[4] What is at question here is not these farmers' right to create and market the perfect tomato. That question, though intriguing, is best answered in an economic/philosophical treatise devoted to unearthing the ethics of capitalism within agricultural production. The questions that this thesis addresses are:

How is the perfect tomato produced?
Who produces the perfect tomato?
For *whom* is it produced?
At what *cost* is it produced, and *who* must pay?

Tomato As Metaphor

Though the focus of this paper is not the production of

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[3] Mott and Snyder 18-19, 128; EPA, "Chlorothalinol: Pesticide Tolerance", 50 Federal Register 26592, June 27, 1985; EPA, "Methamidophos: Proposed Tolerances", 47 Federal Register 39473, August 31, 1983.

[4] Angus Wright, "Rethinking the Circle of Poison," Latin American Perspectives 13, no.4 (Fall 1986): 26-59.

the perfect tomato, it does serve as an effective metaphor for export-oriented agriculture in Mexico. Agricultural production focused in one area with the fruits of the production going elsewhere: That is the story in the Culiacan Valley in Mexico. There, the bulk of pesticides are not used on food crops for the local populace, but on export-oriented crops that require intensive inputs. *How* are they produced, by *whom*, for *whom*, and at what cost? How is it that human beings come to exist within a socio-economic framework that places greater value on the health of the commodity they work to produce than the health of the workers themselves? These are the questions describing a poverty on at least three separate levels: social, economic, and ecological. After presenting a brief historical background, this chapter explains Mexico's pesticide problems as seen in relation to an export-oriented agricultural development model.

Agriculture in Northern Mexico

One vital factor in the development of commercial agriculture in northern Mexico, where the use of pesticides is now prevalent[5], was the absence of a sedentary Indian population. Land for agricultural production, in the northern state of Sonora, was opened up in the 19th century following the enslavement of the nomadic Yaqui Indians. During the

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[5] Louis W. Goodman, "Foreign Toxins: Multinational Corporations and Pesticides in Mexican Agriculture," in Multinational Corporations, Environment, and the Third World, ed. Charles S. Pearson (Durham:Duke UP, 1987) 90.

Porfiriato (1876-1911), an improved system of irrigation and the newly constructed railroad connections to growing markets in the American southwest were used to attract domestic and foreign investors alike to settle this land. Commercial agriculture was firmly established in northern Mexico by the early 1930s.[6]

Mexico and the Green Revolution

In the early 1940s, the Rockefeller Foundation began applying its experiences in health and agriculture to a technical assistance plan in Mexico.[7] This was, in essence, the "birth" of the Green Revolution. The underlying strategy, as is the dominant strategy to alleviate the "food problem" in LDCs today, was to make science-based agriculture the norm in Mexico.

During the post-Revolutionary setting of the Cardenas administration (1934-1940) agrarian reform was returning land to the landless in Mexico. But, as the Foundation's scientists criticized in a later book, it was not enough:

> Agrarian reform had long been one of the principal aspirations in Mexican revolutions...Mexico was being transformed from a country of latifundia [large farms] to one of minifundia [small farms]; whereas a few people had owned much of the land, each of many people now farmed a little land...Land

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[6] Background information for this section was found in Lane Simonian's article "Pesticide Use in Mexico: Decades of Abuse," The Ecologist vol. 18, no.2/3 (1988): 82.

[7] Edmund K. Oasa and Bruce H. Jennings, "Science and Authority in International Agricultural Research," Bulletin of Concerned Asian Scholars vol. 14, no. 4 (1982): 31.

> redistribution was satisfying the hunger of the landless for land, but was it satisfying their hunger for food?[8]

With this question in mind, and the underlying task of creating an agricultural production system based on modern technology, Dr. Herrell De Graff of the Division of Social Sciences of the Foundation set out to answer the question: Where, in a socio-economic sense, does this program begin?

> The owners of large, private farms have a different economic setting than do ejidos [communal farms] and minifundia, mainly lying in the fact that they are managed with commercial intentions. They are operated with a profit and loss account in mind--and operators are guided by the marketplace, by costs and returns, instead of by the families' direct food needs. They are employers rather than suppliers of labor. And to a much greater degree they combine capital with land and manpower resources in an effort to get more efficient and profitable operation...In short, they are a group with similar motivations and aspirations to those of the U.S. commercial farmers--and any good agricultural extension agent from this country, knowing their language and their local conditions, would know precisely how to go about working with them. Better seeds, fertilizers, pesticides, and specialized equipment are not to them foreign ideas of which they are suspicious.[9]

De Graff supported starting agrarian change from the "top down," supplanting agriculture that was need-based with one that found meaning through technological changes and

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[8] E.C. Stakman, Richard Bradfield, And Paul C. Mangelsdorf, Campaign Against Hunger (Cambridge, Mass.: The Belknap Press of Harvard Univ., 1967) 22.

[9] Report from Herrell De Graff to Joseph H. Willits, September 10, 1952, 39-40 (New York: Rockefeller Foundation Archives).

connections to the market economy. The "top" was the large private farms. He recognized that this transformation of Mexican agriculture, the Green Revolution, might cause tension within the existing social relations, but rebutted:

> Nevertheless, when a "development" model is started, and to the extent that it succeeds in the biological improvement of agriculture, much of the economic simplicity of self-sufficing village life is on the way out...
> Until there is motivation to money-wants which the marketplace and money can satisfy--there will be little or no change from self-sufficiency to commercial undertakings...The crucial point is that if money is to be spent, money must be taken in, and the farming system is no longer controlled by the direct needs of the farm family but rather by profit and loss.[10]

As a "development" model, it is easy to see why Keith Griffin states the following of the Green Revolution:

> The Green Revolution is from a technological point of view largely a biological and chemical revolution, but from a socio-economic point of view it is largely a commercial revolution.[11]

The high-yielding varieties of seeds and their requisite chemical fertilizers and pesticides form the chemical and biological revolution. The Green Revolution is a commercial revolution in the socio-economic sense because the agricultural production structure has shifted from self-sufficiency, needs-based, small-scale traditional agriculture

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[10] Ibid., 56-57.

[11] Keith Griffin, Political Economy of Agrarian Change: An Essay on the Green Revolution (Cambridge, Mass.: Harvard UP, 1974): 208.

to larger-scale farms that operate on the needs of the market, by profit and loss, using the latest agricultural technologies.

Mexican Agrarian Policy: The Agro-export Development Model

The internationalization of Mexican agriculture[12], made possible by government investment (i.e. the northern irrigation canals and railroads of the *Porfiriato*) and government policy (adoption and implementation of the Rockefeller Foundation's recommendations), within the capitalist economy results in a development approach that defines resources in a utilitarian manner: Natural resources are for commodity production and capital accumulation. The comparative advantage of a large, mobile, and cheap labor force attracts foreign capital and results in an agricultural commodity production in Mexico that is export-oriented because "producing goods for the mere survival of low wage earners is not as profitable as producing for more affluent markets."[13] David Barkin, in his excellent article entitled "The End to Food Self-Sufficiency in Mexico," goes into a more in-depth analysis of the effects of this internationalization of Mexican agriculture. He describes the crisis in terms of the

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[12] This topic is more fully developed in David Barkin, "The End to Food Self-sufficiency in Mexico," Latin American Perspectives 54 vol. 14, no. 3 (Summer 1987): 271-297, and in Miguel Teubal, "Internationalization of Capital and Agroindustrial Complexes," Latin American Perspectives 54 vol. 14, no. 3 (Summer 1987): 316-364.

