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CHAPTER 1: INTRODUCTION

Research Background

Human pesticide poisoning has reached the dimension of a global health problem. Yet, however "global" the problem appears, it is clearly one concentrated in the developing world. An estimated 99 % of human pesticide poisoning fatalities occur in developing countries, although these countries consume only 20 to 25 % of all pesticides. Due to poverty, small-scale farmers in developing countries are often the most vulnerable to pesticide exposure and poisoning. The high incidence of pesticide poisonings among small-holders is also related to faulty pesticide practices and the high toxicity of pesticides. As farmers use increasing amounts of pesticides, poisonings will continue (Jeyaratnam, 1990; Wesseling et al., 1997; WHO, 1990; Dinham, 1993).

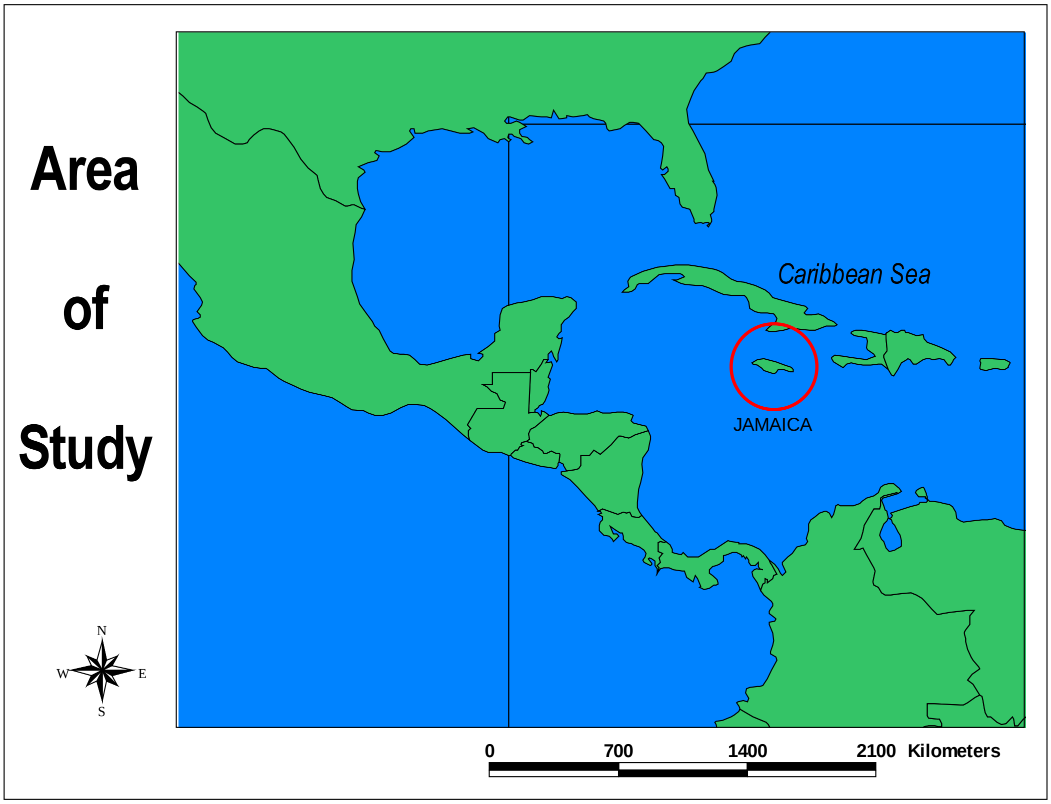
However, scant research has been conducted, especially at the local-level, on pesticide poisoning in the Caribbean. This research uses Jamaica as a case study of the Caribbean. The thesis investigates the health effects of pesticide exposure to small-scale farmers in three Jamaican farming communities.

Jamaica, a former British colony and part of the West Indies, is the third largest island in the Caribbean (see Map 1-1). Subdivided into 13 Parishes, it extends 144 miles in length and 52 miles in width (4,411 square miles). In 1998, the population size was 2.4 million (PRB, 1998). The island is marked by a variety of physical features, ranging from rugged mountains (highest 7,402 feet), dry central plains to humid tropical forests. Agriculture forms the basis of life in rural Jamaica. Crops cultivated range from traditional cash crops like the famous Blue Mountain coffee, sugar cane, banana, and coconut; to subsistence crops including yam, dasheen, cassava, tomato, and hot and sweet pepper. Non-traditional export crops, such as sweet potato and callaloo[1], are promoted in Jamaica as agricultural and economic development efforts. These crops are

[1] A leafy, green vegetable similar in appearance to kale.

largely exported to reach cities in North America and Europe with large Jamaican populations (e.g. Miami, New York, Boston, Toronto, London). An integral part of agricultural production, pesticides are used on plantations and by small-holders.

Map 1-1: Jamaica in the Caribbean Context



(Source: J. Boyer, 1999)

Pesticides

Pesticides are poisons designed to exterminate a target living organism by inhibiting certain vital functions. They are applied predominantly to kill or at least control weeds, insect pests, nematodes, fungi, etc. in agricultural, forestry, and livestock production. Further, they fill an important role in public health efforts to control vectors that spread diseases like malaria, leishmaniasis, dengue fever, and chagas disease (Ware, 1994). Despite the benefits they offer, pesticides can pose problems due to the planet's ecological interconnectedness. What affects a insect or weed will very likely affect humans and the ecosystem.

However, measuring the exact hazard of synthetic pesticides on humans and the surrounding environment is obscured by ignorance. Many unanswered questions remain about the vast number of chemical compounds and limited research on pesticide-environment relationships.

Rachel Carson's influential book "The Silent Spring," published in 1962, first brought the negative impacts of pesticides to public attention. Of the many vocal opponents to pesticide use, or rather misuse, none captured our interest as Carson. Although her scientific methods have been contested, Carson helped people understand the 'evils' of organochlorines which led to government intervention. In 1972, the Environmental Protection Agency (EPA) was established to regulate pesticide use in the United States, and DDT was banned the following year (Schuman and Simpson, 1997; Hansen, 1987; Paarlberg, 1993).

During the 1960s and 1970s, the more toxic yet less residual organophosphates and carbamates replaced organochlorine pesticides (e.g., DDT) globally. Organophosphates were first developed as nerve gases in WWII. As the incidences of reported poisoning increased and medical practitioners were faced new, unfamiliar challenges, concern over acute human poisoning began to grow world-wide. Today, organophosphates cause most poisoning cases in developing countries (Davies, 1987; Edwards, 1993).

Pesticides reach humans and other organisms through the air, soil, water, and food we consume. They contaminate surface- and groundwater resources through agricultural run-off and hazardous pesticide practices. Pesticides may also harm what they aim to protect, destroying crops through misapplication and drift. When broad-spectrum pesticides are applied, the natural balance of the ecosystem is disturbed. Both pests and their natural enemies exterminated, resulting are secondary pest outbreaks. In addition, over 500 pest species have developed resistance to overused pesticides (InZet, 1990). The effects of pesticides on wildlife have been well documented, especially in the disruption of animal reproduction. For example, in the United States alone, pesticides kill an estimated 67 million birds and 0.2 to 6 million fish every year (Pimentel, et al.

1993; Pimentel and Andow, 1984). A decrease in honey bee populations, subsequently disrupting pollination, is also a serious concern. Pesticides further poison thousands of farm animals and pets annually (Pimentel and Andow, 1984; El Sebae, 1993; Pimentel, 1996).

The negative impacts of pesticides are not a purely scientific issue. On the contrary, they are highly politicized. In a recent lawsuit, 500 agricultural workers on Dole and Standard Fruit Company banana plantations in Nicaragua sought retribution for pesticide poisonings suffered in the 1970s and 80s. In response, the two companies threatened to pull their banana production out of the country (Gonsega, 1998).

Global and Regional Poisoning Statistics

In 1973, the World Health Organization (WHO) established a series of global pesticide poisoning estimates, reporting 500,000 poisoning cases annually. In 1986, the WHO raised its estimate to one million cases of unintentional poisoning and 20,000 fatalities. A joint study by the WHO and United Nation Environmental Program (UNEP) in 1990, estimated three million hospitalized cases of which 220,000 resulted in fatalities. The break-down of cases included one million unintentional poisonings and two million suicides. The WHO extrapolated that for every 500 people who have pesticide poisoning symptoms, eleven are admitted to a hospital and one death occurs. In addition, an estimated 772,000 people sought medical treatment for chronic ailments due to long-term exposure (WHO, 1990).

Critics contest that these figures are far too conservative. One study, for example, estimated that each year as many as 25 million agricultural workers were poisoned. A widely quoted statistic by Jeyaratnam (1987) stated that 3 % of all agricultural workers in the developing world experience pesticide poisoning yearly, yet for every reported or hospitalized case, ten remain unreported. Previous to this study, Kahn (1976) claimed that the ratio 1:100 would be more accurate.

Following are pesticide poisoning statistics of select countries and regions in the developing world. In Central America, during the 1960s and 1970s, Honduras and Nicaragua displayed the highest incidence of reported poisoning cases, closely followed by Guatemala and El Salvador. Today, studies show that world-wide, people in Central America have the highest concentration of DDT in their body fat (Faber, 1991).

Table 1-1 presents the results of a landmark study by Jeyaratnam, Lun, and Phoon (1987) of pesticide poisoning in four Asian countries. Data collected from hospitals and surveys provided a larger number of poisoning cases than previously suspected. A similar study by Dharmawardene (1994) found a 22 % incidence of poisoning among farmers in one Sri Lankan district. Van der Hoek, et al. (1998) discovered that pesticide poisonings were the leading cause of death in five out of 25 districts in Sri Lanka.

Table 1-1: Pesticide Poisoning in Four Asian Countries

Country	Sample Size	Pesticide users ever poisoned (%)	Pesticide users poisoned yearly (%)
Indonesia	1192	13.8	0.3
Malaysia	4351	14.5	7.3
Sri Lanka	3438	11.9	7.1
Thailand	4971	19.4	No data

(Jeyaratnam, Lun, and Phoon, 1987: 522-523)

The number of annual pesticide poisoning cases in several African countries (1980s) is shown in Table 1-2. Unfortunately, I have not been able to find a comprehensive source of poisoning statistics for the Caribbean region.

Table 1-2: Annual Pesticide Poisoning in Africa

Country	Population (mill.)	% of Agricultural Labor Force	N Pesticide Poisonings
Sudan	24	80	384,000
Tanzania	23	85	368,000
Kenya	22	80	350,000
Uganda	17	80	272,000
Mozambique	15	70	240,000
Cameroon	11	80	175,000
Zimbabwe	10	80	160,000
Cote d'Ivoire	10	80	160,000
Malawi	8	85	128,000
Senegal	7	80	112,000
Mauritius	2	75	3,200

(Choudhury, 1989; Jeyaratnam, 1990)

The immense variation in figures and estimations suggests that it is impossible to accurately calculate the number of pesticide related poisonings and fatalities. This problem is largely associated with misdiagnosis and underreporting by medical personnel and the failure of poisoning victims to seek medical treatment. Other constraints on reporting adequate data in developing countries include under-funding, poor documentation methods, and lack of disease registries and census data (Wesseling et al., 1997; Pimentel, 1996; WHO, 1990).

In Jamaica, several studies have detected high levels of pesticide (Endosulfan) residue in surface water and aquatic life (fish and shrimp) (Robinson, 1998). One source of information on the health effects of occupational pesticide exposure of Jamaican farmers is the *Pesticide Usage Survey* administered in 1994 by The Stone Group on behalf of the Pesticide Control Authority (PCA). This survey of 1001 individuals, funded by the German Technical Assistance (GTZ), gathered baseline data on pesticide usage across Jamaica. Notably, they found that 19.7 % of people questioned felt "different" after using or handling a pesticide, and 60 % did not wear any protective clothing. Farmers who reported symptoms named dizziness, feeling unwell, headaches, nausea, skin irritation, etc. Another study examining symptomatic cases found that 29 % of persons reported pesticide poisoning symptoms (Rawlins, et al., 1985). In a study of 84 Jamaicans, Davies and Doon (1981) found that 98 % had DDT and 49 % Lindane residues, respectively, in their blood (Reid, 1987). These figures suggest that there is a significant health risk involved in pesticide usage. To my knowledge, no studies of chronic poisoning or the public health roles of health care providers have been conducted in Jamaica.

Objectives

Epidemiologists, entomologists, biologists, medical practitioners, anthropologists, economists, agricultural scientists, and others have been researching the effects of pesticides on human health. Often there is limited collaboration between the academic fields and much disagreement about research findings. The majority of studies are based on hospital data and laboratory experiments. Few surveys of the people affected by pesticides have been administered. Risk assessments based on data gathered in temperate climate trials on healthy male adults are typically the standard. They ignore gender or age variables completely. Further, Jeyaratnam (1990) asserts that only 1 to 2 % of published findings concern acute pesticide poisoning. Those data that do exist for farmers' acute poisoning come from hospital records rather than survey research. In this thesis, I argue that health-effect studies of pesticides should record the voices and concerns of the people directly impacted. This will improve risk assessment and, by doing so, enable governments to make better-informed decisions.

By conducting an intra-household[2] survey, my research aims to overcome some of these shortcomings. The four <u>objectives</u> of this research are to examine: (1) the localized incidence of acute pesticide poisoning as reported by farmers and how it varies geographically; (2) the existence of a relationship between the health outcome and pesticide practices, toxicity of the pesticides, type of crop grown, and marketing methods; and if these vary geographically. In addition, I discuss apparent gender differences in pesticide use and the

[2] Administered to both the female and male household head.

incidence of poisoning; and (3) the farmers' perceptions of the pesticide hazard and poisoning. But as people are not independent of their community and nation, they must be considered within their political-economic context. As a medical geographer employing a structuralist approach, I focus on social, political, and economic forces involved. Therefore, the final objective (4) is to describe the regulatory bodies and structural constraints in the promotion of safe pesticide practices, including the role of medical practitioners, and relate these findings to farmers.

CHAPTER 2: BACKGROUND

This chapter provides a literature review that forms the background for this research. It includes a general discussion of pesticides and human pesticide poisoning, the geography of pesticide poisoning in developing countries, Integrated Pest Management (IPM), gender and poisoning, and agriculture in Jamaica.

A. Pesticides and Human Pesticide Poisoning

1. Pesticides

Synthetic pesticides include active and inert ingredients. To improve their functions, additives such as dissolvents, emulsifiers, and synergists are joined into the specific formulation of pesticide: liquid, dust, granular, wettable powder, etc. Most pesticides are imported from developed to developing countries where they arrive pre-formulated or in raw form and are then formulated locally. Manufacturers label each pesticide on the basis of its active ingredient. Inert ingredients are usually not described even though they may be harmful (e.g. chloroform and carbon tetrachloride). Every pesticide receives a legally-binding label defining target pests and crops, hazard identifications, and safety procedures (Ware, 1994).

There are several methods for classifying pesticides. One entails a classification by target pest, such as insecticides, fungicides, herbicides, bactericides, nematicides, rodenticides, molluscicides, plant growth regulators, desiccants and defoliants, and acaricides. Second, pesticides are joined by the chemical group the active ingredient belongs to, such as organochlorines, carbamates, organophosphates, pyrethroids, microbials, etc. Third, classification can be determined by its effect on health. This includes the chemical's mode of action, i.e. how the chemical harms the organism, such as damage to the central nervous system, cholinesterase inhibition, or enzyme induction. Classification can also be determined by the degree of human health hazard as established by the WHO (see Table 2-1). Such hazard classes are based on LD_{50}s, measured in laboratory rat populations. The figures represent the dosage (milligrams of pesticide per kilogram of body weight) necessary to kill 50 % of the study population. The dose-response is then extrapolated to humans. The lower the LD_{50}, the greater the chemical's toxicity. In geographic regions where there are specific safety concerns about a certain pesticide, the hazard groups may be adapted to meet the need. Using LD_{50}s as a measure of human risk has, however, significant limitations. The extrapolation of laboratory animal to human dose-response is especially problematic (Ware, 1994; WHO, 1990; Schuman and Simpson, 1997; Koh and Jeyaratnam, 1996).

Table 2-1: WHO Pesticide Hazard Classes

			LD_{50} (rat)	
Hazard Class		**Signal Word**	**Oral**	**Dermal**
I (a,b)	**Extremely or Highly Toxic**	**Danger-Poison**	0 – 50	0 – 200
II	**Moderately Toxic**	**Warning**	50 – 500	200 – 2,000
III	**Slightly Toxic**	**Caution**	> 500	2,000 – 20,000
IV	**Relatively Non-toxic**	**Caution**	> 5,000	> 20,000

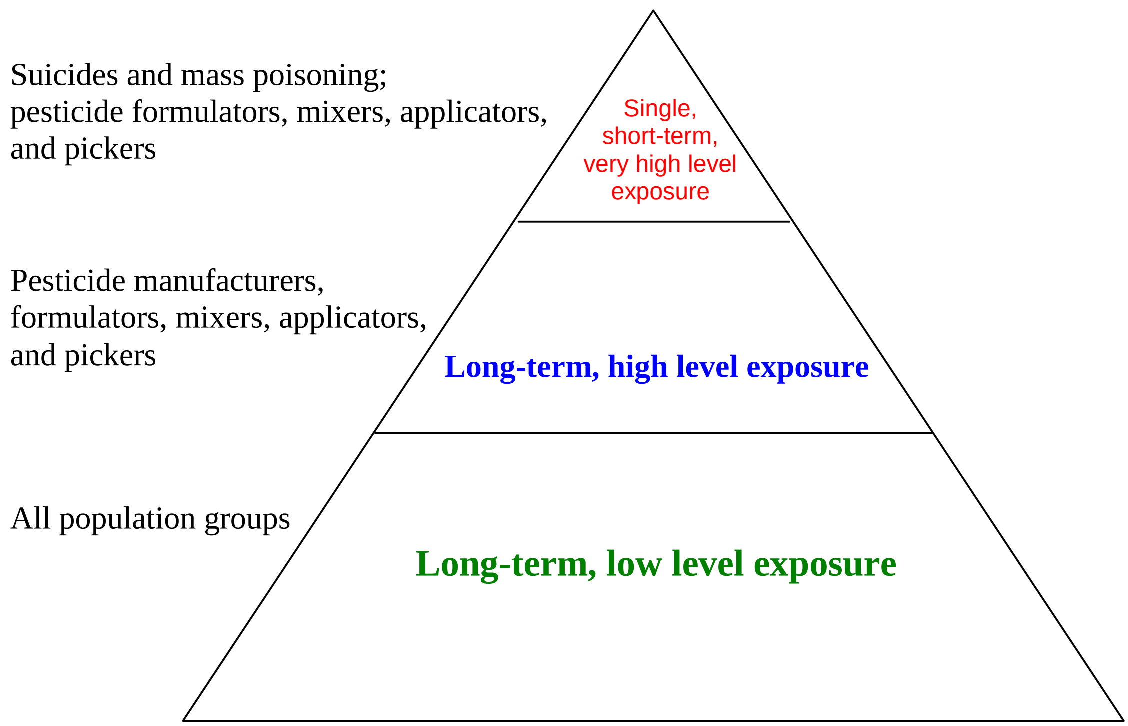
(Adapted from WHO, 1990: 43; Litewka and Stimmann, 1979: 4)

Aside from toxicity, pesticides are also differentiated by their persistence in the environment or organism. Organochlorines, such as DDT and Dieldrin, are known as bioaccumulators and passed up the food-chain. Since these chemicals readily store in body fat, organochlorines may be detected some time after exposure has occurred.

2. Pesticide Poisoning

Pesticide poisoning can be differentiated by intentional and unintentional exposure. Intentional exposure includes suicides and homicides. In some developing countries, such as Indonesia, Thailand, Malaysia, and Sri Lanka, suicides comprise the majority of reported poisonings. Commonly, the herbicide Gramaxone is implicated (WHO, 1990). Unintentional exposure can be broken into occupational and non-occupational categories and defined by long-term and short-term exposure (Davies, et al., 1980; Davies, 1984). Non-occupational exposure can occur through the accidental consumption of contaminated food. First, food such as flour or sugar may be contaminated during storage or transport in conjunction with pesticides. For example, in 1976, 17 Jamaicans died after consuming a food product prepared from flour contaminated with a pesticide (Leslie, 1987). Second, vegetables or fruit may have high levels of pesticide residues. In the United States, it has been estimated that about 50 % of produce in supermarkets has detectable levels of residue (Pimentel and Andow, 1984). Third, poisoning may occur through the consumption of seeds and grains previously dressed for sowing. In 1971-72, for example, 6,530 people in Iraq were hospitalized and 459 died after the consumption of contaminated grain. Fourth, the accidental consumption of pesticides mistaken for food products or beverages is a hazard. An example would be food prepared with a powder pesticide which resembles flour. Finally, non-occupational exposures occur through inappropriate pesticide practices. This includes the treatment of head/body lice and bedbugs, inadequate storage and disposal (e.g. in unlocked/ unmarked containers and reuse of containers), and inappropriate house spraying. Children are particularly vulnerable and most often the victims.

This thesis focuses on occupational poisoning, here defined by exposure during crop production (also includes exposure during pesticide manufacturing and formulation). Occupational exposure comprises about 60 to 70 % of all poisonings. Figure 2-1 displays the occupational exposure risk groups. The size of the categories roughly represents the size of the effected population. As can be seen, the general population is at great risk (Copplestone, 1985; Ferrer and Cabral, 1995; WHO, 1990).



(Adapted from: Davies et al., 1980; Davies, 1984)

Figure 2-1: Population Risk Groups

The health effects of pesticides are differentiated by acute and chronic toxicity or poisoning. Acute toxicity is defined by the person's short-term, high dosage exposure. Symptoms appear within 24 hours. Damage may include chemical burns of the skin and eyes, neurological damage, and liver damage. The symptoms can be distinguished by chemical groups and the severity of poisoning (mild, moderate, and severe). Following are the symptoms for the most common chemical groups:

Organophosphates and Carbamates:
* Mild: fatigue, headache, dizziness, blurred vision, watering eyes, constricted pupils, excessive sweating, nausea, vomiting, stomach cramp, salivation, numbness, tingling sensation.
* Moderate: inability to walk, weakness, slurred speech, chest discomfort, muscle twitching, uncoordination, slow heartbeat.
* Severe: unconsciousness, severe pupil constriction, shock, secretion, breathing difficulty, convulsions, coma, respiratory failure.
Antidote: Atrophine Sulphate intravenously.

The chemicals within this group are generally of higher toxicity and symptoms of acute poisonings occur more rapidly. Chronic symptoms often mimic those of a cold or flu with sore throat, runny nose, aching limbs, and headache. In addition, continuous exposure to organophosphate pesticides has a cumulative effect. As a result, even low levels of exposure can cause serious health complications. In general, the poisoning effects of carbamates are more quickly reversible (Schuman and Simpson, 1997; Hansen, 1987; PIP, 1999).

Organochlorines:
Headache, dizziness, tremors, clonic and tonic movements, muscular weakness, pallor, twitching, convulsions, hyperexcitablity, coma. Nausea and vomiting if ingested.
Antidote: Phenobarbitone or Diazepam to control convulsions.
These chemicals are known for their persistence and bioaccumulation.

Bipyridyls[3]:
Nosebleed, eye inflammation, blistering of skin, transverse cracking of nails, respiratory problems, nausea. If ingested, burning in mouth and throat, ulcers of the mouth, difficulty swallowing, vomiting, diarrhea, stomach pain. Later impaired liver and kidney function and progressive pulmonary failure are experienced.
Antidote: Fuller's Earth (or Activated Charcoal, Bentonite) and Mannitol for gastric lavage (Ware, 1994; Davies, ?; WHO, 1990; Koy and Jeyaratnam, 1996; Bartle, 1991).

Pyrethroids:
Skin paraesthesia, headache, stuffy/runny nose, dizziness, unconsciousness, convulsions, and coma.
Antidote: Activated Charcoal and Diazepam or Barbiturate to control convulsions.
Pyrethroids are synthesized from the pyrethrum flowers (*Chrysanthemum cinerariaefolium*) and generally less toxic to humans; however, they have very high insect and aquatic organism toxicity. Recent studies call for a reevaluation of neurological effects (Edwards, 1993; Perger and Szadkowski, 1994; Forget, 1991).

