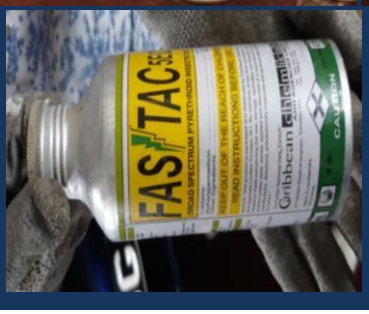


PESTICIDES POISONING EXPOSURES IN FARMING

A STUDY DONE IN JAMAICA AND TRINIDAD & TOBAGO

THE UNIVERSITY OF TECHNOLOGY, JAMAICA

THE CARIBBEAN POISON INFORMATION NETWORK

DECEMBER 2020

Submitted by : Sherika Whitelocke-Ballingsingh

Funded by the Rotterdam Convention

Acknowledgements

I would like to express sincere thanks to the project team members and farmers in Jamaica and Trinidad and Tobago; without whose contribution this project would not be a success.

Special thanks to stakeholders from Jamaica: the University of Technology, Jamaica, Ministry of Agriculture, Rural Agriculture Development Authority in Jamaica, Pesticides Control Authority of Jamaica, and from Trinidad & Tobago, the Pesticides and Toxic Chemicals Inspectorate, Ministry of Agriculture and the Ministry of Health respectively.

Table of Contents

Abbreviations and Acronyms

CDC	Centre for Disease Control
HHP	Highly Hazardous Pesticide
PPE	Personal Protective Equipment
JIS	Jamaica Information Service
RADA	Rural Agriculture Development Authority
APP	Acute Pesticide Poisoning
PAN	Pesticide Action Network
PTCI	Pesticides and Toxic Chemical Inspectorate
PCA	Pesticides Control Authority
UNEP	United Nations Environment Programme
WHO	World Health Organization

1.0 Countries Profiles

1.1 Jamaica

Jamaica is the largest island in the English-speaking Caribbean, and the most populated with 2.93 million people (WorldBank, 2020). The island is divided into fourteen parishes, within the counties of Cornwall, Middlesex and Surrey. The total number of registered farmers are 224,507, majority of whom have a primary education, followed by secondary education, skilled trained and the least with university education (RADA, 2020). A 2016 survey that focused on farmers' knowledge, skills and attitude towards chemicals revealed that most farmers are aware of and practice international standards. They are also sensitized about the risks of pesticides (JIS, 2019).

The Pesticides Control Authority of Jamaica (PCA) is the regulatory body for the Pesticides Act of 1975. The Act was legislated specifically for the control of the pesticidesindustry. PCA through the mandate of the Act functions to: register pesticides, licence persons to import or manufacture registered pesticides, authorize persons to sell restricted pesticides, register premises in which a restricted pesticide may be sold and licence pest control operators along with other functions that may be expedient or necessary for enforcement under the Act.

The excessive use of chemicals by farmers as explained by the Rural Agriculture Development Authority (RADA) is mostly during the periods of pest outbreak. During pest outbreak periods, farmers are said to practice the mixing of numerous chemicals together without adherence to the safety instruction on the label. This has negative implication on residual exposure during the pre-harvest period (JIS, 2017). The main crops with pesticides residues are cabbage, callaloo, pakchoi and thyme (JIS, 2019).

1.2 Trinidad & Tobago

Trinidad & Tobago is located at the south of the West Indian archipelago close to the Venezuelan coast. According to United Nations, it has a population is 1.3 Million as of 2020 (UN, 2020). It is divided into nine regions, three boroughs and fourteen municipal corporations. Agriculture contributes to 0.3 per cent of the national GDP and employs about four per cent of the population, providing revenue for both farmers and agricultural labourers in rural households (New Agriculturist, 2013).

Trinidad the larger of the twin islands had seven distributing pesticides agents and 137 retailers that served both islands (Pinto, 2007). In Trinidad the high use of chemicals and their disposal are the main environmental issues affecting agriculture especially in vegetable growing areas, while on the contrary in Tobago the farming systems are low-in- put with little or no chemicals (New Agriculturist, 2013).

The regulating authority for pesticides is the Pesticides and Toxic Chemicals Inspectorate (PTCI). The PTCI mandate is to that all pesticide used within the country meets international standards and also that the premises where these items are used and stored meet the established regulations. The legal framework that governs the Inspectorate is the Pesticides and Toxic Chemicals Act of 1979. The Pesticide and Toxic Chemicals Regulation is applicable to pesticide importers, distributors, manufacturers, agro-shops, pest control operators etc.

1.3 International Convention

Jamaica and Trinidad & Tobago are both Parties to the Rotterdam Convention. Jamaica ratified and entered into force on August 20, 2002 and February 24, 2004 respectively while Trinidad & Tobago ratified and entered into force on December 16, 2009 and March 16, 2010 respectively (UNEP, 2010). As Parties to the Rotterdam Convention, bothcountries are encouraged to promote and share responsibilities and cooperate, efforts for trade of certain hazardous chemical in an effort to protect human health and the environment. The Convention provides legally binding obligations for the Prior Informed Consent procedure for certain Hazardous Chemicals and Pesticides. International Trade requires that hazardous chemicals and pesticides that have been banned or severely

restricted in countries listed in Annex 111 of the Convention shall not be exported unless explicitly agreed by the importing country. If a government should choose to import a hazardous chemical or pesticide, the exporter will be obliged to provide extensive information on the potential hazards for health and the environment (UNEP, 2010). The Convention also lists Severely Hazardous Pesticide Formulations that may be too harmful to be used by farmers in developing countries (UNEP, 2010).

2.0 Background

Pesticides are defined as any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. They are unique chemicals as they are intrinsically toxic for several biological targets, and their toxicity have limited species selectivity. Nearly fifty per cent of the world's labour force is employed in agriculture. Over the last fifty years, agriculture has deeply changed with a massive utilization of pesticides and fertilizers to enhance crop protection and production, food quality and food preservation. Apart from agriculture, pesticides are also extensively used for public health and domestic purposes (Maroni, 2006).

Pesticide exposure can occur via ingestion, inhalation, dermal absorption or ocular contact. The global problem of Acute Pesticide Poisoning (APP) has been confirmed as extensive by a variety of independent estimates. Most estimates concerning the extent of APP have been based on data from hospital admissions which include only the more serious cases (Jeyaratnam, 1990). Pesticides are a serious public health and environmental problem, particularly in developing countries, where APP is a well-recognized cause for morbidity and mortality (Agriculturist, 2013). A large number of highly hazardous pesticides are easily available, especially in developing countries, and many of them are used in agriculture, often without appropriate protective clothing (PAN, 2016). This affects majority of the working population through increasing exposures to both restricted and banned pesticides from industrialized countries.

Studies on knowledge, attitudes, and practices in developing countries indicated that the unsafe use of pesticides is a rule, resulting in high rates of acute poisonings (Wesseling, 1997). In Caribbean countries, agrochemicals for pesticide use are commonly involved in poisoning (Agriculturist, 2013).

This research project investigated the relationship between the use of pesticides and incidence of poisoning within the farming communities of Jamaica and Trinidad & Tobago. The objectives were to: assess the knowledge of farmers on the use of pesticide, evaluate the practices of farmers when using pesticide and assess the incidence of poisoning from pesticide usage. The expected outcome was to provide information for applicable interventions in an effort to prevent pesticide poisoning. This survey was funded by the Food and Agriculture Organization of the United Nations (FAO) part of the Rotterdam Convention Secretariat.

3.0 Pesticide Poisoning and Farming

An APP is any illness or adverse health effect resulting from suspected or confirmed exposure to a pesticide within 48 hours. Adverse health effects may be localized (dermal and ocular) and/or systemic. These include respiratory, neurotoxic, cardiovascular, endocrine, gastrointestinal, nephrotoxic and allergic reactions (Josef, 2020).

Research in developing countries revealed that annual incidence rates for APP among agricultural workers were 18.2 per 100,000 workers (Josef, 2020). Recent studies in Kenya, Nigeria, Indonesia and Vietnam showed that most farmers in developing countries do not handle highly toxic pesticides in a safe manner. Protective clothing was often thought to be a solution. However, this was not economically feasible for most farmers andalso their inability to properly maintained PPEs. Furthermore, in tropical countries under hot climatic conditions, such clothing is uncomfortable to wear. Farmers' knowledge, practices and incidence of poisoning from the usage of pesticide will be looked at from researches that were conducted.