[13] Barkin 275.

ability of Mexicans to produce food crops for themselves. Now, he states, "the country is obliged to import billions of dollars of food products it cannot afford" which "poses a basic problem of survival for families and communities." He concludes that an export-oriented agricultural system, connected to the international capitalist economy "fosters the disorganization of communities" because "it augurs for the onset of political unrest because of the inability...to create the economic and social opportunities required to productively absorb displaced groups into new activities."[14] Barkin is describing what can effectively be called the rural poor, environmental refugees, or, in the case of the abuse of pesticides in Mexico, the victims.

The Problems of Pesticides in Mexican Agriculture

As discussed in the introduction, the costs of pesticide use arise in two distinct ways: From their chemical structure and in the circumstances of their use. As stated earlier in this chapter, the Northern export-oriented sector of Mexican agriculture is where the most intensive use of pesticides occurs. By analyzing key aspects of export-oriented agriculture, with regard to the problems of pesticide use and abuse, we can begin to understand the situation in Mexico. First of all, *who* produces these crops (laborers, workers) and *how* are they produced (what is the production method that makes pesticides so costly)? Secondly, for *whom* are these

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[14] Barkin 272, 277.

crops produced? Finally, at what *cost* does this occur, and *who* must inevitably pay?

Who?

Barkin effectively described above the process of the marginalization of the rural poor in Mexico. If they are environmental refugees, marginalized by lack of access to land, credit, or other means of income, where do they go? The acute environmental, social, and economic problems created by the flow of the rural landless to such urban areas as Mexico City are enormous. The better known mobile population is the one that continues to pour into the United States seeking economic opportunity. Besides these movements, one major agro-export producing area in northern Mexico is the San Quintin valley on the Baja Peninsula which attracts, from May to December, an estimated 40,000 farmworkers in search of work. Most are Mixtec Indians from Oaxaca, a poverty-stricken region over 1,500 miles to the southeast. They first migrate to the north in search of work on the vegetable farms of the Culiacan Valley, where the produce is generally harvested from December through May, then travel west to San Quintin for that season.[15] This is *who* they are.

How?

How are the crops produced and what significance does it have in relation to pesticide use? One of the problems of

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[15] William Kistner, "Scrutiny of the Bounty", Mother Jones, December 1986: 31.

pesticide use in Mexico emanates from the monocultural planting methods used in Green Revolution, export-oriented agriculture in the north. For example, whereas wheat and corn hybrids of the Green Revolution were developed to produce greater yields, they required massive irrigation and fertilizer and pesticide inputs. The same is true of the export-oriented vegetable crops, such as the perfect tomato, in northern Mexico. Planted in dense stands of single crops, in San Quintin nearly 15,000 acres of tomatoes, this monoculture presents few barriers to pest expansion.[16] Pest expansion means a greater need for increased use of pesticides, leading to increased pest resistance to these pesticides, thus the "pesticide treadmill" begins to spin.

Traditional farming, or subsistence farming, in Mexico is, by contrast, founded on a different set of principles. Mexico's subsistence farmers have, with great success, traditionally used biological controls to minimize damage caused by pests. One of the methods they use is called intercropping: the planting of several different crops together. Intercropping yields a natural barrier to pests in that the damage done by plant-specific pests is limited. Furthermore, the subsistence crop corn, for example, which was first cultivated in Mexico, grows enclosed in a sheath which protects it from pest damage. Subsistence crops have been selected for their adaptability to climate (such as rain-fed

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[16] Simonian 83.

varieties) and their natural resistance to pests.[17]

Who and How?

When considered together, the people working in the fields and the pesticides that are used in export-oriented Mexican agriculture combine in a dangerous dynamic. The crops in the Culiacan and San Quintin valleys require large labor inputs as well as agro-chemical inputs. The laborers in the Mexican fields are also the applicators of the pesticides. That is part of their job. Whether by backpack sprayers, airplanes, or tractor-drawn equipment, agricultural laborers are there mixing the chemicals, spraying the chemicals, and too often breathing, touching, or drinking the chemicals.

A list of the major pesticides used in Mexican agriculture is provided in Table I. As is apparent, the known health hazards of these chemicals ranges widely. Unfortunately, the circumstances of their use in Mexico do not range so widely: The conditions are bad. In observing more than fifty pesticide applications in the Culiacan Valley, Angus Wright noted a virtual absence of the protective gear that is essential to the "safe" dissemination of these chemicals: "No rubber boots, no rubber aprons or coveralls, and no respirators or face masks." More often than not, they wore shorts and short-sleeved shirts, and had on tennis shoes or were barefoot. Some insecticides are fatally toxic in the

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[17] Donald Q. Innes, "The Future of Traditional Agriculture," Focus, Jan. 1980: 1-8.

case of skin absorption of a few grams of the chemical. For example, the herbicide paraquat can, through skin absorption, cause the proliferation of lung cells leading to the partial or total suffocation.[18]

The living conditions in the *campamentos*, the camps in which most of these agricultural laborers and their families live, adds to the problem of pesticide poisoning. To a highly illiterate population, the warnings printed on the pesticide canisters regarding their safe use are almost useless. The sheds in which these people live are often surrounded on at least two sides by fields. Fumigation aircraft and backpack sprayers, spraying to the edge of the fields, contaminate the air and water of the migrant workers. Most campamentos still draw their water from irrigation ditches, where pesticides either fall directly or show up in field run-off. The irrigation and drainage canals also serve as communal bathing and fishing areas. Many of these people are malnourished, adding to the severity of the poisoning effect a pesticide can have.[19] Mexican land-owners oppose investigations into the problem of pesticide poisoning. Thus, official information on pesticide-related illnesses is extremely scarce. Nonetheless, reports do surface:

> Migrant workers frequently complain of headaches and flu-like symptoms. Local clinics report high incidences of respiratory and neurological

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[18] Wright 34.

[19] Wright 35.

> problems among field workers. Many cases of pesticide poisoning are probably misdiagnosed or go unreported. On some occasions, landowners have pressured clinic workers not to diagnose a patient's illness as being due to pesticide exposure. Because of the threat of being fired, field workers are afraid to report their symptoms to doctors. Whatever the exact number, though, pesticide poisoning is a major problem in Mexico.[20]

For Whom Are the Crops Produced?

Mexico is the largest foreign provider of fresh fruits and vegetables for U.S. supermarkets, exporting more than a billion pounds of produce each year.[21] The "Circle of Poison," where pesticides that are banned or heavily restricted are exported to a developing country and then imported back in the residues on imported foodstuffs, has come under closer scrutiny in recent years and Mexican growers have responded. Since the vast majority of the pesticides are used on crops bound for U.S. supermarkets,[22] the consciousness of the U.S. consumer is changing as a result. People are becoming aware of the dangers of the circle of poison and will continue to ask their public officials to protect them from the hazards of these chemicals. In 1981, 15 percent of the sampled beans and 13 percent of the sampled peppers imported into the U.S. from Mexico violated FDA pesticide residue

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[20] Simonian 84.