Organophosphates and carbamates are (acetyl-)cholinesterase inhibiting chemicals. The chemical acetylcholine, found in human and animal bodies, transmits impulses from nerve to nerve. If the enzyme cholinesterase, which breaks down acetylcholine, is inhibited, the nerves continuously transmit impulses and no longer respond to external stimuli. This leads to adverse health effects (Hansen, 1987). Poisoning can be established by testing the cholinesterase levels in the plasma and red blood cells. However, cholinesterase

[3] For example, Gramaxone (Paraquat)

testing has many limitations, including the need for baseline data, variations between laboratory conditions, range of normal levels and acute symptoms, and the non-recognition of delayed poisoning effects. Cholinesterase testing should, rather, be considered a preventative tool if constant monitoring is possible. Exposure to pesticides can further be tested by sampling human tissue (skin and hair) and body fluids (fat, urine, breast milk) (Schuman and Simpson, 1997; Hansen, 1987).

The list of symptoms reveal how difficult it is to accurately distinguish between chemical groups and other illnesses. In fact, Loevinsohn (1987) found that in developing countries where poor diagnostic facilities are the norm, most acute poisoning cases are misdiagnosed as "strokes" (van der Hoek, et al., 1998). Other misdiagnoses include gastroenteritis, epilepsy, and malnutrition (Reid, 1987).

Pesticides poisoning occurs via one of the three routes of transmission: dermal, ingestion, or inhalation. The majority of reported occupational acute poisonings result from dermal exposure through direct contact or contaminated clothing. The risk is heightened by environmental factors such as temperature and humidity, the person's skin characteristics (perspiration and presence of open sores), and the lack of protective clothing. Second, poisoning occurs through inhalation of pesticide contaminated air and dust. The third important route is ingestion. Most non-occupational poisonings occur through ingestion of contaminated food and water and, in cases of suicide, by direct consumption (WHO, 1990).

The intensity of poisoning is related to a number of variables: (a) inherent toxicity of the pesticide's active ingredient; (b) dose or concentration of the compound; (c) duration and frequency of exposure; (d) physical and chemical properties of the pesticide; (e) transmission route; and (f) the physical characteristics of the affected person such as weight and overall health. The final variable suggests that the health risks of pesticides are exacerbated by conditions of poverty, including malnutrition, unsafe drinking water, presence of other infectious diseases, and limited access to health care. Studies have shown that human protein deficiency and dehydration heighten a person’s susceptibility to severe poisoning (Koh and Jeyaratnam, 1996; Ware, 1994; WHO, 1990).

The studies by the following authors have further contributed to our understanding of acute pesticide poisoning: Ferrer and Cabral (1995); Chen, et al. (1991); Jeyaratnam, et al. (1982); Forget, Goodman, and de Villiers (1993), Bull (1982); Jeyaratnam (1987, 1990, 1992); WHO/UNEP (1990); Mowbray (1986); Turnbull (1985); Kanja (1986); O'Malley (1997); Belluck and Benjamin (1990); Cheremisinoff and King (1994); Dinham (1993); Fleming and Herzstein (1997); Schuman and Simpson (1997); and Hallenbeck and Cunningham-Burns (1985).

A multitude of studies have examined chronic poisoning, which may occur at long-term, repeated lower dosage exposures. Chronic poisoning is more difficult to detect outside the laboratory and without biological monitoring. Knowledge about chronic effects of pesticides is predominantly confined to information obtained from laboratory testing on animals and animal/human cell cultures. From these results, the risk is extrapolated to humans. Rarely do studies examine actual human exposures (Wesseling et al., 1997; Pimentel, 1996). The following are the most common chronic effects along with the respective researchers.

Carcinogenic effects of pesticides have been highly publicized. Through linear risk extrapolation of animal data and maximum exposure levels of 550 million people, one study estimated that there are 37,000 cancer cases yearly associated with pesticide use in developing countries (WHO, 1990). Other cancer studies include Steingraber (1997), Swirkey Gold, et al. (1997), Wesseling, et al. (1996), Wolff, et al. (1993), and Bohnen and Kurland (1995). *Reproductive damage, taratogenic (birth defect) and fetotoxic effect, and miscarriage* have also been of great concern. Wharton (1977) was one of the first to link the pesticide DBCP to male sterility. Other studies include Thrupp (1991) and Restrepo, et al. (1990). *Skin disorder*s include dermatitis and allergic sensitization, as described in studies by Adams (1983). Savage, et al. (1988)

found that organophosphates cause *neurological damage* and Maizlish (1987) confirmed resulting behavioral changes. Other studies examining neurological and psychological effects include Fleming, et al. (1994), Stefano, et al. (1989), and Chen et al. (1991). Studies by Dulout, et al. (1985) and Rabello, et al. (1975) examined *cytogenetic effects* as displayed in chromosomal damage.

Pesticides also suppress *immune functions* in the fight against viruses, bacteria, and parasites. This is especially important in developing countries where factors such as malnutrition, limited access to health care, and the presence of other illnesses complicate the matter. Repetto and Baliga (1997) made a strong case for the pesticide-induced suppression of vital immune functions as the occurrence of common diseases increased. Furthermore, pesticide poisonings often remain unrecognized as they are manifested in other diseases. Barnett and Rodgers (1994) described the immunosuppressive effects of Malathion, a pesticide widely used because of its very low toxicity. They found that the risk of contracting viral and bacterial infections is increased by chronic, low-level exposures. Several epidemiologic studies in Moldova discovered increased incidences of infectious diseases. In high pesticide use areas, respiratory and digestive tract illnesses exceeded by two to five times the levels in the control areas (Vasilos, et al., 1993; Kozlyuk, 1994). A third study, which has received greater international attention, is that of Inuit populations of arctic Canada. There, alarmingly high levels of organochlorines (and other toxic materials) were found in breast milk. This has been related to the Inuit diet of fish and marine mammals in which pesticides have bioaccumulated over years. Organochlorines are passed on to infants, rendering them more susceptible to infections (Drew, 1992; Proulx, 1987; Reece, 1987; Julien, et al., 1987; Repetto and Baliga, 1997).

B. Geography of Pesticide Poisoning in Developing Countries

Pesticide practices can be differentiated by the type of farming system (plantation, small-holder), crop produced (most intensive use on rice, maize, cotton, certain fruits, coffee, tea, flowers), and cultivation methods (monoculture, polyculture, crop rotation). Other factors that influence practices include the availability of pesticides and government regulations. Some governments provide agrochemicals free of charge to farmers or subsidize their cost, simultaneously promoting their extensive use and discouraging the acceptance of Integrated Pest Management. Often the economic interests of agrochemical companies shape government regulation.

Pesticide use is also dependent upon the level of farm commercialization. Amount and type used may vary greatly between plantation, cash cropping system, and subsistence farm. Large-scale farms are the greatest consumers, yet use by small-scale farmers has greatly increased in recent years (Copplestone, 1985; WHO, 1990; Wesseling, et al., 1997). Within the theoretical framework of development, it has been documented that some development efforts affect the usage pattern of pesticides. A common, yet contested, paradigm is that pesticides are a necessity to achieve agricultural/economic development and food security. The introduction of high yielding varieties as part of the Green Revolution has increased dependence on chemicals because they require higher inputs (van der Hoek, et al., 1998). New disease environments are created from increased pesticide use or misuse. For example, Loevinsohn (1987) documented a fatality rate increase of 27 % among agricultural workers after the widespread adoption of pesticides by small-scale farmers in the Philippines.

In recent years, multitudinous economic and agricultural development projects have been and are promoting the use of pesticides in export crop production. Non-traditional export crops[4], in particular, require more intensive pest control. Farmers know that high cosmetic standards have to be met in order to export their crops. The subsequent health outcomes have been documented by a number of studies. In Guatemala, Murray and Hoppin (1992) discovered a 70 % incidence in pesticide poisoning symptoms over a two year period as a result of the promotion of melon and broccoli cultivation for export. Thrupp (1991) reported on the massive sterilization of export banana plantation workers

[4] Local crops now produced for export which were previously not major commodities.

in Costa Rica as a result of exposure to DBCP. Similar findings occurred in Jamaica (Patterson, 1996).

As mentioned in the introduction, poisoning and associated fatalities greatly differ between developing and developed countries. Poisoning is more complex and intense in developing countries, where two-thirds of the general population are exposed to pesticides (Forget, 1991). *Exposure to pesticides and poisoning* at the community level is influenced by a number of interrelated environmental, structural, and behavioral conditions. To reduce pesticide poisoning all factors must be taken into consideration.

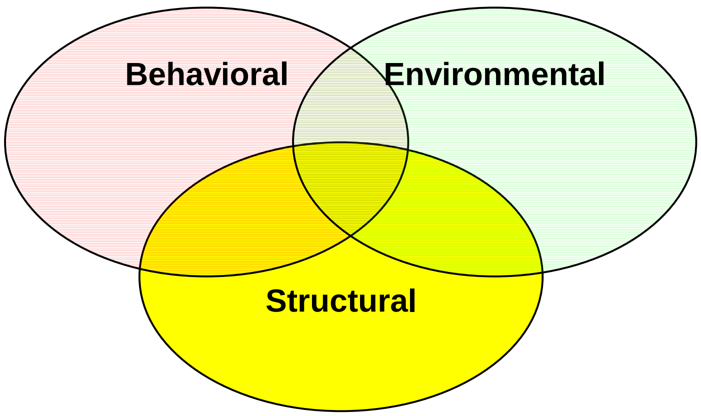


Figure 2-2: Pesticide Exposure Factors

Behavioral factors generally involve a person's knowledge and practice of safe pesticide use. This includes personal protection during application, safe disposal and storage practices, and mixing of different chemicals. Furthermore, living habits such as proximity of a home to the farm are important. How the poisoning risk is perceived by the person may also determine exposure.

Environmental conditions should also be considered. The risk of pesticide poisoning may be intensified in tropical and sub-tropical environments, defined by high temperatures, precipitation, and humidity. High temperatures affect pesticide toxicokinetics (chemical reaction and movement in environment) which can cause increased toxicity, reduced efficacy, and instability. In addition, hot climates make it difficult for persons to wear protective clothing, which may increase the risk of heat stroke. Excessive humidity permits drift and more rapid chemical runoff into groundwater. Pesticide application equipment corrosion is increased and pesticide shelf-life shortened. In addition, pesticides penetrate skin more readily under conditions of high humidity and perspiration (Thrupp, 1990; Reid, 1982).

Structural forces include the availability and quality of personal protective equipment (PPE), type and condition of application equipment, access to pesticide safety information, presence of safety standards and the enforcement thereof, regulated sale of chemicals, labeling of pesticides in foreign or nebulous language, protruding advertisement, and prevailing economic interests of agricultural and agrochemical industries. Access to appropriate, often sophisticated health care is essential. Prompt medical attention is vital in the case of acute pesticide poisoning (Wesseling, 1997; Repetto, 1985; Murray, 1994; Faber, 1991; Dinham, 1993).

C. Integrated Pest Management

Integrated Pest Management (IPM) advocates an approach to pest control that reduces some of the adverse effects of pesticide use without decreasing crop yield and income. It seeks to reduce the negative health and environmental impacts as well as the serious problem of pest resistance. Pest resistance occurs when one pesticide is applied too frequently. Over time, a few insects survive because their genetic make-up renders them less sensitive to the pesticide, and these insects rapidly reproduce resistant strains. In response, the farmer applies more pesticides to fight increasing pest problems, leading to a “pesticide treadmill” (InZet, 1990; Hansen, 1987).

IPM advocates a holistic approach to pest management, regarding the agro-ecosystem as an interrelated whole. IPM is best adapted to local conditions and needs of the farm or community. Alternative pest control methods include specific agricultural practices (e.g. crop rotation, planting dates, irrigation) known as cultural methods, genetic techniques such as use of pest-resistant cultivars, and biological controls (e.g. use of bacteria, introduction of beneficial and/or sterile insects). Reduced dependence on pesticides is the ultimate goal. However, restricted use may still be deemed necessary. Pesticide use should be selective (killing the target organism) rather than broad spectrum (killing all organisms). In Nicaragua, IPM's success has been documented in a study where pesticide poisoning mortality was reduced by 25 % after wide-scale adoption of IPM (Hansen, 1987; Turnbull, 1985; Murray, 1994; InZet, 1990).

In Jamaica, the Caribbean Agricultural Research and Development Institute (CARDI) has been developing and promoting Integrated Pest Management. Within the context of the non-traditional export crop promotion programs supported by USAID, CARDI's main focus is on biological control methods, the reduction of pesticide use, and a decrease in export rejections due to detection of pesticide residues and pests.

D. Gender and Pesticide Poisoning

Women and children have been largely overlooked in research concerning pesticide exposure. Either they have not been recognized as pesticide applicators or their close proximity to the application site is overlooked. As women and men interact, use, and manage their environments differently, each is exposed to certain hazards and illnesses (Kettel, 1996; Murray, 1994).

One study from East Africa proves that women and children are equally prone to suffer from pesticide poisoning as men. Out of 455 reported poisoning cases in Kenya, 38.5 % were men, 31.4 % women, and 30.1 % children. In Tanzania, of 736 reported cases, 44.8 % were men, 48.4 % women, and 6.8 % children (Mbakaya, et al., 1994). Fleming and Herzstein (1997) assert that women may be particularly vulnerable to pesticide poisoning. This has been mainly discussed in conjunction with studies on reproductive damage, such as Colombian women working on flower plantations. Due to constant exposure, these women experience excessively high frequency of miscarriages and give birth to infants with congenital anomalies (Restrepo, et al., 1990).

In order to understand the complexities concerning knowledge, attitudes and practices of pesticides, research must take on a gendered perspective

(Wells and Wirth, 1997). The following questions should be kept in mind when doing gender sensitive pesticide poisoning research.

- Is knowledge of safe use and handling differentiated by gender?
- Do men and women perceive risks of pesticide exposure differently?
- Do perceptions of the costs of health vary according to gender?
- Does the ability to access health care and deal with health problems differ for men and women?
- Do IPM extension efforts benefit men and women equally?

E. Agriculture in Jamaica

Agriculture forms the basis of life in rural Jamaica. In the Caribbean, crop production can be distinguished in general between the plantation system and small-scale farms. Large-scale plantations were introduced to Jamaica (and other Caribbean countries) after 1655 when the island came under British control. Soon thereafter, the British began to import slave laborers from (West) Africa to work on sugar plantations which were located on the fertile coastal plains. In order to meet the food demands of slaves and to import fewer commodities, slaves were later allowed to cultivate their own crops. They either cultivated the land surrounding their homes (“kitchen gardens”) or were allotted small plots of marginal land known as “provision grounds” or “polinks.” The early small-scale farmers grew a mixture of indigenous (sweet potato, cassava, squash, beans, several fruit, etc.), West African (ackee, okra, millet, banana, plantain, etc.), and European (carrots, green vegetables, cabbage, onions, etc.) crops for personal consumption and selling the surplus at Sunday markets. Higglers soon became the main link between the farmer and the market (Mintz, 1985).

Kitchen gardens and provision grounds are thought to be the beginning of small-scale farming and also helped define present day small farms. Mintz referred to the earliest enslaved peasants or small-holders as “proto-peasantry” (1974: 151). Mintz (1985) further traced the origins of small-holders to a number of conditions related to places where plantations failed, control was relaxed, or slaves escaped from plantations. In an earlier book, Mintz (1974) also referred to the establishment of slaves as small-holders as a “mode of response to the plantation system and its connotations, and a mode of resistance to imposed styles of life” (1974:132-133; Brierley, 1991). Following emancipation in 1938, former slaves were able to gain greater independence from the plantation. More recently, Barker (1992) argued that a “structural dualism” exists between the plantations and small-holders as they compete for scarce resources. He explained that another constraint to agriculture in the Caribbean is natural hazards. Floods, hurricanes, droughts, landslides, and soil erosion are common problems on these small island environments (Barker, 1992; Richardson, 1992).

It is suggested that small-holders in the Caribbean should not be viewed as self-sufficient producers; instead, they juggle between production for family consumption, local markets, and export (Mintz, 1985). For this thesis, small-scale farms are defined as under 10 acres (Mintz, 1974). Spence (1996) also referred to small-holdings as less than 10 acres (4 hectares) but said the official definition is 25 acres (10 hectares). In Jamaica, Spence further concluded that farms 10 hectares or less take up 37.8 % of farm area; however, they make up 96.6 % of all farms. In terms of land tenure, much of the land owned by Caribbean small-holders is referred to as family-land. This type of land is equally owned by all family members and usually consists of fragmented parcels which are often some distance from the home. Other types of land tenure are leasing, squatting, and sharecropping (Besson, 1987; Satchell, 1990).

CHAPTER 3: METHODOLOGY AND RESEARCH QUESTIONS

A. Study Design

Survey: Local

Field research was undertaken in Jamaica to understand the localized health impact of pesticide poisoning in a developing country. The primary research tool was the collection of data through an intra-household survey, complemented by field observations. The goal was to gather information on the extent to which pesticides are used, the physiological symptoms experienced during or after pesticide exposure, and the farmer's knowledge, attitude, and safe practice of pesticide use.

Field research took place between June 15 and August 16, 1998 and January 10 to 20, 1999. It was part of a collaborative effort by the Virginia Tech Office of International Research and Development (OIRD) and its Jamaican counterpart, the Caribbean Agricultural Research and Development Institute (CARDI). The research was funded by the United States Agency for International Development (USAID) under the Integrated Pest Management Collaborative Research Support Program (IPM CRSP). IPM CRSP has ongoing projects in several African, Asian, and Latin American countries. USAID mandates a gender component at each of the research sites. Because CARDI staff are primarily entomologists and crop and soil scientists, their work is focused on pest identification and management. They have little expertise in social science research. I, along with Gary Schlosser, was hired to conduct an intra-household survey in three Jamaican farming communities where CARDI has ongoing projects. For CARDI and OIRD, the overall objectives of this survey were to understand the constraints to IPM adoption, the gendered division of labor, and the decision making process at the household level. I was able to include questions associated with pesticide knowledge, attitude, and practice and pesticide poisoning as part of the household survey.

Interviews: Structural

I conducted interviews with health care providers in nearby biomedical hospitals/clinics and private doctors' offices to collect data on the incidence and outcome of registered acute poisonings. Furthermore, I was interested in examining how much medical practitioners know about pesticide poisoning. To gain an understanding of the current regulatory framework, I interviewed key officials in government, pesticide research, and agro-business. These interviews were structured with open-ended questions.

B. Survey

1. Selection of Study Population

A baseline survey of small-scale farmers was administered in three rural communities where CARDI has ongoing research: Grove Farm and Lloyds Pen District, St. Catherine Parish; Hazard and Donnington Castle District, St. Mary Parish; and Rose Hill, Manchester Parish (see Map 3-1). The communities were also selected because they provide variations in the principal crops grown and pest problems experienced. They represent distinct environments of Jamaican low-land and high-land areas and can be distinguished by proximity and access to urban centers and markets.

A probabilistic sampling design was employed to represent the research population. We determined that there was no need to further stratify by wealth because geographic clustering does not exist. With the help of key informants in the community, we mapped every household and assigned each a number. Next, a sample of households was randomly drawn. This gave each household in the community an equal chance of selection. In order to account for the households where persons declined an interview or were not available, we randomly reselected households. To ensure the person's confidentiality, we did not record names.

Map 3-1: Research Sites, Jamaica

(Source: Baseline Data IPM-CRSP)

In the selected households, the aim was to interview both male and female household heads. In talking to both males and females, information on a person's involvement in farming, pesticide use, and decision making was gathered from his and/or her own perspective. In some households, I could only interview one household head because only one existed or the other was unavailable for interview (after repeated attempts to establish contact). In order to determine the extent of a community's reliance on farming and to understand the different activities people engage in, the selection was not limited to farming households (although they formed the majority).

In St. Catherine, Grove Farm was selected because several farmers collaborate with CARDI. Here we found 24 households and randomly selected twelve of them. Since the study population was considered too small, it had to be expanded. The community of Lloyds Pen was chosen because of its proximity and similar characteristics to Grove Farm. In Lloyds Pen, we mapped a total of 59 households and drew 22. In total, we surveyed 30 households and spoke with 44 individuals.

Although the St. Mary sample comprises two districts (Hazard and Donnington Castle), it is considered one continuous community by the inhabitants. We mapped 43 households in a radius of about four kilometers. We randomly selected 33 homes and interviewed a total of 33 and 47 persons.

Rose Hill, Manchester is a relatively large community with a radius of about 6 kilometers. Here we located and mapped 123 homes from which we randomly selected 33. We interviewed 49 persons living in 33 households.

2. Data Collection and Analysis

The survey design was completed by 29 June, 1998 and field tested at the first research site in St. Catherine. The basic design was adapted from CARDI's previously conducted socio-economic survey composed by consultant Peter Espeut. I developed the questions concerning pesticide poisoning which included closed and open-ended questions. Secondly, I designed the questionnaire, *Additional Questions for Farmers Concerning Pesticides*, to gather additional information on pesticide practices. This questionnaire was administered to those respondents who showed interest in continuing the household survey (immediately following). In two of the communities, I was less likely to convince women to continue the survey as they usually seemed more pressed for time to continue their household work. In addition, both surveys often have varying response rates per question mostly related to the fact that the farmers did not wish to answer certain questions because they felt they could not accurately do so. The surveys are found in Appendix A and B.

I conducted survey research in St. Catherine from 1 to 10 July, in St. Mary from 19 to 29 July, and from 4 to 12 August in Manchester. In total, I interviewed 140 individuals from 96 households. Since I resided in each community during the time of field work, I also recorded my field observations. After data collection, I entered and analyzed it in MS Excel and SPSS (Statistical Package for the Social Sciences). The analysis is based on descriptive statistics utilizing frequencies and cross-tabulations.

3. Research Questions and Hypotheses

As presented in the introduction, the first objective is to describe the local realities of pesticide practice and poisoning by examining the incidence of acute pesticide poisonings as reported by community members. In particular, I wish to determine the extent of acute poisonings and compare how they differ among the three geographically different communities. The second objective explores the relationships between the health outcome and crop grown, pesticide toxicity, marketing method, and farmers' knowledge/practice of pesticide use. The theoretical framework defines health events as non-random and assumes a particular process is involved in the distribution of illness, creating a spatial pattern of poisoning (as related to the factors mentioned above). The third, and perhaps most important, objective is to determine the community members' perceptions of pesticide hazard and poisoning. To meet these objectives, I address the following questions and hypotheses. Where appropriate, I discuss gender differences.

- What is the incidence of symptomatic acute poisoning cases as reported by farmers?

This question is examined by referring to reported symptoms of acute poisoning the farmers attributed to pesticide exposure. Therefore, whenever I refer to incidence of pesticide poisoning it is based on the farmer's perception whether or not they had been poisoned.

- Does the incidence of pesticide poisonings significantly differ between places as related to a) the nature of the crop and chemicals used and b) safe pesticide practices and knowledge thereof?

$H_0$1: The toxicity of pesticides and intensity of application determine the incidence of pesticide poisoning.

Rationale: By correlating the incidence of poisoning with the pesticide's toxicity and intensity of application, I hope to prove that in places where more toxic chemicals are used more frequently there is greater risk of exposure and poisoning. Factored into this discussion are the type of crop grown and its marketing channel since pesticide application is thought to be more intensive on certain crops, especially those grown for export.

$H_0$2: Less poisonings are reported in communities where people display greater knowledge of safe pesticide practices.
Rationale: This hypothesis is based on the assumptions of numerous public awareness efforts in poisoning prevention. It is believed people will engage in safe use and handling if they understand how the pesticide risks can be minimized. This hypothesis will be tested by comparing survey results on farmers' reported poisoning to questions concerning knowledge and practice; e.g. use of protective clothing, mixing of "pesticide cocktails," storage and disposal, and decision making.

- How do farmers perceive the pesticide hazard and its related illnesses?

$H_0$3: In communities where pesticide poisonings are reported more frequently, people perceive pesticides as a community health problem.
Rationale: The assumption of this hypothesis is that greater awareness has developed as a result of pesticide poisoning. To understand how farmers make pesticide related decisions, it is important to study how they perceive the health risk. It is often assumed that people in developing countries are not aware of the risk pesticides pose or are not capable of mitigating risks. Farmers' perceptions may provide insight that allows understanding of how often protective equipment is worn. By understanding these perceptions, public awareness campaigns will be more effective. Furthermore, there may be a gendered pattern of risk perception.