3.1 Farmers' Knowledge and Pesticide Usage

Studies on farmers' knowledge on pesticide usage mostly focus on their awareness, of health issues through pesticides exposure, the use of label in preparing pesticides and the differences between each pesticide. An Ethiopian study showed that farmers' knowledge towards safe use of pesticides was significant, with the majority (87.5%) of participants knowing the names of pesticides. Three hundred ninety one (54.4 %), farmers knew at least one of the following pest control methods: manual removal, using bed-net andapplying smoke. The majority (87.5%) of participants knew at least one health related problem following exposure to pesticides. Only 45(6.3%) participants knew health problems associated with pregnancy from exposure to pesticides (Gesesew, 2016)

Another study done in southwest Ethiopia showed the association between farmers' knowledge and attitude towards pesticides. Their knowledge included each of the following: the names of the pesticides, methods of pest control and the use of gloves during pesticide exposure; this was significantly associated with farmers' attitudes towards safe use of pesticides. The likelihood of having positive attitudes among farmers who didn't know pesticides by their name was lower than those who knew pesticides by their name. Positive attitudes towards safe use of pesticides among farmers, who were aware of reduction of pesticide exposure by using gloves, was 1.52 times higher than those farmers who did not have the awareness (Gesesew, 2016)

3.2 Farmers Practice and Pesticide Usage

The use of PPE as a barrier to pesticide exposure is a safety practice in agriculture that has been researched in numerous farming communities across the world. The use of protective gears varies according to farming culture and climatic conditions. Farmers in general, especially in developing countries resort to injudicious and excessive use of pesticides which was linked to the illiteracy and poverty of the rural farming community. Their overriding concern for profitable agriculture has rendered the health of the farmers at a

greater risk of developing dreadful maladies including various types of cancers, reproductive disorders, respiratory, dermal, and neuropsychological problems (Rathinam, 2005).

In Tanzania farmers used a wide variety of PPEs. The PPE most often used were gumboots (38.3%). Other reported PPEs included long coats, hats/helmets, hand gloves, overalls, respirators and facemasks. Most farmers (66.9%) reported no use of PPEs. For farmers who reported, using between 1-6 different types of PPEs; they were of bad quality and in poor condition. Over 60% of the 117 types of PPEs reported among the 40 farmers were damaged or extremely contaminated after inspection. Most (4 out of 6) respirators reportedly used by the farmers were disposable dust masks which are not the recommended PPE to prevent inhalation of pesticide. (Lekei, 2014). The lack of maintenance and use of inappropriate PPEs was evident in this study.

In Palestine the reasons for not using PPEs were; discomfort from hot weather and that it hampered work. In addition some farmers stated that PPE was unnecessary, costly, or unavailable. The majority of the farmers reported that they believed immunity from pesticides could be developed over time (Issa, 2010). The practice of farmers in the usage of PPE in the Ethiopian study revealed that two out of five farmers (41.8%) reported not using PPE, more, than half (58.2%) of farmers reported to have occasionally used at least one PPE. Locally prepared mask (39.9%), boot (29.4%) and hat (21.1%) were most often used PPEs. (Gesesew, 2016). Another study showed that of all the farmers who had ever used pesticides, 407 (63.2%) usually followed the instructions/labels written on the containers of the pesticides. Two out of five farmers (41.8%) reported using no PPE at all (Gesesew, 2016).

3.3 Pesticide Usage and Poisoning

There are limited studies done on chronic health outcomes from pesticide poisoning to demonstrate neurotoxic, reproductive, and dermatologic effects. Exposure assessment consists mainly of Cholinesterase testing, and a few studies have quantified dermal and respiratory exposure (Wesseling, 1997). On the basis of a survey of self-reported minor poisoning carried out in the Asian region, it is estimated that there could be as many as 25

million agricultural workers in the developing world suffering an episode of poisoning each year (Jeyaratnam, 1990).

Agriculture uses 80% of all pesticides in the U.S. Handlers who mix, load and apply pesticides as well as workers cultivating and harvesting crops sprayed with them are at risk of acute poisoning or even death from their exposures (Moses, 1998).

The active ingredients most commonly reported by farmers that were associated with poisoning were Mancozeb (80%), Profenofos (72%), Chlorpyrifos (48%), Endosulfan (35%), Lambda Cyhalothrin (5%) and Cypermethrin (5%). Of the agents involved in reported poisonings, 42.4% were OP and 77.6% were moderately toxic products (WHO Class II). Among the products reported as handled by the farmers, 26% were OP pesticides, and 49% were WHO class II products (Lekei, 2014).

Another study showed pesticides most commonly reported by farmers as associated with poisoning were DDT (21.9%), diatomaceous earth (12.1%), Malathion (9.9%) and the mixture of DDT and diatomaceous earth (12.6%). Of the reported pesticide and associated with poisoning, 41.8, 31 and 24.7% were organochlorine, organophosphate and inorganic respectively , and 69% were moderately toxic products (WHO Class II). Ingestion (88.9%) and inhalation (90.4%) were the major reported routes of pesticide exposure. (Gesesew, 2016)

Another study showed approximately 93% of respondents who reported previous poisoning by pesticides in their lifetimes with frequency ranging from 1 to a maximum of7 times; 76.4% of the poisoned respondents reported two or more poisonings and 63.5% reported 3 or more poisonings. The 112 farmers with past APP reported approximately 432 past poisonings in total. Actions taken after poisoning included drinking milk, attending a health facility, consulting a pharmacist, applying cream to the affected area and washingthe affected part of body. However, most respondents (60%) reported taking no action following the poisoning. Of the 23 farmers who reported attending health facility for poisoning in the past year, there were no records of their poisoning in health facility records for 18 cases. Overall, of farmers who claimed to have experienced a previous poisoning, their information did not appear in health facility surveillance records. There were 875 symptoms associated with the 432 past poisonings reported by the 112 farmers

(Lekei, 2014). Among the farmers who had ever used pesticide, 63 (9.8%) reported to have experienced varying forms of health problems following exposure. The most common symptoms reported were: headache, nausea and vomiting, skin rash and irritation and abdominal pain. Eight out of 63 (12%) participants reported pesticide toxicity related deaths in their family. Most farmers managed their symptoms via home-based care that included drinking milk, applying local creams on the affected area and washing the affected area. One death was reported during home-based care. Of the victims who experienced pesticide toxicity, only 13 (20.6%) farmers reported seeking care from a health facility. Among those who sought care from the health facility, two died in the health institution. Of the 16 victims that did nothing, five deaths were reported (Gesesew, 2016).

4.0 Conceptual Framework

This Conceptual Framework was adapted and modified using the Ecological and Health Belief Model, which theorized that the perception of a health problem being deleterious and re-engineering the environment can result in positive behavioural change. This framework posits that if farmers perceived pesticides usage to be associated with long-term health problems, this can cause a change in behaviour. The Ecological Model on the other hand creates the link between the individual belief and environmental influences, producing safer behavioural practices.

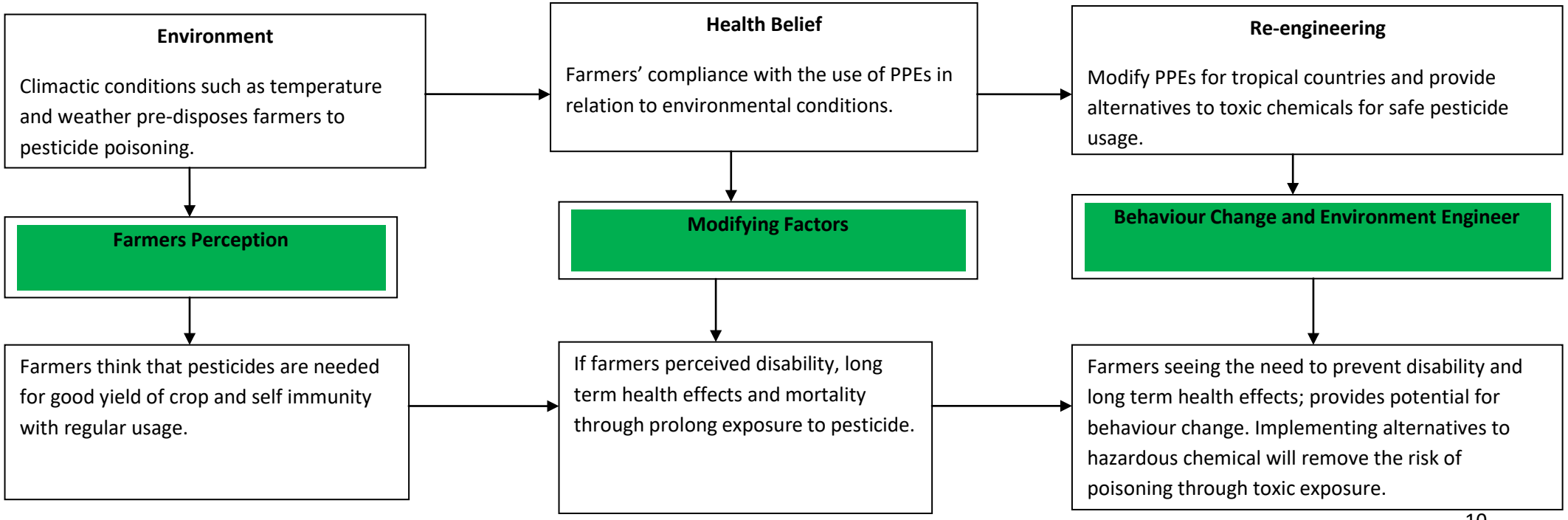


Figure 1: Conceptual Framework for Pesticide Poisoning in Farming

Adapted through the combination of the Ecological and Health Belief Model, *Glanz etal 2002*

5.0 Study Design

The aim of the study was to investigate the relationship between the use of pesticides and incidence of poisoning within the farming communities of Jamaica and Trinidad & Tobago. The objectives were to: assess the knowledge of farmers on the use of pesticide, evaluate the practices of farmers when using pesticide and assess the incidence of poisoning from pesticide usage.