[21] Kistner 30.

[22] Goodman 92.

standards.[23] Moreover, the General Accounting Office (GAO) has been highly critical of FDA testing procedures.[24] In 1977, only 17 percent of those products regulated by the FDA were tested for pesticide residues. The FDA does not test for pesticide residues on pineapples, grapes, and onions imported from Mexico, even though the total tonnage of these products is greater than the total tonnage of beans, squash, and peppers which the FDA does test.[25] In 1981, in one-third of the cases in which samples were found to violate pesticide residue standards the main shipments had already reached the market.[26] As the circle of poison continues, Americans are beginning to connect their health with the health of their field workers abroad. And it takes a poison to do it.

The greater stringency with which consumers ask imported vegetables to be scrutinized also has international implications. The types of pesticides used in Mexico are shifting to reflect EPA and FDA standards. These newly-adopted pesticides, described below, are more acutely toxic to human beings than their predecessors. Citing tougher residue

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[23] Martin Wolterding, "The Poisoning of Central America," Science Sept./Oct. (1981): 66.

[24] GAO, Study By the Staff of the GAO, Monitoring and Enforcing Food Safety: An Overview of Past Studies (Washington D.C.: GAO, 1983): 26.

[25] GAO, Report By the Controller General to the Congress of the United States: Better Regulation of Pesticide Exports and Pesticide Residues in Imported Foods is Essential (Washington D.C.: GAO, 1979): 6, 14.

[26] GAO (1983) 43.

testing standards that the EPA and the FDA have adopted regarding imported foods, many Mexican growers have shifted from the banned and heavily restricted pesticides (such as DDT, DBCP, Aldrin, Dieldrin, and Endrin[27]) to EPA and FDA approved pesticides. This action comes as a means of maintaining the U.S. market. The problem is that the shift has been from organochlorine pesticides that were mainly banned due to their persistence in the environment, to organophosphate pesticides, some of which are more than 30 times more acutely toxic than DDT.[28] This shift is significant in that it would seem, at first glance, that progress had been made towards "safer, accepted" pesticides. The truth remains that these acutely toxic chemicals are still loaded into the same sprayers and planes, sprayed by the same unprotected migrant workers, with no corresponding increase in regulatory capacity as their toxicity increases.

WHO PAYS THE COSTS?

The workers pay the price for their disadvantaged socio-economic position because they are forced to seek employment in extremely dangerous conditions. When the tomato is described as being more important than the laborer, it is not difficult to see that a gross injustice to humanity is being done.

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[27] See Table I regarding the pesticides used in Mexican agriculture and their effects on human health.

[28] Information for this section has been taken from Wright 26-35.

The unwitting accomplice to the crime, the U.S. consumer demanding flawless winter fruits and vegetables, also pays some of the costs of pesticide use in Mexico. Without an efficient regulatory apparatus between the fields in northern Mexico and dinner tables in the U.S., consumers are endangering themselves while eating foodstuffs considered to be among the healthiest available: fresh fruits and vegetables.

The use of pesticides in Mexico has also caused damage to the environment. The run-off of pesticides and other chemicals into Mexican streams, rivers, and bays has resulted in fish kills.[29] Furthermore, Mexico is suffering from many environmental problems associated with pesticide use. The moisture and fertility of the soil has been reduced; the natural resistance of plants has been impaired; and non-target organisms, such as birds and other predators, have been killed.[30] Genetic resistance among pests is increasing which means that either stronger doses of pesticides must be applied or new pesticides developed, or a new strategy of pest control must be embraced such as the Integrated Pest Management program in Nicaragua, the subject of the next chapter.

Conclusion

While not an aim of the Green Revolution, the current

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[29] Mike Goodman and Robert Montemayor, "Pollution: The Necessary Sacrifice?" Los Angeles Times, July 15, 1979: 19.

[30] Robert Engler, "Technology Out of Control," The Nation, April 27, 1985: 492.

state of pesticide use and abuse in export-oriented agriculture in Mexico can be seen as a consequence of the Green Revolution. Concentrating land in the hands of the few may yield certain economic advantages when examined on an international level, but viewing the situation from such a dizzying height ignores the people on the ground, the cheap laborers who create the advantage by being worth less than the plants themselves. Land-use decisions emanating from this agro-export development model are inevitably reflected in the health of the people. Mexico, an exporter of flawless foodstuffs, imports food to feed its own people--people marginalized into a toxic relationship with the chemicals of the fields. Change must come in this dangerous connection of human beings and commodities. Whether the situation is war, threats, blood and oil, or paraquat, cancer, poverty, and the perfect tomato, we need to rediscover the wisdom of the child: The wisdom to be able to tell the difference between a human being and just another thing.

CHAPTER III: THE CASE OF NICARAGUA

"A Happy Town"

In his beautiful book One Hundred Years Of Solitude, Gabriel Garcia Marquez chronicles the life of a family, over succeeding generations, in the village of Macondo. After decades of existing within a subsistence agro-economic system, the village of Macondo finds itself hiring itself out as labor to a foreign-owned banana company that has set up operations in the area. A labor dispute arises as the union leaders begin demonstrations protesting the "lack of sanitary facilities in their living quarters, the nonexistence of medical services, and terrible working conditions."[1] Tired of their demands not being met, the workers took their argument to the courts. Opposing lawyers argued that the company did not have any workers in its employ since they were only hired temporarily and "by a decision of the court it was established and set down in solemn decrees that the workers did not exist."[2]

Though they legally and technically did not exist, the

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[1] Gabriel Garcia Marquez, One Hundred Years Of Solitude (New York: Avon, 1970) 278.

[2] Marquez 280.

workers nonetheless went on strike and, soon after, the company had the authorities begin martial law. A massacre occurred in Macondo as the military was given orders to fire on a crowd of striking laborers and their families. Since these people were never acknowledged as having lives in the first place, the official reaction to their collective death is that it never happened.

> "You must have been dreaming," the officers insisted. "Nothing has happened in Macondo, nothing has ever happened, and nothing ever will happen. This is a happy town."[3]

Marquez begins the next chapter by describing the sudden and drastic changes in the natural world:

> It rained for four years, eleven months, and two days. The sky crumbled into a set of destructive storms and out of the north came hurricanes that scattered roofs about and knocked down walls and uprooted every last plant of the banana groves.[4]

Marquez makes an interesting connection of nature, labor and Central American agriculture. Human beings, officially decreed as having no existence, laboring on land that is officially not owned by them, are killed for their rebellion against the banana company's agricultural production system. The people of Macondo, erased from official existence by decree, were treated as non-persons within the banana company's agricultural system in that the management of the

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[3] Marquez 287.

[4] Marquez 291.

banana grove did not take into account the nutritional and agricultural needs of the people that had farmed this land for generations. The people, recognizing that their historically intimate relationship with the earth, as a provider, was being put asunder by outside interests, organized themselves in the hope of creating a better agro-economic position. Their skills in organization and ability to articulate a unified position against strong and wealthy business interests only succeeded in ensuring their collective death, a death ignored by human authorities but marked by a severe disruption of the natural world and subsequent destruction of the very commodity, bananas, for which they gave their lives.

