AN ABSTRACT OF THE THESIS OF

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This study examined the existence and effectiveness of current pesticide management programs in the Caribbean region. A questionnaire was developed to assess the current pesticide managment programs in the Caribbean region and to determine the strengths and weaknesses of the existing education and training programs, governmental policies, and other resources. Eighty-eight health and agricultural professionals from 14 Caribbean countries completed the questionnaire. These professionals were attending an Agromedical training program entitled, "Train the Trainor," in Trinidad-Tobago and St. Lucia on September 14 - 17, 1982.

Subjects acknowledged throughout the questionnaires that there is a very definite need for improved education and training programs, better safety measures, and more effective legislation in the Caribbean region. The professionals surveyed felt the best means of transferring information were with inservices, followed by public education and

better use of the media. The respondents felt the safety measures could be improved to include safety equipment and clothing for all those directly involved with pesticide use, as well as establishing a poison information center in their community. Education and training would eliminate many of the hazardous consequences stemming from misuse and misinformation.

Pesticide legislation does not appear to be very effective, if it exists. In order to improve the effectiveness, the participants suggested public education, more government regulations, trained personnel, and more qualified staff.

AN INTERDISCIPLINARY ASSESSMENT OF CURRENT PESTICIDE MANAGEMENT PRACTICES IN THE CARIBBEAN REGION

by

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APPROVED:

Redacted for privacy

Assistant Professor of Health in charge of major

Redacted for privacy

Professor Emeritus of Health Education in charge of co-field

Redacted for privacy

Associate Professor of Sociology in charge of co-field

Redacted for privacy

Chairman of Department of Health

Redacted for privacy

Dean of Graduate School

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Typed for researcher by Cheryl A. Graham

DEDICATION

I dedicate this thesis to my mother, for it is from her that I learned that no matter the circumstances that surround the day, it is ours to mold -- we make the best of what we have, and yet, not merely settle for anything less than what we know to be within our reach.

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CHAPTER I

INTRODUCTION

Pesticides are very necessary in our society, contributing to both the control of plagues and vectors and the production of better food. Both of these problems are major challenges being faced by the world today. The control of human illnesses transmitted by insects demands continuous attention, as does food production for a rapidly growing population. It has been estimated that the world population will double toward the end of this century (Astolfi, 1981).

Without the use of pesticides, diseases like malaria would never have been controlled and increases in agricultural productivity over the past few years would not have been possible. In many parts of the world where there is no balanced program of integrated pest management, there are hundreds of millions sick and dying from vector-borne diseases and/or are malnourished.

It is estimated that at least 200 million persons in these areas are afflicted with malaria, 300 million with filariases, and altogether about one in six has some insect vector borne disease (Am. Scientist, Jan.-Feb. 1977).

Dr. John E. Davies, Chairman of the Department of Epidemiology and Public Health at the University of Miami and Dr. Virgil H. Freed, Director of the Environmental Health Sciences Center at Oregon State University have stated that in some regions of the world, one out of every five is

afflicted by serious trypanosome disease, one in twenty is blind, and there is a very high mortality rate in children due to malnutrition and infection. In Davies and Freed's draft, "An Agromedical Approach to Pesticide Management, Some Health and Environmental Considerations," they also state that food may be lost to insects, diseases, and rodents by as much as 20 - 30 percent (Davies and Freed, 1982).

The use of pesticides is very definitely a necessary component of the control of plagues and vectors, and the correct and safe use of these pesticides is an essential part of the entire process and most definitely a prerequisite for the integrated control of pests (Astolfi, 1981).

The concerns of safety for both health and agriculture led to the development of the Agromedical approach to pesticide management. The forerunners of this approach are John E. Davies, Virgil Freed and Ray F. Smith. Smith is from the Department of Entomological Sciences, University of California, Berkeley and Head of the University of California/Agency for International Development (UC/AID) project of plague control.

Agromedicine is a relatively new concept. It deals with the interdisciplinary application of agriculture, applied chemistry, and medicine to the safe global production of food with maintenance of the health conditions of agricultural workers and the general population (Davies, 1978).

Agromedicine deals with all agricultural workers, including women and children employed on the farm, and covers items such as age of admission of children to agricultural employment, maternal protection, and educational training for all of those involved with pesticides.

The concept of pesticide management requires a coordinated multidisciplinary team approach for controlling agricultural pests. The objective is to apply the required amount of pesticide at the precise target area with a minimum of loss to the surrounding environment and without hazard to man.

Statement of the Problem

The purpose of this investigation was to identify the need for improved pesticide management programs in developing countries. Current literature clearly supports a need for additional study in the area of effective pesticide regulation in these countries.

The Caribbean region was chosen as the geographical location for the study because of the accessibility of the desired information at the "Train the Trainor" workshops in Trinidad in November 1982. These were seminar workshops in agromedical practices in pesticide management. A major goal for the training was the development of a country and/or regional agromedical association. Those in attendance were trained to provide additional training to those in the fields.

The Caribbean Commonwealth consists of 12 territories that vary greatly in size. The largest territory is Jamaica, with a population of just over two million and the smallest is Montserrat with only about 12,000 inhabitants (Chernick, 1978). During three centuries the territories have been largely repopulated from outside the Americas: Africa, Europe, Asia and the cultures of various origin have been blended peacefully.

The concept of a Caribbean Free Trade Association (CARIFTA), that formed in May of 1968, suggests the value of cooperation between the

territories. The provisions of the agreement, which formed a free trade area were agreed upon by all 12 Commonwealth Caribbean countries (Chernick, 1978).

There are eight less developed countries (LDCs) in the Commonwealth: St. Lucia, Grenada, St. Vincent, Dominica, St. Kitts, Montserrat, Belize, and Antigua. The more developed countries (MDCs) are Jamaica, Trinidad and Tobago, Guyana, and Barbados.

In August 1973, a Caribbean Community and Common Market (CARICOM) was established. This represented a deepening of regional integration and has achieved such objectives as: establishment of common external tariff, a harmonized system of fiscal incentives for industry, double-taxation and tax-sparing agreements, and the formation of a Caribbean Investment Corporation (CIC) designed to channel funds to the LDCs. Initially, CARICOM was comprised of only the four MDCs, however, by the end of July 1974, all other CARIFTA members had acceded to the Community agreement (Chernick, 1978).

The age structure of the populations of the CARICOM is very young on the average, 46 percent are under the age of 15 and only four percent are over 65 (Census, 1980). Statistics for literacy rate were available for eight of the Caribbean countries. The lowest was Dominican Republic with 68 percent and the highest was Barbados with 97 percent. The average literacy rate for the countries was 83 percent.

Schooling is compulsory in the seven countries reviewed. It is compulsory for the primary level age group which is generally six to 12 or five, six, or seven to 14 years of age. Grenada is the only country reviewed that was not enforcing the compulsory attendance at the time. Attendance in some of the countries drops off a great deal in the

secondary level because of the non-compulsory ruling. Several examples of this are as follows: Suriname -- primary attendance (5-14) 101 percent; secondary attendance (15-19) 47 percent; Dominican Republic -- primary attendance (5-14) 102 percent; secondary attendance (15-19) 29 percent; and St. Lucia -- primary attendance (5-11) 81 percent; secondary attendance (12-17) 38 percent (Kurian, 1982).

All of the seven countries publish a newspaper or newspapers, either daily or non-daily. There is no national news agency in any of those countries.

Radio is a major source for providing information to the public. Of the seven countries where information was available, in 1976 and 1977 there was an average of 320 radio receivers per 1,000 inhabitants. The largest number was in St. Lucia, with 808 receivers per 1,000 people and the least amount of receivers was in the Dominican Republic with 41 per 1,000 inhabitants.

Another source of information that is available in some of the countries is television. In 1976 and 1977 there was an average of 104 televisions per 1,000 people. There were no televisions in Dominica or Grenada and those in St. Lucia were private (Kurian, 1982)(Table 1-1).

The present labor market situation in the CARICOM countries combines a scarcity of skilled workers with an oversupply of the unskilled. Sir Harold Mitchell, a research professor of Latin American Studies at Rollins College, states in "A Political and Economic Study of the Contemporary Caribbean,"

> In the developed countries education opens an increasing number of administrative and technical jobs. The Caribbean, despite improvements, remains handicapped by inadequate educational facilities in comparison with the United States or the Common Market. No one familiar

> with the education of children from rural districts can underrate the problems that face these countries (Mitchell, 1978).

Agriculture in the Caribbean region has traditionally taken two main forms. First, large private estates of plantations, making use of most of the best land, have been the sources of the region's traditional exports -- primarily sugar, but also bananas and citrus fruits. Secondly, large numbers of peasant farms occupying a small proportion of the total land area have mainly produced sustenance crops (Chernick, 1978).

More recently, most sugar plantations are now publicly owned and a higher share of total production comes from cane growers. Small farms also account for a larger share of the production of bananas, citrus fruits, and coconut products.

Large scale agriculture in the West Indies presents many problems. One is that farm work is not well paid and has no prestige. This is a reason why many people prefer to remain unemployed if the only alternative is agricultural employment. A second problem is that there are large tracts of land lying unused or ineffectively used.

The bulk of the export crops other than sugar and most of the foodstuffs consumed locally, are grown on small holdings. In all, these amount to two-thirds of the cultivated land in the Commonwealth Caribbean territories. Some small farmers are fairly well off, but the great majority live in poor conditions on tiny plots of land which they cultivate in a primitive and inefficient way (MacPherson, 1980).

Findings from a 1975 Caribbean Regional Study by the International Bank for Reconstruction and Development showed that except for Trinidad and Tobago where petroleum resources and petroleum exports contribute

substantially to the economy, all other countries are dependent to a greater or lesser extent on agriculture. Agriculture is a source of food, employment, and foreign exchange earnings.

In seven of the Caribbean countries where statistics were available, an average of 41 percent of the land is used for agricultural purposes. The average percentage of the labor force that is employed in agriculture is approximately 35 percent (Kurian, 1982).

This entire region with a population of five million, imports about one billion dollars annually to the United States. This figure is for a range of food items including cereals, dairy products, meat, legumes, and vegetables.

The most accurate way of describing the nature of the agricultural system in the Caribbean is best described by C. W. D. Brathwaite (1980), from the Department of Crop Science at the University of the West Indies, "we have an agricultural system oriented for the production of export crops and dominated by the production of sugar from sugar cane."

Based on current studies it has been shown that the extension services in the region are very inadequate, field extension officers are poorly trained, individual officers are expected to serve too many farmers, transport is inadequate, and teaching aids are poor. There are many reasons why training and education are inadequate in the region. One of those is that the attrition rate among officers is high, a situation which could be corrected by more adequate salaries and greater recognition of their services. Another is that only a very few secondary schools in the entire region provide agricultural training. New extension officers are recruited from those with limited training and are then given special on-the-job training. Their

background is limited or possibly non-existent. Appointees, while being trained, achieve an uneven level of competence in subject matter, and their knowledge of extension methods is weak (Chernick, 1978).

The individuals who are most likely to feel the negative effects from the lack of, or poor training would be the applicators, pickers, and children. These workers are hired to work in fields where inadequate equipment and over-exposure to pesticide residues is a daily occurrence. In July, August, and September of 1981, approximately 300 individuals sustained mild organophosphate poisonings as a result of careless application of pesticides in treating the crops (Davies, 1981). An example of applicator poisoning follows:

> Tony B. was employed as a pesticide mixer and loader for a fixed-wing crop dusting firm. He had started loading the aircraft at 6 A.M. with a mixture of parathion 6-3 and toxaphene. Rubber gloves were the only protective clothing worn, and he was a heavy smoker. He soon began to feel unwell. He was admitted at 11:35 A.M. to the emergency room of a local hospital. He complained of nausea, vomiting, weakness, and blurring of vision. His pupils were constricted and there was profuse perspiration. A screening cholinesterase test revealed severe inhibition. After being put in a shower and scrubbed all over, he was given medications. He remained in the hospital where he improved over the next few days. Blood and urine studies confirmed that the poisoning was due to an exposure to ethyl and methyl parathion (Davies and Freed, 1982).

Purpose of the Study

All too often the farmers, as well as the general public, are reliant upon inadequate information and training programs in regard to safe and effective pesticide management programs. In the developing countries there are many areas that do not have a trained infrastructure of agricultural personnel to deal with many of the problems caused by the transfer of technology involved with the pesticides.

The major intent of this research was to assess the current pesticide management programs in the Caribbean region and to determine the strengths and weaknesses of the existing education and training programs, governmental policies, and other resources. The assessment was based on a comparison with criteria established by Drs. Virgil Freed and John Davies (1982) (Appendix D). In order to accomplish this, the following objectives were established:

(1) develop an assessment tool in order to determine the current pesticide management practices in the Caribbean region.

(2) gather information regarding current pesticide management programs in each country, including but not limited to manufacture, formulation, transport, mixing, application and disposal of pesticides.

(3) identify the existence and effectiveness of training techniques and protective measures for the workers.

(4) determine the various training programs or activities involved in the agromedical approach that could contribute to the successfulness of the pesticide management program.

(5) determine the existence of and effectiveness of the current pesticide legislation.

Research Questions

In keeping with the objectives of this study which are directed at assessing the current pesticide management programs in the Caribbean region and determining the effectiveness of the training programs and governing regulations, this study is focused on the following areas of concern:

A. Education/Training

(1) What forms of information are regularly available to the general public in the Caribbean region regarding the safe use of pesticides?

(2) How necessary is regular training in safe pesticide management? If necessary, how can that training be successfully transmitted to both the general public and those in direct contact with the pesticides?

(3) At what level of sophistication do pesticide management programs occur, and could these programs be improved to encourage more effective pesticide management programs in the Caribbean?

B. Safety

(1) To what extent do individuals working directly with pesticides use safety equipment and clothing?

(2) What is the importance of the existence of a poison information center and a first aid center in the area and how likely is it that the centers could be established? If the establishment is not likely, what are the major obstacles?