5.1 Study Area

A cross-sectional study using random purposive sampling was conducted between January - September 2020 in the islands of Jamaica and Trinidad & Tobago. The catchment areas were in four parishes for Jamaica, namely St Elizabeth, St Catherine, Westmoreland and Clarendon and for Trinidad the larger of the twin islands the catchment areas were the municipalities of Arima, Penal-Debe, Point Fortin and San Fernando. The areas were specifically chosen because they satisfied the criteria for areas where farmers utilized pesticides to grow crops and also areas that were easily accessible during the COVID-19 period.

5.2 Study Population

The sample population was selected from the farming communities based on the criteria of having been exposed to pesticide poisoning during the past three years. The total number of registered farmers in Jamaica according to the RADA is 224,507 and in Trinidad & Tobago the total number of farmers using the data of 4 percent of total population of 1.3 million employed by agriculture is 52,000. Using single population proportion calculation formula, 165 numbers of respondents from Trinidad would be at 7.5 per cent margin of error with a 95 per cent confidence level; this was as a result of COVID-19 pandemic. There were 405 respondents for Jamaica (at a 5 per cent margin of error and a 95 per cent confidence level). The total numbers of participants from both countries were 570.

Trinidad had a low yield in the number of farmers who participated in the study as a result of having a smaller farming population when compared to that of Jamaica. Additional there was a thirty-five percent shortfall of valid questionnaire which did not satisfy the study criteria.

5.3 Data Collection

The data collection instrument was designed using closed and open questions, based on areas of incidence reports under the Rotterdam Convention severely hazardous pesticide formulation report form. The questionnaire covered three areas: Demography, Section A: - Chemical use and exposure and Section B: - Chemical Incidents. The Demographycollected information on gender, age range and location of participants, Section A: -collected information on the perception of health problems with use of chemicals, exposure to chemicals used with details of formulation type, exposure route and manifestation, Section B: - captured the number of incidents per chemical exposure incidence, answer to how, when and where incident/s occurred, use of personal protective gears during incident/s and actions taken after exposure.

Pilot studies were done in both countries to determine the suitability of the data collection tool, and adjustments were made that capture a standard form that was used in both countries with the difference being reference to colloquial names for pesticides. Thequestionnaires were administered mainly through face- to- face interviews, with a small percentage of interviews done via telephone during the COVID-19 lockdown period.Names of farmer were selected from the farmers' records within the catchment areas to conduct the telephone interviews.

5.4 Ethical Considerations

All participants consented to participate in the interviews and were given the option to withdraw from the interview at any point. Identifications such as name and contact number were given by participants for follow up. This information was kept confidential and did not form part of the data analysis.

5.5 Study Limitation

COVID-19 pandemic restricted the movement of interviewers in accessing areas for the interviewing of participants in Trinidad & Tobago. In addition the mode of face- to- face interviews had to be replaced by telephone interviews for a small percentage of the data collection phase.

Due to limited knowledge on the manifestation from pesticide exposure, farmers were likely to underreport all the manifestations experienced when poisoned.

5.6 Statistical Analysis

Data analysis was done using cross tabulation between multiple variables. Descriptive statistics was used for continuous data. The P-value of < 0.5 was considered for statistical significance for modes of exposure in poison incidents and PPE practices. The analysis was done using Statistical Package for the Social Sciences software.

6.0 Results/Findings

6.1 Demographic Information

6.1.1 Gender and Age Distributions

The demographic characteristic of the study looked at the categories of age and gender of participating farmers in both countries as shown in Table 1 below. Total numbers of farmers interviewed were five hundred and seventy (570), of which eighty three percent (473 or 83%) were males and seventeen percent (97 or 17%) females. The age ranges from
< 21 years, 21-40 years and the 41 to 60 years which accounted for the highest numbers for participants within the given age groups.

Age groups by Gender			**Gender**		**Total**
			Male	Female	
Age Groups	**< 21**	**Number**	**16**	**4**	**20**
		% of Total	2.8%	0.7%	3.5%
	21 to 40 years	**Number**	**159**	**39**	**198**
		% of Total	27.9 %	6.9%	34.%
	41 to 60 years	**Number**	**227**	**43**	**271**
		% of Total	39.9%	7.6%	47.6%
	Over 60 years	**Number**	**70**	**10**	**80**
		% of Total	12.3%	1.8%	14.1%
Total		**Number**	**473**	**97**	**570**
		% of Total	83 %	17 %	100 %

Table 1: Farmers' age group and gender

6.1.2 Gender Distribution in Countries

The gender distribution for farmers in Jamaica and Trinidad & Tobago are shown in Table 2 below. Three hundred and forty one (341) males and sixty four (64) females participated from Jamaica, while one hundred and thirty two (132) males and thirty- three (33) females participated from Trinidad &Tobago. All participants experienced one or more pesticides poisoning incidents.

Gender	Countries of study		Total
	Jamaica	Trinidad & Tobago	
Male	341	132	470
Female	64	33	97
Total	405	165	570

Table 2: Farmers' gender by countries

6.1.3 Gender and Age Distribution in Jamaica

In Jamaica, males accounted for three hundred and forty-one (341 or 84.2%) farmers and sixty-four (64 or 15.8%) females. Most (169 or 41.7%) of the interviewed farmers were males and fell in the 41-60 years age group, followed by the 21-40 years age group with 107 (26.4%) males and the least (11 or 2.7%)) were males in the < 21 years age group. Females also had most (28 or 6.9%) participants in the 41 to 60 age group, followed by the 21 to 40 years age group with 27 (6.7%) and < 21 years being the least (4 or 1.0%) of all the age groups.

Jamaica		**Gender**				**Total**
		Male	%	**Female**	%	
Age Groups	< 21 years	11	2.7%	4	1.0%	(15) 3.7%
	21 to 40 years	107	26.4%	27	6.7%	(134) 33.1%
	41 to 60 years	169	41.7%	28	6.9%	(197) 48.6%
	> 60 years	54	13.3%	5	1.2%	(59) 14.6%
Total		341	84.2%	64	15.8%	(405) 100.0%

Table 3: Jamaica's distribution for farmers' gender by age group

6.1.4 Gender and Age Distribution in Trinidad & Tobago

In Trinidad & Tobago, one hundred and sixty-five (165) farmers participated in the study. Of this number one hundred and thirty-two (132 or 80%) were males and thirty-three (33 or 20%) were females. Thirty-five point eight per cent (59 or 35.8%) of males were in the 41 – 60 years age group which accounted for most of the farmers, followed by males in the21 – 40 years age group (31.5% or 52) and the least (5 or 3.0%) were males in the < 21 years age group. The majority (16 or 9.7%) of female farmers were in the 41 -60 years agegroup, followed by the 21 to 40 years age group (12 or 7.3%), the least was for 60 yearsage group (5 or 3.0%) and no participants in the < 21 years age group.