Natural Resources in Central America

Though this novel would be found in the fiction section of most bookstores, Marquez' description of nature, labor and agricultural production in Central America is unfortunately borne of historical precedent. The people in his novel are inextricably linked to the land on which they labor. When the management of these agricultural resources falls into the hands of the banana company, the relationship of the people to the land is no longer based on stewardship and long-term subsistence. The aims and goals of agricultural production in Macondo, when defined by the banana company, turns the villagers' relationship to the land into one of hired, dispensable labor working on the property of a company in a neo-feudal agricultural system. As laborers, the people

ostensibly depend upon the natural resource management skills of their employers, not themselves. The operative question, then, is, "*Who* is managing the resources for *whom*?" since a dependency exists. James Nations and H. Jeffrey Leonard describe the modern connection of Central Americans to natural resources in a similar way: dependency on the management of the land.

> At the heart of Central America's hope for political, economic, and social progress lie the issues of land and renewable natural resources--forests, soil, and water. These resources are the backbone of the region's national economies, accounting for more than half of all economic production, half of all employment, and most exports. And their proper management is the keystone to social and economic development. Moreover, almost 60 percent of the region's 24 million people live in rural areas where they depend directly upon renewable natural resources for their livelihood.[5]

In Marquez' Macondo, the "proper management" of the natural resources was interrupted and disruption occurred, lives were lost, and a raging storm dominated the natural world. In Central America today, the storm that uprooted the banana groves after the massacre of the laborers is analogous to the degradation of the environment and simultaneous marginalization of the rural poor. The storm and massacre are occurring at once in Central America. Once again, it is the

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[5] James Nations and H. Jeffrey Leonard, "Grounds of Conflict in Central America," in Andrew Maguire and Janet W. Brown, eds., Bordering on Trouble: Resources and Politics in Latin America (Bethesda Md.: Adler and Adler, 1986): 57.

question of who is managing the resources upon which everyone depends that will determine the fate of the people and the duration of the storm in the environment.

Guatemala and Honduras

Two examples of the spiral of human and ecological devastation, mirrors of Macondo on a national level, are Guatemala and Honduras. After attempting to redistribute 100,000 acres of land that his administration had nationalized, the Guatemalan government of Jacobo Arbenz was toppled in 1954. The U.S.-based United Fruit Company and the U.S. Central Intelligence Agency worked together to topple this democratically elected ruler, keeping his plans for agrarian reform from becoming a working model of autonomous decision-making in Central American agriculture. Today, landless peasants in Guatemala are encouraged to colonize the fragile rain forests. The question of the distribution of fertile farmland, then, is temporarily eluded but the problem is still the same: Poverty and ecological destruction run hand-in-hand.[6]

Landless peasants in Honduras also stand facing the rain forest as their quest for land, food and income continues. Honduran agriculture is dominated by the presence of huge banana plantations. Over forty percent of Honduras' available arable land is currently cultivated for the benefit of foreign

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[6] Bill Hall and Joshua Karliner, "The Cause of Environmental Woes in Guatemala and Honduras," Utne Reader 25, January/February 1988: 57.

corporations such as United Brands, Castle & Cooke, and R.J. Reynolds. A great deal of the rest of the land is controlled by wealthy Honduran land owners.[7]

These examples of the interconnectedness of natural resources and the people in Central America are not meant to be understood merely as part of a regional phenomenon. The question of "Who is managing the resources for whom?" is essentially global in nature. This question encompasses population and resource pressures and the many political and socio-economic systems within which human beings determine their interactions with the natural systems of the earth. What these examples do point out, though, is well summarized in the introduction to Our Common Future: "It is therefore futile to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying...poverty and...inequality."[8] For example, given the above cases of Guatemala and Honduras, it would be useless to discuss the deep rooted causes of tropical rain forest destruction without first explaining some of the factors that bring people to the act of deforestation: rural poverty and the inequitable distribution of land, governmental "colonization" projects, and the need for firewood as a source of fuel. In the case of pesticide use in Nicaragua, it would

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[7] Ibid.

[8] World Commission on Environment and Development, Our Common Future (Oxford: Oxford University Press, 1987) 3.

be futile to discuss the costs and benefits of both pesticide use and integrated pest management (IPM) programs without first taking a wider perspective encompassing the factors underlying poverty and inequality in Nicaragua, factors that helped lead to the overthrow of the Somoza dictatorship and subsequent transfer of power to the Sandinista National Liberation Front (FSLN) in 1979.

Macondo Revisited

Environmental deterioration, poverty and inequality in Nicaragua are largely a result of the long abuse of natural resources in Central America by both local elites and foreign corporations in the twentieth century. Similar to Marquez' fictional Macondo, the people of Nicaragua had contact with natural resources through the resource management skills (or lack thereof) of large companies and landed interests. For example, many large American timber, banana, and mining companies moved into Nicaragua in the early twentieth century to set up operations. In 1909, the Nicaraguan president, Jose Santos Zelaya, attempted to control foreigners' access to resources. U.S. businessmen paid to have him overthrown and the U.S. Marines subsequently occupied Nicaragua from 1912-1933 and later, in 1934, installed Anastasio Somoza Garcia as dictator. The Somoza family ruled until 1979. By that time, one percent of the population controlled half the land in Nicaragua, Somoza himself owning 20 percent of the best farmland in the country. With export crops such as cotton,

coffee, and sugar dominating Nicaraguan agriculture, Nicaraguan peasants either labored on large plantations or, increasingly in the 1970s, turned to the rain forest for their land needs. Thirty percent of the nation's tropical rainforests disappeared in the 1970s. Poverty, inequality, and environmental destruction have gone hand in hand in Nicaragua since the colonial period, as the control of the nation's natural resources were placed into the hands of powerful foreign interests and the local governing families that they helped to install.[9]

"The Smell of Nicaragua"

Soon after the Sandinistas came to power in Nicaragua, the Nicaraguan Institute of Natural Resources and the Environment (IRENA) was created by the government to maintain environmental protection goals. The ecological legacy that was left to the people of Nicaragua, the Sandinista government, and IRENA was extremely bleak. Pesticide abuse was one of the greatest problems facing the health of the people, the environment, and the economy of Nicaragua. In fact, so predominant was the use of pesticides on cotton fields on the Pacific plain of Nicaragua that, upon his return from exile following the revolution, Ernesto Cardenal wrote this poem:

Now we're close to Leon. Liberated

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[9] Information for this section comes from Joshua N. Karliner & Daniel Faber, "The Other Revolution: Nicaragua's Environmental Crisis", Utne Reader 25, Jan./Feb. 1988: 55-65.