C. Legislation

(1) Has pesticide legislation been adopted in the country, and if so, is it proving to be effective in promoting safer pesticide management?

(2) What would the major areas of concentration be, in order to improve the effectiveness of pesticide legislation?

Justification of the Study

There was a letter written to a school teacher from a group of students in an Italian rural school and reprinted in part in "El Correro" (UNESCO, 1972) that stated in the epigraph, "Perhaps if we could do more we would realize that Pedagogy has something to say in the education for the safe use of pesticides." This statement shows the dissatisfaction with current methods of education and their hopes to develop a program that will be capable of training the individuals involved, in a more practical and learnable manner.

Proper education at all levels can augment extension services and the general ability of farmers to use land more productively. In a

World Bank Country Economic Report on the Caribbean it is noted that the educational system in the region is seriously deficient in agricultural education. Agriculture education at the post-secondary level is now provided in only three countries: Jamaica, Trinidad and Guyana. In addition, education at professional levels is provided by the faculty of agriculture at the University of the West Indies (Chernick, 1978).

The World Bank Country Economic Report further noted that agriculture education at lower levels is currently either non-existent or trivial and that agriculture education should be incorporated into school systems at all ages and levels as a matter of urgency. The content of programs suitable for local conditions and the best way to set such programs up, should be studied at the national level as well as the local level, by the countries of the region.

I. Vassilieff, from the Department of Pharmacology of Instituto Basico de Biologia Medica e Agricola, "Campus de Botucatu," Rubiao Junior, Sao Paulo, Brazil, supports the idea that education is of greatest necessity for the safe use of pesticides. He states,

> The prevention of overexposure is undoubtedly the best insurance against poisoning, and remembering (sic) that all chemical pesticides have some degree of toxicity to man. Everyone who works in pest control should be aware of the potential hazards which accompany their use. This should be asserted constantly because pest control chemicals must be looked upon as two-edged swords: they are not selectively toxic to the target pest, but present varying degrees of hazards to humans as well as non-target plants and animal life (Vassilieff, 1982).

Education requires a very comprehensive approach, not only in dealing with those individuals involved in the actual applications, but those who are affected in any way by the use of pesticides. In the general conclusions and recommendations, formulated under the chair-

manship of Dr. F. Gunter, from a workshop held in Tucson, Arizona in 1980 entitled, "Minimizing Occupational Exposure to Pesticides," there is a short statement reading as follows:

> All field workers must be educated about the hazards of the materials to which they are exposed either as applicators or while working at jobs where they will be exposed to foliar residues" (Gunter, 1980).

It is also stated that all manufacturers and formulators of pesticides should have modern health surveillance programs which should result in early warnings and adoption of appropriate measures.

When training individuals, it is important to be familiar with their previous experience and their cultural beliefs. The backgrounds of the educator and the learner may be very different. These differences need to be taken into consideration. Aida Soto, at the Sixth International Workshop of the Scientific Committee on Pesticides of the International Association on Occupational Health in Argentina, March 1981, stated in a presentation:

> The socioeconomic background and the transcultural problems of the rural workers are sometimes the reason for their natural rejection of our training efforts. The educational level of the trainees is the critical point. Obviously most of the printed hazard information on the label of pesticide containers is of no use to illiterate workers (Soto, 1981).

Another problem accompanying the lack of or weakness of pesticide management programs is legislation, when pesticides are being used as a control or eradicator of pests. An article by J. Briggin concluded that some developing countries have enacted virtually no legislation to govern the importation, registration, and handling of pesticides. There are few countries that are capable of monitoring pesticide residues in food or in

the environment due to lack of facilities or trained personnel. It is for these reasons, even where the laws do exist, it is not uncommon for them not to be enforced as they should (New Scientist, 1978).

I. Vassilieff agrees with Gribbin as to enforcement in his article entitled, "Education of Workers Exposed to Pesticides at a Multidisciplinary Level." He states:

> Many governments have their own legislation and regulations for the application of pesticides comformable to the recommendations by World Health Organization (WHO) and the Food and Agriculture Association (FAO). The rules for chemical safety for workmen are good, but in practice they are less effective because people do not have sufficient knowledge to realize the seriousness of the problems and the possible damage to employment (Vassilieff, 1981).

The need for pesticide use in these developing countries is very evident for both health and food problems and for that reason, pesticide management programs are necessary for human and environmental safety. The education cannot be undertaken by agricultural personnel alone, nor can the goals be accomplished by those in the medical or public health fields alone. Pesticide management should be an integrated interdisciplinary application and approach. It must be noted, however, that a pesticide management program cannot be implemented effectively unless the trained personnel is accompanied by enforced legislation.

Definition of terms

The following terms have been defined to clarify their use in the study:

(1) Agromedicine: A relatively new concept which is concerned with the integrated, interdisciplinary application of the skills and knowledge of

agriculture, applied chemistry, and medicine to the safe global production of enough food of highly nutritional content which will meet the health and nutritional needs of man.

(2) Aldrin: A white crystalline solid which is soluble in most organic solvents and is insoluble in water. It is effective against many agricultural insects, particularly grasshoppers and cotton pests. It is also effective as a larvicide against flies, mosquitoes, sand flies and eye gnats and as a residual spray against flies, mosquitoes, fleas, roaches and other household pests. Howevever, because of its volatility, it does not have as long-lasting residual effect as DDT or dieldren. It is much more toxic to man and animals than DDT and should be used with extreme caution, avoiding inhalations of vapors, dusts, or mists and direct skin contact.

(3) CARICOM: Caribbean Community and Common Market, established August 1973.

(4) CARIFTA: Caribbean Free Trade Association, formed in May of 1968.

(5) Dieldren: It is closely related to aldrin and the same precautions against its toxicity must be taken as against aldrin. It is a white crystalline solid moderately soluble in organic solvents but insoluble in water. It is extensively used for a variety of agricultural insects and forest pests. It is effective as a residual spray against flies, mosquitoes, ants, roaches, earwigs, traitoma bugs, clothes moths, tapestry moths, carpet beetles, and other household pests; as space sprays against adult flies and mosquitoes; as larvicides for control of fly, mosquito and sandfly larvae; and as sprays and dusts against ticks. Its use should be limited to places where contamination of food and food products of man and animals is not a problem and where the risks to

operators applying it can be kept low.

(6) Dichloro-diphenyl-trichloroethane (DDT): It was the first of the important organochlorines that came into use as an insecticide. It is an effective insecticide for mosquito larvae and adults, bed bugs, fleas, lice, non-immune flies, and many other insects. It is a fine white powder and tends to become lumpy when not mixed with other substances. It dissolves very little in water or alcohol, but is soluble in many organic solvents. The persistence of DDT residues is great enough that the residues will continue to be redistributed for many years after use of the pesticide has stopped, presumably presenting a continuing hazard to all biota.

(7) Entomology: The branch of zoology tht deals with insects.

(8) Fumigants: Fumigants have great power to penetrate the lining membranes of both the respiratory and gastrointestinal systems as well as the skin. They also have the capacity to penetrate rubber and plastic used for protective clothing, and they are not very well taken up by the usual absorbents used in respirators. These properties make applicator protection extremely difficult.

(9) Fungicides: Pesticides that kill fungi.

(10) Herbicides: Two of the most common herbicides are 2,4-D and 2,4,5-T, both of which are phenoxy compounds used to kill broadleaf weeds and woody plants. They are often used in combination with fertilizers. Although they are considered only moderately toxic, they do pose a hazard to the user. Furthermore, 2,4,5-T has been found to be teratogenic, i.e., it can cause birth defects in animals.

(11) Insecticide: Compounds used mainly against insect pests.

(12) Integrated Pest Management: Combining the best of all useful

techniques -- biological, chemical, cultural, physical and mechanical -- into a custom-made pest control system.

(13) Lindane: It is a white crystalline solid, insoluble in water but soluble in most organic solvents though not as soluble as DDT. It has a musty odor, is more volatile than DDT and has considerable fumigating properties. It is more toxic to insects than DDT, therefore, its formulations are about one-tenth as strong as DDT. It is effective as a residual spray against flies, mosquitoes, roaches, and other household pests; as a space spray against adult flies and mosquitoes; as a larvicide against fly and mosquito larvae; and as dust and spray against ticks, mites, fleas, and a variety of agricultural pests. Because of its volatility, its effectiveness as a residual spray is limited. It is the most toxic of the benzene hexachloride isomers, but is excreted relatively rapidly and therefore shows the lowest chronic toxicity. Because of its acute toxicity, care should be taken to avoid breathing the fumes, dusts, sprays, or contact with skin.

(14) Malathion: One of the safest insecticides and it is used against a wide range of mite and insect pests, including flies, cockroaches, and mosquitoes resistant to DDT and other insecticides. It may have a disagreeable odor.

(15) Mixers: The individual, usually a farmer, who mixes the pesticide to prepare for application.

(16) Monitoring: The process of following a specific chemical through the environment.

(17) Organochlorines: These are fat-soluble and persistent. There is a wide range of toxicities in this group of pesticides, and endrin has proved to be the pesticide most responsible for episodes of human

poisoning. Acute toxic effects are the result of interference with neural axonic transmission, particularly in the central nervous system. Occupational exposure has been shown to produce liver microsomal enzyme induction.

(18) Organohalogens: Compounds containing fluorine, chlorine, bromine, or iodine, constituting the largest groups of biologically active organic chemicals known. These chemicals are not exclusively man-made.

(19) Organophosphates: These chemicals, for the most part, are insecticides although a few show activity as herbicides. The organophosphates break down somewhat more readily, though some, such as parathion, are known to have considerable persistence under the proper conditions.

(20) Parathion: This is dangerously toxic to animals through inhalation, skin absorption, and swallowing. It is used for agricultural insects. In public health, it is used as fly cords and in mosquito control.

(21) Pesticide: Any substance used to control pests ranging from rats, weeds, and insects to algae and fungi. Pesticides can accumulate in the food chain and can contaminate the environment if misused.

(22) Pesticide Management: Concerns the skills and arts essential to protect man and his environment from unnecessary and avoidable pesticide exposure. Concerns all aspects of pesticide movement through the environment; including manufacture, formulation, transport, mixing, application and disposal. Its goal is to minimize exposure while achieving effective pest management in agricultural, public health and urban settings. It also involves monitoring regular pesticide use to assure their safe and effective application.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Pesticides is a general classification based on chemical groups that include insecticides, rodenticides, fungicides, herbicides, and fumigants. These compounds are manufactured for the sole purpose of destroying some form of life. They are classified as pesticides because they are directed against organisms that society deems undesirable. It is true that a selective toxicity of pesticides is beneficial but all can produce toxic effects in man, animals, and the environment (Vassilieff, 1981).

There has been a drastic increase in the amount of pesticides being exported from the United States. The amount has almost doubled in the last fifteen years. The industry now produces four billion pounds of pesticides each year -- more than one pound for every person on earth. Nearly all of the pesticides are produced in industrial countries but twenty percent are exported to the Third World (Weir, 1980).

In order for these developing countries to manage these pesticides effectively and safely, training is essential. There is a very definite need for training of both the management, or those who supervise the field workers, as well as the workers themselves.

Ray F. Smith, Executive Director for the Consortium for International Crop Protection (CICP) in Berkeley, California defined pesticide management as a:

> technology concerned with the safe, efficient, and economic use and handling of pesticides from the time of manufacture to the final utilization and disposal. Included in this process are formulation,

> packaging, transfer, storage, official registration, labeling for use and sale, selection for use, application and the disposal of containers and unwanted materials. In addition, pesticide management is concerned with the problems of residues in food and in the environment and the total impact of these on man (Davies, et. al., 1978).

A major goal of pesticide management is to reduce pesticide exposure leading to human poisonings and human and environmental contamination. John E. Davies, R. Smith, and V. Freed agree that this goal can hopefully be accomplished through legislative action, intervention studies, and innovative pesticide management practices (Davies, et. al., 1978).

History of Pesticides

The use of pesticides is a relatively new concept. It was not much more than a century ago that the first insecticide was developed. It was in 1865 that Paris green was adopted to combat the Colorado potato beetle. Paris green was arsenical, a stomach poison (Brown, 1978).

It was only in 1939 that the insecticidal value of Dichlorodiphenyltrichloroethane (DDT) was appreciated after being discovered years before in 1874. It was used exclusively for military purposes (e.g., de-lousing and mosquito control) during the period of hostilities. However, wartime work on nerve gases, based on organophosphorous compounds, led to the development of the organophosphate insecticides, which are in many cases effective as, and in general far less persistent than the organohalogens. Organophosphates are therefore less dangerous to the environment.

World War II also encouraged research on herbicides so that farmers could be released for other types of war service. Since that time the growth in chemical pesticides has been phenomenal (Gooding, 1980).

Dr. Virgil Freed states that there are now approximately 900 to 1,000 chemical compounds in 35,000 to 40,000 different formulations, though,

"only about 150 of those chemicals are very widely used" (Freed, 1980). W. J. Hayes, in a book entitled, The Toxicology of Pesticides, agrees with Dr. Freed, stating that those chemicals that are being widely used can be classified as insecticides, herbicides, or fungicides (Hayes, 1975).

History of Agromedical Approach to Pesticide Management

The need for an agromedical approach to pesticide management first became apparent to Dr. Virgil Freed and Dr. John Davies when they visited several areas of the world where food production was the single most important ingredient for economic and technologic development. They also found that vector-borne diseases were a large factor in the health problems of the countries.

Dr. Freed and Dr. Davies found that these countries were having problems with agriculture and the health of the people as a result of the efforts to increase food production by use of pesticides. They state in An Agromedical Approach to Pesticide Management, Some Health and Environmental Considerations:

> The common interest of medicine and agriculture in pest control stems from the shared basic goal of contributing to the health and welfare of humans. While medicine seeks to prevent and cure diseases, agriculture endeavors to provide the food for an adequate and nutritious diet to maintain that health. One without the other is destined to fail. Thus, unwittingly, up until a few years ago each profession pursued its separate interests, particularly with respect to pest control. No longer is this acceptable. The achievement of a healthy productive society is inextricably bound to the simultaneous success of both professions. It is from this fact that the concept of agro-medicine sprang (Davies and Freed, 1982).