Trinidad & Tobago		**Gender**				**Total**
		Male	%	**Female**	%	
Age Groups	< 21 years	5	3.0%	0	0.0%	(5) 3.0%
	21 to 40 years	52	31.5%	12	7.3%	(64) 38.8%
	41 to 60 years	59	35.8%	16	9.7%	(75) 45.5%
	> 60 years	16	9.7%	5	3.0%	(21) 12.7%
	Total	**132**	**80.0%**	**33**	**20.0%**	**(165)**

Table 4: Trinidad & Tobago distribution for farmers' gender by age group

6.2 Farmers' Perception on Pesticides Risk to Health

6.2.1 Farmers' Perception on Pesticides Risk to Health Related Problem

Table 5 below gave results for Farmers' perceived risk of pesticides used on the farm that they thought can be a health problem *(please note: numbers in brackets represent farmers).*

The chemicals that were considered to pose greater health risks through usage by farmers were Caratrax 5EC (202), Gramoxone Super (58), Fastac 5EC (49), Malathion (35) and Paraquat Super (26). The chemicals that were considered to pose no health risk through usage by farmers were Caprid (67), Diazinon 48EC (43), Gramoxone Super (54), Karate Zeon (49), Malathion (38), Paraquat Super SL (36), Selecron (33), Pegasus (31) and Slug Off (25). Gramoxone Super showed marginal differences in perceived health risk of pesticides usage amongst farmers, where (54 or 9%) of the farmers thought it was not a risk to health, (29 or 5%) of farmers thought it might be a risk to health and (58 or 10%) of farmers thought it posed a serious risk to health.

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
2,4 –D Amine	20	7	8	14
Agrotam 440EC	1	0	0	1
Acaramik	0	1	0	6
Agrinate 90	2	5	14	6
Actara 25WG	1	1	0	0
Actril DS	1	1	0	0
Agree	1	1	0	0
Acetellic 50	0	1	0	1
Agromil 250 EC	2	1	1	0
Amine 6D	8	4	1	4

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Arton 72SL	1	2	0	1
Algrass	0	3	1	0
Alverde	1	0	0	0
Avaunt	0	1	0	0
Basta	2	0	0	0
Bausidim	0	0	1	0
Binder 10	0	2	0	2
Bemisan 1.8	1	1	0	0
Bright EC	0	0	1	3
Blazer 72	0	0	0	2

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Broadtril EC	1	2	5	2
Bravo	2	1	0	0
Corozon	1	0	1	0
Carista 2% 200C	1	0	0	0
Crush 200 SC	1	1	2	4
Carbaryl Powder	1	1	0	0
Commando 35	0	0	1	1
Cypro 440 EC	4	5	8	10
Cypertic 20 EC	1	3	1	1
Cure	27	9	8	3

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Caprid	67	24	30	9
Danitol	9	3	5	0
Caratrax 5 EC	12	88	202	3
Diazinon 48 EC	43	21	33	0
Definite	13	11	8	0
Diazinon 60 EC	3	10	10	4
Dipel	1	0	3	0
Dimethoate	1	3	3	0
Dithane	4	3	3	0
Ethrine plus	8	10	1	8
Engeo	2	0	4	0
Ethrel 480	1	0	1	0

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Escolata	0	0	0	1
Fastac	3	22	49	2
Flash	1	1	1	0
Fipronil 20 SC (Fipron)	0	2	2	0
FireStrike	5	0	2	0
Garnet 20 SC	2	2	0	1
Gai Quat 200	42	10	23	1
Gramoxone Super	54	29	58	2

Name of pesticides	Responses to perceived risk as a health problem			
Gramoxone	1	3	3	0
Glyphosate	7	10	20	0
Glyphosate AG 41 SL	0	2	3	0
Hero	0	4	8	2
Karate Zeon	49	17	24	0
Indox 15 SE	16	6	3	0
Kuik	0	0	1	0
Kurmectin	3	0	1	0
Lannate	0	0	3	0
Match	1	0	3	0
NewMectin	9	5	6	1

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Malathion	38	15	35	0
Mapcid	0	0	0	1
Mocap 15G	19	3	5	0
Mancozeb	3	0	2	0
Matrix 24	0	1	0	0
Oblus 5 EC	0	1	3	0
D' Paraquat 27	1	4	9	2
Paraquat 27.6	2	2	7	4
Paraquat Super SL	36	9	26	0
Pegasus	31	8	17	6
Pestac	0	1	0	0

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Pirate 24	0	1	8	1
Rogor 40 EC	0	4	1	1
Regent 200 SC	1	2	5	5
Reglone	1	2	4	0
Regency 200	2	1	1	6
Rogue	0	0	0	2
Romite	0	1	2	0
RoundUp	3	3	13	0
Rotaprid	0	0	2	0
Scorcher	10	2	7	0
Sevin 85 WG	1	5	7	2
Selecron	33	13	14	0

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Supermethrin	15	2	9	0
Sunquat 27	5	7	1	4
Slug Off	25	1	7	0
Swiper	1	0	1	0
Supertak 10 EC	1	0	11	7
Triatix	1	0	2	0
Tabizole	0	0	1	0
Tracer	6	4	5	0

Name of pesticides	Responses to perceived risk as a health problem			
	Not a problem	Somewhat serious	Very Serious	Don't know/Not sure
Tesat 200 SC	0	0	0	1
Triton 10 SC	0	0	1	1
Thiovin 375 SC	1	3	3	7
Thiolarv 37.5 SC	1	1	5	4
Tryclan	1	0	0	0
Velone	1	0	0	0
Vapcomore 20 SL	0	0	1	1
Vydate L	0	2	2	3
Vertimec	4	1	6	0
Xentari	6	4	5	0
Weedless 27.6 L	0	2	3	3

Table 5: Farmers' perception of health-related problems with pesticide usage

6.2.2 Reading of labels by Farmers

At the time of exposure, majority (416 or 72.9%) of the affected farmers were able to read the labels on the pesticides containers/packages. Seventy- three (73 or 12%) indicated that they could not read the label, while fifty-one (51 or 9%) stated that this was not applicable to them and fifty (50 or 5.3%) did not state if they could read the label.

The data further revealed that a larger (52.1 or 38%) proportion of farmers in the 41 to 60 years and older age group indicated that they were not able to read and understand the labels on the pesticides packages. In looking at available labels at the time of usage, four hundred and seventy-eight (478 or 84%) reported that the labels were available on the containers/packages at the time of the incident, forty-seven (47 or 8.2%) stated that the labels were not available, thirty-eight (38 or 8.2%) stated they were not sure if the labels were available, while five (5 or 0.9%) did not respond.

When a comparison between countries were done for labels being present at the time of incident, a higher (88.4%) proportion of the farmers from Jamaica indicated that the labels were present, compared to seventy-three point two per cent (73.2%) for Trinidad & Tobago. A higher (14.5%) proportion of farmers from Trinidad & Tobago compared to three point seven per cent (3.7%) from Jamaica could not recall if the pesticides labelswere present at the time of exposure. Forty-eight point nine per cent (23 or 48.9%) of the farmers in the < 20 years age group recalled that the pesticides containers /packages labels were present at the time the incident occurred.

Instances where farmers had a second incident of poisoning, fifty four (54) of the farmers indicated that the labels on the pesticides containers/packages were present, howevertwelve (12) of them stated that they were not able to read and understand the labels. All seven (7) farmers who experienced a third incident of poisoning stated that the labels were present, however three (3) of them could not read and understand the label. All farmerswho had a fourth incident of poisoning were able to read and understand the labels for the pesticides containers/packages that were present.

6.3 Farmers' Practices in the use of Pesticides

Table 6 showed multiple combination of different chemical for each incident of pesticide poisoning among farmers. Chemical mixture practice reported by farmers revealed that eighty-two point two per cent (468 or 82.2%) did not mix chemical, instead used single pesticide to the application of treating crops, animals or for pest control activities. Eleven point four percent (65 or 11.4%) did a mixture of two pesticides, while only two point eight per cent (16 or 2.8%) did a mixture of four or more chemicals to apply to their crops and treating animals. Farmers also reported a combination of six or more chemicals as a cocktail.

Farmers in Jamaica accounted for the highest number (316 or 78%) in chemical mixture practices in comparison to Trinidad & Tobago with a smaller proportion of (12 or 7.3%). The combination of four (4) or more pesticides was practiced among Farmers in Jamaica. There were no significant differences in practices among farmers in Jamaica and those in Trinidad & Tobago in the combination/mixtures of specific pesticide used based on the p-value 0.182 (Kendall's tau-b parametric test).

Number of Pesticides combination/mixture by Countries of study					
			Countries of study		Total
			Jamaica	Trinidad & Tobago	
Number of pesticides	Pesticide 1	Count	316	152	468
		% of Total	55.5%	26.7%	82.2%
	Mixture /Cocktails of 2 pesticides	Count	54	11	65
		% of Total	9.5%	1.9%	11.4%
	Mixture/cocktail of 3 pesticides	Count	19	1	20
		% of Total	3.3%	0.2%	3.5%
	Mixture /Cocktails of 4 and more	Count	16	0	16
		% of Total	2.8%	0.0%	2.8%
Total		**Count**	**405**	**165**	**570**
		% of Total	71.2%	28.8%	100.0%

Table 6: Pesticides mixtures by farmers

6.3.1 Frequency of Pesticide Usage

Pesticides usage reported among farmers in Trinidad & Tobago showed Caratrax 5 EC to be the most (33 or 20%) used pesticide, followed by Fastac (48 or 29%), Gramoxone Super(15 or 9.1%), Paraquat Super (11 or 6.7%) and Malathion 50EC (10 or 6.1%). The age groups that mostly used Caratrax 5EC were < 21 years (3 or 60%) and 41-60 years (15 or 20%).