> territory. A burning reddish-orange
> light, like the red-hot tip of a cigar.
> Corinto:
> the powerful lights of the docks
> flickering on the sea. And now at last
> the beach at Poneloya and the plane
> coming in to land
> the string of foam along the coast
> gleaming in the moonlight. The plane
> coming down. A smell of insecticide.
> And Sergio tells me: "The smell of
> Nicaragua!..."[10]

Nicaragua had, at this time, the dubious honor of being one of the world's leaders in pesticide poisoning and most of the Pacific coastal plain, about which Cardenal wrote, suffered pesticide contamination.[11] Under the aegis of the Agrarian Reform Ministry (MIDINRA), the Sandinista government turned to alternative methods of dealing with pests, particularly cotton pests, as cotton remains an important crop for earning foreign exchange.[12] What remains a testament to national pest control strategies in the Third World, the integrated pest management (IPM) program was, after 1979, promoted and soon became an effective method of reducing the costs associated pesticide use.

IPM in Nicaragua

The success Nicaragua has enjoyed through the implementation of their IPM program is owed, to a great

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[10] Ernesto Cardenal, "Lights," in Zero Hour and Other Documentary Poems (New York: New Directions Publishing, 1980).

[11] Karliner & Faber, 55.

[12] Lori Thrupp, "Pesticides and Policies: Approaches to Pest-Control Dilemmas in Nicaragua and Costa Rica," Latin American Perspectives 15, no.4, Fall 1988: 59.

extent, to their ability to define the underlying factors of the pre-revolutionary pesticide problems. Nicaragua's major pesticide problems, before the revolution, had to do with the pests that attack cotton. In 1950, both commercial cotton production and pesticide use were just beginning. To increase yields, and compete in the world market, Nicaraguan growers turned more and more to chemicals such as DDT, toxaphene and methyl parathion, and, as the size of their farms grew, a monoculture was developed within which pests could thrive.[13] Between 1952 and 1967, the cotton area expanded 400 percent while cropland dedicated to food grains (corn and beans) by small producers in the cotton growing area dropped over 50 percent.[14] Joseph Collins, in his book Nicaragua: What Difference Could a Revolution Make? Food and Farming in the New Nicaragua, explains that this expansion of cotton was the source of widespread dislocation of peasantry.[15]

At the same time, the need for pesticides was increasing as a result of pesticide resistance. Collins states that in the late 1960's Nicaragua held the world record for the number

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[13] Sean L. Swezey and Rainer Daxl, Breaking the Circle of Poison (San Francisco: Institute for Food and Development Policy, 1983) 1-6.

[14] P. Belli, "An Inquiry Concerning the Growth of Cotton Farming in Nicaragua," (Ph.D. diss., Univ. of California, Berkeley, 1968).

[15] Joseph Collins, Nicaragua: What Difference Could a Revolution Make? Food and Farming in the New Nicaragua (San Francisco: Inst. for Food And Development Policy, 1986): 162.

of pesticide applications on a single crop.[16] Pesticides, by this time, had killed off the natural enemies of many insect species that were never pests before. Therefore the number of pest species in cotton grew from two, in 1950, to 15 by 1979.[17] The number of chemicals grew from three to more than 70.[18]

The economic costs of these chemicals were swallowing large amounts of needed foreign exchange. Poisonings were too common. Collins cites studies showing Nicaraguans having 16 times the world average of DDT in the body and a sample of mothers' milk containing 45 times the permissible level of it.[19] Swezey and Daxl point out that the proximity of the cotton workers' housing to the fields, the illiteracy of the work force, and a recurring malaria problem associated with pesticide resistant mosquitoes all compounded the environmental contamination of food, land, and water that pesticide use produced.[20]

IPM strategies generally entail the use of biological and cultural methods, along with reduced use of chemicals, to improve profitability and environmental sustainability of pest

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[16] Ibid.

[17] Swezey and Daxl 4.

[18] Ibid. 7.

[19] Collins 162.

[20] Swezey and Daxl 2-10.

control.[21] Swezey and Daxl describe methods ranging from "trap-cropping" (leaving two rows of cotton standing after harvest to trap pests such as the boll weevil, *then* applying the pesticides) to growing and applying the *Trichogramma* wasp and *Bacillus thuringiensis* bacteria as natural enemies against cotton pests, to growing the bacterium *Bacillus thuringiensis israeliensis* for use against malaria.[22]

The Nicaraguan IPM program has been successful in the following ways:

> --spraying rates were reduced by 40-60% while production and revenues increased.
> --reliance on foreign chemicals and a scientific dependency on inappropriate technology were discontinued.
> --reduction of pest resistance and a corresponding drop in malaria resurgence
> --protection of wildlife, fisheries, soil, and a significant increase in worker health.[23]

Success is also a result of relating the IPM program to a development policy that seeks greater responsibility to the social and environmental needs of the country.

Conclusion

The IPM program in Nicaragua finds success only through the education of the farmers as to which methods to use, not simply how much to spray. These farmers, after the revolution, are the peasants that received 60% of the nation's

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[21] Thrupp 37.

[22] Swezey and Daxl 15-16.

[23] Swezey and Daxl 9-18.

farmland.[24] Combining an educational pest control strategy with a land reform policy sponsors a healthy stewardship relationship between the worker and the land. Moreover, IPM is a tool Nicaragua has used to escape some of the economic and technological dependence that pervades many relationships between industrialized nations and LDCs. By attacking the factors that underlie poverty and inequality (e.g. land availability, education, agricultural production based on nutritional needs), Nicaragua has made giant steps toward escaping the fate of Macondo, a place where workers are alienated from the earth, laborers are not acknowledged as having any innate worth by their government, and ecosystems are disturbed by those who would over-exploit what nature gives so freely.

The war with the Contras was an ongoing economic, social, political and environmental struggle for Nicaragua which kept much of the success of the Sandinista's programs from being fully realized. Since the February 25, 1990 election and the transfer of power over to Violetta Chamorro's UNO party, clarity in development policy goals has also been obscured. But what must be kept in mind is that the "Sandinistas took power with the intention of reordering the priorities of their society by governing the country on the basis of the 'logic of

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[24] Thrupp 53-61.

the majority'"[25] and they have done so. By introducing IPM, the Sandinistas showed that biological and cultural methods can reduce the economic, social and ecological costs of pesticide use and abuse.

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[25] Marjorie Woodford Bray & Jennifer Duggan Abbassi, "Introduction," Latin American Perspectives 17, no.3, Summer 1990, 3.

CHAPTER IV: A COMPARISON

A comparison and contrast of the use of pesticides in Mexico and Nicaragua is a healthy means of understanding the wider issues of development and the environment. As developing countries struggle to emerge from poverty into a healthier and more stable position in the world economy, their means of doing so may often come at the expense of the environment. This type of growth, over a long period of time, is ultimately retrogressive. The downward spiral of poverty and ecological deterioration, evident in the examples of rain forest destruction in Guatemala and Honduras, is by no means limited to these two countries. Many developing and industrialized nations continue to perceive economic goals and environmental objectives as mutually exclusive. The IPM program in Nicaragua represents a significant departure from this way of thinking.