The Need for Pesticides

In the last thirty years, the introduction and use of chemical pesticides for crop protection has been one of the important technologies contributing to the expanded food production. During the same period, chemical control of insect vectors of disease can also be seen as a major scientific achievement. Before such chemical control programs started, malaria was endemic in 148 countries but by the end of 1974 it had been apparently eradicated in thirty-seven of those countries (British Medical Journal, 1974).

E. Astolfi and J. Higa de Landoni, of the Faculty of Medicine, University of Buenos Aires, Argentina, discuss in their article, "Non Conventional Educational Methods" the seminars that have been held in El Salvador, Indonesia, and the Philippines. These seminars involved the handling of pesticides, taking into consideration both the health and agriculture disciplines. They state:

> The conclusion arrived at in these seminars held in different parts of the world, was that neither the health discipline nor the agricultural discipline doubt the important and continuous role to be played by pesticides in the future demands of the world to increase food production and to practice a continuous control of human illnesses transmitted by insects (Astolfi & de Landoni, 1982).

It is very evident that the control of pests and diseases is vital to the production of food and to maintaining that production. C. W. D. Brathwaite agrees that, "all available data suggest that we need pesticides and there may be instances where pesticide application may be the only answer to sustaining yields of food crops" (Brathwaite, 1980).

Perry L. Adkisson, Deputy Chancellor for agriculture and a professor of entomology at the Texas A & M University, was keynote speaker at a Pest

and Pesticide Management Seminar in the Caribbean in 1980 and he stated:

> The steady improvement in worldwide agriculture yields is directly attributable to the use of chemical pesticides and fertilizers in combination with improved varieties, irrigation, mechanization, and production practices. We presently are dependent on pesticide chemicals to maintain current levels of production (Adkisson, 1980).

Dr. Adkisson also stresses the opinion of the National Academy of Sciences (NAS) in Washington, D.C. as he continues,

> The removal from use of these pesticides would lead to an immediate drop in supply and increase in price of food supplies" (NAS, 1975).

The Office of Technology Assessment, Congress of the United States has conducted research in pest management strategies in crop production and have determined that crop pests cause large annual decreases in yield and the levels of loss that would occur without the use of pesticides are difficult to estimate. They have found:

> In the United States, even with the use of pesticides, the annual loss to pests is estimated to be about thirty percent for cotton and soybean and ten to twenty percent for fruit. The economic impact of the increased pest losses that would occur if no pesticides were used on grains and soybeans would increase the price of food grain, feed grain, and oilmeal by sixty, 200 and seventy-one percent, respectively (OTA, 1979).

Greater losses are being sustained in the developing countries where technologies are not equal to those in the United States. Even though a great amount of pesticides are being used, the losses are many.

There is a very definite need for the use of pesticides in the world today and Dr. Adkisson expresses a worldwide concern in the following statement:

> The world cannot continue indefinitely to sustain the amount of pest-inflicted crop loss without serious consequences to our ability to produce needed quantities of food" (Adkisson, 1980).

The Negative Aspects of Pesticide Use

It is true that the use of pesticides can be beneficial in order to help areas of the world to a better state of health, an assured food supply, and a better chance for successful socioeconomic development (Agency for International Development, 1977). It is also true that improper use of pesticides can provide hazardous consequences. The most serious problems with pesticide management have occurred in the developing countries. Drs. Davies, Freed, and Smith have commented on the effects of the problems in the Annual Review Entomology stemming from these areas not having a trained infrastructure of agricultural personnel to deal with many of the problems caused by the transfer of technology involved with the pesticides (Davies, et. al., 1978).

As we have transferred our technology from industrialized to developing countries, we have also attempted to transfer the same practices. These changes have often been from a temperate to a tropical climate, wherein the same practices are not suitable.

Many of the individuals handling the pesticides are not aware of the hazards of their methods of applying the chemicals onto the fields. They often cannot read the labelling, either because of their illiteracy or because the labels are in another language. It is not uncommon for those in the field to apply the pesticides out of old cans or bottles, by hand, over the crops.

The problems with handling, use, and disposal are evident in the following incidents. Situations such as these usually cause human poisonings and fatalities may often result.

Lucas Brader of the United Nations Food and Agriculture Organization (FAO) stated that

> small shops in Indonesia sell pesticides right alongside the rice and other foods, the people just collect it in sugar sacks, milk cartons, Coke bottles -- whatever is at hand" (Brader, 1979).

Fred Whittemore of Aid for International Development (AID), in an interview, added that

> parathion in Coke bottles stuffed with newspapers with no label is typical and in the rainy season in many tropical countries, the plastic liners used in pesticide bags are used as raincoats. That is an acute problem causing poisonings" (Whittemore, 1980).

A University of California team visiting Pakistan in 1974 reported that "one customer, lacking a suitable container, unwrapped his turban, poured a granular pesticide therein, and replaced it on his head for transport" (New Scientist, 1978).

There is a high number of pesticide poisonings in Central America. This is where twenty-two percent of the world's cotton is produced. In 1974, there were approximately 32,700 metric tons of pesticides used in the production of cotton, mainly organophosphorus pesticides. Common practice involves between thirty and forty applications per season. There were 10.1 million pounds of a mixture of ethyl and methyl parathion imported in 1972 (Pan American Health Organization (PAHO), 1977).

Poisonings were also evidenced in a survey taken by the Instituto Centroamericano di Investigaciou y Technologia Industrial (ICAITI), 1977 in Guatemala, Nicaragua, and El Salvador. It was estimated that there were between 4,000 and 5,000 cases of human poisonings annually in those countries.

A report to Congress by the General Accounting Office (GAO) in 1979 identified a few more cases of pesticide poisoning because of misinformation or misuse of pesticides: 1) improper use of malathion during the summer of 1976 caused at least five deaths and an estimated 2,900 illnesses in Pakistan; 2) aldrin was the suspected cause of thirteen deaths in Brazil in 1975 although it was suspended for use on food crops in the United States in 1974 (U.S. GAO Report, 1979).

C. W. D. Brathwaite discusses some of the practices in the Caribbean and he tells of how pesticides which have been banned in the developed countries are being sold boldly in developing countries at the Seminar and Workshop on Pest and Pesticide Management held in Christ Church, Barbados in 1980. He commented that,

> Moreover, as a result of these approaches, some farmers have become hooked on chemicals as a drug addict could be hooked on cocaine, spraying religiously with a cocktail of dangerous chemicals every seven to ten days. This wanton dumping of chemicals into the Caribbean environment may have severe ecological consequences in the future (Brathwaite, 1980).

The aspect of disposal of the pesticides is also a major concern. In an interview with Dr. Virgil Freed, he stated:

> One horrible example is dieldren in the Cameroon. A couple of years ago too much dieldren was ordered, and the extra drums were simply placed outside in a jungle area. Now the containers have deteriorated and the dieldren is spilling all over. I was there and saw the chemical sitting in puddles on the ground. There were people living in huts nearby. There could very well be subtle effects on them (Freed, 1980).

Throughout the world, the World Health Organization (WHO) estimates that 500,000 people are poisoned by pesticides each year. Five thousand of these poisonings are fatal (DeCrosta, 1979).

The statistics and incidents that are available are all indicators of improper handling, use and disposal of the pesticides used mostly in the developing countries. As can be seen, a major cause of the misuse of the pesticides is the lack of adequate information and training of those individuals who handle, use, and dispose of the chemicals.

The Need for More Effective Pesticide Management Programs in Developing Countries

It is obvious that there is a very definite need for improved information and more effective pesticide management programs. E. S. Tisingh, an entomologist with the Caribbean Epidemiology Center, feels that there should be regular refresher training of personnel on the safe use of pesticides:

> They should be constantly reminded of the potential danger to themselves and others if pesticides are carelessly handled, and this can come only from regular training and motivation" (Tikasingh, 1980).

Those who are implementing such programs must remember that direct transfers of technology are not possible. There are major differences to be taken into consideration when developing training programs. Developing countries are sovereign nations with differing socioeconomic and bureaucratic structures, differing climates, differing physical and biological features of the environment, different crops, and above all, especially in the area of education of the people, would be the differing cultural systems (AID, 1976).

Gene Pollard, an entomologist at the University of the West Indies, identifies various other problems. He points out in a paper presented at the Seminar and Workshop on Pest and Pesticide Management in the Caribbean, that the problems stemming from advanced technology and the expense

involved when using pesticides for optimum food production are not the only problems that these countries are facing. He said:

> The real problem is not simply increased pesticide use but rather their overuse and misuse and the resulting environmental contamination. While money is available in developed countries for the research and development of novel approaches to pest control, such financing, as well as trained personnel, is unavailable or extremely hard to come by in third world countries (Pollard, 1980).

We may all have the same goals in mind but the methods to attain those goals will not be the same. I would like to share a story told about the village of Achedemade Bator in Ghana, West Africa. It was told on the television special, "Pesticides and Pills," that was broadcast on October 5, 1981.

> The village consists of approximately 200 men, women, and children and is very isolated. The village is on the shores of Lake Volta. Fish is their main source of protein and their main source of income. The fishermen in the village showed how they used to catch fish. They poisoned them with a chemical called Gammalin 20. The fishermen poured it into the lake water, which was also their only source of drinking water. They got the chemicals from women who bought cans or bottles of it in local shops. In the United States, Gammalin 20 is called Lindane. Hooker Chemical, a subsidiary of Occidental Petroleum produces it. Rhone Poulenc of France, Imperial Chemical of Britain, and other smaller firms in West Germany and Spain also produce Lindane. The restriction of Lindane began in 1969, both in the United States and Western Europe. The Environmental Protection Agency (EPA) is currently reviewing additional restrictions because exposure to Lindane may cause cancer and birth deformities in test animals, and because it poisons fish. The people in Achedemade Bator noticed about a ten percent decline in the number and size of the fish in the past few years. Without the fish, the village had no source of income. The fish catch declined to such a degree that something had to be done. A Ghanian organization taught one of the villagers the connection between the use of Lindane to kill fish, the decline in the fish count, and the effect on the health of the people. The villager used a flannel

> board and cut out figures and explained the situation to the rest of the villagers. The villager used the term DDT for all pesticides and urged the people to stop using the chemical. The witch doctor of the village was at the meeting and he agreed that the use was dangerous. In a ritual ceremony following the meeting, he issued a tabu on the use of Lindane (PBS, 1981).

Regardless of what techniques and training programs are used, individuals must be educated as to the consequences of improper management of pesticides. Pesticides do have value when they are used correctly but otherwise they are a detriment to nature and all that is natural.

CHAPTER III

METHODS AND PROCEDURES

This chapter considers the issues related to the sample population and the construction of the questionnaire. The procedures involved in the collection of data, as well as the treatment of the data are also discussed.

Population

The subjects completing the questionnaire were a group of professionals from the Caribbean region who represented agricultural and health fields. They were taking part in Agromedical training programs in Trinidad-Tobago and St. Lucia that took place September 14 - 17, 1982.

A total of 109 individuals participated in the two training sessions. Eighty-eight of the 109 participants (81%) responded to the questionnaire; the largest number -- 56 -- from Trinidad and Tobago. The participants represented 24 different occupations, most of them involved in the areas of public health -- nine health occupations with 39 individuals and agriculture -- ten occupations with 34 individuals.

Construction of the Questionnaire

The pesticide management questionnaire permitted collection of data required to meet the specific objectives of this study. The questionnaire was constructed with the assistance of the Survey Research Center at Oregon State University and Dr. James Grieshop, an educational specialist at the University of California, Davis. Dr. Virgil Freed also contributed to the development of the questionnaire.

From the discussions with these individuals and after reviewing pertinent literature, questions for the questionnaire were developed. The preliminary questionnaire consisted of 27 questions.

Assistance in evaluation of the questionnaire was requested during a meeting with Drs. Freed and Grieshop at Oregon State University. Dr. Grieshop was at Oregon State University to discuss the plans of the upcoming workshop in Trinidad with Dr. Freed at the time. Shortly after our meeting Dr. Grieshop was contacted by telephone and we corresponded both by mail and telephone for the remainder of the time. Consultation time was required from the Survey Research Center at OSU. The assessment tool was discussed at several different meetings with the consultant.

The Survey Research Center assisted initially with construction of the preliminary draft and Dr. Grieshop evaluated the questionnaire from that point. Taking into conisderation the comments and suggestions offered by these individuals, a revised questionnaire consisting of 18 questions was developed (Appendix A).

The questionnaires were hand-carried to the Agromedical workshop in Trinidad-Tobago and administered by Dr. Grieshop during the initial session. The completed questionnaires were forwarded to OSU upon the return of Dr. Grieshop to the United Staes.

Treatment of the Data

After receiving the completed questionnaires from Dr. Grieshop, coding instructions were developed. The coding instructions were developed with the assistance of a consultant from the Oregon State University Computer Center, and in cooperation with Dr. James Grieshop.

Once the key was completed, the questionnaires were hand-marked as to the respective codes.

Dr. Grieshop also administered a questionnaire of his own while at the workshops in Trinidad-Tobago. The questionnaire was basically an evaluation of the proceedings. When consulting Dr. Grieshop, it was decided that, on certain questions, the same codes would be used for both questionnaires. This would minimize confusion when the results were shared. For example, on questions that asked for a response of yes, no, don't know, or no response: yes = 1, no = 2, don't know = 3, and no response = 0, consistently.

Explanation of Coding

Each questionnaire was given an identification number, from 01 to 88. The 18 questions were coded in 49 columns on the computer punch cards. Columns 1 and 2 consisted of the identification number. Question 1 offered nine items so columns 3-9 were coded accordingly. This same procedure was used for the remaining questions.