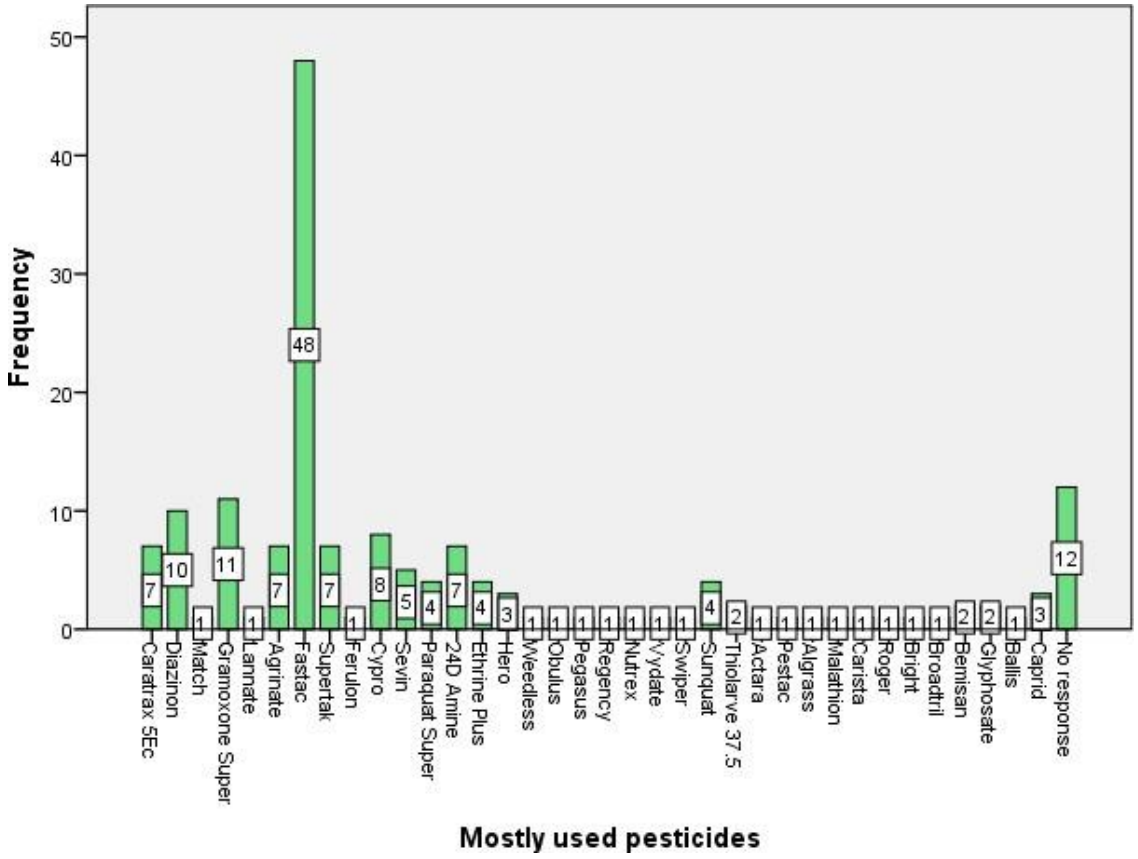


Figure 2: Pesticides mostly used by farmers in Trinidad & Tobago

In Jamaica farmers reported Caratrax 5EC to be the most (194 or 47.9%) used pesticide, followed by Gramoxone Super (22 or 5.4%), Diazinon 60 EC (14 or 3.5%) and Paraquat Super (10 or 2.5%). Further analysis of the data revealed that a larger (51.5% or 69) proportion of farmers within 21-40 age groups and forty two point four percent (25 or 42.4%) in the > 60 years old age group mostly used Caratrax 5EC.

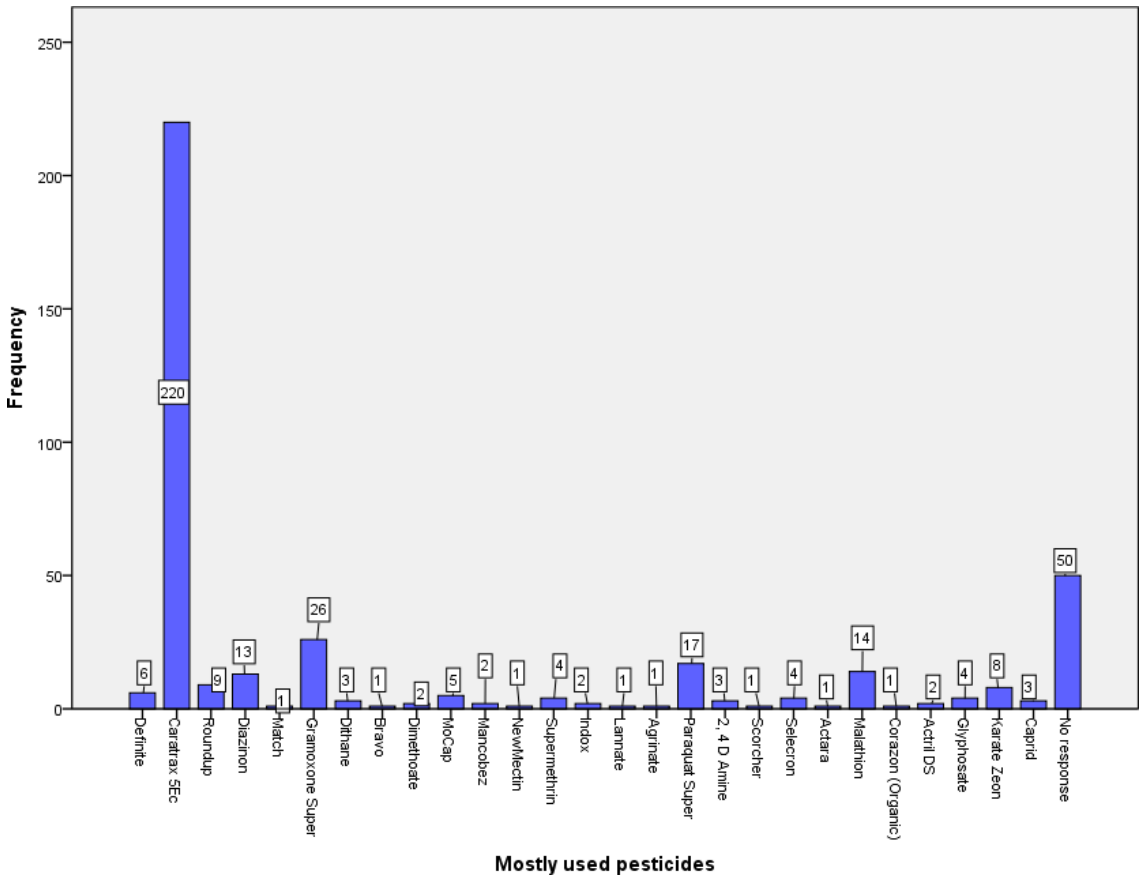


Figure 3: Pesticides mostly used by farmers in Jamaica

In comparing the frequently used pesticides within countries, a larger (194 or 47.9%) proportion of farmers in Jamaica used Caratrax 5EC compared to twenty per cent (33 to 20%) in Trinidad & Tobago. A larger proportion ((48 or 29%)) of the farmers in Trinidad & Tobago reported mostly using Fastac 5EC.

An overall view of pesticide usage in both countries showed (refer to Figure 4), Caratrax (227 or 39.9%) is the most frequently used pesticide, followed by Gramoxone (37 or 6.5%), Diazinon (23 or 4%) and Paraquat Super (21 or 3.7%). Majority of pesticides used accounted for application to crops.