Economics of Pesticide Use

Both Mexico and Nicaragua predominantly use pesticides on export-oriented crops. Despite the successes of the IPM program, Nicaraguan cotton and coffee production still relies on imported pesticide technology. The reliance, though, is waning as the economics of continued pesticide use is being

supplanted by the savings made in IPM. For example, in the 1982 program reduced pesticide applications saved a net $2.93 million in insecticide use. The 1983 program resulted in a net benefit of over $2.9 million. Productivity increased as pesticide applications decreased.[1] Moreover, the pesticides that were used were not those that had been banned in industrialized countries, such as lindane, aldrin or dieldrin, but rather synthetic pyrethroids considered less harmful to humans and the environment. By combining revolutionary goals of reduced international economic and technological dependence, chemical dependence, with the IPM revolution, Nicaragua has effectively demonstrated that the economic advantages of pesticide use, measured in crop productivity, are not absolute. IPM is a viable alternative.

In contrast to the Nicaraguan government's goal of reduced dependence on these chemicals, the Mexican government can be seen as a vested interest within the economic realm of agro-chemicals. Fertilizantes de Mexico (FERTIMEX), a state-owned company, is the biggest single producer of pesticides in Mexico with current sales near $160 million per year.[2] Furthermore, more than fifty foreign companies play an active

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[1] Sean L. Swezey, Douglas L. Murray, and Rainer G. Daxl, "Nicaragua's Revolution in Pesticide Policy," Environment, vol. 28, no. 1 (1986): 34.

[2] Louis W. Goodman, "Foreign Toxins: Multinational Corporations and Pesticides in Mexican Agriculture," in Multinational Corporations, Environment, and the Third World, ed. Charles S. Pearson (Durham: Duke UP, 1987): 91.

role in Mexican pesticide production and importation. Combining an overall development policy that sponsors export-oriented agricultural commodities in the North, a state sponsored pesticide corporation and a regulatory atmosphere of neglect, the Mexican government officially endorses and subsidizes the use of pesticides without the ability or will to deal with the costs of pesticide use. If the motive behind this scheme is purely economic, the fact that $30 million in needed foreign exchange was spent in 1983 importing pesticides brings this motive into question.[3]

With the ever-increasing prospect of a free trade agreement with the United States, the problems of pesticide use in Mexico may be exacerbated. Chapter II describes the shift, in accordance with EPA and FDA standards, from organochlorine pesticides to the more acutely toxic organophosphate pesticides in northern Mexican export agriculture. Free trade with the United States may bring agricultural capitalists in droves seeking the cheap labor and lax regulatory standards of Mexico and, combined with the use of these pesticides, may create a situation where the U.S. exports the environmental and social costs of capitalist expansion and attempts to import the benefits. The benefits, the cheaper agricultural commodity, may not be a gain when pesticide residues continue returning to the U.S. consumer, endangering human health on either side of the border.

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[3] Goodman 93.

The Social Distribution of the Costs and Benefits of Pesticide Use

Land reform created a situation in Nicaragua where the IPM program could flourish. Whereas land ownership in pre-revolutionary Nicaragua was extremely concentrated and the bulk of the people depended upon the owners for the proper management of the natural resources, after the revolution the people were able to make many of their own management decisions. In terms of agricultural production, this is very important because the person working the land now has a stronger connection to the land than that of plantation laborer. With a meaningful interconnectedness between worker and land, the IPM program in Nicaragua, largely spread by networking educators working in the field, has become successful as a function of people understanding natural processes to a greater depth. Pesticides are used in many developing areas of the world without any knowledge, by the applicator, of the processes at work. In pre-revolutionary Nicaragua, the rural peasantry bore many of the health costs of pesticide use without the ability to enjoy the benefits. These were not their crops. These were not their decisions. Their labor, not their knowledge, defined their worth. The IPM program in Nicaragua, combined with the land reforms, invested in the education and health of these people, reversing the social injustice of a class of people forced to live with a toxic substance.

The social distribution of the costs and benefits of pesticide use in Mexico most closely reflect the conditions in Somoza's Nicaragua. With the majority of the pesticides used in Mexico being concentrated on the irrigated, export-oriented tracts in the north, the costs of pesticide use are distributed inequitably with the poor bearing the greatest share. These people, described by one grower as having less worth than the plants they tend, labor to earn a living in unsafe working conditions, social conditions where illiteracy prevents pesticide labels from having any impact, and in a state committed to chemical pest control methods.

An important distinction between Mexico's situation and Nicaragua's concerns the management of the resources. Whereas land reform was an essential part of the Sandinista revolution and integral to the implementation of the IPM program, Mexican and foreign interests in Mexico enjoy the benefits of having a migratory, landless agricultural laboring class that mix, apply, eat, breathe and drink the pesticides used on crops bound for another marketplace.

The linkage of these fields to the American marketplace creates another dangerous dynamic in terms of the distribution of the costs and benefits of pesticide use in Mexican agriculture. If, as the growers might suggest, the benefits are witnessed in productivity and the quality of the product itself, then the argument for the use of pesticides must first tackle the issue of pesticide residues. The effects of

pesticide use are, in this case, by no means benign. Chapter II describes the food supply coming across the border as largely untested, and when tested, found to be 70 per cent contaminated. Moreover, these tests by the FDA are under a great deal of scrutiny over their efficacy and ability to detect a wide range of substances. With the possibility of a free trade agreement with Mexico, the U.S. consumer may find cheap produce of questionable safety from Mexico replacing the American grown produce that is subject to tighter quality controls. The social distribution of costs and benefits is international in nature, with the Mexican workers absorbing much of the costs while the actual benefits (cheaper winter produce in the United States) are tempered by the pesticides themselves: Their persistence and toxicity endangers the consumer and worker.

Ecological Damage

Environmental damage is a significant aspect of pesticide use and abuse in both Nicaragua and Mexico. In Nicaragua, where the health effects of pesticides have been witnessed most clearly in direct poisoning, ecological disruption has also made it possible for a widespread resurgence of the malaria mosquito. The combination of cotton production expansion and excessive pesticide use has been implicated as the main cause, through increased pest resistance, of this

resurgence.[4] The widespread abuse of pesticides in Nicaragua before the revolution, mainly in the cotton plantation regions of the Pacific coastal plain, contaminated groundwater sources, destroyed fish populations in many lakes and rivers receiving agricultural runoff, and decimated populations of natural pest predators. Integrated pest management and a coordinated pesticide reduction plan has allowed Nicaragua to reverse many of these destructive trends through IPM education, restricting banned pesticides, and using pesticides as a last resort in crop protection.

In Mexico, the shift from organochlorine pesticides to organophosphate pesticides, a change to meet the FDA standards, has resulted in pesticide use that is less persistent in the environment. Instead of having, for example, large amounts of DDT entering and staying in Mexican water supplies and soils, the problem is now related to the acute toxicity to humans of pesticides such as methyl parathion. Mexico continues to use pesticides not registered for use in other countries, pesticides known to have detrimental health and environmental consequences associated with their use. Unlike Nicaragua, the regulatory apparatus and will does not exist in Mexico to reverse the ecological deterioration caused by pesticide misuse. With the prospect of increased marketability of Mexican produce in the United

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[4] G. Chapin and R. Wasserstrom, "Agricultural Production and Malaria Resurgence in Central America and India," Nature 293 (1981): 181-85.

States, we stand at the demand-side of an economic equation that can go in a multitude of directions. If we ask the federal government, in agencies such as the FDA and EPA, to protect the consumer by restricting the exportation of chemicals and regulating the importation of foodstuffs, the pesticides usage south of the border may change for the better out of economic necessity.