On the open-ended questions, the responses were categorized as to the most common responses for coding purposes. There were four questions in regards to demographics. When consulting with the Computer Center, it was also decided that the following would accompany the coding instructions: 1) frequencies for all questions; and 2) cross-tabulation between the specified questions.

When the coding and coding instructions were completed, along with the additional information, the code values were transferred to computer sheets. The data were run twice through because of the multiple response data. One was run through with all of the missing value

indicators in -- if someone did not respond to a particular question, they were left out. In the other run, new variables were created -- everyone was included. For example, in question 2, the responses were 2-A, 2-B, 2-C, and 2-D. If there was no response to any of those, Q2-E was included so they would be included in the summary table.

This method was also used in the cross-tabulations. For example, questions 1 and 16 -- types of information by country. In Trinidad-Tobago, 47 individuals responded to question 1 in the first run and the percentages were calculated accordingly.

In the second run, there was an extra category added representing the individuals who did not respond. There were actually 56 people from Trinidad-Tobago so this extra category added the other nine individuals. The percentages reflected the total number of individuals, or 56, rather than 47.

After reviewing the results from the first computer printout, a copy was sent to Dr. Grieshop for his input on the breakdown and categorization of the information. It was necessary at this point to determine what information was pertinent, as well as determine how to proceed.

Additional consultation with the Oregon State University Computer Center followed and further instructions were given. In order to identify the existence and effectiveness of training techniques and protective measures for the workers, the results initially showed frequencies of occurrences of safety equipment, safety clothing, and need for a poison information center. The frequencies were then cross-tabulated against country of employment, as well as occupation. The questions included the following categories of workers when questionning training

or safety measures: mixers, transporters, applicators, and field workers.

The question dealing with suggestions for training programs or activities that would contribute to the success of the pesticide management program were tallied as to the ten most common answers from the questionnaires. These answers were then analyzed for frequencies of occurrence. The frequencies were then cross-tabulated by countries and occupation to identify similarities and contrasts.

Rather than have 14 different countries, because of the fact that most respondents were from Trinidad-Tobago, the countries were grouped into: 1) Trinidad-Tobago; and 2) All Others. Occupations were grouped into: 1) Agriculture; 2) Health; and 3) All Others. Data were also categorized by the average number of years in the respondent's profession.

CHAPTER IV

RESULTS AND DISCUSSION

Description of the Subjects

The subjects completing the questionnaire were a group of professionals from the Caribbean region. They were taking part in Agromedical training programs in Trinidad-Tobago on September 14 - 17, 1982.

Eighty-eight persons completed the questionnaire, and of those, there were 24 occupations represented -- ten (42%) occupations in the agricultural field and nine (38%) occupations in the health field. Those occupations included in the agricultural discipline were: agronomist, five (5.7%); entomologist, four (4.5%); agricultural officer, 12 (13.6%); plant pathologist, two (2.3%); agricultural registrar, one (1.1%); pest control manager, two (2.3%); agricultural inventory manager, one (1.1%); crop protection officer, one (1.1%); agricultural assistant, five (5.7%); agricultural extension coordinator, one (1.1%). Those included in the occupation of health were: public health inspector, 10 (11.4%); veterinarian, one (1.1%); nurse, four (4.5%); medical doctor, six (6.8%); district health visitor, seven (8.0%); safety officer, two (2.3%); public health officer, six (6.8%); health supervisor, two (2.3%); and environmental health, one (1.1%). The remaining were categorized into "Other." These included: chemist, five (5.7%); teacher, two (2.3%); standards engineer, one (1.1%); sales representative, two (2.3%) (Table 4-1).

Fifty-six (64%) of the professionals were from Trinidad-Tobago and the next largest group was from St. Lucia, consisting of nine (10%) individuals. The total participants from other countries were as follows: Barbados, two (2.3%); Grenada, two (2.3%); St. Vincent, one (1.1%); St.

Ketts, two (2.3%); Dominica, two (2.3%); Antigua, one (1.1%); Suriname, two (2.3%); Dominican Republic, two (2.3%); Anguilla, one (1.1%); Jamaica, two (2.3%); Montserrat, two (2.3%); and Guyana, one (1.1%). Three (3.4%) responses were blank (Table 4-2).

The number of years experience that the individuals had in their professions varied from less than one year to over 20 (Table 4-3). The greatest number was in the one to four years experience category, with 23 (26%) responding. The second largest response, or 20 (22%) was in the four to seven years experience category. The smallest response was the same in the 15 to 20 and 20+ categories with three (3%) persons in each category.

The question regarding the highest level of education included categories of high school graduate, college graduate, graduate degree, and other. Thirty-seven (42%) of the respondents had a graduate degree; 21 (24%) were college graduates; and 17 (19%) had graduated from high school (Table 4-4).

The results of interest to this study were broken down into three main categories: education/training; safety; and legislation. Data were tallied and placed into tabular format.

TABLE 4-1

OCCUPATION OF RESPONDENTS*

Profession	Total	Percentage	Average No. Yrs.
1. Agronomist	5	5.7	5.1
2. Entomologist	4	4.5	4.8
3. Public Health Inspector	10	11.4	14.2
4. Veterinarian	1	1.1	8.5
5. Nurse	4	4.5	8.3
6. Chemistry Field	5	5.7	7.1
7. M.D. Practitioner	6	6.8	5.3
8. District Health Visitor	7	8.0	11.8
9. Agricultural Officer	12	13.6	4.5
10. Teacher	2	2.3	5.5
11. Safety Director	2	2.3	12.5
12. Plant Pathologist	2	2.3	2.5
13. Agricultural Registrar	1	1.1	5.5
14. Pest Control Manager	2	2.3	2.5
15. Agriculture Inventory Manager	1	1.1	2.5
16. Standards Engineer	1	1.1	8.5
17. Public Health Officer	6	6.8	6.8
18. Health Supervisor	2	2.3	4.0
19. Crop Protection Officer	1	1.1	8.5
20. Sales Representative	2	2.3	5.5
21. Agricultural Assistant	5	5.7	3.3
22. Environmental Health	1	1.1	17.5
23. Agricultural Extension Coordinator	1	1.1	12.5

*These data represent responses to question 17a of the questionnaire: What is your profession or occupation?

TABLE 4-2

COUNTRY OF EMPLOYMENT*

Country of Employment	Total	Percentage
1. Trinidad-Tobago	56	63.6
2. St. Lucia	9	10.2
3. Barbados	2	2.3
4. Grenada	2	2.3
5. St. Vincent	1	1.1
6. St. Kitts	2	2.3
7. Dominica	2	2.3
8. Antigua	1	1.1
9. Suriname	2	2.3
10. Dominican Republic	2	2.3
11. Anguilla	1	1.1
12. Jamaica	2	2.3
13. Montserrat	2	2.3
14. Guyana	1	1.1

*These data represent responses to question 16 of the questionnaire: In what country do you work?

TABLE 4-3

YEARS OF EXPERIENCE IN PROFESSION*

Number of Years	Total	Percentage
a. 0 - 1	6	6.8
b. 1 - 4	23	26.1
c. 4 - 7	20	22.7
d. 7 - 10	14	15.9
e. 10 - 15	15	17.0
f. 15 - 20	3	3.4
g. 20+	3	3.4
Mean = 12 years		

*These data represent responses to question 17b of the questionnaire: How long have you been in this profession?

TABLE 4-4

HIGHEST LEVEL OF FORMAL EDUCATION COMPLETED*

Level of Education	Total	Percentage
a. High School	17	19.3
b. College Graduate	21	23.9
c. Graduate Degree	37	42.0
d. Other	10	11.4
Mean	21.25	

*These data represent question 18 of the questionnaire: What is the highest level of formal education you have completed?

Education/Training

Data from this investigation indicates that extension and bulletins, radio, posters, and education/training are the main forms of information that are available to the public regarding the safe use of pesticides (Tables 4-5 and 4-6). They were ranked in the top four in all countries and all occupations. Extensions and bulletins ranked number one in all categories.

TABLE 4-5

FORMS OF INFORMATION AVAILABLE TO THE GENERAL PUBLIC.*
BY COUNTRY

Media	Trinidad-Tobago	All Others
Extension & bulletins	24 (43%)	19 (66%)
Radio	19 (34%)	19 (66%)
Education/training	11 (20%)	12 (41%)
Posters	10 (18%)	13 (45%)

*These data represent responses to question 1 of the questionnaire: What forms of information are regularly available to the general public regarding the safe use of pesticides?

TABLE 4-6

FORMS OF INFORMATION AVAILABLE TO THE GENERAL PUBLIC,* BY OCCUPATION

Media	Agriculture	Health	All Others
Extension & bulletins	28 (79%)	9 (24%)	5 (50%)
Radio	14 (39%)	18 (49%)	5 (50%)
Posters	13 (36%)	7 (19%)	3 (30%)
Education/Training	12 (33%)	10 (27%)	1 (10%)

*These data represent responses to question 1 of the questionnaire: What forms of information are regularly available to the general public regarding the safe use of pesticides?

The training available to those who work directly with the pesticides was of great importance because of the hazardous consequences stemming from improper use. Applicator poisoning reportedly occurred as a result of a worker's exposure to the pesticide concentrate. On most occasions, exposure was the result of dermal absorpotion although dust and powders which can be inhaled and lead to poisoning (Davies, 1982).

The largest number of respondents were aware of training available to the applicators in all countries: 21 (70%) in Trinidad-Tobago and 20 (95.2%) in all other countries. In addition, percentages of those responding to an awareness of training given to transporters, appeared relatively low; only 13% from Trinidad-Tobago and 23 percent from all other countries (Table 4-7).

Training appeared equally important through the entire process -- from dockside to application. The drums were transported from the ship to a dockside warehouse or to a storage facility that was usually adjacent to the formulation sites. Both sites were potentially hazardous,

TABLE 4-7

TRAINING IN PESTICIDE MANAGEMENT FOR SELECTED WORKERS*
BY COUNTRY OF EMPLOYMENT

Type of Worker	Trinidad-Tobago	All Others
a. Mixers	14 (47%)	15 (71%)
b. Transporters	4 (13%)	5 (24%)
c. Applicators	21 (70%)	20 (95%)
d. Field Workers	17 (57%)	14 (67%)

*These data represent responses to question 2 of the questionnaire: Are you personally aware of training in pesticide management provided to the following?

TABLE 4-8

TRAINING IN PESTICIDE MANAGEMENT FOR SELECTED WORKERS*
BY OCCUPATION

Type of Worker	Agriculture	Health	All Others
a. Mixers	16 (67%)	10 (46%)	2 (50%)
b. Transporters	3 (13%)	5 (23%)	0 (0%)
c. Applicators	22 (92%)	15 (68%)	3 (75%)
d. Field Worker	17 (71%)	11 (50%)	3 (75%)

*These data represent responses to question 2 of the questionnaire: Are you personally aware of training in pesticide management provided to the following?

especially considering the marginal conditions of some sites. There were some areas that had new concrete buildings with excellent ventilation and drainage facilities, with the pesticide drums locked in for safe keeping.

In some areas, drums were sometimes piled on top of each other on a dirt floor. When it rained, the puddles of pesticides may have been washed to adjoining warehouses where rice and flour were being stored (Davies, 1982).

It is encouraging to see that the respondents were aware of training programs for the applicators, mixers, field workers and transporters; however, because of the hazardous consequences, percentages should be higher.

Results in Table 4-9 show that 84 (95.5%) of the 88 respondents felt that regular training in safe pesticide management was needed for the workers. This would include all those who have direct contact with the chemical pesticides.

TABLE 4-9
NECESSITY OF TRAINING FOR PESTICIDE WORKERS*

Category Label	Total/Percent
a. Strongly Agree	84 (95.5%)
b. Agree	3 (3.5%)
c. No Response	1 (1.1%)

*These data represent responses to question 3 of the questionnaire: I think regular training in safe management of pesticides is needed for those who handle chemical pesticides.

In order to see an effective pesticide management program become a reality, the respondents ranked training/inservices and public education/media as number one and number two, respectively (Tables 4-10 and 4-11). All of these involve educating the people; those who are in direct contact, as well as the general public.

TABLE 4-10

PESTICIDE MANAGEMENT EDUCATION EFFORTS DESIRED*
BY COUNTRY OF EMPLOYMENT

Education Effort	Trinidad-Tobago	All Others
a. Training/Inservice	42 (75%)	16 (55%)
b. Public Education/Media	34 (61%)	16 (55%)
c. Enforce Laws	12 (21%)	4 (14%)
d. Ongoing Education	16 (29%)	1 (3%)

*These data represent responses to question 13 of the questionnaire: What activities, programs or efforts would you like to see occur in order to encourage more effective pesticide management programs?

TABLE 4-11

PESTICIDE MANAGEMENT EDUCATION EFFORTS DESIRED*
BY OCCUPATION

Education Effort	Agriculture	Health	All Others
a. Training/Inservice	26 (72%)	27 (73%)	3 (30%)
b. Public Education/Media	19 (53%)	23 (62%)	7 (70%)
c. Enforce Laws	7 (19%)	7 (19%)	2 (20%)
d. Ongoing Education	5 (14%)	8 (22%)	3 (30%)

*These data represent responses to question 13 of the questionnaire: What activities, programs or efforts would you like to see occur in order to encourage more effective pesticide management programs?

Reference should be made to the question regarding types of information available to the public and key in on how the people obtain their

information and target that aspect of the media. Another necessary effort should be put into enforcing laws, according to the respondents of the questionnaire. Enforcing laws ranked third and fourth in all countries and all occupations, respectively, as seen in Tables 4-10 and 4-11.