C. Interviews

1. Selection of Study Population

The first group of interviews were with health care providers, selected on the basis of where poisoning victims sought medical treatment. I interviewed a private doctor in Gutters, St. Catherine; a nurse practitioner at the Gayle Health Centre, St. Mary; and a doctor at the Mandeville Public General Hospital, Manchester (see Maps 4-1, 4-2, and 4-3).

Secondly, I interviewed officials and researchers from the agricultural/pesticide, agrochemical, and regulatory sectors (listed below). Most of the interviewees were recommended by CARDI staff.

Agricultural Sector: the Plant Protection Specialist of the Rural Agricultural Development Authority (RADA)[5] under the Ministry of Agriculture; a member of the Pesticide and Pest Research Group at the University of West Indies, Jamaica; three CARDI entomologists; and members of the former Jamaica Agromedical Association (JAMA). Regulatory: the Registrar and Deputy Registrar of the Jamaican Pesticide Control Authority (PCA). Agrochemical Industry: the general manager of a multinational agrochemical manufacturer and distributor based in Jamaica.

2. Data Collection and Analysis

I collected information through interviews and supplemented this with relevant materials and statistics gathered while in Jamaica. In Chapter 6, I present the results of data collection and analysis.

3. Research Questions and Hypotheses

The final objective of this research is to understand the structural constraints in the promotion of safe pesticide practice. I will examine the existing

[5] RADA (Rural Agricultural Development Authority), under the Ministry of Agriculture, is responsible for agricultural extension services. Per Parish there are four to six extension agents, each serving about 2,500 farmers. The extension agent is expected to travel to each community and provide technical assistance to farmers.

regulatory structure and legislation concerning pesticide use. This section includes a discussion of the role of medical practitioners in mitigating poisoning. In Chapter 6, I deliver a general discussion of the following research questions.

- What are the structural (political, economic, and social) constraints to pesticide legislation?

This question is addressed in a general discussion of the role of the agrochemical industry, export crop production, the commitment of government to regulate pesticides, and the commitment of actors (i.e. CARDI, Ministry of Agriculture) in promoting Integrated Pest Management.

- How do experts perceive the pesticide health hazard?

Here I provide a discussion of how the pesticide hazard, pesticide poisoning, and mitigation are perceived by officials in the agricultural, health, and agrochemical industry sectors. It covers how and why their perceptions differ, especially when compared to those of small-scale farmers.

- What is the status of health facilities and how much do practitioners know about pesticide poisoning?
- How much do health care providers know about the communities they serve?

These questions are answered by presenting and discussing the findings from interviews administered to health care providers.

CHAPTER 4: RESULTS – LOCAL REALITIES

This chapter summarizes the results of the survey findings. The first section describes the three communities. It is divided into community, agricultural, and health profiles. The information is derived from the *IPM CRSP Socioeconomic Household Survey* (Appendix A). The second section reports the findings about pesticide use. The results are based on the household and the *Additional Questions for Farmers Concerning Pesticides* surveys (Appendix B).

A. Community Descriptions

Grove Farm and Lloyds Pen, St. Catherine

Community Profile

Grove Farm and Lloyds Pen are located in the hot and arid south-central zone of the island. Grove Farm is a crescent-shaped community straddling the main highway between Mandeville and Kingston. Lloyds Pen lies about two kilometers (km) southwest of Grove Farm (see Map 4-1). The terrain is flat and, on average, the area receives less than 50 inches of rain annually. In Jamaica, there are two wet seasons, May to June and September to November (STATIN, 1997). During 1998, Jamaica, as did much of the Caribbean, experienced a drought which was evident during my visit in June. Lack and/or high cost of water are the most frequent complaints of farmers. Access to water is largely gained by purchasing water from public or private pipes. A few households have their own tanks for capturing rain (see Table 4-1 for exact figures).

In St. Catherine[6], I surveyed a total of 44 individuals living in 30 households, of which 46 % are female and 55 % male. The average household size is 5.6 members. Jamaican households, as found in this research, generally are comprised of a male and female (married or unmarried) couple, their children

[6]For simplicity, I will generally refer to the communities by their Parish names: St. Catherine, St. Mary, and Manchester.

(the couple's joint children but often also the children each have brought to the family from other relations), their parent, grandchildren, and often temporary residents (usually relatives). However, on the compound one can find several related "households" living together, but in separate economies. Most household in St. Catherine are headed by both a male and female (63 %); followed by single male (23 %) and single female households (13 %). The mean age of persons interviewed is 41 years (median is 38) ranging from 22 to 70 years. In terms of education, most persons attended a primary or all-age school (see Table 4-1). In Jamaica, these school include grades one to six. Secondary or high school are grades seven to eleven (or 13). By gender, there is no significant difference in education between men and women (see Table 4-2).

Table 4-1: Education of Respondents, St. Catherine

	Women (%)	Men (%)
None	6	0
Primary/All-Age	63	62
Secondary/High School	25	31
College (including nursing & teacher)	6	8
Total Respondents (N)	16	13

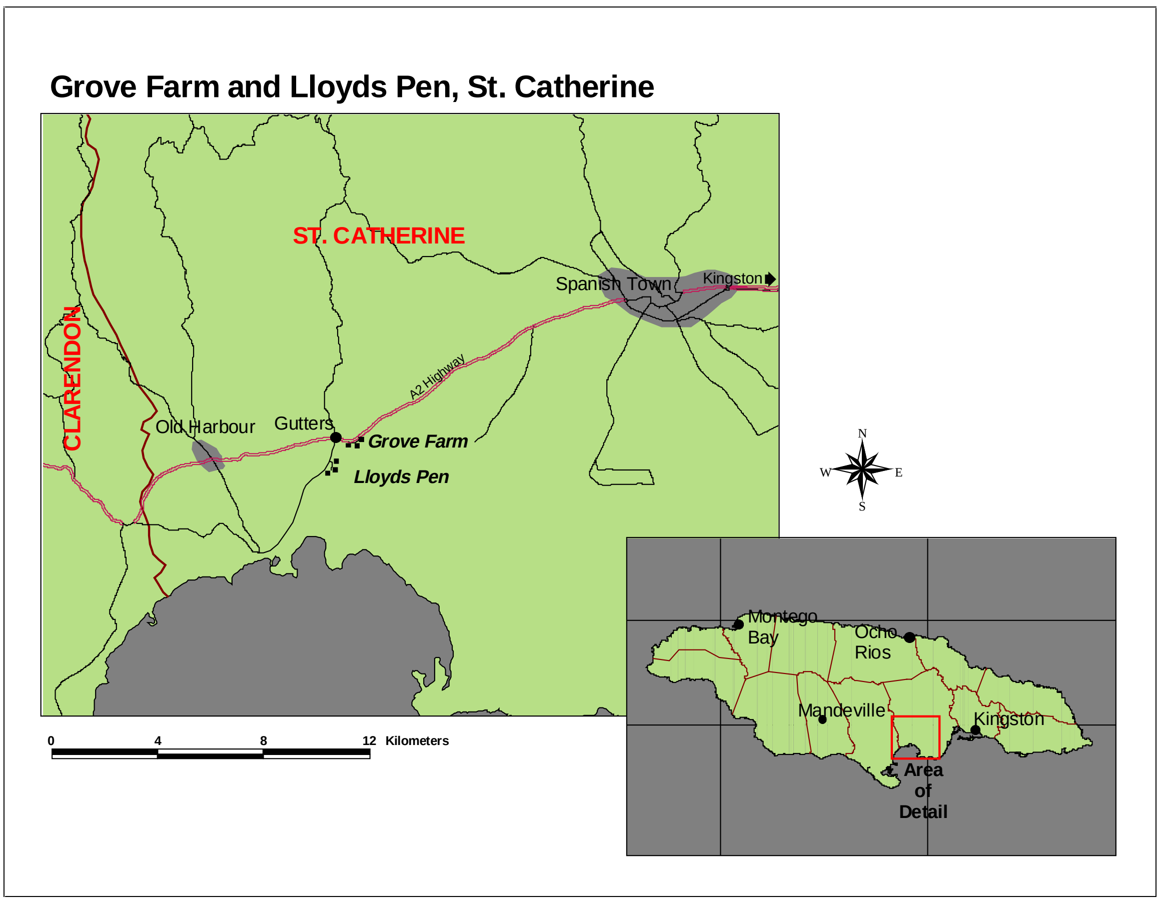
When asked about occupation, 73 % of individuals (70 % of households) said they engage in crop production. Due to the relative proximity and access to the urban centers, some people travel of Spanish Town (14 km), May Pen (20 km), or Kingston (35 km) for employment. In addition, the Jamaica Broilers chicken factory in Spring Village (two kilometers north), employs a large number of individuals in the area. Besides farming, some of the other occupations are: housewife, higgler[7], dressmaker, carpenter, shopkeeper, clerk, factory worker, mechanic, street or market vendor, laborer/days work, and taxi driver.

In order to understand local living circumstances and to make comparisons between communities, we made a record of housing conditions. In St. Catherine, homes are often quite small and constructed of simple materials,

[7] Higglers are persons, mainly women, who buy produce from farmers and sell them at public markets.

such as wood and corrugated steel. Seventy-seven % (N=30) of homes are constructed of cement and 23 % (N=9) are wood structures. The majority of people, 68 % (N=15), live in one to two rooms, 27 % (N=6) have two to three rooms, and only one household (5 %) has four to five rooms. In these communities, homes are generally clustered in a core area along roads. Homes are usually built on small parcels (less than one acre) and a few are able to sustain small kitchen gardens. Distances between homes and farm fields range from 0.25 to 2 kilometers (km).

Map 4-1: St. Catherine Research Site



(Source: Baseline Data IPM-CRSP)

In addition, a number of questions were added to gain a perspective of what households possess and constraints people face. In terms of available land (owned, rented, rent-free, etc.), nearly one-half of villagers have one acre or less. Most people have several smaller plots separately located on which crops are produced. In animal ownership (N=41), 42 % own goats, 32 % cows, 7 % pigs, and one person raises some poultry. Due to close proximity to the main transportation route (highway A2) the vast majority of households have access to electricity. In addition, most own televisions and telephones, but few own an automobile. In food preparation, 54 % use gas stoves, although 39 % use both wood and gas, especially since empty gas containers are expensive to fill. In addition, many traditional Jamaican dishes are prepared using wood burning stoves (see Table 4-2).

Agricultural Profile

In St. Catherine, 34 % of farmers are female and 66 % are male. This means that 55 % of women are involved to a lesser extent in farm production compared to 88 % of men. I found that women usually farm together with their partners, rather than cultivating separate crops. The principle crops grown in this area are okra and callaloo. Table 4-2 provides information on other important crops. Not included in the table but listed by one to two persons are citrus fruit, pak-choi, passion fruit, sugar cane, dasheen, and hot pepper. In Jamaica, tools used in agricultural production include hoes, machetes, and pitchforks. To prepare the land for cultivation, most farmers hire tractors at a significant cost.

As mentioned earlier, many farmers cite lack of water as their most serious concern. Some farmers use irrigation, though they have sporadic access to public pipes and irrigation canals. The second most important problems is pest attack on okra and callaloo, followed by the high cost of inputs, mainly pesticides and fertilizers. I learned that farmers apply more chemicals today because a large number of pests have developed resistance to overused pesticides. Many farmers express that they would like to cultivate more crops, yet drought and pest problems keep them from doing so. Others were not able to sustain themselves and stopped farming altogether.

Most produce is marketed at the farmgate via higglers. Nearly 50 % of farmers (or other household members) take their crops to sell at the Kingston Coronation market[8], the island's largest market. Most farmers say their preferred market channel would be to sell it themselves but this is not always feasible.

Questions concerning export found only 14 % (N=4) who sell or have in the past sold to an exporter. Farmers, whether or not they export, are generally aware of the requirements (e.g. no pest damage and large size). Three farmers add that the crop should have no pesticide residue. Of the 24 who do not export, 25 % (N=6) have tried but were unsuccessful either because the exporter/middleman does not frequent the community or the farmer grows too small an amount to be of interest to exporters. Seventy-five percent (N=18) have never tried to export.

As part of IPM promotion in St. Catherine, CARDI is researching callaloo. This crop is susceptible to damage from a large number of pests. Often farmers are not able to distinguish the pests, which is a necessity for proper pest management. The *Lepidoptera* (caterpillar) has received the greatest attention as it proves resistant to a number of pesticides. CARDI is training farmers to scout and identify insects and calculate damage thresholds. Ideally, pesticides will be used with more precision. Further research is concentrated on developing methods to better preserve callaloo, such as dipping it in salt solution, for export and sale at local markets (Clarke-Harris, 1998).

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[8] It is estimated that 40 % of Jamaican higglers sell their crops at Coronation market (MinAg, 1978).

Table 4-2: St. Catherine Community and Agricultural Profile: N (%)

Total N Interviewed	**Individuals** 44	**Households** 30		
Gender	**Female** 20 (46)	**Male** 24 (55)		
Education (n=29)	**None** 1 (3)	**Primary & All-age** 18 (62)	**Secondary & High School** 8 (28)	**College** 2 (7)
Total Acres (n=42)	**0** 1 (2)	**0.10 – 1.0** 17 (41)	**1.25 – 5.0** 10 (24)	**5.25 –10.5** 14 (33)
Electricity (n=29Hh[9])	**Yes** 27 (93)	**No** 2 (7)		
Telephone (n=28Hh)	23 (82)	5 (18)		
Television (n=29Hh)	25 (86)	4 (14)		
Automobile (n=28Hh)	5 (18)	23 (82)		
Water Access (n=42)	**Private/public pipe & buy water (pay)** 30 (71)	**Public pipe & community tank (free)** 7 (17)	**Personal rain tank** 5 (12)	
Cooking (n=28Hh)	**Gas only** 15 (54)	**Wood only** 2 (7)	**Gas & Wood** 11 (39)	
Farming	**Yes** 32 (73)	**No** 12 (27)	**Female Farmers** 11 (34)	**Male Farmers** 21 (66)
Crops (n=32)	Okra		24 (75)	
	Callaloo		20 (63)	
	Cucumber		9 (28)	
	Mango		7 (22)	
	Sweet Pepper		6 (19)	
	Tomato		5 (16)	
	Coconut		5 (16)	
	Banana/Plantain		4 (13)	
	Pumpkin		3 (9)	
Major Problems (n=29)	Drought		21 (72)	
	Pests		18 (62)	
	Marketing		8 (28)	
	Labor (shortage, expensive)		4 (14)	
	Expensive pesticides/fertilizers		3 (10)	
Marketing Methods (n=27)	To Higgler		18 (67)	
	To Public Market		13 (48)	
	To Public from Roadside/Farmgate		4 (15)	
	To Exporter		2 (7)	
	To Factory		1 (4)	

[9] Hh = Households

General Health Profile

I asked people (N=44) if they were aware of any health problems in their community. Of 35 who responded, 82 % (N=28) believe there are no health problems, 18 % (N=6) list cold and flu, and 3 % (N=1) cancer. This response is striking and raises the question: Are illnesses really not present? A plausible explanation is that people are not accustomed to speak about their personal ailments. I usually found out about a person's health problems from other family or community members. The country-wide health profile shows that Jamaicans largely suffer from "Western" illnesses (often related to obesity) such as hypertension, diabetes, arthritis, and cancer. Diseases generally associated with tropical countries like malaria, yellow fever, dengue fever, etc. currently do not pose a major health threat (STATIN, 1997).

When asked about health care preferences (N=39), most people list private doctors as their first choice 64 % (N=25), public hospital or clinic are second 54 % (N=21), and self treatment third 21 % (N=8). In reality, people are forced by financial constraints to frequent public clinics and hospitals.

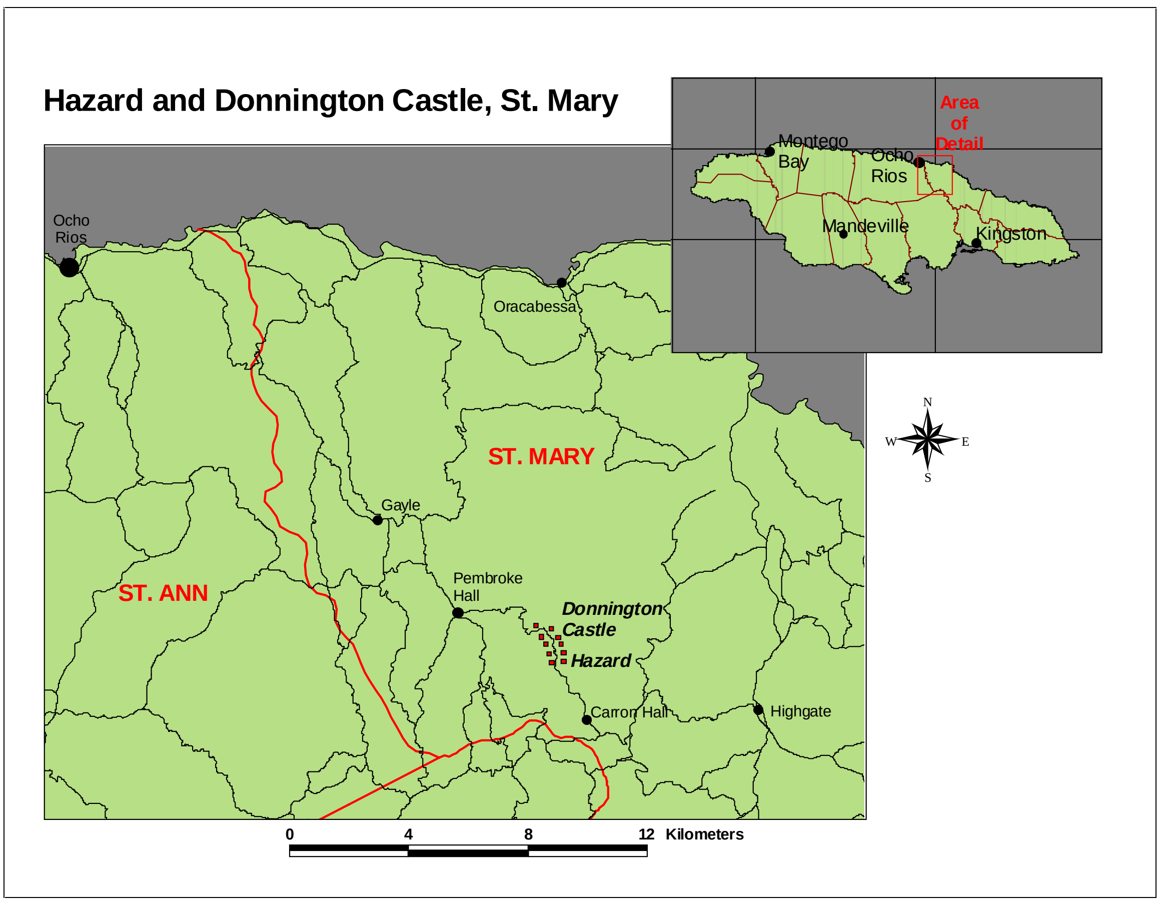
The locations where people (N=38) sought health care are Old Harbour health center or private doctors by 58 % (N=22), the Spanish Town public hospital 50 % (N=19), and the Gutters private doctor 18 % (N=7). Road conditions and availability of transportation to these places are fairly good. The distance from Lloyds Pen to Gutters (on the highway to Kingston and a main transportation area) is 1.9 km and from Grove Farm to Gutters 0.7 km. Then the distance from Gutters to Old Harbour is 5 km, to Spanish Town 13.5 km, and to downtown Kingston 34.5 km.

Hazard and Donnington Castle, St. Mary

Community Profile

Hazard and Donnington Castle Districts are located in a mountainous and densely vegetated northern section of the country. In radius, the community spans about four kilometers. Homes cluster along the road between Carron Hall and Pembroke Hall (see Map 4-2). Public transportation, such as buses or vans, passes through the area sporadically. Instead, most people travel by taxi to the nearest town. Poorly maintained roads pose a major obstacle in this rural area, especially during periods of heavy rainfall.

Map 4-2: St. Mary Research Site



(Source: Baseline Data IPM-CRSP)

Forty-seven individuals in 33 households were surveyed. The male-female breakdown is 49 % and 51 %, respectively. Of 33 households, 61 % are headed by a male and a female, 24 % by a male alone, and 15 % by a single female. The mean age of the persons interviewed is 51 years (Median = 54) with a range of 23 to 79 years. Interviewees in St. Mary were older than in the other communities which is perhaps a reflection of the area's more rural character. In addition, several single male household heads were over the age of 70 and generally living alone because their partners left them many years ago. Most people have a primary or all-age school education (Table 4-4). Broken down by gender, women do seem to have slightly higher levels of education (Table 4-3). Farming is listed as an occupation by 100 % of persons interviewed. Secondary occupations include: housewife, dressmaker, teacher, shopkeeper, higgler, carpenter, and preacher.

Table 4-3: Education of Respondents, St. Mary

	Women (%)	Men (%)
None	0	13
Primary/All-Age	70	81
Secondary/High School	25	6
College (including nursing & teacher)	5	0
Total Respondents (N)	20	16

Regarding housing conditions, 74 % (N=31) live in modest cement homes and 26 % (N=11) in wood houses. In housing size, 34 % (N=14) are one to two rooms, 49 % (N=20) two to three rooms, and 17 % (N=7) four to five rooms. On average, each household has 4.7 members. In addition, 34 % (N=16) of persons own cows, 21 % (N=10) own goats, and 11 % (N=5) own poultry.

The majority of people rent, own, lease, or hold rent-free between 1.25 to 5 acres of land. One-quarter of the households are located at a distance from the power line and do not have access to electricity. Only one home owns a telephone, 50 % have televisions, and 19 % own automobiles. Relatively frequent rainfall, totaling about 78 inches annually, supplies water (STATIN, 1997). Most can take advantage of piped water while fewer collect water from a natural spring (see Table 4-4).

Agricultural Profile

People stated that their farm fields are located anywhere between 0.3 to 3 km from their home; but some have adjacent fields. In St. Mary, we found a large variety of crops cultivated in hillside agriculture with slopes between 45 to 60 % (STATIN, 1997). Very few households grow fewer than two crops. The major crops include: tomato, hot pepper, yam, banana, sugar cane, etc. (see Table 4-4). Less than 10 % of the farmers grow carrots, sweet potato, corn, dasheen, citrus fruit, bread fruit, callaloo, and cassava. Crop irrigation is not available for most farmers.

Lack of marketing channels is listed as the major constraint by three-quarters of farmers. Farmers complain that few higglers come through the area to buy crops. In the past, farmers used government subsidized transportation for the export market bound crops. Now, they sell nearly all crops on domestic markets via higglers, or a household member takes it to a public market in Linstead or Kingston. A few sell their coffee or cocoa to a nearby factory. Limited transportation is the major constraint on marketing. Other problems listed are pests, high cost of pesticides and fertilizers, hired labor shortage and expense, and inadequate rainfall in the recent months.

Of 45 respondents, only 16 % (N=7) sell or have in the past sold to an exporter. Of the 38 farmers who have not exported, 53 % (N=20) have tried but were unsuccessful because either the exporter/middleman does not come through the area or the farmers grows too small of an amount to be of interest; and 47 % (N=18) have never tried. In order to meet export requirements, all 24 respondents cite the need for the crop to be of best quality with no pest damage, 21 % (N=9) say it has to be the largest, and one says it should have no pesticide residue.

In St. Mary, I found a nearly equal number of women and men who engage in farming. Women say they participate in the different aspects of crop production. They plant, spray pesticides, harvest, and market crops. Most women farm together with their male partners or other male household members. However, some women cultivate crops or raise livestock on their own. Decision making on these activities are generally made independently from their partners and form the basis or separate economies.

In St. Mary, CARDI's IPM research focuses on hot pepper crops (mainly Scotch Bonnet). The goal is to train farmers to identify mites as well as aphids which transmit viruses, a connection which may be difficult to make. Farmers learn about exclusion practices through on-farm experiments. Here a mesh screen is draped over seedlings to protect them from pests and build healthy plants (Martin, 1998). However, the cost of purchasing this synthetic screen may be an obstacle for farmers.