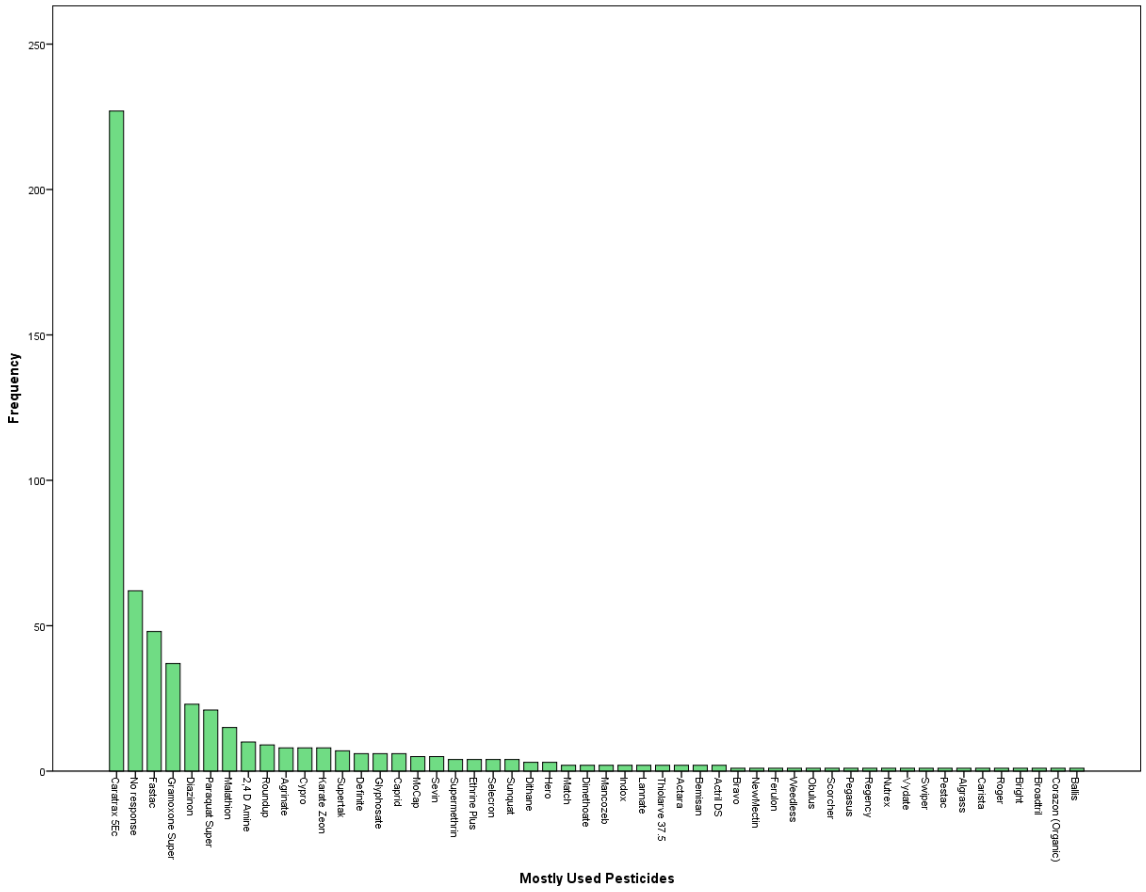


Figure 4: Pesticides mostly used by farmers in Jamaica and Trinidad & Tobago

6.3.2 Activities of Farmers during exposure

The two main activities that farmers were involved in during pesticide exposures were mixing and application of pesticides in the field. The activities in Table 7, showed that majority (370 or 65%) of the farmers reported exposure during field application, while 48 or 8.4% were exposed while mixing and 46 or 8.1% by a combination of both field application and mixing. The activities that were least (1 or 0.2%) associated with pesticide exposures were, standing in the treated field, loading pesticides into sprayer, mixingpesticides, and application in or around the house. Some farmers carried out more than one activity at the time of exposure for a particular incident.

Activities carried out at time of exposure	Frequency	Percent
Application in field	370	65.0%
Application in and around house and standing in treated field.	1	0.2%
Application to field and livestock	3	0.5%
Loading sprayer and application in field	10	1.8%
Application in field and standing in treated field.	12	2.1%
Mixing pesticides and standing in treated field	1	0.2%
Mixing and loading pesticides into sprayer.	7	1.2%
Mixing, loading pesticides to sprayer and applying pesticides to field.	1	0.2%
Mixing, loading and applying of pesticides in field.	8	1.4%
Mixing the pesticide	48	8.4%
Mixing pesticide, application to field and in and around house.	1	0.2%
Loading pesticides into sprayer	10	1.8%
Application to livestock/animals	4	0.7%
Application in and around house	18	3.2%
Vector control application (mosquito etc.).	2	0.4%
Standing in treated field	13	2.3%

Activities carried out at time of exposure	Frequency	Percent
Application in field and mixing pesticides.	46	8.1%
Application in field and in and around house	3	0.5%
Other: spraying green house, opening pesticide bottle to smell, eat crop sprayed with chemical and cleaning spray pan.	3	0.5%
No response	9	1.5%
Total	**570**	**100.0%**

Table 7: Farmers' pre-exposure activities in Jamaica and Trinidad & Tobago

6.3.3 Farmers' PPEs Practices

Figure 5 gave the results for PPE usage by farmers in both countries. Seventy-nine per cent (79.01%) of farmers indicated that they wore some amount of personal protective equipment when using pesticides to carry out activities, while nineteen per cent (19.2%) didn't wear any personal protective equipment. The reference to some personal protective equipment worn meant that at no single exposure to pesticides were farmers wearing all therequired gears.

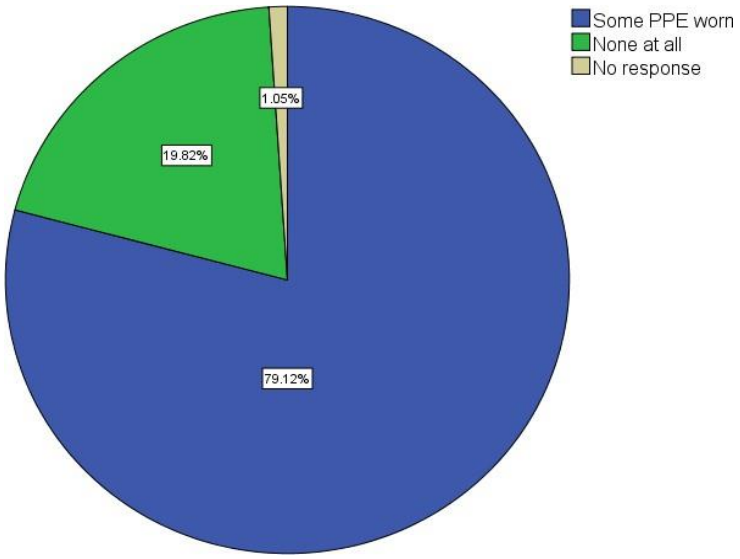


Figure 5: PPE compliance at time of exposure

6.3.4 Types of PPEs used by Farmers in Jamaica and Trinidad & Tobago

A higher proportion of farmers in both countries did not wear most of the PPEs during the time of exposure to pesticide. The main PPEs worn by majority of the farmers for both countries were Boots (45.7%) for Jamaica and Long pants (77.8%) for Trinidad & Tobago. In comparing the top five PPEs mostly worn by farmers in both countries, the data showed that while boots were the highest in Jamaica it was the second highest in Trinidad & Tobago (76.4%) and while long pants were the highest in Trinidad & Tobago it was the fourth along with gloves in Jamaica. The least worn PPEs in both countries were goggles (12.8%) for Jamaica, respirator 14.5% for Trinidad & Tobago and coverall 18.0 % and 16.4% respectively for Jamaica and Trinidad & Tobago. A greater proportion of farmers inTrinidad & Tobago wore PPEs such as dust mask, goggles, gloves, boots, long pants and shirt compared to same PPEs worn by the Jamaican farmers.

PPEs worn at time of exposure	Proportion of farmers within countries of study					
	Jamaica %			Trinidad & Tobago %		
	No	Yes	No response	No	Yes	No response
Gloves	75.6	21.2	3.2	75.9	22.4	1.8
Coverall	78.8	18.0	3.2	81.8	16.4	1.8
Goggles/glasses	84.0	12.8	3.2	77.6	20.6	1.8
Respirator	82	14.8	3.2	83.0	14.5	1.8
Dusk Mask	71.4	25.4	3.2	65.5	32.7	1.8
Boots	51.1	45.7	3.2	21.8	76.4	1.8
Shoes	84.9	11.9	3.2	89.7	8.5	1.8
Long sleeve shirt	48.4	48.4	3.2	23.6	75.5	1.8
Long pants	43.7	21.2	3.2	51.3	77.8	1.8

Table 8: PPEs worn by farmers in Jamaica and Trinidad & Tobago

6.3.5 Farmers rational for non-compliance to PPEs

The four main reasons for non-compliance to wearing PPEs as reported by farmers in both countries were that they thought the PPEs were unnecessary, uncomfortable, and expensive and too warm for the climate. Table 9 showed that twenty- nine per cent (165 or 29%) of farmers did not wear appropriate and adequate personal protective equipment because they thought it was unnecessary, 72 or 12.7% said they were uncomfortable , while (46 or 8.1%) and (41 or 7.2%) respectively said they were too expensive and too warm.