Safety

Regarding safety equipment and clothing, again the question pertained to those involved directly with pesticides: mixers, transporters, applicators, and field workers. It apepars in Tables 4-12 and 4-13 that the largest number of respondents were aware of applic tors and mixers normally using safety equipment or clothing when handling pesticides. Those in Trinidad-Tobago numbered 12 (63.2%) and 13 (72.2%) in all other countries for applicators; and 12 (63.2%) and 12 (66.7%) for mixers, respectively. Six (31.6%) from Trinidad-Tobago and 7 (38.9%) from all other countries were aware of the field workers normally using safety equipment or clothing and only one (5.3%) and four (5.6%) from Trinidad-Tobago and all other countries, respectively, were aware of transporters normally using safety equipment or clothing.

TABLE 4-12

USE OF SAFETY EQUIPMENT OR CLOTHING WHEN HANDLING PESTICIDES* BY COUNTRY OF EMPLOYMENT

Type of Worker	Trinidad-Tobago	All Others
a. Mixers	12 (63%)	12 (67%)
b. Transporters	1 (5%)	1 (6%)
c. Applicators	12 (63%)	13 (72%)
d. Field workers	6 (32%)	7 (39%)

*These data represent responses to question 4 of the questionnaire: In your country or area do the following groups of workers normally use safety equipment or clothing?

TABLE 4-13

USE OF SAFETY EQUIPMENT OR CLOTHING WHEN HANDLING PESTICIDES*
BY OCCUPATION

Type of Worker	Agriculture	Health	All Others
a. Mixers	11 (61%)	9 (64%)	3 (75%)
b. Transporters	0 (0%)	2 (14%)	0 (0%)
c. Applicators	13 (72%)	9 (64%)	2 (50%)
d. Field Workers	6 (33%)	7 (50%)	0 (0%)

*These data represent responses to question 4 of the questionnaire: In your country or area do the following groups of workers normally use safety equipment or clothing when handling pesticides?

Those in Trinidad-Tobago felt it was of greatest necessity for a poison information center in their community. Thirty-five (62.5%) responded and in the other countries, 11 (37.9%) responded that it was of "greatest necessity" (Table 4-14). Table 4-15 shows that there was not much difference of opinion between occupations, all ranking "of greatest necessity" number one, except for those in the health occupation in "all other" countries. They ranked it second with two (20%) responding to "greatest necessity" and six (60%) responding to "very necessary" for a number one ranking (Table 4-15B).

Sixty-nine (78%) of all asked felt that it was very important to have a first aid center staffed with qualified individuals in their community. Table 4-16 shows that only two (2.3%) felt it not too important and 11 (12.5%) answering the questionnaire said such a facility already existed.

Nearly 80% of the respondents felt it was very important to have a first aid center with qualified staff in their community, however, the

TABLE 4-14

NEED FOR A POISON INFORMATION CENTER*
BY COUNTRY OF EMPLOYMENT

Category Label	Trinidad-Tobago	All Others
a. Greatest necessity	35 (63%)	11 (38%)
b. Very Necessary	17 (30%)	12 (41%)
c. Somewhat Necessary	3 (5%)	6 (21%)

*These data represent responses to question 5 of the questionnaire: A poison information center is sometimes located in a community. How necessary do you feel a poison information center is for your community?

TABLE 4-15

NEED FOR A POISON INFORMATION CENTER*
BY OCCUPATION

Category Label	Agriculture	Health	All Others
a. Greatest Necessity	18 (50%)	20 (54%)	6 (60%)
b. Very Necessary	11 (31%)	14 (38%)	4 (40%)
c. Somewhat Necessary	7 (19%)	2 (5%)	0 (0%)

*These data represent responses to question 5 of the questionnaire: A poison information center is sometimes located in a community. How necessary do you feel a poison information center is for your community?

TABLE 4-16

IMPORTANCE OF A FIRST AID CENTER*

Category Label	Total/Percent
a. Very Important	69 (78.4%)
b. Somewhat Important	5 (5.7%)
c. Not Too Important	2 (2.3%)
d. Already Exists	11 (12.5%)

*These data represent responses to question 6 of the questionnaire: How important is it to have a first aid center staffed with qualified individuals in your community?

likelihood of its establishment was not as positive. Nineteen (33%) of those from Trinidad-Tobago felt it was "not too likely" to establish a first aid center and 16 (28.6%) felt it was "very likely." Ten (34.5%) from all other countries answered it was "somewhat likely" and seven (24.1%) felt it "very likely" (Table 4-17).

The response to the likelihood of the establishment of a first aid center in regard to occupation is represented in Table 4-18. Thirteen (36.1%) of those in agriculture felt it was "not too likely" for a number one answer, 13 (35.1%) of those in the health field said it was "very likely" for a number one answer, and of those in other occupations, the largest response of four (40%) was in the "not too likely" category.

Those in the health field felt there was a greater possibility of having a center established. This could possibly be due to the fact that those in a particular field often tend to have a more positive attitude with something directly related to that field. Those people could possibly see how it would become a reality because of their familiarity with such a project.

TABLE 4-17

LIKELIHOOD OF A FIRST AID CENTER BEING ESTABLISHED*
BY COUNTRY OF EMPLOYMENT

Category Label	Trinidad-Tobago	All Others
a. Very Likely	16 (29%)	7 (24%)
b. Somewhat Likely	8 (14%)	10 (35%)
c. Not Too Likely	19 (34%)	5 (17%)
d. Not At All Likely	5 (9%)	1 (3%)
e. No Response	8 (14%)	6 (21%)

*These data represent responses to question 7 of the questionnaire: If your community does not have a first aid center staffed by qualified individuals, what is the likelihood that a first aid center could be established?

TABLE 4-18

LIKELIHOOD OF A FIRST AID CENTER BEING ESTABLISHED*
BY OCCUPATION

Category Label	Agriculture	Health	All Others
a. Very Likely	6 (17%)	13 (35%)	2 (20%)
b. Somewhat Likely	10 (28%)	6 (16%)	2 (20%)
c. Not Too Likely	13 (36%)	7 (19%)	4 (40%)
d. Not At All Likely	2 (6%)	4 (11%)	0 (0%)
e. No Response	5 (14%)	7 (19%)	2 (20%)

*These data represent responses to question 7 of the questionnaire: If your community does not have a first aid center staffed by qualified individuals, what is the likelihood that a first aid center could be established?

The number one obstacle to a first aid center for all countries, as seen in Table 4-19, is trained personnel. This was also true for all occupations, as represented in Table 4-20. A facility such as this already exists, according to 36 (64.3%) from Trinidad-Tobago and 11 (38%) from all other countries. Funds, government approval, equipment were all ranked as third, fourth, or fifth in all countries and occupations as major obstacles to setting up a first aid program in their community.

TABLE 4-19

MAJOR OBSTACLES TO SETTING UP A FIRST AID PROGRAM*
BY COUNTRY OF EMPLOYMENT

Obstacle	Trinidad-Tobago	All Others
a. Trained Personnel	56 (100%)	27 (93%)
b. Already Exists	36 (64%)	11 (38%)
c. Funds	15 (27%)	13 (45%)
d. Equipment	18 (32%)	9 (31%)

*These data represent responses to question 8 of the questionnaire: In order to set up a first aid program in your community, what are at least three major obstacles or problems to setting up a program?

TABLE 4-20

MAJOR OBSTACLES TO SETTING UP A FIRST AID PROGRAM*
BY OCCUPATION

Obstacle	Agriculture	Health	All Others
a. Trained Personnel	35 (97%)	36 (97%)	12 (120%)
b. Already Exists	18 (50%)	20 (54%)	7 (70%)
c. Government Approval	12 (33%)	13 (35%)	5 (50%)
d. Funds	17 (47%)	9 (24%)	2 (20%)

*These data represent responses to question 8 of the questionnaire: In order to set up a first aid program in your community, what are at least three major obstacles or problems to setting up a program?

Legislation

Of the 14 countries represented at the workshop, there were five countries that responded that their country had not adopted any pesticide legislation: St. Vincent, Antigua, Jamaica, Montserrat, and Guyana. One (100%) from Anguilla did not know, as well as four (7.3%) from Trinidad-Tobago (Table 4-21).

One hundred percent of those from the following countries responded that their country had adopted pesticide legislation: Barbados, Grenada, St. Ketts, Dominica, Suriname, and Dominican Republic. Thirty-five (63.5%) and eight (88.9%) from Trinidad-Tobago and St. Lucia, respectively, responded yes; whereas 16 (29.1%) and one (11.1%) from St. Lucia responded that their country had not adopted legislation.

As to the effectiveness of the legislation, if adopted, there was a high frequency of "no response" being the number one answer. This was true for 19 (33.9%) from Trinidad-Tobago and 10 (34.5%) from St. Lucia. In

TABLE 4-21

ADOPTION OF PESTICIDE LEGISLATION*

Country	Yes	Percentage	No	Percentage	Don't Know	Percentage
Trinidad-Tobago	35	63.5	16	29.1	4	7.3
St. Lucia	8	88.9	1	11.1	0	0
Barbados	2	100.0	0	0	0	0
Grenada	2	100.0	0	0	0	0
St. Vincent	0	0	1	100.0	0	0
St. Ketts	2	100.0	0	0	0	0
Dominica	2	100.0	0	0	0	0
Antigua	0	0	1	100.0	0	0
Suriname	2	100.0	0	0	0	0
Dominican Republic	2	100.0	0	0	0	0
Anguilla	0	0	0	0	1	100.0
Jamaica	0	0	1	100.0	0	0
Montserrat	0	0	2	100.0	0	0
Guyana	0	0	1	100.0	0	0

*These data represent responses to question 10 of the questionnaire: In your country, has pesticide legislation been adopted?

Trinidad-Tobago, the second largest response was in the "not at all effective" category -- 18 (32.1%). All others responded next with nine (31%) saying they were "somewhat effective." Zero from Trinidad-Tobago said that they were "somewhat effective." Table 4-22 shows that those in the other countries tended to respond more positively than those in Trinidad-Tobago and Table 4-23 represents the attitude that those in the health field and other occupations appeared to feel that overall, the pesticide legislation was a bit more effective.

Table 4-24 indicates that the largest number of individuals from Trinidad-Tobago responded that public education, 21 (37.5%); more government regulations, 17 (30.4%); and trained personnel, 12 (21.4%) would improve the enforcement and effectiveness of the laws and regulations. In other countries the three most popular suggestions were: qualified staff, 10 (34.5%); public education, nine (31%); and more government regulations, six (20.7%).

TABLE 4-22

EFFECTIVENESS OF LEGISLATION*
BY COUNTRY OF EMPLOYMENT

Category Label	Trinidad-Tobago	All Others
a. No Response	19 (34%)	10 (35%)
b. Not At All Effective	18 (32%)	3 (10%)
c. Somewhat Effective	0 (0%)	9 (31%)
d. Very Effective	1 (2%)	0 (0%)

*These data represent responses to question 11 of the questionnaire: If yes, how effective do you feel this legislation has been in promoting more safe pesticide management?

TABLE 4-23

EFFECTIVENESS OF LEGISLATION*
BY OCCUPATION

Category Label	Agriculture	Health	All Others
a. No Response	11 (31%)	12 (32%)	5 (50%)
b. Not At All Effective	13 (36%)	5 (14%)	3 (30%)
c. Somewhat Effective	5 (14%)	3 (81%)	0 (0%)
d. Very Effective	1 (3%)	0 (0%)	0 (0%)

*These data represent responses to question 11 of the questionnaire: If yes, how effective do you feel this legislation has been in promoting more safe pesticide management?

TABLE 4-24

HOW EFFECTIVENESS OF PESTICIDE LAWS/REGULATIONS CAN BE IMPROVED*
BY COUNTRY OF EMPLOYMENT

Category Label	Trinidad-Tobago	All Others
a. Public Education	21 (38%)	9 (31%)
b. More Government Regulations	17 (30%)	6 (21%)
c. Qualified Staff	10 (18%)	10 (35%)
d. Train Personnel	12 (21%)	3 (10%)

*These data represent responses to question 12 of the questionnaire: What suggestions do you have for improving the enforcement and effectiveness of these laws and regulations?

In looking at the same question by occupation (Table 4-25), both agriculture, 10 (27.8%) and health, 17 (45.9%) ranked public education as number one. Those in other occupations listed more government regulations, six (60%) and enforcing of laws, five (50%) as number one and two, respectively.

TABLE 4-25

HOW EFFECTIVENESS OF PESTICIDE LAWS/REGULATIONS CAN BE IMPROVED*
BY OCCUPATION

Category Label	Agriculture	Health	All Others
a. Public Education	10 (28%)	17 (46%)	3 (30%)
b. More Government Regulation	8 (22%)	8 (22%)	6 (60%)
c. Qualified Staff	6 (17%)	11 (30%)	2 (20%)
d. Enforce Laws	3 (8%)	7 (19%)	5 (50%)

*These data represent responses to question 12 of the questionnaire: What suggestions do you have for improving the enforcement and effectiveness of these laws and regulations?

The agricultural respondents listed more government regulations, eight (22.2%) and more penalties, seven (19.4%) to round out the top three answers. Those in the health field ranked qualified staff, 11 (29.7%) and more government regulations, eight (21.6%) as second and third.

The questions regarding the respondent's knowledge of restrictions on what pesticides may be repackaged yielded the largest number of responses in the "no" and "I don't know" categories (Tables 4-26 and 4-27). The only exception to this was in the "all others" category for different occupations in all other countries (Table 4-27B2).

Based on the results of the questionnaire, it would appear that: 1) the respondents feel that an increased emphasis for safer and more effective pesticide management programs would benefit the Caribbean region. Those participating in the workshop and completing the questionnaire were individuals who were involved directly, for the most part, with the issues at hand; 2) participants were of the opinion that

the workers in the field, as well as the general public, should be better informed of the hazardous consequences stemming from misuse and misinformation of pesticides; 3) to assure that pesticide information is used properly, the individuals responded that education and training were a necessity; 4) the respondents felt that the legislation in existence should be accompanied by specific regulations that can be uniformly enforced.