Table 4-4: St. Mary Community and Agricultural Profile: N (%)

Total N Interviewed	**Individuals** 47	**Households** 33			
Gender	**Female** 24 (51)	**Male** 23 (49)			
Education (n=36)	**None** 2 (6)	**Primary & All-age** 27 (75)	**Secondary & High School** 6 (17)	**College** 1 (3)	
Total Acres (n=43)	**0.25 – 1.0** 6 (14)	**1.25 – 5.0** 25 (58)	**5.25 – 9.5** 5 (12)	**10.0 –15.0** 4 (9)	**18.0 – 40.0** 3 (7)
Electricity (n=32Hh)	**Yes** 24 (75)	**No** 8 (25)			
Telephone (n=32Hh)	1 (3)	31 (97)			
Television (n=32Hh)	16 (50)	16 (50)			
Automobile (n=32Hh)	6 (19)	26 (82)			
Water Access (n=46)	**Public pipe (free)** 41 (89)	**Natural spring** 15 (33)	**Personal rain tank** 5 (12)	**Private pipe (pay)** 2 (4)	
Cooking (n=30Hh)	**Gas only** 8 (27)	**Wood only** 10 (33)	**Gas & Wood** 11 (37)		
Farming	**Yes** 47 (100)	**No** 0	**Female Farmers** 24 (51)	**Male Farmers** 23 (49)	
Crops (n=47)	Tomato		23 (49)		
	Hot pepper		22 (47)		
	Yam		16 (34)		
	Banana		15 (32)		
	Plantain		13 (28)		
	Sugar cane		12 (26)		
	Coffee		11 (23)		
	Cucumber		10 (21)		
	Cocoa		10 (21)		
	Pumpkin		9 (19)		
	String beans		9 (19)		
	Coconut		8 (17)		
	Cabbage		7 (15)		
Major Problems (n=43)	Marketing		33 (77)		
	Pests		21 (49)		
	Expensive pesticides/fertilizers		10 (23)		
	Labor (shortage, expensive)		9 (21)		
	Drought		8 (19)		
Marketing Methods (n=46)	To Higgler		39 (85)		
	To Public Market		13 (28)		
	To Factory		4 (9)		
	To Public at Farmgate/from Vehicle		3 (7)		
	To Exporter		2 (4)		

General Health Profile

In St. Mary, interviewees exhibit a greater variety of health conditions than in the St. Catherine; however, one-half (N=22) claim there are no health problems in the area. In this rural community people seemed more at ease and open to discuss health conditions. The following health problems are identified by 44 respondents:

Cold and flu 23 % (N=10)
High blood pressure 23 % (N=10)
Diabetes 16 % (N=7)
Arthritis 11 % (N=5)
Stomach problems 5 % (N=2)
Cancer 5 % (N=2)
Chickenpox, measles, stroke, obesity 2 % (N=1) each.

These ailments form major causes of morbidity and mortality according to the Jamaican Statistical Institute (STATIN, 1997).

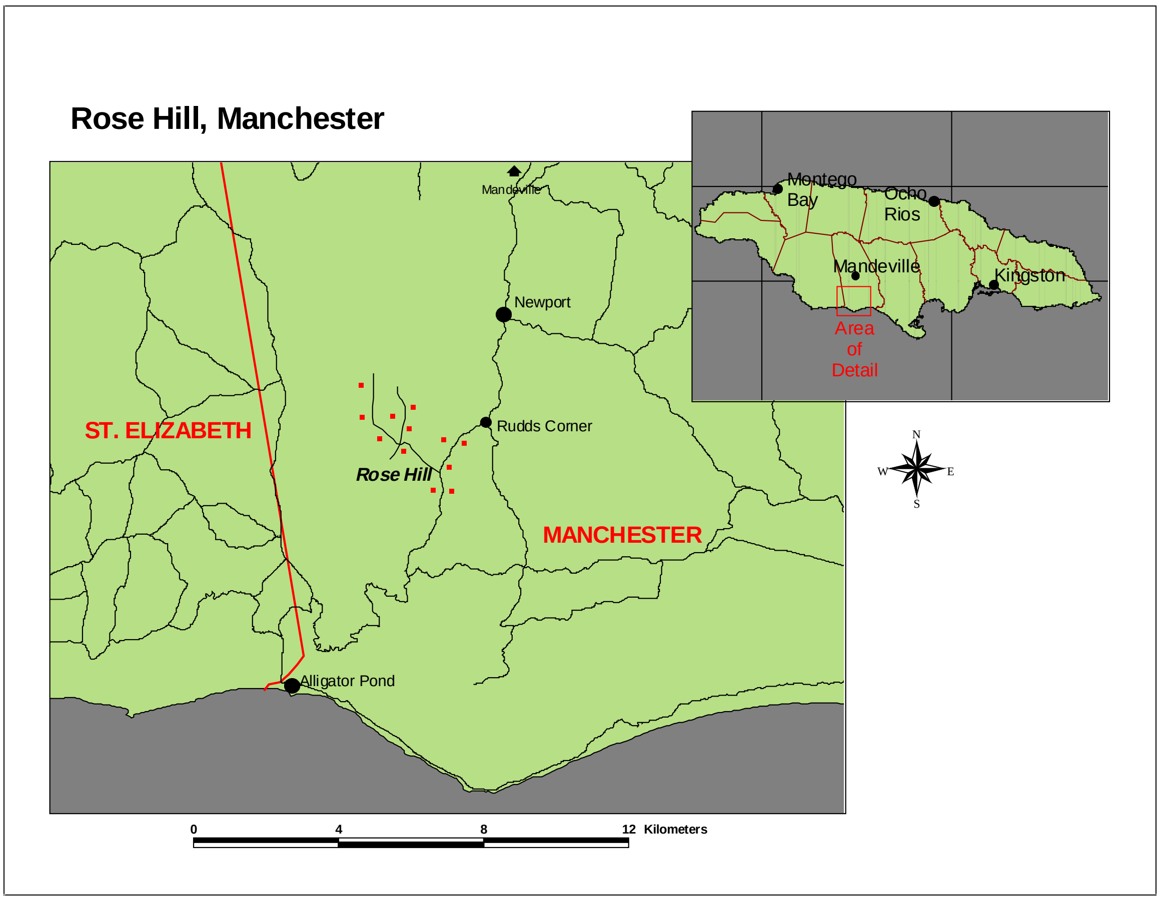
When asked about health care choices (N=45), 76 % (N=34) prefer a public hospital or clinic, 33 % (N=15) a private doctor, and 9 % (N=4) rely on self treatment. In conversation I found that people actually prefer to consult a private doctor; however, the high cost makes this impossible for many. Places where people (N=44) sought medical attention include: 59 % (N=26) list Gayle health center or private doctor. Gayle is about 11 km from Hazard, however, due to bad road conditions it takes about 35 minutes to reach there. Second, 30 % (N=13), of people list Highgate health center or private doctor. The distance from Hazard to Highgate is about 14 km and travel requires at least 45 minutes. Other hospitals listed are: Port Maria hospital by 11 % (N=5), about 20 km away; Annotto Bay hospital by 7 % (N=3), about 27 km away; and St. Ann's Bay hospital by 7 % (N=3), about 40 km in distance.

Rose Hill, Manchester

Community Profile

Rose Hill includes 123 homes and encompasses a radius of six kilometers. It is the largest of the three communities and located on the main road between Mandeville and Alligator Pond (see Map 4-3). The area receives about 50 to 70 inches of rainfall per annum, and is semi-arid (STATIN, 1997). Rolling hills and striking red-colored soils make the area very attractive. The landscape is marked by scattered homes, sweet potato fields, and grazing land for cattle. Many people have their farm fields nearby (0.2 to 2 km) or adjacent to the home.

Map 4-3: Manchester Research Site



(Source: Baseline Data IPM-CRSP)

In this community we interviewed a total of 49 people in 32 households, of which 51 % are female and 49 % male. The mean household member size is 5.9. Of the 33 households, 64 % have both a male and female household head, 21 % only a male household head, and 15 % are headed by a female. The mean age of persons interviewed is 47 years (median is 43), ranging from 23 to 91 years. The majority of persons have a primary/all-age school education (Table 4-6). Table 4-5 displays that by gender, levels of education are similar, however, women are more likely to hold a college or professional degree. Of the 10 % who hold a secondary occupation or do not engage in farming, their jobs include: housewife, teacher, carpenter, shopkeeper, construction, nurse, domestic help, tractor diver, and hairdresser.

Table 4-5: Education of Respondents, Manchester

	Women (%)	**Men (%)**
None	4	9
Primary/All-Age	61	61
Secondary/High School	13	26
College (including nursing & teacher)	22	4
Total Respondents (N)	23	23

Thirty-six percent of the people possess (own, rent, lease, rent-free, etc.) 1.25 to 5 acres of land and one-third have 5.25 to 10 acres. Much of the land in this area is owned by the bauxite company *Alpart* (Aluminum Partners of Jamaica), from which the majority of farmers lease land for $JA[10] 100 per acre per annum. This enables farmers to work larger parcels of land. People gain access to water primarily by catching and storing water in rain tanks, although precipitation has been low in recent months (Table 4-6).

For housing material, 95 % (N=42) of the homes are constructed of cement and 5 % (N=2) of wood. In size, homes (R=47) vary from 30 % with one to two rooms, 40 % with two to three rooms, and 32 % with four to five rooms. The majority of households have electricity, telephones, and televisions; and nearly one-third own an automobile. In animal ownership, of 49 persons 39 %

(N=19) own cows, 25 % (N=12) goats, 16 % (N=8) chickens, 4 % (N=2) pigs; and one farmer owns a donkey.

Agricultural Profile

Farmers report that *Alpart* is expected to move into the area within the next ten years to mine bauxite. As a condition of leasing land, farmers are discouraged to grow 'permanent' crops such as tree crops or bananas, although local conditions may be suitable. There is an air of uncertainty for the farmers of Rose Hill, as they await relocation by *Alpart*. Most farmers believe that this may improve their lives, but also say farming will most likely be discontinued.

In Rose Hill, nearly every farmer grows sweet potato. This root crop grows well on bauxitic soils with relatively low inputs. Sweet pepper and tomato are of second and third importance (see Table 4-3 for additional crops). Other crops listed by less than 5 % include turnips, Irish potato, gungu, watermelon, pumpkin, avocado, corn, peas, callaloo, string beans, and hot pepper. The majority of farmers sell their highest quality sweet potatoes to exporters. The lesser quality and vegetable crops are sold on local market, mainly via higglers or by a household member. When asked about export (N=42), 86 % sell or have in the past sold their crops to an exporter. Of the six farmers who have not exported, one tried but was unsuccessful because he had no access to an exporter/middleman; the other five farmers have never attempted export. In order to meet export requirements, all 38 people cite the need for the crop to look its best with no pest damage and twelve say it has to be large in size.

Pest problems are listed as the greatest problem by farmers. Fertilizers and herbicides are often the only agrochemicals applied to sweet potato fields. This is due to the nature of the pests, such as the sweet potato weevil and soil grub, which spend a very short time on the surface and are difficult to control with pesticides when inside the root. In this area, CARDI (and RADA) promotes sweet potato weevil traps that function by emitting the female sex pheromone thereby attracting the male weevils which then drown in water. Traps are easily

[10] The current exchange rate is US$ 1 = JA$ 35.

constructed from plastic bottles, but sex pheromones are imported from the United States and cost $JA 500 for five (enough for one season). Most farmers have heard of the traps but few can remember which agency did the training or where they can purchase them. Only one or two farmers actually use them in their fields. Another problem CARDI seeks to remedy is the inability of some farmers to link the adult and the immature weevils as the same insect (Lawrence, 1998). Other agricultural constraints listed are drought conditions and marketing problems. People often use additional land for cattle grazing rather than crop production mainly due to production constraints. Some farmers suggest they would cultivate more crops if conditions permitted.

Many women consider themselves farmers, 84 % compared to 96 % of men. Women are an integral part of on-farm activities. They do everything from planting, spraying pesticides, and harvesting, to marketing the crops. In general, women cultivate crops together with their partner although some grow their own crops separately.

Table 4-6: Manchester Community and Agricultural Profile: N (%)

Total N Interviewed	**Individuals** 49	**Households** 32			
Gender	**Female** 25 (51)	**Male** 24 (49)			
Education (n=46)	**None** 3 (7)	**Primary & All-age** 28 (61)	**Secondary & High School** 9 (20)	**College** 6 (13)	
Total Acres (n=44)	**0.25 – 1.0** 7 (16)	**1.25 – 5.0** 16 (36)	**5.25 – 10.0** 13 (30)	**10.5 –20.0** 4 (9)	**20.5 – 89.0** 4 (9)
Electricity (n=31Hh)	**Yes** 25 (81)	**No** 6 (19)			
Telephone (n=31Hh)	19 (58)	13 (42)			
Television (n=30Hh)	23 (77)	7 (23)			
Automobile (n=31Hh)	8 (26)	23 (74)			
Water Access (n=46)	**Personal rain tank** 38 (78)	**Community tank** 7 (14)	**Neighbor's tank** 7 (14)	**Buy it** 3 (6)	
Cooking (n=31Hh)	**Gas only** 11 (36)	**Wood only** 6 (19)	**Gas & Wood** 14 (45)		
Farming	**Yes** 44 (90)	**No** 5 (10)	**Female Farmers** 21 (48)	**Male Farmers** 23 (52)	
Crops (n=44)	Sweet potato		42 (95)		
	Sweet pepper		23 (52)		
	Tomato		21 (48)		
	Carrot		12 (27)		
	Cabbage		10 (23)		
	Coffee		4 (9)		
	Yam		3 (7)		
Major Problems (n=43)	Pests		27 (63)		
	Drought		18 (42)		
	Marketing		14 (33)		
Marketing Methods (n=43)	To Exporter		36 (84)		
	To Higgler		35 (81)		
	To Public Market		6 (14)		

General Health Profile

Perceived community health problems include (N=47 respondents):

High blood pressure15 % (N=7)
Cold and flu 13 % (N=6)
Arthritis 6 % (N=3)
Diabetes, stomach problems, cancer 4 % (N=2) each
Asthma 2 % (N=1).

Sixty-eight percent (N=32) said no problems are presented.

When asked about preferred health care choices (N=47), the public hospital or clinic is listed first by 64 % (N=30), followed by private doctors by 58 % (N=27). Places where health care has been sought are the public hospital and private doctors in Mandeville by 87 % (N=40) of people and or the Newport health clinic by 15 % (N=7). In distance, Mandeville is 16 km from Rose Hill and Newport five km away. Road conditions and transportation availability are fairly good in this area.

B. Survey Findings

This section presents the results of the survey concerning pesticides, taken from the *IPM CRSP Socioeconomic Household Survey*. It also describes the findings from the *Additional Questions for Farmers Concerning Pesticides* questionnaire. Here there is a separate discussion for each of the communities, divided into the role of pesticides; knowledge, attitude, and practice (KAP) of pesticide use; perception of pesticide hazard; pesticide poisoning; and gender and decision making.

St. Catherine

- **Role of Pesticides:**

Of the 32 individuals who farm in St. Catherine, 94 % (N=30) regularly apply pesticides. In 21 farming households, pesticides are used by 91 % (N=19). Pesticides are usually applied using backpack sprayers (92 %), mist blowers (15 %), and hand pumps (8 %). Table 4-7 displays the wide variety of pesticides used by farmers in St. Catherine most of which are in the moderate hazard class; including Gramaxone, they total 21. The most widely used pesticides are Lannate, Basudin, and Malathion. All persons, regardless of whether or not they engaged in farming, were asked about herbicide usage. Twelve persons (27 %) out of 44 total respondents use Gramaxone on farm fields or in yards to control weeds. Lannate and Basudin are two of the most toxic insecticides available in Jamaica and pose a potential health hazard in this community.

Table 4-7: Pesticides Used in St. Catherine

Pesticide (Trade Name)	N	Percent	Hazard class[11]
Lannate	15	58	I
Basudin	14	54	II
Malathion	14	54	III
Champion	7	27	II
Sevin	3	12	II
Belmark	2	8	II
Karate	2	8	II
Kocide	2	8	II
Dithane	2	8	III
Dirtman	2	8	?
Decis	2	8	II
Topsin	2	8	III
Selecron	1	4	II
Agree	1	4	IV
Pegasus	1	4	II
Dursban	1	4	II
Dimethoate	1	4	II
Tempo	1	4	II
Dieldrin	1	4	I
Fusilade	1	4	IV
Total Respondents	26		

From conversation with farmers and field observations, I found that pesticides are an integral part of crop production in St. Catherine. Farmers say they cannot imagine farming without them. This is clear from the fact that only one of 13 persons knows of any alternative pest control methods, such as crop rotation. Asked about their perception of the role of pesticides in crop production, nearly 70 % surveyed believe that the quality and quantity of the crop increases with pesticide use, whereas a third says there is no difference. One-half state that the price they receive at the market increases if pesticides are used, whereas the other half say it does not change (see Table 4-8). In addition, four farmers believe that the application of pesticides will enable them to export their crops.

Most farmers feel that they use more pesticides today than they did ten years ago. The explanations provided is because pesticides are less effective

[11] Hazard class: I = High, II = Moderate, III = Slight, IV = Non-toxic (WHO, 1990).

and there is a greater pest problem today. Few farmers say the same amount or less is used today (Table 4-8). In addition, many also note that pesticides are much more expensive today. CARDI reports that some pests in the area have developed resistance to pesticides. Farmers, in coping with heavy crop losses, now apply more pesticides.

Table 4-8: Pesticide Impact & Change in Use, St. Catherine

%	Increased	Same	Decreased	N
Crop Quality & Quantity	69	31	0	26
Crop Price	50	50	0	26
Amount Used Today	77	12	6	17

- **KAP – Pesticide Use:**

Of the 20 persons who farm and spray[12] pesticides, 35 % (N=7) apply pesticides *when* pests or damage are detected. The majority of 65 % (N=13), however, spray on a routine basis every four to eight days. In IPM, prophylactic treatment is not encouraged. Farmers, for one, may be unnecessarily exposed to pesticides. Furthermore, pests may develop resistance.

Table 4-9 depicts how farmers decide the *type* of pesticide to use. The majority rely on their own experience. In the pest identification portion of the survey we found, however, few farmers able to correctly identify the pest, a necessary step in choosing the proper pesticide. In addition, 32 % (N=6) of farmers say they use their own judgement when deciding the *amount* of pesticide to apply, whereas 68 % (N=13) refer to the pesticide label. However, I never witnessed farmers reading labels. The reason, perhaps, is that some farmers may be functionally illiterate[13] and unable to understand the technical language on labels. Furthermore, pesticides are often purchased in smaller quantities and poured into mislabeled or unmarked containers. Even with labels available, many non-traditional export crops (e.g. callaloo) are not specified as a crop for

[12] Note that the Jamaican farmers often refer to the application of pesticides as “to spray” regardless of how they are actually applied.

which a pesticide can be used. Instead, farmers make up their own directions based on trial-and-error.

Table 4-9: How Farmers Decide on Type of Pesticide, St. Catherine

	N	Percent
Own experience	14	74
Other farmers recommended	3	16
Farmstore recommended	1	5
Learned it in school	1	5
Total Respondents	19	100

Table 4-10 shows farmers' answers to the sources of pesticide information they use. As can be seen, one-half of the farmers prefer to reference the pesticide label. A smaller number obtain advice from other farmers and the farmstore. There is no distinct difference between male and female responses. Clearly, farmers understand the various information sources available, but it is questionable whether they really take advantage of them. My findings, consistent with those of other researchers, suggest that farmers often act individually—experimenting with pesticides—rather than consulting others (Grossman, 1998; Johnson, 1972).

Table 4-10: Preferred Information Sources, St. Catherine

	Women %	Men %	Total (N)
Label recommended	15	35	13 (50%)
Other farmer recommended	8	12	5 (19%)
Farmstore recommended	8	8	4 (15 %)
Trial & Error	4	4	2 (8%)
Relative recommended	0	4	1 (4%)
RADA recommended	0	4	1 (4%)
Former employer	0	4	1 (4%)
Total Respondents (N)	9	17	26

[13] In the 1994 census, the Statistical Institute found 24.3 % illiteracy among Jamaicans (30.1 % male, 19.4 % female) (STATIN, 1997).

The *Additional Pesticide Questions* survey was administered to a smaller number of individuals (N=13), of which one (8 %) is female and 12 (92 %) are male (see Table 4-11). With this small sample of women, it is difficult to make comparisons along gender lines. A large portion of questions aim at uncovering the farmer's actual practice versus knowledge of safely handling pesticides. There is variation in the number of respondents per question because people did not feel they could "accurately" answer each question. I did, however, appreciate the frankness of farmers. They often made the connection that what they practice is not synonymous with the recommended safe practice.

Under hot tropical conditions, the best time to apply pesticides are the early morning or evening hours, providing there is no rainfall. The rationale is to minimize the exposure risk due (the applicator will perspire less) and to make the wearing of protective clothing more bearable. Most farmers say they spray during these times, yet one prefers to spray in the afternoon and two say they do so at anytime of the day. Also important is the availability of well-functioning, properly maintained application equipment. Fifty-five percent of the farmers say they regularly have problems with their equipment. It was not unusual for a farmer to describe how a pesticide has damaged their skin, especially through leakage of faulty equipment onto their back.

Perhaps most important, all of interviewees spray pesticide "cocktails." Farmers mix together pesticides, often an insecticide with a fungicide, because they believe this will improve the quality of the crops, improve efficacy of the pesticide, and kill immature pests. But, the mixing of pesticides causes unpredictable chemical reactions that may render a less effective or even a more toxic compound. In doing so, the use of a pesticide "cocktail" reflects experimentation on behalf of the farmer.

I believe that research concerning pesticide poisoning must look at the risk to the community—a public or community health approach—rather than just aggregating individual health outcomes. Therefore, I asked if other persons were nearby when farmers spray. The minority answer "no." Most often, those in close proximity are community members, farmers, and family members. On separate occasions, I observed farmers spray their fields and every time there were other members of the community nearby. In addition, I saw children play at the mixing or application site.

Personal protective equipment (PPE) is essential in protecting the applicator and consists of full body coverage (long-sleeved shirts, long trousers, gloves, boots, cap, eye protection) and respiratory protection (dust mask, handkerchief, or respirator). In St. Catherine, 31 % say they always wear protective clothing, 54 % sometimes, and 15 % never. However, when asked what is worn, 39 % say they wear "normal" clothing (T-shirt, short or long trousers, and water boots). Long-sleeved shirts and trousers and water boots are always worn by 46 %. Whereas disposable dust masks are considered the most important piece of PPE, 54 % say they actually wear them. Inhalation of pesticides is perceived as more hazardous than dermal exposure, while in truth it is the opposite. This is related to the fact that many associate pungent odors with high toxicity. Disposable dust masks are available at farm stores for only $JA10. I believe that, while better than nothing, they actually provide little respiratory protection. The material easily absorbs liquid, which increases the risk of dermal exposure. A safe pesticide practice which prescribes that clothing is taken off and laundered immediately after application, is something 46 % say they do. The other-half wear contaminated clothing until the end of the day. Under these conditions, a person can contaminate themselves (and others) during the day. It was not unusual for a person I was interviewing, to handle small children (children are more susceptible to poisoning) directly following pesticide application (same clothing, unwashed hands). During the time I spent in all the communities, I found only one person fully protected with clothing and a respirator. This older gentleman told me that he began wearing the equipment out of concern for his health, following repeated poisonings. However, the "norm" in each of the communities is to see people spray in T-shirts, shorts, and often in bare feet. Farmers are aware of the protection they should wear but find excuses (e.g. it is too time consuming or cumbersome).

While basic safety standards recommend when using pesticides not to the enter the field for 48 to 72 hours after application (depending on the pesticide), about one-half of farmers adhere to this time frame (Warburton, et al., 1995). On the other hand, several reenter their field after a few hours. With most pesticides applied to callaloo and okra, a general standard is not to harvest the crop until one week has passed. One-third of farmers harvest much too soon (within zero to two days), increasing the exposure risk.

Safe storage and disposal greatly reduce the risk of pesticide-related accidents. As an obvious precaution, pesticides should be kept in locked containers, preferably outside of the home. Yet a significant number of farmers keep their pesticides inside the house, while more store it in the farm field. During interviews, I often saw pesticides stored inside houses. In one case, the pesticide was kept in a rat poison container in the kitchen where small children were playfully attempting to open the container and show me what was inside. Safe disposal necessitates that empty pesticide containers be buried or burned. Many farm fields I visited had empty pesticide containers strewn about in a haphazard manner; a practice reported by three-quarters of farmers. This practice increase the probability of accidental exposures of children and animals. In addition, empty bottles are often reused as storage containers for other products.