CHAPTER V: SOLUTIONS AND CONCLUSIONS

Both Mexico and Nicaragua utilize pesticides to increase agricultural output on predominantly export-oriented crops. These crops are grown for the foreign exchange earning they create. The economic realities of each specific developing country dictates how it will perceive environmental protection measures as feasible and desirable. In Mexico, a long history of economic dependence on its northern neighbor continues to shape its relationships to natural resources. In Nicaragua, a country also with a long history of foreign domination and dependence, we see how revolutionary change in resource allocation and attitude towards a more ecologically sustainable style of economic development can create the conditions for a successful program such as their IPM program.

The costs of pesticides come from either the chemicals themselves or the circumstances of their use. In Mexico, it is apparent that the chemicals are shifting toward more acute toxicity while the circumstances of their use become worse and worse. In Nicaragua, a reduction in the use of the chemicals, made possible through IPM, and better education in the application of the pesticides that are applied, have been instrumental in helping the country escape the spiral of

poverty and ecological degradation. The war with the Contras, a tremendous source of economic, social and political upheaval has been the main stumbling block to greater success in these programs. The UNO defeat of the Sandinistas in the February 25, 1990 election has mainly served to place the economic, social and ecological woes in the hands of another party. With international assistance and a strengthened economy, Nicaragua's technical, scientific and regulatory success in IPM should continue.

While the IPM success in Nicaragua has served as inspiration for other developing countries to begin severing the international lines of chemical dependency, for a similar program to enjoy success in Mexico, a shift would have to take place in the overall direction of agricultural policy. As long as Mexico continues to devote what limited arable land it has to export-oriented agriculture, and continues to be a net importer of foodstuffs for their populace, the co-existing conditions of poverty and pesticide damage to humans and the environment will continue. Within the capitalist model of development, human and environmental damage is nowhere figured against profit, at least in the case of Mexican agriculture. As the supermarkets fill with perfect looking tomatoes, the fields of Mexico are walked with the unsteady steps of an ill Mexican farm worker. As the packing sheds are filled with commodities that continue to fetch lower prices, the drainage canals take in their toxic cargo, only to flow elsewhere and

continue the rapid disruption of ecosystems. This externalization of the costs of capitalism is, at best, racist and a gross injustice to other human beings and the resources they work to earn a living.

Solutions

Mexico, and other less developed countries, will continue to be plagued by problems of pesticide abuse unless they can create a regulatory framework that has the ability to regulate pesticide use, works within an overall agricultural policy that stresses an educated interconnectedness between the farmer and the land, and can account for human and environmental costs of pesticide abuse. The problem is that "progress" and "development" dictate, at least currently in the Salinas government, that Mexico pursue a development path paved on the backs of her agricultural laborers. Trying to create sustainable agricultural production systems on this development path will prove difficult for Mexico or anyone. The lesson that is being taught humanity is:

> Modification of the environment to fit the needs of a production system is much less likely to be sustainable than modification of the production system to fit environmental constraints.[1]

An agricultural production system centered solely on immediate productivity, without taking into account the social, economic and environmental costs of environmental modifications, such as pesticide use, is, in the short- and long-run, detrimental

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[1] Reid (et al.) 25.

to human beings and ecosystems. The IPM program in Nicaragua represents a production system that attempts to better fit environmental and social constraints.

Changes on a Local Level

Still other ways to address problems of pesticide damage to humans and the environment, in both the U.S. and countries that we export pesticides to and import food from, is by acting locally through the power of the purse, the right to be informed, and legislative change.

The Power of the Purse

An excellent methodology for making a plan of action is found in asking the question: "What is my connection to the problem of pesticide abuse in Mexico?" For example, the choices we make as consumers must be seen as one of the driving forces behind pesticide use in Mexico. Mexico, as discussed in Chapter II, is the largest foreign provider of fresh fruits and vegetables for our supermarkets, exporting over a billion pounds of fresh produce to this country each year. The time to look for this produce is between November and May, when U.S. farms are producing less.

Through the power of the purse, consumers can boycott Mexican produce and tell the U.S. produce distributors, investors, and Mexican growers that for personal health, humanitarian, and environmental reasons, their produce is not wanted anymore. By supporting organic produce and products, consumers make an investment into sustainable agriculture.

Be Informed

There are many organizations that are making strides to address the problems that arise from the foreign and domestic use of pesticides. By contacting these organizations, one can learn more about local and global pesticide problems, solutions, and the most recent developments in pesticide legislation.

By joining one of these organizations, one can begin to actively support issues such as safe food, the banning of harmful pesticides, or the protection of fieldworkers, to name a few. The names and addresses of the major organizations working on pesticide and related environmental issues are:

Americans For Safe Food
1501 16th St., NW
Washington D.C. 20036
(202) 332-9110

National Coalition Against Misuse of Pesticides (NCAMP)
530 7th St., SE
Washington D.C. 20003
(202) 543-5450

Natural Resources Defence Council (NRDC)
90 New Montgomery St.
San Francisco, CA 94105
(415) 777-0220

Northwest Coalition for Alternatives to Pesticides (NCAP)
P.O. Box 1393
Eugene, OR 97440
(503) 344-5044

Pesticides Action Network (PAN)--North America Regional Center
Pesticide Education Action Project
P.O. Box 610
San Francisco, CA 94101
(415) 771-7327

Legislative Solutions

The power of the pen can say to legislators, "The time to act on pesticide issues is now." This last fall, a progressive bill went through Congress with mixed approval. While it is by no means a solution in itself, the Pesticide Export Reform Act of 1990 is one of the first comprehensive pieces of legislation to deal with the domestic and international implications of pesticide use. This Act is divided into two parts. The first part, known as Title I, reforms the export provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Title II amends the provisions of the Food, Drug and Cosmetic Act, the Federal Meat Inspection Act, the Poultry Products Inspection Act and the Egg Products Inspection Act which regulate the presence of pesticides in imported food. Highlights of this proposed Act are:

Title I:

* Bans the export of all unregistered pesticides, including pesticides that were never registered, and pesticides that have had their registrations canceled or voluntarily withdrawn.

* Prohibits the export for agricultural use of pesticides that are not registered for agricultural use in the U.S.

* Requires that the governments of importing countries give their "Prior Informed Consent" (PIC) to the restricted use pesticides, pesticides that are the subject of special review, suspension or cancellation proceedings, or a conditional registration and pesticides on the World Health Organizations lists of Class IA "extremely hazardous" and Class IB "highly hazardous" pesticides.

* PIC system permits export only to countries that have an effective pesticide regulatory program.

* Makes data submitted to EPA concerning exports, including shipments, available to the public.

* Provides countries with information concerning alternatives to the pesticide (including non-chemical alternatives) before they consent to the importation of the pesticide.

* Allows the temporary export of any pesticide if its use is the only way to halt the spread of a communicable disease that poses a serious threat to public health.

* Limits the export of unregistered experimental pesticides to the amount that is necessary to accumulate the data needed to justify registration. Requires the prior consent of the countries where the experiments would be conducted.