TABLE 4-26

EXISTENCE OF PESTICIDE REPACKAGING RESTRICTIONS*
BY COUNTRY OF EMPLOYMENT

Category Label	Trinidad-Tobago	All Others
a. Yes	7 (13%)	7 (26%)
b. No	21 (38%)	13 (48%)
c. Do Not Know	27 (49%)	7 (26%)

*These data represent responses to question 14 of the questionnaire: Are there restrictions on what pesticides may be repackaged?

TABLE 4-27

EXISTENCE OF PESTICIDE REPACKAGING RESTRICTIONS*
BY OCCUPATION

Category Label	Agriculture	Health	All Others
a. Yes	8 (22%)	4 (11%)	1 (11%)
b. No	16 (44%)	11 (31%)	6 (67%)
c. Do Not Know	12 (33%)	20 (57%)	2 (22%)

*These data represent responses to question 14 of the questionnaire: Are there restrictions on what pesticides may be repackaged?

All of the above criteria should be followed if the development of an effective pesticide management program is to occur. All involved agencies would benefit the program by acting and interacting with each other, as well as within their own professions.

An interdisciplinary approach, such as the Agromedical approach, with knowledgable individuals can lead to the education of the educators. They in turn can teach the general public as well as those directly involved with the pesticides, effective and safe handling practices. This could eventually lead to a general awareness and safer, more effective pesticide management programs.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the findings of the study, the following conclusions were drawn in the areas of education/training, safety, and legislation in pesticide management:

Education/Training

Information regarding the safe use of pesticides is available to the people of the participating Caribbean countries mainly through bulletins and extension programs, according to the professionals completing the questionnaire. The respondents were aware of training programs provided to those in direct contact with the pesticides, however, the study showed that this was not true for all phases of management. Training appeared to be available to the applicators more than any other phase of the dock-side to final application process.

Ninety-six percent of the respondents in the study stated that regular training in safe pesticide management is needed. It was felt by the participants that in order to obtain the necessary training, inservices would be the most beneficial means. Public education and media used ranked as a second method of transferring information to both the general public and those in direct contact with the pesticides. The results of this study also showed that there should be an emphasis on enforcing the laws that exist in those countries where pesticide legislation is present.

Safety

Safety is an integral part of a pesticide management program. Those individuals directly involved with the pesticides not only require training

but they need to apply that knowledge to such safety measures as safety equipment and clothing. The largest number of participants responded that applicators and mixers normally use safety equipment and clothing, whereas a very small percentage were aware of the field workers normally using safety equipment and clothing.

It is generally recognized that a lack of safety precautions can lead to hazardous consequences for those directly and indirectly involved. Sixty-three percent of the participants from Trinidad-Tobago felt a poison information center was of "greatest necessity" in their community and 38 percent from all other countries. Although of "greatest necessity" did not represent the largest percentages in each category, when it did not rank number one, it was a close second and "very necessary" ranked number one.

Importance of the establishment of a first aid center with qualified staff was also assessed. Seventy-nine percent of the respondents said they felt it was very important and 13 percent said that such a facility already existed.

Of that 79 percent who felt it very important, 33 percent in Trinidad-Tobago said it would not be too likely to establish such a center and 29 percent said it was very likely. This response was a bit more pessimistic than those in the other countries; 35 percent said it was somewhat likely and 24 percent said it was very likely. Seventeen percent responded that it was not too likely.

This question, when looked at by occupation, has a different outcome. In agriculture, 36 percent answered that a center was not too likely for a number one response. In health, 35 percent said it was very likely for a number one answer. Those in other occupations had 40 percent who responded to the not too likely category.

All countries and occupations responded that trained personnel is the number one obstacle in the establishment of a first aid center in their community. Other major obstacles were listed as funds, government approval, and equipment.

Legislation

Pesticide laws and regulations exist in eight (57%) of the countries represented at the workshop. There were participants from 14 countries and of those, five (36%) countries responded that their country had not adopted any pesticide legislation. One participant did not know.

Literature supports that the adoption of pesticide legislation appears to be only a portion of the solution to safer and more effective pesticide management. These laws will not benefit anyone unless they are enforced.

The results as to the effectiveness of the legislation, if adopted showed conflicting responses with the "no response" category being the largest. A close second in Trinidad-Tobago was in the "not at all effective" category with a 32 percent response and no one responded that they were "somewhat effective." Respondents in all other countries reflected a higher degree of optimism with 31% indicating that the legislation was "somewhat effective."

In order to improve the effectiveness of the pesticide legislation the participants felt that some of the major areas to concentrate on would be public education, more qualified staff, more government regulations, and trained personnel. Public education was ranked number one by those in agriculture (28%) and health fields (46%). Those in other fields chose more government regulations (6%) and law enforcement (5%) as their main suggestions for improving the effectiveness of pesticide legislation.

The participants from all countries responded that they would like to see more training programs and inservices, along with public education and use of the media in order to encourage more effective pesticide management programs in the Caribbean region. Seventy-five percent in Trinidad-Tobago responded to training/inservice and 52 percent responded to the same from all other countries.

All occupations agreed that training/inservice was the number one choice to encourage more effective programs, with 72 percent in agriculture, 73 percent in the health field, and 70 percent of all other occupations. Public education/media ranked as the number two suggestion for all occupations, with 53 percent of those in the agricltural field responding; 62 percent in the health field; and 30 percent in all other occupations. Thirty percent in all other occupations also chose ongoing education as a program to encourage more effective pesticide management.

Recommendations

(1) This study suggests that a comprehensive pesticide management program be introduced into the primary school curriculum and continue throughout secondary and post-secondary schooling. The subject matter could be included in science, health/safety, or environmental health -- wherever appropriate for the particular school system.

(2) From the results of the data, it appears that there should be a great deal of emphasis and energy placed on public education programs for the general populace in the Caribbean region. The programs should take advantage of the major methods by which the people obtain their information: extension and bulletins, radio, posters, and newspapers.

(3) Conducting quarterly inservices for those giving information to, and/or training those individuals involved directly in the handling of the pesticides -- from dockside to final application -- is a necessity, according to the respondents. These "trainers" can in turn educate those involved with up-to-date materials and information.

(4) Unilateral support for an interdisciplinary infrastructure of agromedicine in the Caribbean region is slowly occurring. Experts from the different disciplines should work together to provide the necessary information to serve as a basis for inservices and training programs.

(5) The need for further sutdy to assess the effectiveness of the current pesticide legislation in the Caribbean region has been clearly identified. The study should determine legal steps necessary for effective regulation and enforcement of pesticide use.

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APPENDICES

APPENDIX A

PESTICIDE MANAGEMENT QUESTIONNAIRE

PESTICIDE MANAGEMENT QUESTIONNAIRE

The proper management of pesticides in your country is an important issue. Currently, programs of education and training, governmental policies and other resources aid in this activity. The purpose of this questionnaire is to increase our understanding of what programs, policies and resources are available in your country.

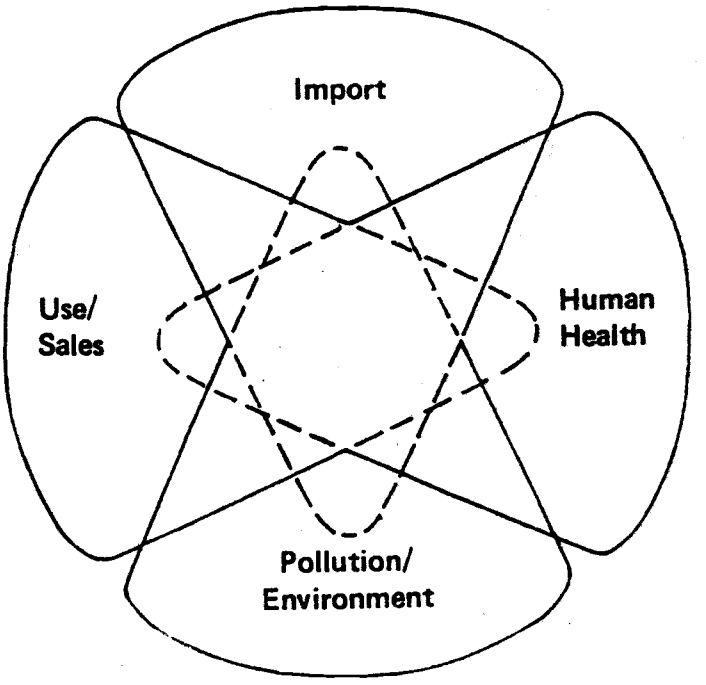
Please take 15 minutes to read and complete the following questions -- most can be answered by circling a number. The questionnaires will be collected at the end of the third day of training.

The results of this questionnaire will be compiled and shared with all the individuals involved in the Trinidad and St. Lucia training on the Agro-Medical Approach to Pesticide Management.

Thank you.

INSTRUCTIONS

Please read each question and answer it on the basis of your current work and responsibilities. If you cannot answer a specific question, please write (or circle) "Don't know."



PESTICIDE MANAGEMENT QUESTIONNAIRE

1. What forms of information are regularly available to the general public regarding the safe use of pesticides? (Circle numbers that apply)

   1. television
   2. radio
   3. newspapers
   4. magazines
   5. posters
   6. extension and bulletins
   7. educational or training programs
   8. Other (Specify) _____
   9. Don't know

2. Are you personally aware of training in pesticide management provided to the following: (Circle appropriate answer for each)

a. Workers who mix pesticides	Yes	No	Don't know
b. Workers who transport pesticides	Yes	No	Don't know
c. Workers who apply pesticides	Yes	No	Don't know
d. Field workers	Yes	No	Don't know

3. I think regular training in safe management of pesticides is needed for those who handle chemical pesticides. (Circle number that applies)

   1. I strongly agree
   2. I agree
   3. I disagree
   4. I strongly disagree
   5. Don't know

4. In your country or area do the following groups of workers <u>normally</u> use safety equipment or clothing when handling pesticides?

a. Workers who mix pesticides	Yes	No	Don't know
b. Workers who transport pesticides	Yes	No	Don't know
c. Workers who apply pesticides	Yes	No	Don't know
d. Field workers	Yes	No	Don't know

5. A poison information center is sometimes located in a community. How necessary do you feel a poison information center is for your community? (Circle one number)

   1. Of greatest necessity
   2. Very necessary
   3. Somewhat necessary
   4. Unnecessary
   5. Already exists in my community

6. How important is it to have a first aid center staffed with qualified individuals in your community? (Circle one number)

   1. Very important
   2. Somewhat important
   3. Not too important
   4. Not at all important
   5. Already exists in my community

7. If your community does not have a first aid center staffed by qualified individuals, what is the likelihood that a first aid center could be established? (Circle one number)

   1. Very likely
   2. Somewhat likely
   3. Not too likely
   4. Not at all likely

8. In order to set up a first aid program in your community, what are at least three major obstacles or problems to setting up a program?

   a. _____

   b. _____

   c. _____

   d. _____

9. I think chemical pesticides are very necessary for agricultural production in my community. (Circle one number)

   1. I strongly agree
   2. I agree
   3. I disagree
   4. I strongly disagree
   5. Don't know

10. In your country, has pesticide legislation been adopted? (Circle one number)

    1. Yes 2. No 3. Don't know

11. If yes, how effective do you feel this legislation has been in promoting more safe pesticide management? (Circle one number)

    1. Very effective
    2. Somewhat effective
    3. Not too effective
    4. Not at all effective
    5. Don't know

12. What suggestions do you have for improving the enforcement and effectiveness of these laws and regulations? Please list at least two suggestions.

    a. _____

    b. _____

    c. _____

    d. _____

13. What activities, programs or efforts would you like to see occur in order to encourage more effective pesticide management programs? Please list at least two.

    a. _____

    b. _____

    c. _____

    d. _____

14. Are there restrictions on what pesticides may be repackaged? (Circle one number)

    1. Yes 2. No 3. Don't know 4. If yes, what are the restrictions?

15. Is there anything else you would like to say concerning improving pesticide management programs? Your comments are welcome.

16. In what country do you work?_____

17. What is your profession?_____

    How long have you been in this position? _____years

18. What is the highest level of formal education you have completed? (Circle one number)

    1. High school graduate
    2. College graduate
    3. Graduate degree
    4. Other (specify)_____

THANK YOU

APPENDIX B

TABULATED DATA

TABLE 4-5B*

FORMS OF INFORMATION AVAILABLE TO THE GENERAL PUBLIC
BY COUNTRY OF EMPLOYMENT

Information Available	Rank	Trinidad-Tobago	Rank	All Others
a. Television	6	8 (14.3%)	6	8 (27.6%)
b. Radio	2	19 (33.9%)	2	19 (65.5%)
c. Newspaper	4	10 (17.9%)	5	10 (34.5%)
d. Magazines	7	7 (12.5%)	7	1 (3.4%)
e. Posters	4	10 (17.9%)	3	13 (44.8%)
f. Extension and Bulletins	1	24 (42.9%)	1	19 (65.5%)
g. Education/Training	3	11 (19.6%)	4	12 (41.4%)
h. Other	8	6 (10.7%)	7	1 (3.4%)
i. Don't Know	6	8 (14.3%)	8	0 (0%)
j. None Listed	5	9 (16.1%)	7	1 (3.4%)

*This table represents complete data to question 1 of the questionnaire and corresponds to Table 4-5 on page 38 of the text.

TABLE 4-6B

FORMS OF INFORMATION AVAILABLE TO THE GENERAL PUBLIC
BY OCCUPATION

Information Available	Rank	Agriculture	Rank	Health	Rank	All Others
a. Television	7	5 (13.9%)	4	8 (21.6%)	2	3 (30%)
b. Radio	2	14 (38.9%)	1	18 (48.6%)	1	5 (50%)
c. Newspaper	5	9 (25%)	4	8 (21.6%)	2	3 (30%)
d. Magazines	6	6 (16.7%)	8	2 (5.4%)	-	0 (0%)
e. Posters	3	13 (36.1%)	5	7 (18.9%)	2	3 (30%)
f. Extension and Bulletins	1	28 (77.8%)	3	9 (24.3%)	1	5 (50%)
g. Education/Training	4	12 (33.3%)	2	10 (27.0%)	4	1 (10%)
h. Other	10	1 (2.8%)	7	4 (10.8%)	3	2 (20%)
i. Don't Know	9	2 (5.6%)	6	5 (13.5%)	-	0 (0%)
j. None Listed	6	4 (11.1%)	6	5 (13.5%)	4	1 (10%)

*This table represents complete data to question 1 of the questionnaire and corresponds to Table 4-6 on page 39 of the text.