Further, I asked farmers whether they occasionally mix/dilute more pesticides than they actually need for crop treatment and three-quarters say they "sometimes" do. Most will then use it up or save it for next time. These practices are considered hazardous since crops may be over-treated and pre-mixed pesticides have a short shelf-life. It would be safer if farmers attempted greater accuracy in measurement or gave the unused portions to another farmer.

Finally, farmers were asked if they know of anything that should not be done while spraying. All respond they should not eat, while others say not to drink or smoke during this time. Examination of these survey results indicates that many farmers engage in pesticide practices that render them more susceptible to exposure and poisoning. From follow-up questions and personal conversation I learned that most farmers have some understanding of safe use and handling but often do not practice them.

Table 4-11: Pesticide Knowledge, Attitude and Practice, St. Catherine

	Women (N=1)		Men (N=13)		Total	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Application Time						
Morning	1	8	8	62	9	69
Anytime	0		2	15	2	15
Evening	0		2	15	2	15
Afternoon	0		1	8	1	8
Equipment Problems (N=11)						
Yes	0		6	55	6	55
No	0		5	46	5	46
Leaks	0		3	27	3	27
Mix Different Chemicals						
Yes	1	8	12	92	13	100
Others Nearby						
Yes	1	8	10	77	11	85
Community members	1	8	5	39	6	46
Farmers	0		4	31	4	31
Family members	0		3	23	3	23
No	0		2	15	2	15
How Often Is PPE Worn						
Sometimes	0		7	54	7	54
Always	0		4	31	4	31
Never	1	8	1	8	2	15
What Is Worn						
Normal	1	8	4	31	5	39
Dust mask	0		7	54	7	54
Water boots	0		6	46	6	46
Long trousers	0		6	46	6	46
Long-sleeved shirt	0		6	46	6	46
Gloves	0		3	23	3	23
Overalls	0		3	23	3	23
Eye protection	0		3	23	3	23
Cap	0		2	15	2	15
Respirator	0		1	8	1	8
Raincoat	0		1	8	1	8
Most Important Piece of PPE (N=9)						
Dust mask	1	11	7	78	8	89
Overalls	0		1	11	1	11

Table 4-11 continued

What Is Done With Clothing						
Take off at end of day	0		7	54	7	54
Take off immediately	1	8	5	39	6	46
Reentry Time After Spray						
Following day	0		7	54	7	54
Few hours later	0		3	23	3	23
Immediately	1	8	1	8	2	15
2-3 days later	0		1	8	1	8
Harvest Time After Spray						
Following week	0		7	54	7	54
After 1-2 days	0		3	23	3	23
Depends on pesticide	0		2	15	2	15
Within the same day	1	8	0		1	8
Storage (N=12)						
In the field	0		5	42	5	42
In the house	1	8	2	17	3	25
In the shed	0		3	25	3	25
In the cellar	0		1	8	1	8
Disposal (N=8)						
Throw into field	1	13	5	63	6	75
Bury in the field	0		1	13	1	13
Throw into garbage	0		1	13	1	13
Ever Mix Too Much (N=12)						
Sometimes	0		9	75	9	75
Never	0		3	25	3	25
What Is Done With Leftover (N=10)						
Use it up	0		6	60	6	60
Save for next time	0		6	60	6	60
Throw it away	0		1	10	1	10
Should Not Do While Spraying (N=9)						
Eat	0		9	100	9	100
Drink	0		7	78	7	78
Smoke	0		7	78	7	78

- **Perception of Pesticide Hazard:**

The following questions are to gain a better understanding of farmers' perceptions of the health hazard pesticides pose to them and the community. In St. Catherine, 26 % (N=7) of farmers believe pesticides are a community health problem. Through conversation, I found that people believe pesticide poisoning is commonplace in the community; however, it is largely seen as part of the occupational hazard of farming. Some people explained to me that if one does not feel sick, something may be wrong with the pesticide or they have not sprayed enough.

Nearly all farmers believe certain pesticides are too dangerous to use. Lannate is listed by fourteen farmers as too dangerous yet it is the most widely used pesticide in the community. This chemical is considered highly toxic. In the United States, its restricted use status allows only licensed professionals to apply it. Currently, the Jamaican Pesticide Control Authority is reviewing the option on discontinuing registration due to its high toxicity. An additional chemical listed by two people as dangerous is the long-banned organochlorine Dieldrin. In a follow-up response the farmers profess this chemical is still available for sale in Jamaica, raising the question how a world-wide banned chemicals reach the country. Other dangerous pesticides named are Basudin, Champion, Selecron, Gramaxone. All of theses chemicals pose a health hazard especially if misused.

Table 4-12: Pesticide Hazard, St. Catherine

	Yes	**No**
Pesticide Hazard in Community (N=27)	26 % (7)	74 % (20)
Some Too Dangerous (N=30)	93 % (28)	7 % (2)
Some Safe (N=26)	62 % (16)	39 % (10)
Same to Humans (N=25)	60 % (15)	40 % (10)

Concerning the perceived safety of pesticides, 62 % believe that safe pesticides exist. Safer chemicals listed are Basudin, Karate, Agree, Malathion, Champion. Basudin should not be considered a safe pesticide because of its high toxicity. The other pesticides are relatively "safe" due to lower toxicity;

although they are still implicated in some cases of poisoning if not properly used. It is not surprising three farmers say the pesticides they apply are safe. While pesticides are seen as a hazard, and some too dangerous, many also believe that certain ones are “safe” to use. In other words, people think that the pesticide they use is “safe” while the others are “dangerous.”

One question, “Do all pesticides have the same effects on humans,” included in the survey was to determine if persons believe all pesticides have the same action or if they have a sense of the complexities. The majority of individuals believe all pesticides have the same, perhaps harmful, effect on humans (see Table 4-12). This measure does not indicate if people really understand the complexities and relationships.

- **Pesticide Poisoning:**

To determine the incidence of symptomatic pesticide poisoning cases, each farmer was asked: “Have you ever felt different during or after applying a pesticide or being near an application site?” More than half, 56 % (N=18), answer “yes” and 44 % (N=14) “no.” Table 4-13 presents the poisoning symptoms experienced. Most common ailments are feeling dizzy and weak, headache, and feeling unwell. These symptoms are usually associated with mild to moderate organophosphate or carbamate poisoning (see pg. 11/12). Other symptoms are unconsciousness and burning skin which point to more severe poisoning and dermal exposure. Sinus and respiratory problems may be a response to chronic organophosphate or carbamate poisoning. The pesticides involved in these incidences are Lannate (N=10), and Basudin, and Champion (N=1 each). The implication of Lannate and Basudin is predictable since they are the most toxic. In fact, other studies of poisoning cases in Central American countries found that Lannate is in the top five list of pesticides responsible for poisoning (Wesseling, et al., 1997). Lannate also causes severe skin and eye irritation. Basudin is problematic because of its extremely low inhalation LD_{50}. Although poisonings are often misdiagnosed by health care providers, people apparently understand the connection between pesticide exposure and feeling ill.

The wide variety of categories of acute or chronic poisoning symptoms support this point.

Of those who feel they have been poisoned, 28 % (N=5) are women and 72 % (N=13) are men. This means that 46 % of women who farm have been poisoned compared to 62 % of men. I found that most people were poisoned during pesticide application; one woman was poisoned while being nearby a field that was being treated with pesticides and another while working in a farm supply store.

Six of the farmers poisoned say they sought medical attention. They chose the Spanish Town public hospital, Old Harbour health centre, and the private doctor in Gutters Town. A the Spanish Town hospital one person was given an intravenous drug and three received tablets from the private doctor and at the health center. The low rate of treatment conforms with findings in other developing countries. A plausible explanation is that people say they are "accustomed" to feeling unwell when they handle pesticides and do not bother to seek treatment. In fact, some farmers tell me that one "can get used to poisons" with frequent use. In several cases, the farmers conveyed they are often "knocked out" or "licked[14]" by the pesticide but they did not see a doctor. The cost of medical treatment is a further obstacle.

Table 4-13: Pesticide Poisoning Symptoms, St. Catherine

	N	Percent
Dizzy and Weak	16	94
Headache	7	41
Felt Unwell	6	35
Unconsciousness	5	29
Burning Skin	5	29
Nausea	3	18
Burning Eyes	2	12
Itching	2	12
Vomiting	2	12
Sinus Problem	2	12
Respiratory Problem	2	12
Excessive Sweating	1	6
Total Respondents	17	

To understand the general prevalence of pesticide poisoning in the community, I asked if the villager knows others in the community poisoned by pesticides. Over two-thirds, 58 % (N=19), answer “yes.” They cite other relatives, farmers, and community members as poisoning victims. Again, the pesticide Lannate is most frequently associated with poisoning. Several farmers note that pesticide poisoning is commonplace, affecting a large number of people in and outside of the community. However, none of the farmers have heard of any chronic illnesses attributable to pesticide poisoning.

In order to discover if home remedies are used to prevent or treat poisoning I asked farmers: “Is there anything you can do before or after you spray to prevent poisoning or make you feel better?” Drinking bissy, a tea made from ground Kola nut, is the most frequent action taken (Table 4-14). Others may “drink something” before or after spraying, such as milk, water, lime water, or something sweet. It should be noted that in cases of pyrethroid poisoning the consumption of milk worsens the condition. Approximately one-quarter believe that spraying on an empty stomach is hazardous. To counter this effect, they eat a meal or bread before spraying. Two male farmers also say the consumption of soil or clay has medicinal effects. This practice, known as geophagy, is widely practiced in many developing countries (and among African-Americans in the U.S.). The literature suggests women largely consume clays for nutritional purposes, especially during pregnancy (Abrahams and Parsons, 1996). Surprisingly only men listed the practice in this survey. In Jamaica, two studies conducted by Robinson et al. (1990) and Wong et al. (1992) found the wide-spread practice of geophagy mostly by children. It is clear that people have adopted certain eating and drinking habits to mediate pesticide poisoning symptoms.

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[14] Meaning unconscious.

Table 4-14: Home Remedies, St. Catherine

	N	Percent
Bissy	9	43
Drink something	6	29
Eat something	5	24
Eat soil	2	10
Fever grass tea	1	5
Rubbing alcohol	1	5
Nothing	2	10
Total Respondents	21	

- **Gender and Decision Making:**

Of the 30 pesticide applicators, 37 % are female and 63 % male. This corresponds with the fact that less women farm in this community as related to the proximity to urban centers and the ability to seek employment there. Farmers were asked three questions concerning the role of gender in pesticide decision-making. Such queries are important for IPM promotion and safe pesticide practice campaign because the allow organizations to more effectively target their efforts. Two of the questions were "Who decides that a pesticide should be used in the household" and "Who chooses the type of chemical." For both questions the vast majority of farmers answer the male household head decides while three people say both the male and female household heads decide. Along gender lines, all of the 18 males respond they alone decide, whereas women say the partner decides(Table 4-15).

The other question was, "Who actually purchases the pesticide." Three-quarters say the male household head buys them followed by both household heads. All males answer they buy it alone, while one says that both household heads do this together. In contrast, women respond their partner, both, or another male family member makes the pesticide purchase. In summary, the male household head was named most frequently as the decision maker when it comes to pesticides. Along gender lines, men always claim they alone decide (or buy), while some women say they both share the task. This answer suggests that men are the sole decision makers although further follow-up and analysis is necessary to make definite statements. It is interesting that those women who spray pesticides themselves also list their male partner as the decision maker. This would mean that they use pesticides but do not choose or buy them which is problematic if they wish to, for example, use a less toxic one or adopt IPM.

Table 4-15: Decision Making, St. Catherine

	Women say	Men say	Total
Who decides on and chooses the pesticide?			
Female HH[15]	0	0	0
Male HH	5	18	85% (23)
Both HH	3	0	11% (3)
Other Male	1	0	4% (1)
Who buys the pesticide?			
Female HH	0	0	0
Male HH	3	17	74 % (20)
Both HH	5	1	22 % (6)
Other Male	1	0	4% (1)

[15] HH= Household head

St. Mary

- **Role of Pesticides:**

In St. Mary pesticides are used by 92 % (N=43 of 47) of individuals and 91 % (N=30 of 33) of household. Pesticides are applied using a backpack sprayer (87 %) or handpump (13 %). One woman insists that many farmers also apply pesticides manually especially when they are unable to afford or borrow the equipment. She says the pesticide, liquid or dust, is placed in a bucket and then sprinkled by hand over the crop; a highly hazardous practice. Farmers identify 12 pesticides (including Gramaxone) (Table 4-16). The fungicide Dithane and the insecticide Sevin are the most important pesticides for farmers. Over half of the villagers use the herbicide Gramaxone, a class I hazard. Most chemicals are in the moderate hazard class. Farmers emphasize the need to use pesticides on their tomato and hot pepper crops to fight mites, aphids, and associated fungal diseases. Only one respondent mentions an alternative pest control method, such as applying soil or ash to the crop.

Table 4-16: Pesticides Used in St. Mary

Pesticide (Trade Name)	N	Percent	Hazard class
Dithane	23	66	III
Sevin	21	60	II
Selecron	10	29	II
Malathion	9	26	III
Karate	8	23	II
Champion	6	17	II
Bravo	3	9	II
Dieldrin	2	6	I
Basudin	2	6	II
Belmark	1	3	II
Ridomil	1	3	III
Total Respondents	35		

When asked about the effect of pesticides, three-quarter of farmers believe it improves crop quality while the rest feel it remains the same. Similarly, 71 % think the plant produces larger quantities as well, and fewer say pesticides do not effect quantity. Furthermore, several believe they are able to charge more for pesticide treated crops. In fact, three farmers say they are able to export their crops if they use more pesticides. None of the farmers answer that crop quality, quantity, or price "would decrease" with pesticide application (see Table 4-17). These answers suggest farmers feel pesticides provide benefits and represent a necessary component of crop production.

Asked if the amount of pesticide they use has changed in the last ten years, the majority of 67 % say that much more is used today. Farmers attribute this to greater quantities of pests and less effective chemicals. Fewer say that they use the same amount or less today. Those who use less pesticides now than a decade ago claim that they are no longer able to afford them (Table 4-17).

Table 4-17: Pesticide Impact & Change in Use, St. Mary

%	Increased	Same	Decreased	N
Crop Quality	75	25	0	40
Crop Quantity	71	29	0	38
Crop Price	63	37	0	38
Amount Used Today	67	17	13	24

- **KAP – Pesticide Use:**

When asked how the farmer (N=35) decides *when* it is time to treat the crop with pesticides, 29 % (N=10) answer when pests and damage are seen and 67 % (N=24) spray on a routine basis. Of those who practice prophylactic spraying, most do so every eight to fourteen days. As in St. Catherine, most farmers spray whether or not pests are observed.

In the *amount* of pesticides to apply, 49 % (N=17) report that they use their own judgement, the same number of farmers refer to the pesticide label, and one person consults the farmstore. Correspondingly, the vast majority rely on their own experience when deciding *which pesticide* to use (see Table 4-18). Again, the farmers act individually rather than consulting others.

Table 4-18: How Farmers Decide on Type of Pesticide, St. Mary

	N	Percent
Own experience	25	71
Label	3	9
RADA recommended	3	9
Does not matter what is used	2	6
Depends on price	1	3
Other farmer recommended	1	3
Total Respondents	35	100

Table 4-19 displays the results for the answers of available and preferred information sources. Here farmers, especially female, believe the pesticide label is the most important source of information. A significant number say that the farmstore, other farmers, and agricultural extension agents (RADA) are available sources of information, but few actually list them as their preferred choice.

Table 4-19: Preferred Information Sources, St. Mary

	Women %	Men %	Total (N)
Label recommended	32	16	15 (48%)
Trial & Error	3	13	5 (16%)
RADA recommended	3	10	4 (13%)
Farmstore recommended	7	3	3 (10 %)
Other farmer recommended	3	3	2 (7%)
Jamaica Agricultural Society	0	3	1 (3%)
CARDI	0	3	1 (3%)
Total Respondents (N)	15	16	31

The results of the *Additional Pesticide Questions* are provided in Table 4-20. In St. Mary, this questionnaire was administered to a total of 21 persons. The nearly equal sample size of 48 % (N=11) female and 52 % (N=12) male allows for an examination of gender differences.

In St. Mary, most farmers spray during the cooler morning or evening hours. Yet one-quarter of farmers, mostly female, believe pesticide application can occur at anytime of the day. Equipment problems are listed by a significant number of farmers. In conclusion, people are at a greater risk of exposure because of faulty equipment. The majority of farmers also mix pesticide “cocktails” rather than spraying only one type of chemical. In addition, many say they sometimes mix too much which they then use up on the crop or save it for the next application time. The 65 % affirmative response to the presence of other persons when spraying pesticides confirms that not only the applicator but also other community members are at risk.

An investigation of personal exposure control measures reveals a surprisingly high number of individuals who confess, they never wear protective clothing. Men and women responded similarly. Only one male claims he always uses PPE. Few farmers wear a dust mask despite the fact that is considered the most important protective gear by 70 %. Most pesticide applicators do understand that they must take off their clothing immediately after application; however, a significant number, mainly women, do not launder clothing until the end of the day or they wait until the clothing appears soiled.

Following pesticide treatment, a significantly large number of individuals reenter the field within a few hours or just continue working in it. Most people are aware they should wait at least one week before harvesting the crop, but two farmers say they harvest the following day. A large percentage store pesticides in the home or the farm field rather than locked away. Similarly, people do not dispose of empty pesticide containers in a safe manner. One-third of farmers throw them into the household garbage, or into the farm field. Farmers do not display as much knowledge about what not to do while applying pesticides. In fact, several farmers say they cannot think of anything they should not do, while one-half say “eating” is inappropriate.

In summary, from the data presented and personal observations made, the farmers of St. Mary engage in a number of practices that increase their risk of exposure and subsequent poisoning. I found no significant difference between males and female in pesticide knowledge or practice.

Table 4-20: Pesticide Knowledge, Attitude and Practice, St. Mary

	Women (N=11)		Men (N=12)		Total	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Application Time						
Morning	7	30	9	39	16	70
Anytime	4	17	2	9	6	26
Evening	0		3	13	3	13
No rain	0		1	4	1	4
Equipment Problems						
No	7	30	6	26	13	57
Yes	4	17	6	26	10	44
Leaks					5	22
Mix Different Chemicals						
Yes	7	30	9	39	16	70
No	4	17	3	13	7	30
Others Nearby						
Yes	6	26	9	39	15	65
Farmers	0		6	26	6	26
Community members	4	17	1	4	5	22
Family members	2	9	2	9	4	17
No	5	22	3	13	8	35
How Often Is PPE Worn						
Never	10	44	9	39	19	83
Sometimes	1	4	2	9	3	13
Always	0		1	4	1	4
What Is Worn						
Normal	10	44	9	39	19	83
Dust mask	1	4	4	18	5	22
Long trousers	1	4	2	9	3	13
Long-sleeved shirt	1	4	2	9	3	13
Water boots	1	4	2	9	3	13
Eye protection	0		1	4	1	4
Cap	0		1	4	1	4
Gloves	0		1	4	1	4
Most Important Piece of PPE						
Dust mask	10	44	6	26	16	70
Gloves	4	17	0		4	17
Overalls	0		3	13	3	13
Nothing helps	1	4	1	4	2	9
Long-sleeved shirt	0		1	4	1	4
All help	0		1	4	1	4

Table 4-20 continued

What Is Done With Clothing						
Take off immediately	6	26	8	35	14	61
Take off at end of day	5	22	1	4	6	26
Wear until dirty	0		3	13	3	13
Reentry Time After Spray						
Immediately	7	30	3	13	10	44
Few hours later	3	13	6	26	9	39
Following day	1	4	2	9	3	13
2-3 days later	0		1	4	1	4
Harvest Time After Spray						
Following week	7	30	6	26	13	57
Depends on pesticide	3	13	2	9	5	22
Following day	1	4	1	4	2	9
After 2 weeks	0		2	9	2	9
After several months	0		1	4	1	4
Storage						
In the field	6	26	4	17	10	44
In the house	5	22	4	17	9	39
In the shed	0		3	13	3	13
In the cellar	2	9	1	4	3	13
Disposal (N=20)						
Throw into garbage	4	20	3	15	7	35
Throw into field	3	15	3	15	6	30
Bury in the field	1	5	4	20	5	25
Burn it	2	10	1	5	3	15
Throw into toilet	1	5	1	5	2	10
Ever Mix Too Much						
Sometimes	6	26	8	35	14	61
Never	5	22	3	13	8	35
Always	0		1	4	1	4
What Is Done With Leftover						
Use it up	4	17	7	30	11	49
Save for next time	3	13	2	9	5	22
Give to other farmer	1	4	2	9	3	13
Throw it away	1	4	1	4	2	9
Never mix too much	4	17	1	4	5	22
Should Not Do While Spraying						
Eat	5	22	7	30	12	52
Drink	2	9	2	9	4	17
Smoke	2	9	1	4	3	13
Talk	1	4	0		1	4
Do not know	3	13	5	22	8	35

- **Perception of Pesticide Hazard:**

In St. Mary, the minority of farmers believe that pesticides pose a health threat to their community (see Table 4-21). Some think that the problem is less apparent in Hazard and Donnington Castle than in the community of Derry (about five kilometers north) where pesticide are used more extensively on banana. The great majority perceive certain pesticides that are too dangerous, including: Gramaxone, Karate, Selecron, Malathion, Sevin, Dieldrin, and Mocap. According to the hazard classification, Gramaxone, Dieldrin, Mocap, Karate, Sevin, and Selecron are all highly to moderately hazardous pesticides and should be considered dangerous. Malathion is a slightly toxic chemical. Farmers offer a number of explanations concerning chemicals that pose a threat. They include: a) if the pesticide smells strong, b) if too much is applied, c) if children are exposed, and d) if they reach fish. As mentioned earlier, it is a common misconception that toxicity is related to odor, although pesticides with a pungent odor may agitate the respiratory system. Some people believe that they can become accustomed to “stronger” chemicals through frequent use. Medically this is impossible, instead, continuous exposure may result in chronic illness or more severe acute effects.

Concerning the safety of pesticides, chemicals such as Dithane, Sevin, and Malathion are listed as safe to use. In reality, Malathion and Dithane exhibit a lower toxicity than Sevin. In addition, some farmers respond that the pesticides *they use* and any pesticide used on vegetables are safe. These answers do not indicate how much is really understood about actual hazard. On the other hand, a significant minority say safe chemicals do not exist. Finally, examining the varying effects of pesticides, 32 % (N=11) believe that all pesticides have the same effect on humans and 69 % (N=24) disagree (see Table 4-21). This may suggest that people are aware that toxicity and hazard vary according to pesticide.

Table 4-21: Pesticide Hazard, St. Mary

	Yes	No
Pesticide Hazard in Community (N=43)	19 % (8)	81 % (35)
Some Too Dangerous (N=41)	93 % (38)	7 % (3)
Some Safe (N=41)	73 % (30)	27 % (11)
Same to Humans (N=41)	32 % (11)	69 % (24)

- **Pesticide Poisoning:**

Determining the incidence of pesticide poisoning, 41 % (N=19) of farmers say they experienced poisoning symptoms during or after pesticide exposure, and 59 % (N=27) say this has not occurred. By gender, 42 % (N=8) of the poisoning victims are women and 58 % (N=11) men. The calculated incidence is 33 % of woman and 48 % of men have been poisoned. Table 4-22 displays the associated poisoning symptoms experienced. The most frequent responses are feeling unwell, dizzy/weak, and headache; all of which are ailments usually identified with organophosphates, carbamates, or pyrethroids. The frequency of sinus problems points to possible chronic exposure effects which mimic cold symptoms (see pg. 11/12). In addition, Gramaxone poisoning may manifest itself in stomach and sinus problems. The chemicals implicated in the poisoning are Gramaxone, Selecron, Karate, Malathion, and Belmark. The herbicide Gramaxone is listed as the causative agent for most pesticide poisoning cases in developing countries (Wesseling, et al., 1997). It is a highly toxic and dangerous chemical widely available and used in Jamaica. I saw farmers and non-farmers use Gramaxone to control weeds in the yard. Selecron (organophosphate) and Karate (pyrethroid) are extensively applied insecticides with moderate toxicity.