Other reasons for not wearing PPEs included the quotes below. Of the sixty-two (62 or 10.9 %) farmers who cited justifications, noted in other responses were: *"I don't like, care or use them"*, *"It was unplanned spraying", "PPE is worn based on nature of the pesticide application in the field"*, *PPE is stifling and itch*", *"Forgot PPE at home", "Don't have time or know where to purchase protective gears", "PPE doesn't fit well"*, and *"Didn't know the pesticide that was being used was so dangerous*".

A comparison was done between countries for farmers' rationale for non-compliance to wearing PPEs. The findings were that one hundred and four (104 or 25%) farmers from Jamaica were of the opinion that the PPEs were too warm, while sixty-one (61 or 37%) from Trinidad & Tobago shared the same opinion. Equal proportion (59 or 14.6%) of Jamaican farmers thought that the PPEs were uncomfortable, too warm and also expensive.Sixty-one (61 or 37%) shared the view that PPEs were uncomfortable, thirty-five (35 or 8.6%) thought they were expensive and eleven (11 or 6.7%) farmers in Trinidad & Tobago shared similar views.

Frequency of responses	Frequency	%
Too warm	41	7.2%
Too expensive to buy	46	8.1%
Didn't think it was necessary	165	29.0%
Too uncomfortable	72	12.7%
Too warm and expensive to buy	19	3.3%
Too expensive to buy and uncomfortable	4	0.7%
Too expensive to buy and not necessary	7	1.2%
Too warm, expensive, and uncomfortable	2	0.4%
Not necessary and uncomfortable	5	0.9%
Too warm, expensive to buy and unnecessary	2	0.4%
Too warm and didn't think its necessary	5	0.9%
Too expensive to buy, not necessary, and uncomfortable	2	0.4%
Too uncomfortable, too warm, expensive to buy and unnecessary	2	0.4%
Others	62	10.9%
No response	135	23.7%
Total	569	100.0%

Table 9: Farmers' reasons for PPEs non-compliance

6.3.6 Pesticide Application Methods

In both countries backpack sprayer was the most (283) frequently used method to apply pesticides, followed by mist blower (85). The combination application methods were mist blower and backpack sprayer (55), backpack sprayer, hand Sprayer and mist Blower (1). All application methods were used at the time of exposure to the pesticides.

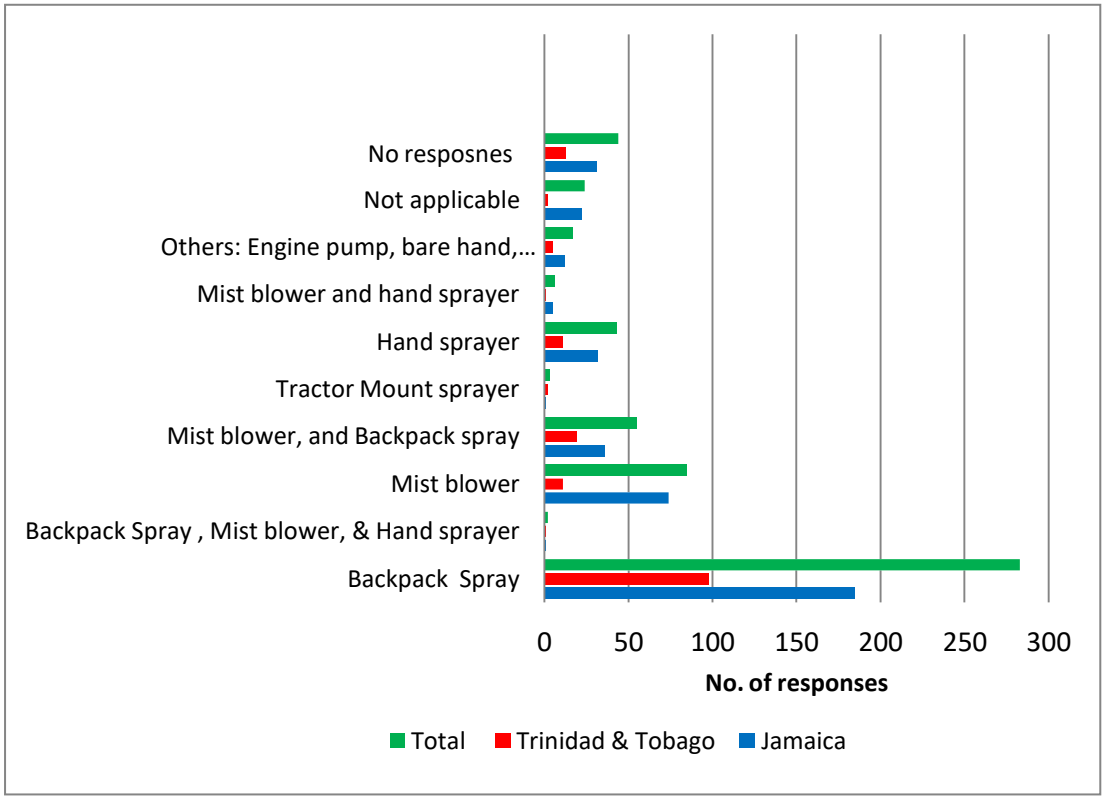


Figure 6: Farmers' pesticide application method

6.4 Poison Incidents by Farmers

6.4.1 Routes of Exposure for Pesticide Poisoning

Table 10 below gives a description of the pesticides used, number of farmers affected and manifestations experienced when exposed to pesticides.

Dermal Manifestation:- The data identified sixty-three (63) farmers that had dermal irritation as a result of using Caratrax 5EC, Fastac 5EC (14) and Gramoxone (9). These were the most frequently used pesticides by farmers. There was a significant relationship between the pesticides used and skin irritation based on the P-value .004 (Goldman Krushel Tau test). The highest number of farmers (12) who reported dermal rashes was asa result of exposure to Caratrax 5EC pesticide. More dermal burns were recorded among farmers who were exposed to Caratrax 5EC, Fastac 5EC, Gramoxone Super, Paraquat Super SL, Definite, Karate, Zeon and Diazinon. Caratrax 5EC also accounted for the highest number of farmers (172) who experienced skin burn due to pesticide exposure.

Ocular:- Blurred vision was not experienced by many of the farmers who used thedifferent pesticides. However, thirteen (13) farmers revealed they experienced blurred vision as a result of using Caratrax 5EC, and three (3) who used Fastac 5EC. Caratrax 5EC also contributed to eye irritation experienced by eighteen (18), of the forty-four farmers. Watery eye and pin point pupil were the least experienced exposures encountered by farmers.

Respiratory:- Gramoxone (13) and Caratrax 5EC (11) respectively accounted for the majority of farmers who experienced coughing. It was noted that farmers who were exposed to Caratrax 5EC, Paraquat Super SL, Sevins and 2,4-D' Amine experiencedtightness in their chest. Thirty-five (35) farmers who experienced sneezing used Caratrax 5EC, thirteen (13) Gramoxone Super and twelve (12) Paraquat Super. The largest number seventeen (17) of those who experienced runny nose were exposed to Caratrax 5EC, followed by four (4) who were exposed to Gramoxone.

Gastrointestinal:- Vomiting and diarrhoea were the least reported symptoms after pesticides exposures; however seven (7) farmers felt nauseated after using Gramoxone Super.

Nervous System:- Forty-four (44) farmers reported having experienced headache, after exposure to the pesticides they used. Seven (7) farmers associated the use of Gramoxone Super and Paraquat Super respectively with feeling headache after spraying. Confusion, unconsciousness, tremor/trembling, fainting and excessive salivation were the least manifestation of pesticide poisoning experienced by farmers. However, eleven (11) farmers reported they experienced excessive sweating due to exposure mainly from Caratrax 5EC and Fastac 5EC.