* Requires worldwide notification every time a new registration of a pesticide is granted, or that the regulatory status of an existing registration is changed, such as being made conditional, classified for restricted use, canceled, suspended, or voluntarily withdrawn. Information on alternatives (including non-chemical) to the pesticide in question must accompany this notice.

* Requires EPA to initiate the development and implementation of international pesticide regulatory programs and research into alternative agriculture.

Title II:

* Requires EPA to work with other federal agencies to develop and implement effective programs to monitor and control pesticide residues on food imported into the United States.

* Automatically revokes tolerances for pesticide residues in food for pesticides that are no longer registered for use on those food items.

* Requires that, when EPA establishes a tolerance level for pesticides in food, EPA must consider the effect of those pesticide residues on the people who consume that food the most or who are particularly vulnerable to the pesticide's effects (e.g., children, the elderly, particular ethnic groups).

* Prohibits EPA from establishing tolerances for pesticides in food if there is no practical testing method available for that pesticide in food.

* Requires that the names of pesticides used on imported food be included in shipping documents that accompany that food. This will assist those agencies that monitor pesticide residues in food to target their testing programs more effectively. The Act imposes penalties on importers who do not comply with this requirement.

More recently, Senate Agriculture Committee Chairman Patrick Leahy has sponsored the Circle of Poison Prevention Act of 1991. Costa Rican farmworkers testified before the committee that they have now become sterile from working with pesticides banned for use in the U.S. but exported to their country. Leahy's bill, a revival of much that is in the Pesticide Export Reform Act, would outlaw the export of pesticides that are banned or unregistered. Congress needs to pass this legislation for the safety of thousands of workers, their families, and consumers worldwide.

CONCLUSION

Wars generally serve as the mileposts in the study of history in American grade schools. Future generations, if they are fortunate enough to be alive to look back upon this portion of human history, may describe the war as a self-directed one: Humanity fighting tooth and nail against the natural systems that make life itself possible on this planet. Pesticides represent a technological intervention into the natural balance of predator and prey. Their toxicity and persistence in the environment bring into question their appropriateness regardless of the circumstances of their use, let alone within the impoverished conditions of a developing country. Due to their persistence in the environment and

toxicity to the organisms coming into contact with them, pesticides are both an ecological and a social issue. Because the use of pesticides has proven to increase crop yields, and the introduction of pesticides into less developed countries was in many cases part of the Green Revolution, pesticide use can debated on nutritional and technological grounds. In the case of Mexico and Nicaragua, the socio-economic factors surrounding pesticide use and abuse prove to be the most important element in beginning to understand technological, economic, and environmental injustices caused by capitalist expansion. The most important issue at stake here is one of methodology: How do we approach this problem? To continue to externalize the costs of pesticide use and abuse as another example of the necessary evils of economic development, we continue down a destructive pathway. If we categorize and compartmentalize the problem as essentially economic, essentially environmental, social or political, we err in methodology and miss the point. A philosophical justification for the way we are treating the earth is needed. It will not be found in any system attempting to "use" nature and simply discard what is not needed. Rachel Carson, in her book Silent Spring, put the issue of pesticides into proper philosophical perspective almost thirty years ago. We need to climb above our mundane, destructive level of consciousness manifested in the various "laws" of human nature and stand where she stood.

> The "control of nature" is a phrase conceived in arrogance, born of the

> Neanderthal age of biology and philosophy; when it was supposed that nature exists for the convenience of man.
>
> The concepts and practices of applied entomology for the most part date from that Stone Age of science. It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth.[2]

The survival of the human species depends, for the first time, on a radical change in how we approach life socially, economically, but first of all, philosophically.

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[2] Rachel Carson, Silent Spring (Boston: Houghton-Mifflin, 1962): 261-62.

TABLE 1. Pesticides Used in Mexican Agriculture

The herbicide 2,4-D is used on cereals, propanil on rice, trifluralin on cotton, and atrazine on sorghum. The fungicides captan and quentozene are used in seed dressings while the inorganic fungicides are applied to a variety of fruits and vegetables. Most insecticides are used on a whole spectrum of crops.

Pesticide/ Insecticide	Tons Used (1978 Estimate)	*Suspected Environmental Health Effects*
Organochlorines		
DDT	4930	Nerve damage (ND)
BHC	2060	ND
Toxaphene	2290	Cancer (C), Reproductive system effects (RSE)
Endosulfan	136	ND
Endrin	127	C, RSE, Mutations (M), Pre-natal damage (PND)
Heptachlor	255	C
Organophosphates		
M-Parathion	2970	C, ND, PND
E-Parathion	1515	C, ND, PND
Malathion	170	PND
Dimethoate	340	C, M, PND
Disulfoton	21	C, M, Damage to spleen
Monocrotophos	425	Highly toxic but rapidly excreted
Chlorpyrifos	30	No listing of suspected effects (NLSE)
Trichlorfon	106	C, M, ND, PND, Paralysis
Organophosphates		
DDVP	80	NLSE
Azinphos	255	C
Methamidophos	255	NLSE

Carbamates		
Carbaryl	1275	C, M, Heart defects, Behavioral effects, Kidney damage
Methomyl	297	Liver and spleen damage
Carbofuran	68	M
Pyretoids	20	Respiratory failure
Other insecticides	809	
Herbicide		
Phenolics		
DNPB	30	C
NItrofen	42	PND
Phenoxies		
2,4-D	1200	C, M, Death due to cardiac failure or ventrical fibrilations
Carbamates		
EPTC	25	NLSE
Herbicide		
Diuron	225	C, M, PND, Red blood cell destruction, Damage to spleen
Flumeturon	17	C, M
Linuron	34	PND, M, Bone marrow change
Diazines		
Bentazone	25	Kidney damage
Trazines		
Atrazine	340	Cardiac dilations, Convulsions, Liver hemorrhaging, Growth retardation
Ametryne	319	M, Paralysis, Kidney damage, Spleen hemorrhaging
Amides		
Propanil	250	Mutations
Quat. Amm.		
Paraquat	85	Abdominal pain, ND, Convulsions, Spleen hemorrhaging, Respiratory collapse

Tolodines		
Trifluralin	340	C, M, PND
Others		
Dalapon	51	M, Kidney damage, Weight loss
Dicamba	21	PND
MSMA	85	M, PND
Other herbicides	380	
F u n g i c i d e Inorganics		
Copper Sulphate	935	C, Cirrhosis of the liver, M, PND, RSE, Pulmonary fibrosis
Other copper compounds	640	NLSE
Sulphur Dust	1020	NLSE
Chlorinated Phenols		
PCP	110	P N D , C , Hypertension, Nerve, Liver, and Kidney damage
Chlorothalinol	21	Kidney damage, PND
Quintozene	423	C
Dithiocarbamates		
Mancozeb	705	NLSE
Propineb	85	C
Zineb	85	PND, RSE
F u n g i c i d e Phtalamides		
Captan	111	C, M, PND
Folfet	13	C, M, PND
Amine derived		
Benomyl	2	Liver damage, M
Others		
Triademefon	19	NLSE
Other Fungicides	59	

Source material: W.H. Hallenback and K.M. Cunningham-Burns, Pesticides and Human Health; Christopher Maltby, Report on the Use of Pesticides in Latin America.

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