Of the 19 poisoning victims, only five sought medical attention. These people consulted a private doctor in Gayle or Highgate or the Highgate and Gayle health centre, where skin creams and tablets were administered. One person was instructed not to use pesticides again, which the farmer indicates he is unable to comply with. Another poisoning victim had no money to seek medical treatment. Both cases may be reasons why persons in St. Mary rarely visit health care providers.

In examining the overall prevalence of poisoning, nearly half of the farmers say they know others who have been poisoned. Poisoning victims include family members, farmers, and community members. Several mentioned farmers in Derry and one recalled a suicide in which Gramaxone was involved. In addition, one farmers knows of a case in which pesticide use was implicated in cancer. One other farmer has heard of a person with chronic skin problems also related to repeated pesticide exposure. Clearly, few farmers are aware of chronic pesticide poisoning.

Table 4-22: Pesticide Poisoning Symptoms, St. Mary

	N	Percent
Felt Unwell	11	58
Dizzy and Weak	10	53
Headache	7	37
Sinus Problem	5	26
Burning Skin	2	11
Nausea	2	11
Rash	2	11
Itching	2	11
Stomach ache	2	11
Unconsciousness	1	5
Burning Eyes	1	5
Swelling	1	5
Total Victims	19	

In Table 4-23 the types of home remedies people know of and use are displayed. Here the most common answer is “no” home remedies. Bissy tea is used by fewer farmers than in St. Catherine, to mediate the negative effects of pesticides. Others say they drink milk, tea, and lime water.

Table 4-23: Home Remedies, St. Mary

	N	Percent
Nothing	24	62
Bissy	7	18
Drink something	5	13
Wash off	4	10
Eat something	3	8
Aloe vera	1	3
Sersey	1	3
Cassava	1	3
Oil	1	3
Total Respondents	39	

- **Gender and Decision Making:**

Much as a gender breakdown of farming, roughly equal numbers of men (49 %) and women (51 %) in St. Mary say they apply pesticides. To the decision making questions the following answers are provided (N=36): 17 % say that the female household head decides that pesticides should be used, compared to 53 % who say the male household head and 28 % who list both household heads. When asked about who in the household chooses the type of pesticide to be applied, the majority say the male household head does so, followed by the female household head and both household heads.

Concerning the purchase of pesticides, again the majority say the male household head is in charge. Table 4-24 provides the results and also shows how the answers vary according to the respondent's gender. It can be seen that women are much more likely to list themselves or both household heads as the decision maker (or buyer) while the majority of men say they alone decide about and buy pesticides. One can conclude that both male and females probably tend to overstate their decision-making role in the household (men more so). In fact, we do not get at who actually decides and it cannot be assumed that this is a static process.

Table 4-24: Decision Making, St. Mary

	Women say	Men say	Total
Who decides on pesticide use?			
Female HH[16]	5	1	17% (6)
Male HH	4	15	53% (19)
Both HH	8	2	28% (10)
Other Female	1	0	3% (1)
Who chooses the pesticide?			
Female HH	6	1	19% (7)
Male HH	6	15	58% (21)
Both HH	5	2	19% (7)
Other Female	1	0	3% (1)
Other Male	1	0	3% (1)
Who buys the pesticide?			
Female HH	6	1	19 % (7)
Male HH	7	14	58 % (21)
Both HH	3	3	17 % (6)
Other Female	1	0	3 % (1)
Other Male	3	0	8 % (3)

[16] HH= Household head

Manchester

- **Role of Pesticides:**

In Rose Hill, Manchester, of the 44 persons who farm, 89 % (N=39) use pesticides and 11 % (N=5) do not. Moreover, pesticides are used in 96 % of households (N=27 of 28). Backpack sprayers (76 %) are the main method of pesticide application. Followed by hand pumps (19 %), mist blowers (5 %) and manual methods (5 %). As in St. Mary, the manual application of pesticides is most hazardous. Table 4-25 shows the 16 (including Gramaxone) most prevalent pesticides farmers spray. The fungicide Dithane and the insecticides Decis and Malathion are the most frequently used. In addition, Gramaxone is used by 53 % of 49 villagers. As discussed in the agricultural profile, pesticides are mainly used on vegetable crops such as sweet pepper and tomato to control fungal and insect pests. Due to the nature of sweet potato pests, few pesticides can effectively control them. This is perhaps why more people mention alternative pest control methods such as (N=21): sweet potato weevil traps (19 %), manual removal (10 %), introduction of beneficial insects (5 %), and application of soil or ash (5 %). I found that farmers are very interested in the sweet potato sex pheromone. As mentioned earlier, few are actually using them.

Table 4-25: Pesticides Used in Manchester

Pesticide (Trade Name)	N	Percent	Hazard class
Dithane	15	50	III
Decis	11	37	II
Malathion	11	37	III
Champion	10	33	II
Karate	5	17	II
Kocide	4	13	II
Selecron	3	10	III
Ridomil	3	10	III
Bravo	2	7	II
Lannate	1	3	I
Dipel	1	3	IV
Belmark	1	3	II
Basudin	1	3	II
Mocap	1	3	I
Dieldrin	1	3	I
Total Respondents	30		

Concerning crop quality and quantity, most farmers believe they increase if pesticides are used. In addition, not quite the majority claim that the price one is able to receive for the crop will increase with pesticide use as well. Three farmers also contest they are able to export their crop if they used additional pesticides (Table 4-26).

When asked about a change in pesticide quantity used in the last ten years, most farmers say they use more today because more pests exist or pests are resistant. Several also say they use the same amount. Because of the high price of pesticides and recent drought conditions, three farmers say they use less pesticides (Table 4-26).

Table 4-26: Pesticide Impact & Change in Use, Manchester

%	Increased	Same	Decreased	N
Crop Quality & Quantity	66	34	0	35
Crop Price	46	54	0	35
Amount Used Today	46	25	13	24

- **KAP – Pesticide Use:**

When asked about pesticide practices, 39 % of the farmers say they apply them *when* they detect the pest or damage, whereas 61 % spray on a routine basis every eight to fourteen days. This is similar to the responses in the other communities. Table 4-27 portrays how farmers decide *which type* of pesticide to use. Here the majority rely on their "own experience." Furthermore, most farmers decide *how much* to spray by reading the pesticide label (80 %) or using their own judgement (12 %); one person also consults the farmstore and fellow farmers. Again, these answers suggest many farmers act individually when deciding on pesticide use and most claim they refer to the label for guidance.

Table 4-27: How Farmers Decide on Type of Pesticide, Manchester

	N	Percent
Own experience	19	76
Farmstore recommended	5	20
Other farmer recommended	2	8
Jamaican Agricultural Society	1	4
Total Respondents	25	

The frequency of answers concerning preferred and utilized sources of pesticide information is presented in Table 4-28. As with the previous decision-making and practice questions, farmers clearly prefer the pesticide label and trial and error. Female farmers list the pesticide label and farmstore most frequently compared to the label and personal experimentation for male farmers.

Table 4-28: Preferred Information Sources, Manchester

	Women %	Men %	Total (N)
Label recommended	22	26	13 (48%)
Trial & Error	4	22	7 (26%)
Farmstore recommended	11	4	4 (15%)
Other farmer recommended	0	11	3 (11 %)
Total Respondents (N)	10	17	27

Following are the results for the *Additional Pesticide Questionnaire* administered to 21 persons in Rose Hill (Table 4-29). Here we interviewed six females (29 %) and 15 males (71 %).

The majority of farmers apply pesticides during the cooler morning and evening hours. Three female farmers spray during the afternoon; this response could be related to the fact that many women are preoccupied with domestic tasks, such as cooking and childcare, during the morning and evening hours. Most farmers say community members, farmers, and family members are in close proximity to the application site when they spray. These numbers suggest that a significant portion of the community is at risk to exposure and poisoning.

Half of the farmers report equipment problems, further increasing their exposure risk. Nearly all farmers engage in mixing different pesticide “cocktails” together. Of the 58 % who say they sometimes or always mix/dilute too much pesticide, most save the mixture for the next application time. In terms of pesticide storage, nearly half of the farmers have a storage shed available where pesticides can be locked up. Yet some store them inside the house and in the farm field. Disposal occurs by burning or burying the empty container. Others haphazardly throw it into the garbage or the field.

Similarly to St. Mary, 86 % of farmers never wear protective clothing. Only one person says they are always fully protected. If the farmer happens to wear protective equipment, they usually choose a dusk mask. This item is considered the best protection. Some farmers further take off and launder their clothing immediately, whereas about half follow the more hazardous practice of wearing contaminated clothing until the end of the workday. Much as the previous answers, nearly half do not reenter the field until the following day, but many still do so immediately or after a few hours.

In summary, it is revealing that about half the farmers provide answers which fall into the more hazardous or safe behavior category which was also confirmed by field observations. No significant differences exist in the responses of men and women, although the small sample size of women does not allow us to be more conclusive.

Table 4-29: Pesticide Knowledge, Attitude and Practice, Manchester

	Women (N=6)		Men (N=15)		Total	
	N	Percent	N	Percent	N	Percent
Application Time						
Morning	4	19	14	67	18	86
Evening	2	10	3	14	5	24
Afternoon	3	14	0		3	14
Equipment Problems						
Yes	4	19	7	33	11	52
No	2	10	8	38	10	48
Leaks					2	10
Mix Different Chemicals						
Yes	6	29	14	67	20	95
No	0		1	5	1	5
Others Nearby						
Yes	4	19	10	48	14	67
Community members	2	10	5	24	7	33
Farmers	1	5	5	24	6	29
Family members	1	5	0		1	5
No	2	10	5	24	7	33
What Is Worn						
Never	6	29	12	57	18	86
Sometimes	0		2	10	2	10
Always	0		1	5	1	5
How Often Is PPE Worn						
Normal	6	29	12	57	18	86
Dust mask	0		4	19	4	19
Cap	0		3	14	3	14
Long trousers	0		3	14	3	14
Long-sleeved shirt	0		2	10	2	10
Water boots	0		2	10	2	10
Eye protection	0		2	10	2	10
Gloves	0		1	5	1	5
Most Important Piece of PPE (n=19)						
Dust mask	5	26	6	32	11	58
Raincoat	1	5	3	16	4	21
Overalls	0		2	11	2	11
Eye protection	0		2	11	2	11
Long-sleeved shirt	0		1	5	1	5
Everything important	0		1	5	1	5

Table 4-29 continued

What Is Done With Clothing						
Take off at end of day	1	5	9	43	10	48
Take off immediately	5	24	4	19	9	43
Wear until dirty	0		2	10	2	10
Reentry Time After Spray (n=19)						
Following day	2	11	7	37	9	47
Few hours later	2	11	2	11	4	21
Immediately	2	11	2	11	4	21
2-3 days later	0		2	11	2	11
Harvest Time After Spray						
Following week	3	14	9	43	12	57
After 2 weeks	2	10	2	10	4	19
Depends on pesticide	0		4	19	4	19
Within the same day	1	5	0		1	5
Storage						
In the shed	2	10	8	38	10	48
In the house	2	10	4	19	6	29
In the cellar	1	5	2	10	3	14
In the field	1	5	1	5	2	10
Disposal						
Burn	3	14	8	38	11	52
Throw into garbage	2	10	4	19	6	29
Bury in the field	0		4	19	4	19
Throw into field	2	10	1	5	3	14
Ever Mix Too Much						
Sometimes	3	14	7	33	10	48
Never	3	14	6	29	9	43
Always	0		2	10	2	10
What Is Done With Leftover (n=20)						
Save for next time	2	10	7	35	9	45
Use it up	1	5	1	5	2	10
Never mix too much	3	15	6	30	9	45
Should Not Do While Spraying (n=15)						
Eat	5	33	7	47	12	80
Drink	2	13	4	27	6	40
Smoke	1	7	2	13	3	20
Touch mouth/eyes	1	7	1	7	2	13

- **Perception of Pesticide Hazard:**

In Rose Hill, only two farmers express that pesticides pose a health threat to the community. This is balanced by the view of 90 % who say certain pesticides are too dangerous to use. They see Lannate as the most dangerous chemicals, followed by Gramaxone, and Malathion, Selecron, Belmark, Dieldrin. Several persons add that special precautions must be taken when handling these pesticides. Not many Rose Hill farmers say they use Lannate, yet they seem aware of its hazardousness. Gramaxone is widely use in Manchester and poses a poisoning hazard. One farmer also claims Dieldrin is available for purchase in the area (see Table 4-30).

Concerning pesticide safety, two-thirds of the farmers believe that some pesticides are safe; the others view them as unsafe. “Safe” chemicals include Malathion, Dithane, Decis, Champion, Bravo, and Karate. Malathion, Dithane, and Bravo all have lower toxicity values than Karate, Decis, and Champion which present a moderate hazard. Seven farmers believe that the chemicals they use are safe, suggesting a certain bias. Some 86 % of the farmers believe that pesticides are not all equally harmful to humans. A possible explanation is that people are more aware of the pesticides’ varying toxicity.

Table 4-30: Pesticide Hazard, Manchester

	Yes	No
Pesticide Hazard in Community (N=41)	5% (2)	95% (39)
Some Too Dangerous (N=40)	90% (36)	10% (4)
Some Safe (N=39)	64% (25)	36% (14)
Same to Humans (N=35)	86% (30)	14% (5)

- **Pesticide Poisoning:**

To the question about whether the farmer has ever felt unwell when exposed to pesticides, 31 % (N=15) answer “yes” and 69 % (N=33) “no.” Of those who felt unwell, 35 % (N=5) are women and 64 % (N=9) men. The weighted results are 24 % of female and 39 % of male farmers have been poisoned. Although only 5 % previously stated pesticides pose a community health problem, the above figures suggest pesticides should be considered a health risk. The most frequent poisoning symptom experienced as a result of exposure is feeling dizzy and weak . As the other symptoms provided in Table 4-31, they point to organophosphate, carbamate, or pyrethroid exposure. The pesticides implicated in poisoning are Gramaxone (N=6) and Lannate, Karate, Decis, Champion, and Kocide (N=1 each). Of the 15 people who fell ill, only a farmer who is also a nurse sought medical treatment at the Mandeville public hospital after she was poisoned while spraying her crops.

Table 4-31: Pesticide Poisoning Symptoms, Manchester

	N	Percent
Dizzy and Weak	11	73
Headache	5	33
Felt Unwell	3	20
Nausea	2	13
Burning Skin	1	7
Respiratory Problem	1	7
Itching	1	7
Burning Eyes	1	7
Slurred Speech	1	7
Total Victims	15	

When asked if they know others who have been poisoned by pesticides, 19 % (N=8) respond they know “other farmers or community members.” Two have heard of a farmer who died of pesticide poisoning and one person claims that “many farmers” are poisoned in the community. Examining knowledge of chronic illnesses associated with pesticides, 17 of 21 say they know of none so affected. Yet three people know of cancer victims and another of someone with a chronic skin problem. They associated these conditions with repeated exposure.

Table 4-32 lists the types of home remedies used in Rose Hill to mediate the negative health effects of pesticides. Most persons respond they use nothing and some say eating a meal before spraying helps.

Table 4-32: Home Remedies, Manchester

	N	Percent
Nothing	27	68
Eat something	7	18
Drink milk/lime water	2	6
Bissy	1	3
Wash off	1	3
Eat dirt	1	3
Sersey	1	3
Dandelion	1	3
Total Respondents	40	

- **Gender and Decision Making:**

Pesticide application does not appear highly gender segregated (46 % female, 54 % male). Examining pesticide related decision making, farmers provide the same responses regarding who decides if and where pesticides should be used, who chooses the pesticide, and who actually buys it. Few say the female household head chooses; followed by both and most frequently the male is in charge of decision making and purchase. As in the other communities it is striking how gender differentiated the answers are (see Table 4-33). Here women and men say they either alone or together decide or purchase and men only acknowledge the role of women as equal rather than sole decision makers.

Table 4-33: Decision Making, Manchester

	Women say	Men say	Total
Who decides on use, chooses, buys pesticide?			
Female HH[17]	7	0	21%(7)
Male HH	2	13	46% (15)
Both HH	4	6	30% (10)
Other Male	2	0	6% (2)

[17] HH= Household head

CHAPTER 5: DISCUSSION OF 'LOCAL REALITIES'

The purpose of this chapter is to synthesize the results presented in Chapter 4 and address the research questions and hypotheses. First, I examine the findings and relevant hypotheses of the household surveys in the three communities. This discussion covers pesticide poisoning; the farmers' perception of pesticides as a health hazard; and their knowledge, attitude, and practice concerning pesticides.

A) Pesticide Poisoning

Individual Risk

The first research question is to determine the incidence of reported symptomatic poisoning cases. Poisoning symptoms were reported by 56 % (N=18 of 32) of people in St. Catherine, 41 % (N=19 of 46) in St. Mary, and 31 % (N=15 of 48) in Manchester. Examining the reported incidence by household presents interesting results: one or more episodes of poisoning were experienced in 76 % of households in St. Catherine, 42 % in St. Mary, and 43 % in Manchester. According to these figures, pesticide poisoning is a serious concern in each community. There is also variation between the communities, allowing for further analysis. During interviews, I had the impression that some farmers would generally report poisonings only if they felt seriously ill. Therefore, the incidence may, in fact, be higher than reported.

By gender, of the total poisoning victims, 28 % in St. Catherine, 42 % in St. Mary, and 35 % in Manchester were female. Weighted by percent of women/men who farm and spray in each community shows that men, on average, were 1.5 times more likely to experience or report poisoning (see Table 5-2). This is, in part, related to the fact that women apply pesticides less frequently than men. It may suggest, without further analysis, that women are less likely to report poisoning or they are more cautious when applying pesticides.

The most frequently reported symptoms in all three communities were feeling unwell, dizzy and weak, and headache (see Table 5-1). These ailments resemble mild to moderate acute poisoning associated with most pesticides. It is plausible that these symptoms point to organophosphate, carbamate, or pyrethroid poisoning (see pgs.11-12). The most frequently implicated chemical in St. Catherine is Lannate; in St. Mary, Gramaxone, Selecron, and Karate; and in Manchester, Gramaxone. All of these pesticides can manifest themselves in the presented ailments. In each community, most farmers insisted that feeling unwell is a commonplace rather than an isolated incidence.

Farmers rarely called on health care providers in the case of poisoning, and women perhaps less than men (although the size of the sample discourages a definite statement, see Table 5-2). Most importantly, villagers expressed they were accustomed to "feeling ill" when exposed to pesticides and therefore did not need to consult a doctor. Others said they did not have the available funds to see a doctor. Instead, people devised their own systems of mitigating or preventing poisoning. The prevalence of home remedies or preventative measures is displayed in Table 5-1. In St. Catherine, these home remedies played a more significant role in dealing with pesticide use. Bissy (grated Kola nut) is boiled into a beverage and used by 43 % of individuals. Eating a meal, drinking sugar water or milk before or after pesticide application was listed in all three places. Eating clay or soil was reported in St. Catherine and Manchester. Yet, the majority in St. Mary and Manchester said "nothing helps." This suggests that in places like St. Catherine where poisoning is reported most frequently farmers will devise and rely on home remedies or "folk" antidotes to a greater extent. None of the farmers interviewed knew of or kept "formal" antidotes (such as activated charcoal).

These figures display that farmers in St. Catherine not only report the highest incidence of poisoning, they also provide a greater variety of symptoms. The relative high frequency of unconsciousness and burning skin point to severe poisoning, often a result of cumulative effects of chronic exposure. On the other hand, people in Manchester reported poisoning to a lesser extent and severity.

What are the reasons for this? The answers are suggested later in this discussion.

Table 5-1: Poisoning Symptoms & Home Remedies

%	St. Catherine	St. Mary	Manchester
Symptoms			
Dizzy/Weak	94	53	73
Headache	41	37	33
Felt Unwell	35	58	20
Unconscious	29	5	0
Burning Skin	29	11	7
Sinus Problem	12	26	0
Home Remedies			
Nothing	10	62	68
Bissy	43	18	3
Drink	29	13	6
Eat	24	8	18

Chronic exposure

As introduced in Chapter 2, chronic poisoning effects are difficult, if not impossible, to determine. In fact, some cancers do not present themselves until 20 or more years after exposure (WHO, 1990). In a report by agricultural scientist Hutton (1987), he claimed: "many Jamaicans suffer chronic pesticide related illnesses that are never recognized" (14). To determine to what extent farmers understand the risk of chronic poisoning and what the actual prevalence is, they were asked if they had seen any evidence of chronic effects. In St. Catherine, no one had heard of chronic illnesses linked to pesticides. In St. Mary, one person knew of a cancer patient and another knew of someone with chronic skin problems; compared to Manchester where three persons knew a cancer, and one a dermatitis patient. Seemingly more persons in Manchester had heard of chronic poisoning, but these results do not allow for conclusive statements.

The fact that many farmers complained they often felt ill when exposed to pesticides leads me to believe that they are experiencing chronic low level intoxication. Symptoms of chronic organophosphate and carbamate poisoning resemble a cold or flu which can be linked with the reported ailments of sinus problems and headaches. It is not clear from the literature nor from interviews with health care providers how much poisoning a person can endure before more serious ailments present themselves. Overall, I found that farmers were not fully aware of the consequences of repeated exposure and how this is manifested. As reported earlier, continuous exposure to organophosphates leads to cumulative effects; something farmers should know.

Community Risk

Questions concerning community risk are vital because they attempt to define the community's health, rather than aggregating individual health outcomes. By determining the community prevalence of pesticide poisoning, it displays a pattern of responses that correspond with previously reported individual poisonings, in that the majority are reported by St. Catherine farmers (see Table 5-2).

A further indication of community risk is whether others were in close proximity during application. Here farmers in each of the communities provide high affirmative responses (see Table 5-2). An individual's exposure risk is further heightened if they come in contact with application equipment and improperly stored pesticides. Women are especially susceptible to poisoning when laundering pesticide contaminated clothing. In conclusion, the majority of community members, including children, are regularly exposed to pesticides.

Table 5-2: Pesticide Poisoning Results

	St. Catherine	St. Mary	Manchester
Total Sample	N=44	N=47	N=49
Farming	73 %	100 %	90 %
Female	34	51	48
Male	66	49	52
Apply Pesticides	94	92	89
Female	37	51	46
Male	63	49	54
Individuals Ever Poisoned	56	41	31
By Household	76	42	43
Percent of Women	46	33	24
Percent of Men	62	48	39
Medical Attention	N=6	N=5	N=1
Female	N=1	N=1	N=1
Male	N=5	N=4	0
Know Other Victims	58	44	19
Others Nearby	85	65	67

Pesticide Toxicity and Application Intensity

The most frequently used pesticides in the three communities are presented in Table 5-3. The following Table (5-4) includes these pesticides and their WHO hazard classification, oral and dermal LD_{50} (in ranges as found in various experiments), chemical group and target pest, and United States restricted use status (Ware, 1994; PIP, 1998). In the United States, restricted use classification is determined by the Environmental Protection Agency (EPA) and requires that the applicator be licensed to use and handle the particular pesticide. Usually, high-tech protective equipment and safe practice are essential. Many of the readily available and widely used pesticides in Jamaica are restricted use pesticides. In addition, several pesticides used in the communities exhibited high levels of toxicity. As presented in Chapter 4, St. Catherine farmers used some of the most toxic chemicals, such as Lannate, Gramaxone, and Basudin. Those used in St. Mary and Manchester tended to be less toxic, with the exception of Gramaxone.

Table 5-3: Most Frequently Used Pesticides

St. Catherine	St. Mary	Manchester
Lannate	Dithane	Dithane
Basudin	Sevin	Decis
Malathion	Selecron	Malathion
Champion	Malathion	Champion
Sevin	Karate	Karate
Gramaxone	Gramaxone	Gramaxone

Pesticide toxicity is not a singular determinant of poisoning, as the frequency of pesticide application and the nature of the crop are important factors. In St. Catherine, farmers sprayed their crops every four to eight days in contrast to every eight to fourteen days in St. Mary and Manchester. Moreover, pesticides were applied on a routine basis in every community rather than based on pest presence or damage. In all three communities, pesticides were used almost exclusively on vegetable crops. In St. Mary and Manchester, they included mostly tomatoes and hot/sweet peppers. Here pesticides were applied to control fungal diseases and insect pests such as aphids and mites. In St. Catherine, okra and callaloo are the most important crops and *Lepidoptera* the most bothersome pest.