TABLE 4-10B*

PESTICIDE MANAGEMENT EDUCATION EFFORTS DESIRED
BY COUNTRY OF EMPLOYMENT

Education Effort	Rank	Trinidad-Tobago	Rank	All Others
a. Public Ed/Media	2	34 (60.7%)	1	16 (55.2%)
b. Ongoing Education	3	16 (28.6%)	6	1 (3.4%)
c. Enforce Laws	4	12 (21.4%)	3	4 (13.8%)
d. Agromedical Association	5	8 (14.3%)	5	2 (6.9%)
e. Improved Legislation	6	4 (7.1%)	4	3 (10.3%)
f. Monitor and Check	6	4 (7.1%)	4	3 (10.3%)
g. Extension Programs	7	3 (5.4%)	6	1 (3.4%)
h. Training/Inservice	1	42 (75.0%)	1	16 (55.2%)
i. Poison Control	8	1 (1.8%)	6	1 (3.4%)
j. None Listed	8	1 (1.8%)	2	5 (17.2%)

*This table represents complete data to question 13 of the questionnaire and corresponds to Table 4-10 on page 42 of the text.

TABLE 4-11B*

PESTICIDE MANAGEMENT EDUCATION EFFORTS DESIRED
BY OCCUPATION

Education Effort	Rank	Agriculture	Rank	Health	Rank	All Others
a. Public Ed/Media	2	19 (52.8%)	2	23 (62.2%)	1	7 (70%)
b. Ongoing Education	4	5 (13.9%)	3	8 (21.6%)	2	3 (30%)
c. Enforce Laws	3	7 (19.4%)	4	7 (18.9%)	3	2 (20%)
d. Agro-Medical Association	6	3 (8.3%)	5	6 (16.2%)	4	1 (10%)
e. Improved Legislation	6	3 (8.3%)	6	3 (8.1%)	4	1 (10%)
f. Monitor and Check	6	3 (8.3%)	7	2 (5.4%)	3	2 (20%)
g. Extension Programs	5	4 (11.1%)	9	0 (0 %)	5	0 (0%)
h. Training/Inservice	1	26 (72.2%)	1	27 (73.0%)	2	3 (30%)
i. Poison Control	7	0 (0 %)	8	1 (2.7%)	4	1 (10%)
j. None Listed	5	4 (11.1%)	7	2 (5.4%)	5	0 (0%)

*This table represents complete data to question 13 of the questionnaire and corresponds to Table 4-11 on page 42 of the text.

TABLE 4-15B1

RANK ORDER OF NEED FOR A POISON INFORMATION CENTER*
BY OCCUPATIONS IN TRINIDAD-TOBAGO

Category Label	Rank	Agric.	Rank	Health	Rank	All Other
a. Greatest Necessity	1	11 (55%)	1	18 (66.7%)	1	5 (62.5%)
b. Very Necessary	2	6 (30%)	2	8 (29.6%)	2	3 (37.5%)
c. Somewhat Necessary	3	3 (15%)	3	0 (0%)	3	0 (0%)

*This data represents responses to question 5 of the questionnaire: A poison information center is sometimes located in a community. How necessary do you feel a poison information center is for your community?

This table corresponds to Table 4-15 on page 45 of the text.

TABLE 4-15B2

RANK ORDER OF NEED FOR A POISON INFORMATION CENTER*
BY OCCUPATIONS IN ALL OTHER COUNTRIES

Category Label	Rank	Agri.	Rank	Health	Rank	All Other
a. Greatest Necessity	1	7 (43.8%)	2	2 (20%)	1	1 (50%)
b. Very Necessary	2	5 (31.3%)	1	6 (60%)	1	1 (50%)
c. Somewhat Necessary	3	4 (25%)	2	2 (20%)	2	0 (0%)

*This data represents responses to question 5o of the questionnaire: A poison information center is sometimes located in a community. How necessary do you feel a poison information center is for your community?

This table corresponds to Table 4-15 on page 45 of the text.

TABLE 4-18B

LIKELIHOOD OF A FIRST AID CENTER BEING ESTABLISHED*
BY OCCUPATION

Category Label	Rank	Agriculture	Rank	Health	Rank	All Others
a. Very Likely	4	1 (6.3%)	1	4 (40%)	1	1 (50%)
b. Somewhat Likely	1	6 (37.5%)	2	3 (30%)	1	1 (50%)
c. Not Too Likely	2	5 (31.3%)	3	0 (0%)	2	0 (0%)
d. Not At All Likely	4	1 (6.3%)	3	0 (0%)	2	0 (0%)
e. No Response	3	3 (18.8%)	2	3 (30%)	2	0 (0%)

*This table represents complete data to question 7 of the questionnaire and corresponds to Table 4-18 on page 47 of the text.

TABLE 4-19B*

MAJOR OBSTACLES TO SETTING UP A FIRST AID PROGRAM
BY COUNTRY OF EMPLOYMENT

Category Label	Rank	Trinidad-Tobago	Rank	All Others
a. Already Exists	2	36 (64.3%)	3	11 (37.9%)
b. Trained Personnel	1	56 (100 %)	1	27 (93.1%)
c. Equipment	4	18 (32.1%)	4	9 (31,0%)
d. Location	7	12 (21.4%)	7	3 (10.3%)
e. Funds	5	15 (26.8%)	2	13 (44.8%)
f. Government Approval	3	23 (41.1%)	5	7 (24.1%)
g. Community Cooperation	8	9 (16.1%)	9	1 (3.4%)
h. Public Awareness	6	14 (25.0%)	6	4 (13.8%)
i. Communication	9	4 (7.1%)	8	2 (6.9%)

*This table represents complete data to question 8 of the questionnaire and corresponds to Table 4-19 on page 48 of the text.

TABLE 4-20B*

MAJOR OBSTACLES TO SETTING UP A FIRST AID PROGRAM
BY OCCUPATION

Obstacle	Rank	Agriculture	Rank	Health	Rank	All Others
a. Already Exists	2	18 (50.0%)	2	20 (54.1%)	2	7 (70 %)
b. Trained Personnel	1	35 (97.2%)	1	36 (97.3%)	1	12 (120%)
c. Equipment	4	12 (33.3%)	3	13 (35.1%)	5	2 (20 %)
d. Location	6	7 (19.4%)	5	7 (18.9%)	6	0 (0 %)
e. Funds	3	17 (47.2%)	4	9 (24.3%)	5	2 (20 %)
f. Government Approval	4	12 (33.3%)	3	13 (35.1%)	3	5 (50 %)
g. Community Cooperation	7	3 (8.3%)	6	6 (16.2%)	6	0 (0 %)
h. Public Awareness	5	8 (22.2%)	6	6 (16.2%)	4	3 (30 %)
i. Communication	8	1 (2.8%)	7	2 (5.4%)	4	3 (30 %)

*This table represents complete data to question 8 of the questionnaire and corresponds to Table 4-20 on page 49 of the text.

TABLE 4-22B*

EFFECTIVENESS OF LEGISLATION
BY COUNTRY OF EMPLOYMENT

Category Label	Rank	Trinidad-Tobago	Rank	All Others
a. Very Effective	5	1 (1.8%)	6	0 (0 %)
b. Somewhat Effective	6	0 (0 %)	2	9 (31.0%)
c. Not Too Effective	3	10 (17.9%)	3	6 (20.7%)
d. Not At All Effective	2	18 (32.1%)	4	3 (10.3%)
e. Don't Know	4	8 (14.3%)	5	1 (3.4%)
f. No Response	1	19 (33.9%)	1	10 (34.5%)

*This table represents complete data to question 11 of the questionnaire and corresponds to Table 4-22 on page 51 of the text.

TABLE 4-23B*

EFFECTIVENESS OF LEGISLATION
BY OCCUPATION

Category Label	Rank	Agriculture	Rank	Health	Rank	All Others
a. Very Effective	6	1 (2.8%)	6	0 (0 %)	4	0 (0%)
b. Somewhat Effective	3	5 (13.9%)	5	3 (81.4%)	4	0 (0%)
c. Not Too Effective	4	4 (11.1%)	2	10 (27.0%)	3	2 (20%)
d. Not At All Effective	1	13 (36.1%)	4	5 (13.5%)	2	3 (30%)
e. Don't Know	5	2 (5.6%)	3	7 (18.9%)	4	0 (0%)
f. No Response	2	11 (30.6%)	1	12 (32.4%)	1	5 (50%)

*This table represents complete data to question 11 of the questionnaire and corresponds to Table 4-23 on page 52 of the text.

TABLE 4-23B1*

EFFECTIVENESS OF LEGISLATION
BY OCCUPATION IN TRINIDAD-TOBAGO

	Rank	Agriculture	Rank	Health	Rank	All Others
a. Very Effective	3	1 (5%)	4	0 (0 %)	4	0 (0 %)
b. Not Too Effective	3	1 (5%)	1	8 (29.6%)	3	1 (12.5%)
c. Not At All Effective	1	11 (55%)	3	4 (14.8%)	2	3 (37.5%)
d. Don't Know	3	1 (5%)	2	7 (25.9%)	4	0 (0 %)
e. No Response	2	6 (30%)	1	8 (29.6%)	1	4 (50.0%)

*This table represents complete data to question 11 of the questionnaire and corresponds to Tble 4-23 on page 52 of the text.

TABLE 4-23B2*

EFFECTIVENESS OF LEGISLATION
BY OCCUPATION IN ALL OTHER COUNTRIES

Category Label	Rank	Agriculture	Rank	Health	Rank	All Others
a. Somewhat Effective	1	5 (31.3%)	2	3 (30%)	2	0 (0%)
b. Not Too Effective	2	3 (18.8%)	3	2 (20%)	1	1 (50%)
c. Not At All Effective	3	2 (12.5%)	4	1 (10%)	2	0 (0%)
d. Don't Know	4	1 (6.3%)	5	0 (0%)	2	0 (0%)
e. No Response	1	5 (31.3%)	1	4 (40%)	1	1 (50%)

*This table represents complete data to question 11 of the questionnaire and corresponds to Table 4-23 on page 52 of the text.

TABLE 4-24B*

HOW EFFECTIVENESS OF PESTICIDE LAWS/REGULATIONS CAN BE IMPROVED BY COUNTRY OF EMPLOYMENT

Suggestion	Rank	Trinidad-Tobago	Rank	All Others
a. More Government Regulations	2	17 (30.4%)	3	6 (20.7%)
b. Qualified Staff	5	10 (17.9%)	1	10 (34.5%)
c. Public Education	1	21 (37.5%)	2	9 (31.0%)
d. More Penalties	4	11 (19.6%)	7	1 (3.4%)
e. Agency Integration	7	2 (3.6%)	7	1 (3.4%)
f. Enforce Laws	5	10 (17.9%)	4	5 (17.2%)
g. Train Personnel	3	12 (21.4%)	6	3 (10.3%)
h. Media Use	6	6 (10.7%)	8	0 (0 %)
i. Monitoring	5	10 (17.9%)	5	4 (13.8%)
j. None Listed	5	10 (17.9%)	2	9 (31.0%)

*This table represents complete data to question 12 of the questionnaire and corresponds to Table 4-24 on page 52 of the text.

Table 4-25B*

HOW EFFECTIVENESS OF PESTICIDE LAWS/REGULATIONS CAN BE IMPROVED BY OCCUPATION

Suggestion	Rank	Agriculture	Rank	Health	Rank	All Others
a. More Government Regulations	3	8 (22.2%)	3	8 (21.6%)	1	6 (60%)
b. Qualified Staff	5	6 (16.7%)	2	11 (29.7%)	4	2 (20%)
c. Public Education	1	10 (27.8%)	1	17 (45.9%)	3	3 (30%)
d. More Penalties	4	7 (19.4%)	6	5 (13.5%)	6	0 (0%)
e. Agency Integration	7	2 (5.6%)	7	1 (2.7%)	6	0 (0%)
f. Enforce Laws	6	3 (8.3%)	4	7 (18.9%)	2	5 (50%)
g. Train Personnel	5	6 (16.7%)	4	7 (18.9%)	4	2 (20%)
h. Media Use	8	1 (2.8%)	6	5 (13.5%)	6	0 (0%)
i. Monitoring	4	7 (19.4%)	5	6 (16.2%)	5	1 (10%)
j. None Listed	2	9 (25.0%)	3	8 (21.6%)	5	1 (10%)

*This table represents complete data to question 12 of the questionnaire and corresponds to Table 4-25 on page 53 of the text.

TABLE 4-27B1*

EXISTENCE OF PESTICIDE REPACKAGING RESTRICTIONS
BY OCCUPATION IN TRINIDAD-TOGABO

Category Label	Rank	Agriculture	Rank	Health	Rank	All Others
a. Yes	3	5 (25%)	3	2 (7.4%)	3	0 (0 %)
b. No	2	7 (35%)	2	8 (29.6%)	1	5 (71.4%)
c. Don't Know	1	8 (40%)	1	17 (63.0%)	2	2 (28.6%)

*This table represents complete data to question 14 of the questionnaire and corresponds to Table 4-27 on page 54 of the text.

TABLE 4-27B2*

EXISTENCE OF PESTICIDE REPACKAGING RESTRICTIONS
BY OCCUPATION IN ALL OTHER COUNTRIES

Category Label	Rank	Agriculture	Rank	Health	Rank	All Others
a. Yes	3	3 (18.8%)	2	2 (25.0%)	1	1 (50%)
b. No	1	9 (56.3%)	1	3 (37.5%)	1	1 (50%)
c. Don't Know	2	4 (25.0%)	1	3 (37.5%)	2	0 (0%)

*This table represents complete data to question 14 of the questionnaire and corresponds to Table 4-27 on page 54 of the text.

APPENDIX C
DEMOGRAPHIC INFORMATION ON THE SAMPLE

TABLE 1-C

POPULATION, AREA, AND CHIEF TOWN OF SELECTED CARIBBEAN ISLANDS

Country	Area (sq. mi.)	Population	Chief Town	Population of Chief Town
1. Antigua and Barbuda	170	70,000	St. John's	25,000
2. Bahamas	4,400	185,000	Nassau	112,000
3. Barbados	166	139,000	Bridgetown	12,430
4. Bermuda	21	54,000	Hamilton	3,000
5. British Honduras now Belize	8,900	124,000	Belize City	39,000
6. British Virgin Islands	59	10,484	Road Town	2,183
7. Cayman Islands	100	11,000	George Town	3,000
8. Dominica	290	72,000	Roseau	11,924
9. Grenada, Carriacou and The Grenadines	133	96,000	St. George's	8,400
10. Guyana	83,000	763,000	Georgetown	195,000
11. Jamaica	4,400	1,897,000	Kingston	506,000
12. Montserrat	39	12,000	Plymouth	3,000
13. St. Ketts-Nevis-Anguilla	171	64,000	Basseterre	13,055
14. St. Lucia	238	103,000	Castries	40,000
15. Trinidad-Tobago	1,980	1,061,850	Port of Spain	94,000
16. Turks and Caicos Islands	166	6,000	Grand Turk	2,339

TABLE 2-C

GENERAL DEMOGRAPHIC INFORMATION FOR SELECTED CARIBBEAN COUNTRIES

	Dominican Republic	Dominica	Grenada	Barbados	Suriname	St. Lucia	Trinidad /Tobago	Jamaica
Percent ag[a] land	49	24	44	60	0.3	50	28	
Percent work force in ag	57	50	40	9.6	19	50	13	
Percent of GDP in ag	21		35	14	11.2		0.3	
Percent literacy rate	68	80	76	97	80	80	95	86
Instructional language in schools	Spanish/ English		Dutch					
Compulsory? Ages	Yes (7-14)	Yes	Compulsory (6-14)	Yes (5-14)	Yes (6-12)		Yes (6-12)	
Percent Schooling								
Primary Ages	102 (5-14)	99	114 (5-10)	101 (5-14)	81 (5-11)			
Secondary Ages	29 (15-19)		86 (11-17)	47 (15-19)	38 (12-17)			
No schooling	40						11.6[b]	
Daily newspapers	10	4[c]	3[d]	1	7[c]/7[e]	5[c]	3[e]	
Newspapers/1,000 people		121	65	115			124	
Radios/1,000 people	41[f]	128[g]	229[f]	526[f]	257[g]	808[f]	253[f]	
TVs/1,000 people	33[f]	None	None	194[f]	87	private	103[f]	

[a] ag = agriculture

[b] Over 25 years old

[c] Non-daily

[d] Weekly

[e] Daily

[f] 1976

[g] 1977

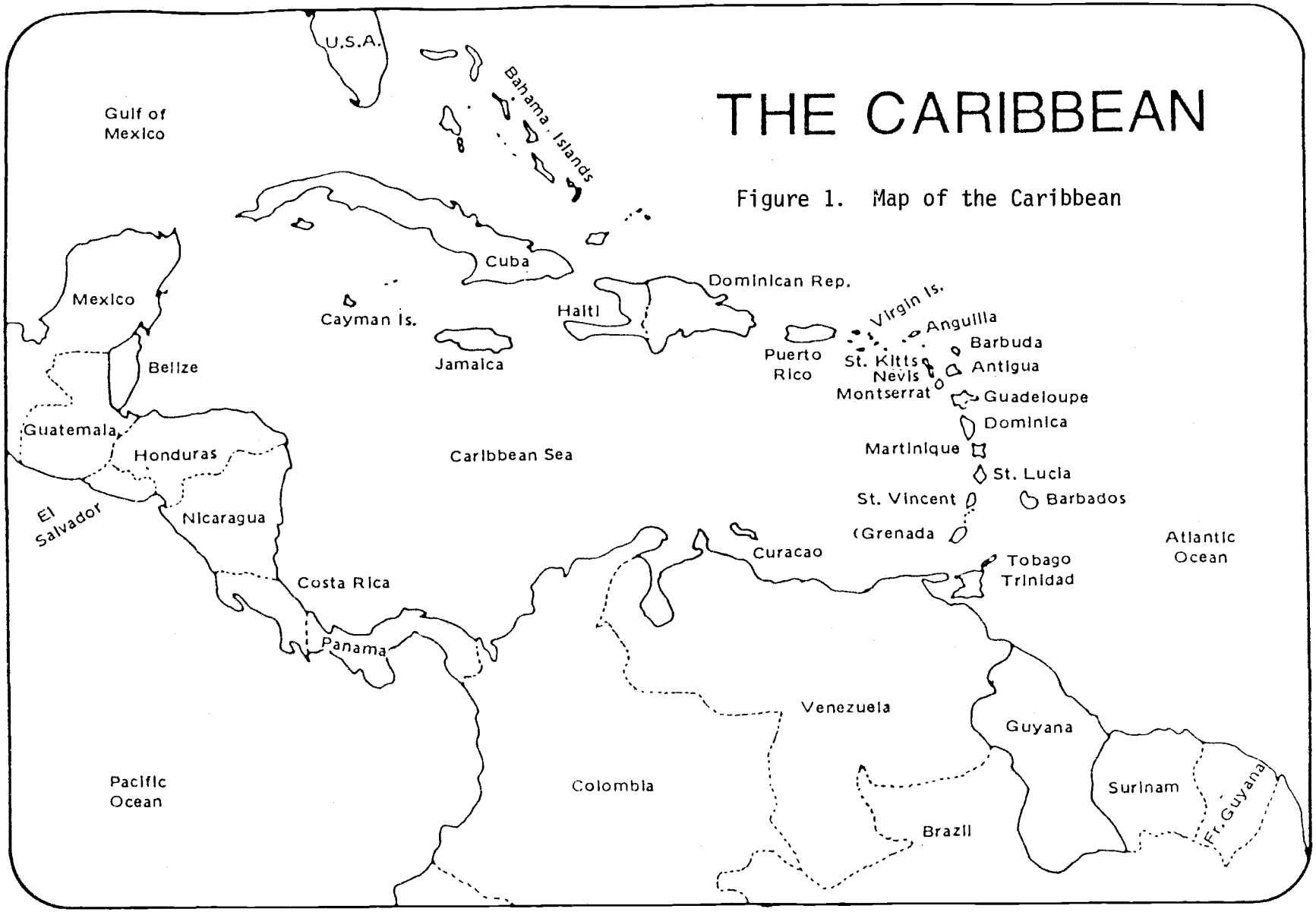


Figure 1. Map of the Caribbean

APPENDIX D

INTERNATIONAL STANDARDS OF SAFE MANAGEMENT PRACTICES

STRATEGY FOR INCREASED PESTICIDE PROTECTION

Policy-making bodies within tropical countries must recognize and act upon their responsibility to ensure that the increasing potential threat to the safety of their environment be reduced. International standards must be considered in relation to the specific requirements of tropical countries. In so doing, relevant intermediate technology could be developed. The peculiar needs for increased pesticide protection revolve around developing systems for:

INFORMATION	to increase and maintain a source of information on pesticide use for tropical conditions.
LEGISLATION	to formulate and implement practical measures which will ensure safe use of pesticides within the context of available resources.
EDUCATION	to develop and train technical persons and the general public in their own responsibility for human and environmental safety.

Information must be provided which will allow pesticides to be selected and used correctly. Mechanisms must be set up and maintained for:

Effective dialogue and cooperation between government, industry and universities or other regional and international organizations.

Field testing of formulations under conditions which more closely represent tropical extremes. This will determine the effective modes of formulation, e.g., an encapsulated dust or granular product which resists ultraviolet degradation for a longer period, also precise rates and intervals for application. The relevance and actual duration of Re-entry Risk intervals will change dependent on the rate at which a product breaks down in the tropical environment. The selection of effective adjuvants will ensure a more lasting retention of pesticides on foliage in areas with heavy precipitation. Lastly, acceptable tolerance limits will be crucial.

A system must be developed to safeguard the territory from self-interest in the chemical manufacturing industry. Manufacturers with local distributors in tropical countries must be encouraged to provide certain services as a requirement of their franchise, vis, the regular service of regional technical representatives. Productive dialogue with these individuals is necessary for local researchers to develop formulations and rates of application most suited to a particular tropical situation. They must also provide information on the required antidotes for cases of over exposure.

Samples of different formulations or products for strict quality control analyses. This would decrease the incidence of reduced quality in the products which sometimes are accepted because the price is competitive.

A mechanism must be established for developing a History and Record of Pesticide Use, Exposure and Incidences of Poisoning. A system will have to be instituted for regular general monitoring of agricultural products; other users of pesticides, soil, aire, and water for detection of pesticide residues which exceed safe limits. Initially, this system will have to be relatively inexpensive and easy to use, e.g., use of thin layer chromatography.

These objectives will never be accomplished without the necessary legislation and the infrastructure to enforce the regulations devised.

Clear comprehensive legislation and regulatory processes are vital as the basis for the control and monitoring which tropical countries need to do to sustain a proper program of pesticide protection. These processes must ensure:

(1) Strict control of the quality and safety of pesticide products used within a territory.

(2) Observance of clear guidelines for proper storage of chemical and treatment of foodstuff in warehouses.

(3) Registration and certification of all pest control operators after these have satisfied basic requirements of training.

(4) Compliance with all safety regulations for workers by manufacturers or distributors of pesticides within the region.

(5) Development of a system of inspection for urban and rural areas to ensure that regulations are being followed. Penalties must be imposed for any infringement of the law.

(6) Ensure policy be directed at maintaining the necessary research programs which would provide local information on effective rates and times of application as well as residue limits.

(7) Control of the manner in which media advertising is used to promote sale of pesticide products. Information thus released must comply with guidelines for pesticide protection.

Training and education is a continuous process and would operate at three (3) levels.

Technical personnel who will advise on handling of pesticides and treatment of cases of exposure.

Applicators.

General public.

Prophylactic measures would reduce the degree and incidence of danger in pesticide misuse. For technical personnel and applicators, training must be geared towards:

development of relevant effective pest management programmes.

maintenance of standards to ensure safety of the operator, e.g.,

(1) ensuring operator's use protective apparatus as a requirement to employment.

(2) insistence on the development of light protective clothing suitable for use under the tropical conditions. Also reduce the chance of discomfort by applying pesticides in the cooler periods of the day.

(3) provide all regular users of pesticides with tags to be attached to the coveralls bearing the following information:

(a) Name

(b) Name(s) of chemicals used

(c) Antidote.

(4) selection of the correct pesticide formulation for a specific situation.

(5) application of pesticides at rates recommended locally.

(6) realization that increased dosage need not mean increased kill. Where resistance to a pesticide has developed, select another in combination with other means of control.

(7) where orthodox calibrated utensils are difficult to obtain, construct a more economical local substitute which is VISIBLY different from a food container.

(8) establish a system where protective clothing remains at the farm and is laundered there. Exposure to sun after laundering also increases the photochemical breakdown of a pesticide (see Chap. XV) and consequently the amount of residue which remains. Operators must be encouraged to shower before returning home.

Protection of other persons and the general environment is also vital. Some measures to be taken are:

Safe separate storage for chemicals. Keep these away from human or animal food or where children may have easy access.

A safe practical method of container and chemical disposal must be found for tropical situations.

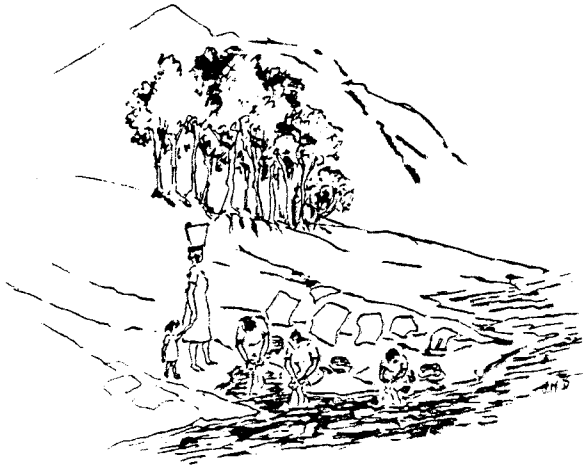
Empty pesticide containers should never be used for other purposes including garbage collection. Chemical companies could encourage the return of large containers.

All chemicals must be kept away from natural water sources. Where cultivation is near a water source, the use of a narrow, closely planted "buffer strip" of a crop, e.g., grass or short legume, helps to trap excessive run-off of the pesticide into the water.

Where a river or pond is the nearest available water source, it is better to collect water and carry away from the source for mixing pesticides than to leave the pesticide container near the waterway.

Application of a pesticide to foliage when a shower is imminent is a waste of time, resources and a hazard to the environment.

When applying pesticides near fish ponds select a chemical with lower reported toxicity to fish.



Never wash clothes worn while applying pesticides in rivers or ponds.

Remove livestock and reap produce BEFORE a pesticide is applied.

Training and education must also be directed at recognition and treatment of cases of poisoning.

Regular training of health personnel must be maintained so that proper recognition and treatment of pesticide poisoning victims be adopted.

Education of the general public must also be continuous on the safe use, storage and disposal of pesticides and steps be adopted in the event of pesticide poisoning.

In the rural environment, train at least on influential member of the community, e.g., village headman, to recognize symptoms of pesticide poisoning and the steps for FIRST AID.

Devise a system for transport of a victim of pesticide poisoning in any community to the nearest resuscitative resource (clinic, doctor, nurse or emergency room).