I was told by CARDI entomologists that pesticides were applied more intensively in St. Catherine because of *Lepidoptera's* resistance to overused pesticides. For the same reason, more toxic chemicals were used in the hope of controlling pest outbreaks. This finding supports the first hypothesis which links more poisoning with higher toxicity and intensity of use (e.g. St. Catherine).

Non-traditional Export Crop Production

Few farmers had access to export market channels in St. Catherine (14 %) and St. Mary (16 %). In Manchester, 84 % of farmers were exporting sweet potato. Interestingly, most farmers in all three communities displayed some knowledge of export requirements (highest quality and no pest damage). In addition, four farmers in St. Catherine and three each in St. Mary and Manchester said to avoid rejection by port authorities, the crop should have no pesticide residue. When asked how this can be avoided, farmers said they should not harvest prior to one week after pesticide application; none said they should spray less. However, it is not possible to examine how poisoning is related to crops produced for export. The reasons are that St. Catherine and St. Mary farmers did not export at any comparative scale, crops were too different to compare and contrast, and in Manchester pesticides were applied minimally to sweet potatoes.

Table 5-4: Profile of Most Commonly Used Pesticides

Pesticide Trade name (Common name)	**Type**[18]	**LD_{50} Oral**	**LD_{50} Dermal**	**WHO Classification Class**	**WHO Classification Hazard**
Basudin (Diazinon)*	I OP	76 – 400	379 – 600	II	Moderate
Champion/Kocide (Copper Hydroxide)	F CC	1,000	______	II	Moderate
Decis* (Deltamethrin)	I P	31 – 5,000	>2,000	II	Moderate
Dithane (Mancozeb/Maneb)	F TC	> 5,000	10,000	III	Slight
Gramaxone (Paraquat)*	H B	48 – 113	80 – 325	I	High
Karate (Lambda-cyhalothrin)*	I P	56 – 144	632	II	Moderate
Lannate (Methomyl)*	I C	17	1,000	I	High
Malathion (Malathion)	I OP	885 – 1,375	4,000	III	Slight
Selecron (Profenofos)	I OP	400	472	II	Moderate
Sevin (Carbaryl)	I C	250 – 850	2,000	II	Moderate

***Restricted Use Pesticide** (Litewka and Stimmann, 1979; PIP, 1998; Ware, 1994)

[18] F= Fungicide, H= Herbicide, I= Insecticide.
B= Bipyridyl, C= Carbamate, CC= Copper Compound, OP= Organophosphate, P= Pyrethroid, TC= Thiocarbamate.

B) Perception of Pesticide Hazard and Poisoning

Every farmer who reported symptoms of poisoning linked them to an incidence of pesticide exposure. This exposure generally occurred during pesticide application, except for the cases of two women who were reportedly poisoned because of (1) close proximity to an application site and (2) employment in a farm supply store.

During interviews, most farmers showed a certain nonchalance about the risks of pesticide exposure. While villagers knew pesticides are dangerous, they also believed nothing could be done about this, nor did they think pesticide exposure was life threatening. In fact, Jamaican farmers usually refer to pesticides as “poisons.” Most pesticides identified by farmers as too “dangerous” to use, were listed as the ones they apply. Furthermore, farmers, perhaps as a justification for why they used pesticides, said safe chemicals also exist. How some farmers perceived toxicity was found to be erroneous. They concluded that the most toxic pesticides kill the most insects. People also believe that illnesses are transmitted through (bad) air, therefore, pesticides with strong odors are often deemed most toxic. In reality, these two factors do not determine toxicity on humans.

As can be seen in Table 5-2, the vast majority of farmers used pesticides in crop production. In fact, farmers said that pesticide application would increase crop quality or quantity. Clearly, most perceive that the benefits of pesticide use outweigh the negative effects. It is difficult to promote non-chemical pest control methods under these conditions. However, farmers often complained about the high price of pesticides. As Table 5-5 presents, few response variations exist between the communities. Nor could I determine any significant difference between answers of males and females concerning the importance of pesticides in crop production.

Episodes of poisoning were commonplace in all three communities. In my opinion, pesticides pose a health hazard to the communities. Yet few farmers named pesticides as a serious community health problem (see Table 5-5). Their responses may be related to an earlier explanation of why villagers rarely complained about general health problems. Villagers seemed less comfortable labeling something as a community or personal health concern. In addition, several farmers displayed a sort of "resistance myth" where they claim that one is able to "get used to poisons" with frequent use.

In summary, I felt that farmers understand that pesticides pose a risk to them and their families. However, the risk is perceived as part of a farmer's life. The variations in response frequency concerning community health risk (ranging from 5 to 26 %) support the third hypothesis. The case of St. Catherine supports this hypothesis which states that where more poisonings are reported, pesticides are perceived as a greater community health hazard. However, I do not feel that farmers in St. Catherine were, overall, more aware of the dangers compared to the other communities.

Table 5-5: Perception of Pesticide Hazard

%	St. Catherine	St. Mary	Manchester
A Community Hazard	26	19	5
Some Too Dangerous	93	93	90
Some Safe	62	73	64
None Safe	38	27	36

C) Pesticide Knowledge, Attitude, and Practice

Several questions included in the survey allowed measurement of safe pesticide practices. This section examines several of the questions to determine a link between pesticide poisoning and pesticide use and handling.

In order to decide on the appropriate type of pesticide and its application method, farmers must know the target pest they aim to control. In the pest identification section of the survey I found that many farmers were unable to distinguish several key pests. They also had difficulty linking adult and immature stages to one insect or knowing that some insects transmit viruses. It is not difficult to see why farmers without training are often not able to make these connections on their own.

Farmers purchase pesticides from farmstores, but few of them said pesticide vendors are a source of reliable information. The majority of farmers in the three communities said they decided which pesticide to apply by relying on their "own experience" (see Table 5-6). This attitude is problematic since agrochemicals are continuously changing. For example, how would they know about less toxic or more selective pesticide alternatives? In fact, some farmers may have been fighting the wrong target insect all along.

When deciding how much to spray, the pesticide's label was named as the most important source of information. But, as presented in the results, labels are not always attached to smaller quantities of pesticides or they are written in technical language. In all three communities, the majority of farmers applied pesticides routinely. Little time was spent on pest and damage identification or determining damage thresholds. The problem is that prophylactic spraying results in overuse and, therefore, increases the chances of exposure.

In each of the three communities, farmers' behavior appeared highly individualized and independent, yet they lack the technical background needed to select and use pesticides safely. Agricultural extension agents (RADA) should, theoretically, provide technical assistance in the farming communities. In reality, farmers continuously complained about RADA's absence. As defined under the Code of Conduct, agrochemical companies also have the responsibility to inform and train farmers. This was something I never witnessed.

Table 5-6: Pesticide Decisions

%	St. Catherine	St. Mary	Manchester
Decide on Type			
Own Experience	74	71	64
Decide How Much			
Label	68	49	80
Own Judgement	32	49	12
Information Sources			
Label	50	48	48
Trial & Error	8	16	26
Routine Application	65	67	61

Farmers also engaged in individual experimentation in the hope of finding the “right” mixture of fungicide and insecticide that would render their crops pest free. Indiscriminate mixing of “pesticide cocktails” is highly hazardous, especially in tropical climates (chemical reactions may be intensified). In addition, much exposure occurs during the actual mixing/diluting process. At this crucial step, I never saw farmers protected. Instead, I saw family members exposed to additional risk if farm fields were near the home, as mixing occurred in the same area where other household activities (bathing, cooking, laundering) took place.

Safe storage and disposal are two areas that may help to avoid accidental poisoning. In St. Catherine and St. Mary, the majority of farmers stored pesticides unlocked in the house or field; compared to lower numbers in Manchester because people claimed to have separate storage units or cellars. Paradoxically, I felt that while farmers were aware of safe storage practices, they did not practice these or lacked the necessary space. Most people in St. Catherine and St. Mary also did not bury or burn empty pesticide containers as recommended by safety procedures; instead, they were thrown into the field, garbage, or toilet. This was practiced to a lesser extent in Manchester. It appeared that most farmers did not understand the hazard of simply disposing of empty containers with household garbage or into farm fields.

The risk of exposure is greatly increased if farmers reenter fields within 48 hours of pesticide application, because the chemicals need time to dissipate. Over 80 % of farmers in St. Mary, and about 40 % in the other two communities, say they continue working in the field or reenter after a few hours. Many farmers voiced that they saw no merit in waiting one to two days before reentering their fields nor could they spare the time. Safe practice recommends that danger signs are displayed in the field during this time to warn community members; however, this was never done. To avoid unnecessary exposure and pesticide residue, crop harvesting should not occur prior to one week after application. However, one-third of St. Catherine farmers harvested before one week had expired, which is disturbing considering the toxicity of chemicals used in this area (see Table 5-7).

Cases of pesticide application exposure are generally associated with the farmer's failure to protect her/himself. The percentage of farmers who never wore Personal Protective Equipment (PPE), which is defined here as additional protective clothing (such as gloves, long trousers and shirt, dust mask, water boots, etc.), is 83 % in St. Mary, 86 % in Manchester, and 15 % in St. Catherine (see Table 6-7). These numbers display the greatest variations of KAP results between the three communities. Basing the second hypothesis on this question disproves that in places where less poisonings are reported that farmers are more cautious.

In conversation, I found that farmers were more concerned with inhalation exposure, and this is the reason for naming dust masks as the most important piece of protection. However, the most frequent route or pesticide transmission is dermal. With T-shirts and shorts, farmers are protected to a very limited extent against skin absorption. This becomes an issue especially as many farmers listed faulty equipment (leakage) as a concern. Exposure risk was further increased by not taking off clothing immediately after pesticide application. None of the farmers conveyed that they were formally trained to wear protective clothing and maintain equipment.

It cannot be assumed farmers rarely wear PPE because they are ignorant. I am under the impression that farmers have some knowledge of basic safety precautions. However, knowledge and practice often do not coincide. In addition, there are several constraints to proper protection such as the hot and humid climate and non-availability and cost of specialized protective equipment.

Table 5-7: Knowledge, Attitude, and Practice Results

%	St. Catherine	St. Mary	Manchester
Never wear PPE	15	83	86
Always wear PPE	31	4	5
Equipment problems	55	44	52
Store in house/field	67	83	39
Unsafe disposal	88	65	43
Reentry immediate/ after a few hours	38	83	42
Mix pesticides	100	70	95
Leave on clothing	54	39	58
Harvest after less than one week	31	9	5

Evidence of IPM Adoption

After examining human pesticide poisoning, I think it is now appropriate to assess the status of the adoption of IPM. As evidence of adoption of IPM is non-existent, no comparisons of any kind can be made. It appears, after time spent in the communities and conversations with officials in agriculture, in the face of pesticide poisonings, high levels of pesticide residues, and pest resistance, that IPM is a movement worthy of pursuit. Moreover, the high cost of pesticides is forcing farmers to consider alternatives. IPM is still in the developmental stages in Jamaica, therefore, few farmers have heard of it. Further, CARDI and RADA (the two IPM promoters) are not visible to most small-holders. Problematic is the fact that that IPM officials I worked with had very little understanding of the socio-economic conditions in the communities. Without simple socio-economic descriptions of the communities and their problems (e.g. high cost of pesticides, lack of water, income, and labor), IPM will not succeed, concedes a specialist from RADA. This person added that few benefit from RADA’s presence.

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CHAPTER 6: RESULTS AND DISCUSSION – STRUCTURAL CONSTRAINTS

In this chapter, I summarize information gathered from interviews and literary sources dealing with the structural constraints of pesticide regulation and safe use in Jamaica. The first section provides a historical background to pesticide use and regulation, leading to the current day. Second, I discuss the regulatory constraints of pesticide imports and crop exports from the island. Third, I present the perceptions of professionals and government officials about pesticide hazards and poisonings. Fourth, a summary of interviews with medical practitioners is presented. This section also includes the status of poisoning statistics collection in Jamaica and a general discussion of health sector constraints.

History of Pesticides Use and Regulation in Jamaica

Formulated organochlorine pesticides were first introduced to Jamaica around 1945. By the 1960s, DDT and 2,4-D were used extensively. DDT and Dieldrin were especially important in the Malaria Eradication Program, which began in 1958. By 1961, malaria transmission was completely interrupted (Naylor, 1974). Historically, pesticides were largely used on plantation crops such as banana, sugar cane, and coffee. Today, pesticides have been fully adopted by small-scale farmers. Most farmers I interviewed have been using pesticides as long as they can remember.

During the 1990s, Jamaican pesticide imports increased drastically (inflation should be take into account), according to the Food and Agriculture Organization of the United Nations (FAO, 1999) (see Table 5-1). Currently, 17 agrochemical companies directly formulate pesticides in Jamaica. The increased amount of pesticides formulated in Jamaica lends to the decrease of imported pesticides.

Table 6-1: Jamaican Pesticide Imports

Year	US $
1997	10,121,000
1996	11,863,000
1995	9,000,000
1990	6,748,000
1985	4,456,000
1970	2,000,000
1965	1,853,000

(FAO, 1999)

In 1997, the Pesticide Control Authority (PCA) reported a total of 1,497,365.2 Kg of pesticides imported to Jamaica, worth $US 11,210,792. The majority arrived from the United States – 380,939 Kg ($2,370,072) and the United Kingdom – 267,143 Kg ($1,559,327). The greatest demand was for herbicides and insecticides (see Table 5-2).

Table 6-2: Type of Pesticide Import, 1997

Imported Pesticides	Total (%)
Herbicides	43.4
Insecticides	39.9
Fungicides	12.9
Rodenticides	2.3
Other	1.5

(PCA, 1997: 14)

Regulation

To regulate the sale and purchase of pesticides in Jamaica, the Drugs and Poisons Control Board was established in 1952 under the Drugs and Poisons Control Act. The Food and Drugs Act of 1964 and the Pharmacy Act of 1966 (although not brought into operation until 1975) followed. Yet this legislation did not place many substantial restrictions on pesticide import and use.

By 1975, momentum carried the movement to encompass comprehensive regulation of commercial aspects of pesticides. In February 1975, the *Pesticide Act* was passed in the Jamaican House of Representatives. The Act called for the registration of pesticides, licensing of pesticide manufacturers, importers, and distributors, authorization of distributors of restricted pesticides, and the licensing of pest control operators. Most importantly, the Act called for the establishment of the Pesticide Control Authority (PCA). However, the Act was not promulgated until 1987. Due to lack of commitment and funding and disagreement about which Ministry (Agriculture or Health) would be responsible for it, the PCA was not fully functional until 1993 (Hutton, 1987; PCA, 1997).

In the interim (1975-1987), the Pesticide Advisory Committee oversaw the regulatory functions. However, its process was considered less than satisfactory. Out of concern about lacking regulation, a special interest group, the Jamaican Agromedical Association (JAMA), was formed in October 1981. Professionals from agricultural, health, trade and commerce, education, and agrochemical sectors came together to seek solutions to the increased incidence of human and livestock poisoning, pest resistance, and environmental contamination. JAMA was the first organization of its kind in the Caribbean that focused on encouraging cooperation between the parties involved.

JAMA's operational philosophy was based on an "agromedical approach," in which the agricultural and health sectors work together to promote pesticide safety. Key JAMA members were inspired by the "agromedical approach" at a conference (1980) on Pest and Pesticide Management in the Caribbean, held in Barbados. The conference marked the first time that agricultural and health professionals in the Caribbean came together and recognized their "mutual responsibility" (Hutton, 1981:5). Subsequently, in 1981 and 1982 "Train the Trainer" programs took place in Jamaica, Trinidad, and St. Lucia. This series of workshops sought to train agricultural and health professionals in promoting pesticide safety.

JAMA set out to promote public awareness through advertisement and farmer training. Further, its goals included to encourage continued pesticide management and research and the enforcement of government legislation. In particular, it pushed for the promulgation of the Pesticide Act. A former JAMA president pointed out that "before JAMA, no one took poisoning serious."

While supporting a noble effort, the joining together of “experts” with conflicting interests and agendas was fraught with difficulties. Discord in the membership was, according to several former JAMA members, the reason why JAMA dissolved in 1985. Several former members said that the major conflict began when a representative of an agrochemical company became the president of JAMA. Today, no real linkages exist between the agricultural and health sectors nor between the agrochemical and health sectors. However, most officials I interviewed agreed that a multi-disciplinary approach to pesticide research and safety promotion is necessary.

With technical and financial assistance from the German Agency for Technical Cooperation (GTZ), the PCA was fully established in 1993. During this time the GTZ committed funding that would last until December 1998. A sustainable source of funding is presently the PCA’s concern since government allocations and pesticide distributor fees only cover basic functioning costs. As part of the Ministry of Health, the PCA is able to receive some funding. However, the PCA has autonomy to keep its own accounts and the freedom to act independently of the government. Currently, the PCA, headed by a Registrar, has six employees. As the PCA has limited resources and staff, it relies on the expertise of other agencies (such as RADA) for educational training as well as the University laboratories for pesticide residue analysis.

The main objectives of the PCA are, as specified under the Pesticide Act, to register pesticides and license importers and pest control operators. But the PCA has also been at the forefront of campaigns to raise public awareness about pesticide safety. In 1997/98, a series of radio advertisements and television skits presenting the “Dos and Don’ts of Pesticide Use” (also known as “Mine Yu ‘Cide”) was launched; and a comic strip is planned for the future. In 1994, the PCA consulted the Stone Team to do an island-wide baseline survey of pesticide use and misuse. In 1999, the PCA will repeat the study, particularly to assess the impact of the public awareness program. However, after such a short time, it may be difficult to link the impact of the campaign to actual awareness or practice of farmers.

In 1997/98, the PCA, in collaboration with the United States, initiated an island-wide effort to dispose of unwanted pesticides. A total of 8,000 Kg were collected and transported to the United States for incineration. In 1998, the PCA was also planning a program with a hospital in St. Elizabeth Parish to train health care providers in the diagnosis of poisoning and to provide the hospital with cholinesterase testing field kits. Although the PCA has developed and carried out a number of important efforts to ensure pesticide safety their actual enforcement capabilities seem limited.

Pesticide Import and Crop Export

Pesticide Imports:

Safe pesticide practice cannot be considered exclusive of pesticide commerce. In recent years, the trade of highly toxic pesticides, especially those classified as restricted use, banned, or not registered in the countries of origin, has received global attention. More than 95 % of global pesticide exports originate from the United States, Japan, Germany, United Kingdom, Switzerland, France, and Italy (Goldberg, 1985). In 1986, an estimate of world-wide pesticide commerce found that 30 % of pesticides are banned or severely restricted in the country of export (Inzet, 1990). The United States alone, between 1992 and 1994, sold 114,000 tons of banned pesticides to developing countries (Reynolds, 1997). One researcher said that 25 % of pesticides leaving the United States and bound for developing nations are restricted or banned (Bottrell, 1984). Furthermore, less that two percent of United States pesticide exports are inspected (Larsen, 1998).

Multinational agrochemical companies are theoretically able to by-pass the laws of the home countries by opening subsidiaries in other countries such as Jamaica. Legislation does not extend beyond the borders of the home country, erasing the trace of accountability on behalf of agrochemical companies. In a recent lawsuit, 26,000 farm workers in 12 developing countries sued DBCP manufacturer Dow as the extensive use of this pesticide caused sterility in male farmers. DBCP is an example of a pesticide a multinational company was able to export, although banned in the United States since 1979. However, in a $ 52 million settlement, which marked only the beginning, Dow admitted no liability. In reaction, Dow filed a lawsuit against Dole Fruit Co. for allowing their farm workers to use DBCP (Morris, 1999).

In order to regulate trade, in 1985 the FAO developed the voluntary *International Code of Conduct on the Use and Distribution of Pesticides.* Undersigned member nations were asked to follow guidelines to promote responsible trade and foster cooperation between exporting and importing countries. The Code called on agrochemical industry to practice good pesticide labeling and non-deceptive advertisement. In 1989, the Code of Conduct adopted the Prior Informed Consent (PIC) clause which allowed importing countries to formally refuse or accept pesticides. Here exporting countries must provide information on pesticides which importing countries then respond to. The shortcoming of the Code is that it has no enforcement capability.

In the United States, NGOs and governmental officials have targeted breaking the “Circle of Poison,” where restricted use or banned pesticides are exported and returned to the United States as residue on imported crops. The “Circle of Poison Bill” to stop the export of those pesticides banned or non-registered in the United States was recently reintroduced in Congress after failing three times (1990, 1991, 1994). It is believed that agrochemical manufacturers were able to block the Bill (Reynolds, 1997; WHO, 1990; Paarlberg,1993; Goldberg, 1985).

In Jamaica, the PCA regulates the import of pesticides by requiring registration of all pesticides. In an interview, the PCA Registrar expressed that some agrochemical distributors are reluctant to register their chemicals and pay the $JA 7,500 fee per pesticide. An agrochemical company representative told me that pesticide importers pay no customs duties or taxes. It is unclear to what extent banned or otherwise hazardous pesticides reach Jamaica. One indication is a recent event conveyed by the PCA Registrar. Here mosquito coils imported from China and labeled as pyrethroid pesticides in reality contained DDT.

Exporting Crops:

In the United States, the Food and Drug Administration (FDA) establishes Defects Action Levels (DALs) for allowable pest damage on fruit and vegetables. In recent years, DALs have steadily decreased, translating into higher cosmetic standards. This, in turn, requires more intensive pest control on the part of producers, however, coming at a cost. For example, in 1987 and 1988, 12.2 % of crops shipped from the Dominican Republic to the United States were rejected by the FDA due to high levels of pesticide residue (Murray and Hoppin, 1992). One FDA study found that 35 % of food in the United States has detectable pesticide residue, of which 1 to 3 % is above the legal tolerance. One reason for increased pesticide use is the perception that United States consumers demand blemish-free products. However, the consumer is often not aware of the connection between blemish-free produce and increased pesticide use (Pimentel, Kirby, and Shroff, 1993; Pimentel, 1996). A study by Lynch (1991) argues that if consumers are informed about this connection, the majority chooses produce grown with less pesticide over produce that appears perfect. The results of a survey conducted by Ott (1990) indicate that 97 % of consumers in the United States would prefer pesticide-free food and 50 to 66 % would be willing to pay higher prices for this assurance (Pimentel, Kirby, and Shroff, 1993).

In Jamaica, many non-traditional export crops (such as callaloo, hot pepper, and sweet potato) reach markets in North America and Europe where demand is created by large Jamaican populations. In fact, non-traditional exports have been promoted by the Ministry of Agriculture and development organizations such as USAID. Since 1984, the United States Department of Agriculture operates a pre-clearance system at the dock or airport in Jamaica where local authorities spot-check the export crop for pesticide residue and pest presence before departure from the island. Under a “satellite farming system,” exporters have turned to a large number of small-scale farmers to supply crops, this has led an increasing amount of crops exported by small-holders (Murray and Hoppin, 1992). In field work, I found that a significant number of Jamaican small-holders are exporting crops and that most are aware of the cosmetic standards and strict guidelines for the absence of pests. Some farmers are also aware of pesticide residue limits. Often the farmer must decide whether to spray more to avoid damage or less to avoid high levels of residue. Most farmers choose more pesticides but as large amounts of crops are rejected at the port of exit, farmers lose in the end. They are economically dependent on using pesticides (treadmill).

From the viewpoint of an agrochemical company representative, the problem of rejection due to pesticide residue on export crops only existed in the past. According to the same source, during this time the agrochemical distributors placed an advertisement in a local newspaper informing exporters to contact the Ministry of Agriculture or pesticide distributors in order to determine tolerance levels for their particular crops. Yet other key officials in agriculture contest that this problem is still very real. Complicating the matter, most Jamaican non-traditional export crops do not have maximum pesticide residue allowance levels determined. Instead, tolerance levels established for other crops are used, for example, spinach in the case of callaloo. In comparison, pesticide residue analysis is not carried out on products sold domestically nor on the large quantities of products imported (especially from the United States). As can be seen, the Jamaican consumer is not protected. In summary, the development of non-traditional export crops come at a significant public health cost as consumers in Jamaica and in destinations of exported crops are exposed to pesticide residue.

Perceptions of Pesticide Poisoning

Several key Jamaican officials who work in agriculture and pesticide regulation/research confirmed that the number of human pesticide poisonings has increased. The PCA Registrar said that he believes many small-scale farmers in rural areas are victims of poisoning, yet farmers believe poisoning is "part of their occupation" and rarely wear protective clothing. Others interviewed said that pesticide induced suicides and chronic illnesses are a growing problem in Jamaica. Another pesticide researcher said he has personally seen chronic disorders and added that an environmental researcher in Portland Parish claimed cancer rates are soaring because of pesticide use. One interviewee suggested that other reported poisonings, such as food poisonings, may instead be pesticide related. Most officials, however, believed farmers were largely poisoned because of ignorance of safe pesticide practices. Their solution was to extend educational and training programs to farmers and to promote IPM. A conclusion that conflicts with the findings of this research. In addition, I believe most officials interviewed were generally unaware of local, on-farm conditions.

Not surprisingly, others do not agree that pesticides present a significant health risk to farmers. In fact, there is considerable variation in determining a poisoning case. The Registrar defined poisoning as "anything that effects your body." In contrast, an agrochemical company manager believed it is not a case unless the person had to seek medical treatment and the medical practitioner diagnosed it as poisoning. The company representative related the story of one farmer who complained of poisoning by a pesticide the company produces. When the company went to investigate the case, they immediately concluded that the farmer was not poisoning, rather became "nauseated by the strong smell" of the chemical because he "was not used to it." However, there is no evidence that one is able "to get used to" a pesticide. It is evident that it would be very difficult, if not impossible, for farmers to demand an agrochemical company to be liable.

Medical Practitioner Interviews

In each community, one medical facility was selected to represent the locale. I chose to interview the particular medical practitioners based on frequent responses of where farmers, if poisoned, sought medical attention. The questions were open-ended in structure and covered poisoning incidence, diagnosis, treatment, and antidote availability. In Gutters, St. Catherine, I interviewed a private doctor; in Gayle, St. Mary, a nurse practitioner at the Health

Centre; and in Mandeville, Manchester, a doctor at the Public General Hospital. The following is a summary and comments of the three interviews.

Gutters, St. Catherine (09.07.1998)

The doctor at Gutters explained that most of his patients suffer from "cough and cold, hypertension, diabetes, arthritis, and housewives' anxiety and depression." Every growing season, he saw on average eight pesticide poisoning patients. Most patients came in October when extensive spraying of callaloo occurred. Diagnosis of poisoning was made by "what they tell you." In general, he did not know which pesticide was responsible for the poisoning. In mild cases of poisoning, Gravol tablets (Dimenhydrinate), an antagonist to induce vomiting, are given. In moderate poisoning cases, the antidote Atrophine Sulphate (costs about $JA 200) was prescribed. As the doctor did not know these medicines off hand, he had to look them up. In severe cases of poisoning, he referred the patient to the Spanish Town public hospital. There, he estimated, treatment costs about $JA 600. He said that although he has no formal training to recognize and treat pesticide poisoning, he did not believe it is much of a problem in the community. In addition, he disclaimed that the home remedy 'bissy' has any medicinal value. People, he said, merely believe "it cures all."

Mandeville, Manchester (11.08.1998)

The doctor has seen about 14 to 15 poisoning victims, mostly male, since he started working at Mandeville hospital in 1995. He said that most cases are a result of suicide where Gramaxone is ingested. He described ingestion of Gramaxone is generally irreversible resulting in a slow and painful death. In unintentional poisoning, diagnosis occurred by smelling the chemical's odor on the person's clothing. However, the doctor rarely knew the type of pesticide involved. In fact, during the interview he consistently made the mistake of referring to pesticides as fertilizers. He described the most common pesticide poisoning symptoms as dizziness, sweating, feeling bad, and dilated pupils. To treat poisoning within the first 24 hours, Atrophine Sulphate is administered intravenously. The treatment costs about $JA 1,000. The doctor appeared to have no formal training in poisoning recognition and treatment.

<u>Gayle, St. Mary (19.01.1999)</u>

The nurse practitioner I interviewed had been working at the Gayle Health Centre for ten years, mainly in primary care. This health centre is largely run by nurses. A doctor sees patients once or twice per week. The most common illnesses treated were hypertension, diabetes, respiratory infections, colds and flu, sexually transmitted infections (including HIV/AIDS), skin diseases, and accidental wounds. She expressed concern about the increased incidence of young cancer victims (30 years and under), however, did not know the reason for this. The clinic's visitation fee was $JA 50 for those who can afford to pay.

The nurse practitioner had not seen many pesticide poisoning cases at the health center, but admitted she could not really recognize them. She said it would be helpful if the health centre were provided with some literature or posters to help identify the symptoms and treatment. Some time ago, she cared for a six year old boy who drank a liquid pesticide stored in an old cough syrup bottle. She believed farmers should be supplied with and encouraged to use protective clothing.

In summary, I found that the health care providers displayed limited knowledge of pesticide poisoning diagnosis and treatment. The findings conform with a study of medical practitioners in six Jamaican hospitals conducted in 1983 by University of West Indies medical students which found that health care providers made little attempt to get at the root of pesticide poisoning. They generally did not accurately identify the type of pesticide involved nor assessed how and why the pesticide was used (Reid, 1987). All interviewees in my study concluded that pesticide poisoning is not a major health concern in the areas they serve. However, I believe they are far removed from these communities and know little of farming.

Pesticide Poisoning Statistics

To assess community health or community risk it is necessary to have an indication of morbidity and mortality incidence/prevalence. In Jamaica, the Health Information Unit (Epidemiology Unit), under the Ministry of Health, is responsible for the collection of health statistics as reported by health care providers. Yet poisoning statistics, in particular, have been described by one expert as "woefully lacking." Persons interviewed related this to under- and mis-reporting by health care providers. In addition, RADA parish offices are required to collect pesticide poisoning statistics from their extension agents. Still, no "official" statistics exist.

The following are statistics I was able to collect. Between 1961 and 1986, the Epidemiology Unit reported 243 poisoning cases and 61 fatalities. Most cases were thought to be related to the ingestion of pesticide contaminated food. More recent statistics, published by the Health Information Unit, report 37 pesticide poisoning cases in 1995, 75 in 1996, and 65 in 1997. During an interview at the Mandeville public hospital, I was able to obtain some statistics for the period of 1996 to 1998. During this time, a total of eleven poisoning cases were reported (outcomes unknown). Nine of the patients were male and two were female, ranging from 14 to 57 years in age. In the record provided, poisoning cases were not diagnosed or documented as standard case definitions rather they were listed as "poisoning, acute poisoning, insecticide, chemical, Lannate, Gramaxone, or organophosphate."

Health Sector Constraints

As discussed, the problem of underreporting was evident on part of health care providers. The Jamaican Health Information Unit manages a passive surveillance where it relies on medical facilities and agricultural extension offices to provide their statistics. Passive surveillance systems are problematic because health professionals often fail to report or are unable to recognize poisonings, especially low notification is found by private doctors. Mild poisonings are clearly missed in such a system (London and Bailie, 1998). Furthermore, there is no formal training/education program in medical and nursing schools to identify and treat cases of poisoning.

Currently, Jamaica has no poisoning control center which would function as a hotline for poisoning victims and health care providers. A former JAMA member explained that she and others have tried to establish it on three occasions without success. For this effort, Shell Corporation donated all the necessary equipment which was placed in the Pediatrics Unit at the Kingston University Hospital. However, internal conflicts (at the hospital) and no interest in staffing the center hindered its establishment. Recently, there has been renewed interest on part of the PCA and a United States Non-Governmental Organization to get the poisoning control center running.

Overall, the approach to pesticide poisoning by health care providers has been in the treatment of poisoning when it presents itself (clinical/biomedical approach). No effort is made to get at the root of the problem in order to prevent poisoning (public health/community health approach). To attempt any change in farmers' health behavior, medical personnel must understand local conditions, which currently is not evident.

CHAPTER 7: CONCLUSION

Summary

This thesis examines pesticide practices and their health effects among small-holders in three Jamaican farming communities. In this chapter, I first discuss the limitations of the study and suggest future research. Next, I propose recommendations at the international, regional, and local scales. The results, similar to findings of researchers in other developing countries, suggest farmers are economically dependent upon pesticides and currently have no non-chemical alternatives. As presented in the discussion, I found that farmers in these communities are continuously poisoned by pesticides. I discovered that variations are mainly related to the nature of the crop and pest problems, such as the prevalence of pest resistance in St. Catherine. Farmers are also without the assistance of agricultural extension. Perhaps the current severity of pest resistance could have been avoided if farmers were trained in pesticide practices that minimize its development, such as rotation of pesticides. Pesticide knowledge, attitude, and practice responses were relatively uniform in the communities (with the exception of protective clothing). Nor could I find significant variation between male and female responses, although women apply pesticides to a lesser extent. In conclusion, pesticide poisoning is a serious health concern among Jamaican small-holders. This problem is, however, not easily remedied. It would require either that farmers change their behavior to avoid exposure, pesticides become less readily available, or viable alternatives are developed.

Limitations

The first limitation of this research is the sole reliance on symptomatic cases for the determination of poisoning incidence. However, in absence of adequate poisoning statistics and testing facilities, there was no other option. Secondly, the reliability of farmers' responses concerning pesticide practices may at times be questionable since some of the issues are sensitive. Thirdly, the small sample size and limited time to complete the survey and to make field observations were constraints. Finally, the survey demanded much time as it was also composed of questions not related to my research, which took time away from pesticide questions.

Suggestions for further research:

- A survey of health facilities to assess the status of poisoning recognition and reporting.
- Island-wide data collection of pesticide use and poisoning information from small-holders.
- Assessment of public health impact and identification of high risk populations.
- Mapping of disease and usage patterns as related to pesticides.

Recommendations

Following I provide recommendations that are mainly targeted at legislative changes concerning health and agriculture at the international, regional, and local scale.

International

- Global commitment to non-chemical approaches to pest control, e.g. IPM. This could become an example-setter for the IPM CRSP's major donor, the United States Agency for International Development (USAID). How does USAID reconcile with the contradiction that it supports IPM while its government allows the export of restricted or banned pesticides to developing countries?
- Communication between pesticide importing and exporting countries. An international effort to stop the trade in banned, unregistered, and severely restricted pesticides rather than just notification.
- Agrochemical companies must realize their responsibilities and adhere to the FAO Code of Conduct. In addition, a system of industry liability, especially for farmworkers and small-scale farmers, should be devised.

- Development of appropriate PPE for tropical climates and less toxic chemicals.
- Greater involvement of international organizations (UN, WHO, NGOs).

Regional (Caribbean)

- Establish and maintain regional connections between Caribbean countries.
- Singh and West (1985) suggest a "Caribbean Poison Centre" or a "Caribbean Pesticide Surveillance Unit" to: collect data and conduct local monitoring of use and poisoning; inform health facilities, pesticide users and the general public about pesticides; and form connections with international organizations.

Local (Jamaica)

A) Governmental

- Legislative control of use and enforcement. Patterns of pesticide misuse and poisoning may indicate that regulation alone may be useless as enforcement and liability systems are a necessity.
- Phasing out most toxic pesticides and control imports to assure quality and safety of pesticides. Access to reliable and periodic statistics on pesticide use patterns (import, sale).
- Government commitment to a non-chemical approach (e.g. IPM).
- Pesticides should be available in smaller, individually packaged containers with labels.
- Establish strict and clearly defined guidelines for most frequently used pesticides (when, how much, reentry, what to wear, etc.) (Davies, et al., 1982).
- The PCA performs many important functions and acts as an example for other Caribbean countries. However, it requires sustainable funding, backing from the government, and enforcement capabilities.
- An agromedical approach to pesticide management is vital! Medical, agricultural, agro-business, trade and commerce, and private (pesticide

vendors, pest control operators) sectors must collaborate. Especially the Ministries of Agriculture and Health should forge a strong connection.

- Provide safety inspection system, especially for plantation workers.
- Support university research into pesticides and their alternatives.
- Establish and improve the collection of poisoning statistics (uniform documentation, improve the quality). Possibly adopt an active surveillance system (clinic-based). For example, in Nicaragua, through daily telephone reports, early detection of poisoning outbreaks became possible (Mcconnell and Hruska, 1993).
- Strengthen agricultural extension: provide technical assistance on a continual basis to help farmers identify pests and select pesticides. IPM officials must include the investigation of socio-economic conditions of farming communities to better target their efforts.
- Residue monitoring on imported and locally sold crops.
- Make PPE available and affordable.

B) Health Sector

- First, survey health care facilities to assess current capabilities.
- Establish a Poisoning Control Center. Agrochemical companies should supply medical facilities and the poison control center with up-to-date pesticide information.
- Adopt pesticide poisoning recognition and treatment as part of the medical and nursing school curriculum; hold training courses/workshops in medical facilities.
- Ensure all health care facilities have antidotes available.
- Community-based initiatives! Currently, public health inspectors travel to rural areas to educate villagers about sanitation, food safety, and plumbing. The public health program could integrate occupational/agricultural health more effectively (Jeyaratnam, 1990).
- Health care providers need awareness of local conditions.
- Possible transport of poisoning victims.

- Establish a register of cancer, cardiovascular diseases, and birth defects to link chronic poisonings (WHO, 1990).

<u>C) Small-holders</u>

- The safe-use strategy is a paradox because it "actually promotes and increases the use of pesticides without preventing or controlling the adverse effects as claimed" (Wesseling, et al., 1997: 291). There is little evidence that training and education in safe use and handling alone works.
- Train farmers in first aid and how to recognize chronic effects.
- Community storage and disposal facilities.
- A community-based approach to accomplished long-term behavioral change (Shutske and Ohmans, 1995).
- Provide farmers with tangible and affordable pest control alternatives.

In order to realize any of the above initiatives, the government must prove long-term commitment. I suggest that, rather than solely focusing on minimizing the "bad" (i.e. pesticide use), more effort should be targeted at developing new ideas and approaches. As long as pesticides remain indispensable there will be no change. Most importantly, any further research or action should first seek input of farmers and communities.

APPENDIX

(A) IPM CRSP Socioeconomic Household Survey

Caribbean Agricultural Research & Development Institute /
Virginia Polytechnic Institute and State University

Household #_________
2. Community____
3. Sex___________
4. Age___________
5. Training received____

Agricultural School	On-the-job Employer	Supplier None

Primary occupation_____________________
Secondary_______________________
No. of years farming in this area______________
Elsewhere_____________________
Distance from home to farm___________________________

8. **Household composition** *(Female Household-Head)*

Relation to Respondent	**Sex**	**Age**	**Education**	**Principal Occupation**	**Secondary Occupation**	**If away part-time: current residence? for how long?**
1. **Self**						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Housing Material *(Observe)*___________________________________
(a) No. of Animals (+kind)___________________________________
(b) How do you get water (ask about quantity & quality)_____________
(c) Where do you do your cooking______________________________
(d) Electricity____________
(e) Telephone________________
(f) Vehicle______________
(g) Bicycle______________
(h) TV________________

10. **Land Profile**

Parcel	Size (acres)	Tenure	Who holds it	Amount cultivated currently/ last cycle
#1 (house)				
#2				
#3				
#4				
#5				

Total Acreage__________

What are some of the problems you have on the farm or in the community

Crop	Problem	Problem over time

Household Decision Making and Marketing

12. **What crops does the household currently grow and who performs what tasks?**

Crop	Nurs Prep	Land Prep	Plant	Fert & Spray	Weed	Reap	Post Harv	Market
Major								
Other								

13. Who makes decisions about the target and other crops? (self/partner/both)
14. Who decides who does the work with the target crop and/or other crops?
15. Who decides if you will hire workers and how much to pay?

16.

Crop	**Who sells it** *(deals with buyer or takes to market)*	**Who decides how to use the income**
Major:		
Other:		
Animals/animal products:		
Non-farm sources of income:	**Who earns or receives it**	

17. Where do you market your crops?

Market	**Target/Other Crops**	**Who sells/To where**
H.m. to public market		
H.m. to roadside		
H.m. from a vehicle		
H.m. to restaurant, hotel, supermarket, institution		
H.m. to public at farmgate		
To higgler at farmgate		
To exporter at farmgate		
To factory at farmgate		
Take to higgler		
Take to exporter		
House-to-house		

H.m. = Household member

18. Who decides how the crop will be sold?
19. If you had a choice, which method of marketing would you prefer? Why?
20. Do you do business directly with exporters? Yes No
If not, why?
21. Have you ever tried to sell to exporters? Yes No
22. Do you know of any special requirements that have to be met before you can export?

Pesticides and Decision Making

23. Do you use pesticides on the target/other crops? Which ones?

Crop	Pesticides Used
1.	
2.	
3.	
4.	
5.	
6.	

24. If you use chemicals, do you think it will...
increase decrease not change
...the quality of your crop?
25. If you use chemicals, do you think it will...
increase decrease not change
... the amount of crops
you sell
26. If you use chemicals, do you think it will...
increase decrease not change
...the price you will get for your crops?
27. If you control pests, would it change where you sell? Yes No
If yes, how?
28. How do you decide when to spray?
29. How do you decide which chemical to use?
30. How do you decide how much to use?
31. Are pesticides always available (Where)? Yes No
32. Where do you get your information about when, what, and how much to spray?

Farm supply store
Relative
Extension officer
Trial and Error
Employer
Agric.school
Read label
Other farmers
Radio/TV
Field day (by whom_____________)
Other________________

33. Which source of information have you found most useful and why?
34. How much pesticides are bought per week_______________________
Since you began farming, have you seen any change in the amount of chemicals you use?
35. Who in the household decides that you should use pesticide (self/partner/both)?
Who chooses the pesticide?
Who buys the pesticide?

Health and Poisoning

36. Are some pesticides too dangerous to use? Yes No
Which ones and why?
37. Are some pesticides safe to use? Yes No
Which ones and why?
38. Are all sprays equally harmful to insects/diseases? Yes No
39. Are all sprays equally harmful to humans? Yes No
40. What are the major health problems in your farming community?
41. Do pesticides pose a health problem in your community?
Yes No Explain
42. After applying/handling pesticides, or being near an application site, have you ever felt any "different?" Yes No
What symptoms?
What was the chemical?
43. Have you ever had any of the following symptoms?

Itching	Burning skin	Diarrhea
Felt unwell	Nausea	Burning eyes
Dizziness	Headaches	Other__________
Rash	Vomiting	

44. Do you know of anyone who has fallen ill because of pesticides?
Yes No Explain.
45. Have you ever sought medical attention after applying/handling pesticides?
Yes No Where?
46. Where would you seek medical attention in case of a medical emergency?
Name________________

Public hospital/clinic	Self-treatment (What________)
Private hospital/clinic	Herbalist
Private doctor	Other_____________

47. Would that be the same in the case of poisoning? Yes No
48. What is the distance from your farm to the health provider in case of Poisoning?
49. Is there anything you can do before or after you spray to prevent poisoning or make you feel better? Anything you can eat or drink?

(B) Additional Questions for Farmers Concerning Pesticides

1. Do you mix different chemicals together?
2. What time of the day do you apply pesticides?
3. Who is nearby during application
4. Are domestic animals kept nearby
5. What kind of application equipment are you using
6. Are there any problems with the equipment
7. What do you wear during application?

   long-sleeved shirt — dust mask — eye protection
   long trousers — respirator — other________
   gloves — water boots
   coveralls — cap
8. Do you wear PPE:

   always — sometimes — never
9. What do you feel is the most important piece of protective equipment/clothing?
10. After spraying, how long do you wait before entering the field?

    continue working — following day
    1-2 hrs. — other__________
    within the same day
11. After spraying, how long do you wait before reaping?

    1-2 hrs. — following week
    within the same day — other___________
    following day
12. After spraying, what do you do with your clothing?

    take off immediately — wear at home
    wear until dirty — other_________________
    take off at end of the day
13. How and where do you store the pesticide?
14. How and where do you dispose of the pesticide?
15. Do you find that you make more pesticide mixture than you need?

    Sometimes — Always — Never
16. What do you do with what is left over?
17. What are some of the things that should not be done while spraying?
18. Have you heard of cases of: cancer, infertility, miscarriage, birth defects, long-term respiratory problems, neurological damage, skin disorders, etc., in relation to pesticides?
19. Do you use any other methods of pest control other than chemical?

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Curriculum Vitae

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<u>Education</u>

Virginia Polytechnic Institute & State University, Blacksburg, VA
Master of Science in Geography (May, 1999)
Area of Emphasis: Medical Geography
Advisor: Charles M. Good
Specialization: International Research and Development
GPA: cumulative 4.0

University of Idaho, Moscow, ID
Bachelor of Science in Geography (May, 1997), *cum laude*
Minors: International Studies, German
GPA: cumulative 3.8

University of Maryland, Augsburg, Germany
Associate of Arts (May, 1993)
GPA: cumulative 3.8

<u>Work Experience</u>

<u>Graduate Teaching & Research Assistant</u>, to Dr. Charles M. Good, Department of Geography, Virginia Tech, Blacksburg, VA (Aug.1997- May 1999). Teaching assistant in World Regions Geography, Medical Geography, and Geography of Africa. Provided student assistance and held review sessions and occasional lectures. Research assistant to Dr. Good's USAID funded project to assess the role of traditional healers in HIV/AIDS prevention in Tanzania.

<u>Researcher</u>, Office of International Research and Development, Blacksburg, VA. (June 1998- Aug. 1998, Jan. 1999). Conducted an intra-household survey in rural Jamaica as part of an Integrated Pest Management project.

<u>Medical Assistant</u>, Planned Parenthood of the Blue Ridge, Blacksburg, VA (Jan.1998- Aug.1999). Patient care and counseling; laboratory work.

<u>Research Assistant</u>, to Dr. Harley E. Johansen, Department of Geography; University of Idaho, Moscow, ID (Aug.1994-May 1997). Collected, recorded and

analyzed data for NSF grant funded project concerning locational patterns of Scandinavian business development and investment in the Baltic region.

Research Team Member, Department of Geography, University of Idaho (Present). Data collection through pedestrian traffic counts, statistical modeling of data (SPSS), and map compilation (ArcView) in support of the proposed University Commons.

Intern, through the University of Minnesota Studies in International Development; Kisii, Kenya (Sept. 1995-June 1996). Internship at the Kisii District Hospital: counseled in family planning, administered physical examinations and infant immunizations. Volunteer work at the Mosocho Dispensary: administered infant immunizations and prenatal and postnatal maternal check-ups; assisted in rural outreach program for AIDS awareness and prevention.

Student Ambassador, University of Maryland; Augsburg, Germany, (1992-93); led panel discussions; participated on the Dean's board; counseled drop-out risk high school students; assisted in registration; conducted campus tours.

Other Experience

Virginia Tech freshmen mentor (academic counseling); tutor to students with learning disabilities; translator (German/English) at a Japanese machinery company; nurse's aid (nursing home).

Skills

- Cartographic techniques and software: ArcView, Arc/Info, Atlas GIS
- Word processing, spreadsheet and statistical: SPSS, MS Excel, MS-DOS, MS Word, WordPerfect
- Research: U.S. Census data, TIGER files; survey design and administration
- Foreign languages: bilingual: English/German, working proficiency: Spanish and Swahili, beginning: French.

Awards

Graduate Teaching Assistant, Virginia Tech
Alumni Award for Excellence (top 1.5 % of graduating seniors), University of Idaho
Larson Scholarship, University of Idaho
Caldwell Geography Scholarship, University of Idaho
Smith Geography Scholarship, University of Idaho
Dean's list every semester

Activities

Public Relations Officer, International Club at Virginia Tech
President, Made in Germany and Austria at Virginia Tech
President, Students for Environmental Awareness
Geography Department Delegate, Virginia Tech Graduate Student Assembly

Member, Phi Theta Kappa Honors Society
Member, Virginia Tech Geographic Society
American Association of Geographers

Travel
Europe, Kenya, Tanzania, Uganda, Malawi, Mozambique, Zimbabwe, Egypt, Mexico, Canada, Columbia, Jamaica, Costa Rica, Cuba, Grand Cayman, Panama.

Interests
Gardening, hiking, camping, skiing, traveling, reading

References
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