Names of Pesticides	Number of Farmers Affected	Manifestation/Symptoms
Caratrax 5EC	172	Dermal:- skin burn, irritation and rash. There is a significant relationship between the pesticides and their manifestations when exposed to the skin based on the P-value .004 (Goldman and Krushel Tau.
Fastac	21	
Gramoxone Super	11	
Diazinon	6	
Sunquat	4	
Cypro 440 EC	6	
Malathion 50 EC	4	
Karate Zeon	5	
Definite	5	
Lannate	1	
Caratrax 5EC	221	Ocular: Eye irritation burning, -blurred vision - pin point pupil, tear production/watery eye. There is significant relationship between the pesticides and the manifestations when exposed to the eye based on p-Value .012
Fastac	10	
Agrinate	3	

Names of Pesticides	Number of Farmers Affected	Manifestation/Symptoms
Gramoxone,	13	Respiratory: Running nose, sneezing, coughing
Caratrax, 5EC	35	
Malathion	8	
Fastac	5	
Paraquat Super	9	
Sevin 85% WP	2	
Gramoxone Super	7	Gastrointestinal: Stomach pain, diarrhea vomiting
Sevin 85% WP	1	
Fastac	6	
Agrinate	2	
Caratrax	6	Nervous System: Dizziness, trembling/ tremor1 unconsciousness confusion
Fastac	6	
Paraquat Super	7	
Diazinon	2	
Agrinate	2	

Table 10: Manifestations for frequently used pesticides

Table 11 outlined details of other manifestations as stated by farmers. Dermal contact was the most (311 or 54.6%) frequent single mode of exposure recorded among the farmers. One hundred and forty-two (142 or 25%) single route of exposure was through inhalation, and ingestion was the least (3 or 0.5%) route of exposure.

In the category of dermal exposure to pesticides one hundred and forty-eight (148 or 47.6%) were in the 41 to 60 years age group, followed by those in the 21 to 40 yearswhich accounted for one hundred and nine (109 or 35%). Farmers in < 20 years age group recorded the least (8 or 2.6%) dermal exposure.

Seventy-four (74 or 13%) of the farmers reported multiple routes of exposure to pesticides. Thirty-two farmers (32 or 5.6%) were exposed through dermal contact and inhalation, twenty five (25 or 4.4%) through dermal contact and ocular route, while the combinations of dermal, ocular and ingestion routes accounted for the least (1 or 0.2%).

			Age Groups				Total
			< 21	21 to 40 yrs old	41 to 60 years old	> 60 years old	
Mode of Exposure	**Inhalation**	Number	8	46	74	14	142
		% of Total	1.4%	8.1%	13.0%	2.5%	24.9%
	Ingestion	Number	0	3	0	0	3
		% of Total	0.0%	0.5%	0.0%	0.0%	0.5%
	Ocular	Number	0	11	21	7	39
		% of Total	0.0%	1.9%	3.7%	1.2%	6.8%
	Dermal	Number	8	109	148	46	311
		% of Total	1.4%	19.1%	26.0%	8.1%	54.6%
	Dermal & **Ocular**	Number	3	10	7	5	25
		% of Total	0.5%	1.8%	1.2%	0.9%	4.4%
	Dermal, **Ocular & Inhalation**	Number	0	4	2	1	7
		% of Total	0.0%	0.7%	0.4%	0.2%	1.2%
	Dermal& **Inhalation**	Number	1	12	14	6	33
		% of Total	0.2%	2.1%	2.5%	1.1%	5.8%
	Inhalation & **Ocular**	Number	0	3	5	1	9
		% of Total	0.0%	0.5%	0.9%	0.2%	1.6%
	Dermal, Ocular & Ingestion	Number	0	0	1	0	1
		% of Total	0.0%	0.0%	0.2%	0.0%	0.2%
Total		Count	20	198	272	80	570
		% of Total	3.5%	34.7%	47.7%	14.0%	100.0%

Table 11: Routes of pesticides exposure by age groups

Table 12 below summarized farmers' report of other manifestations to which exposure to Caratrax 5EC was frequently cited as being a causative pesticide for some of the adverse effects. The farmer who reported spitting / coughing blood indicated he was exposed to Caratrax 5EC. Caratrax 5EC was also purported by farmers to cause numb limbs and five (5) farmers reported experiencing nose bleeding.

Responses	Frequency	Percentage	Exposure to Pesticides
Oral: dry/hoarseness of throat, numb /swollen lips, spitting blood/coughing blood, cold sore	6	1.1%	Caratrax 5 EC Gramoxone, Super Ethrine Plus
Dermal: swollen skin, dry peeling of skin	1	0.2%	Caratrax
Limbs: numb limbs, tingling in fingers	3	0.5%	Sevin 85% Caratrax, Glyphosate
Nose: bleeding nose, difficulty in breathing, asthmatic attack and sinus affected	11	1.9%	Caratrax %EC, NewMectin Diazinon
Body: lethargy, pains, light-headedness	9	1.6%	Caratrax 5EC, Gramoxone Super Selecron
Erectile dysfunction over time	2	0.4%	RoundUp

NB. Percentages are calculated based on the number (570) of persons in the study

Table 12: Summary on farmers' report of other manifestations

6.4.2 Pesticide Poison Exposure Period

In Figure 7, three hundred and forty-four (344 or 60.4%) farmers were exposed to pesticide less than 6 months ago, eighty-six (86 or 15.1%) within the past 1 to 2 years, eighty-three (83 or 14.6%) within the past 6 to 12 months, fifty-four (54 or 9.5%) more than 2 years ago and 0.5% did not state an exact time frame within the three year period.

The period for the highest numbers of exposures for farmers in both countries was less than 6 months. The differences in both countries farming population were minimal (61.2% Jamaica and 58.2% Trinidad & Tobago) for farmers exposed to the pesticide less than 6 months ago. Fifteen point three per cent (15.3%) and fourteen point five per cent (14.5%) respectively for Jamaica and Trinidad & Tobago were exposed to pesticides within a 1 to 2 years period.

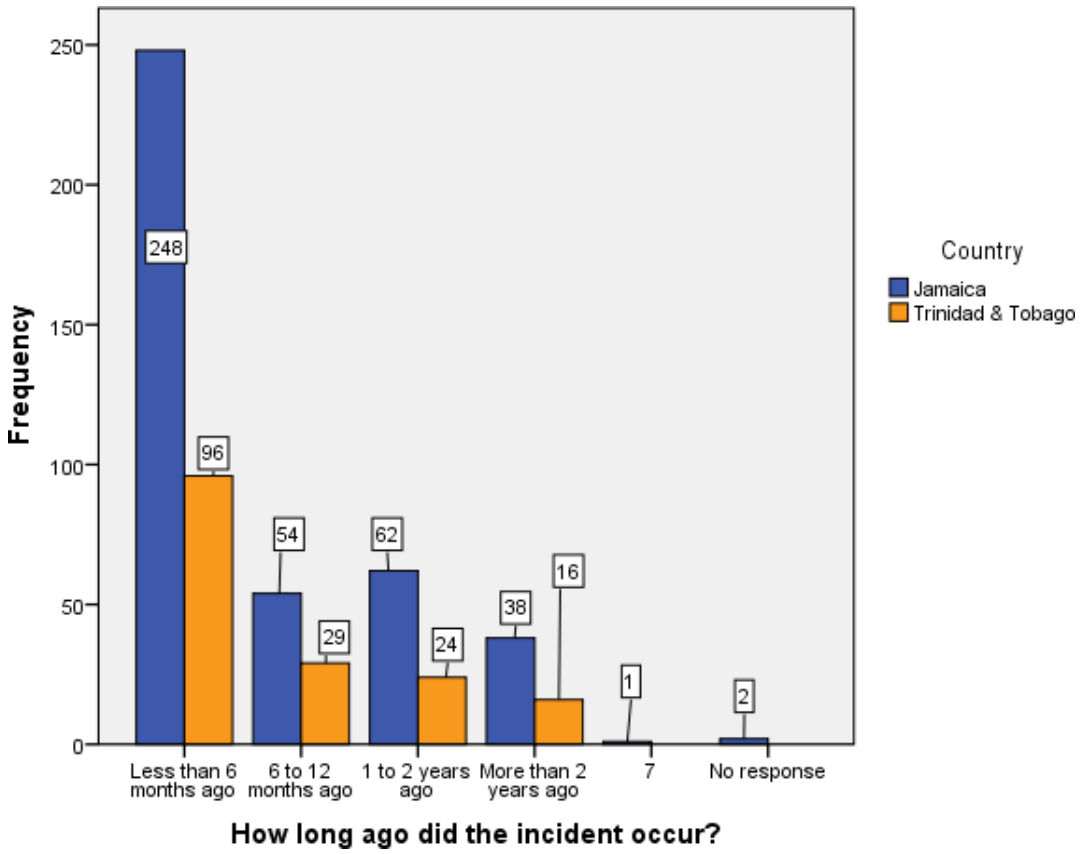


Figure 7: Periods of pesticide exposures

6.4.3 Farmers' Description of Incident Exposure

Farmers were asked to give a description of how each poison incident occurred, theresponses were captured using a thematic approach as indicated in Table 13 below. Farmers experienced multiple incidents that are reflected in Figure 8; however Table 13 showed results for each farmer's description of their experienced poison incident(s).

Majority of the farmers (41%) indicated that during application the wind blew the pesticides on their body areas (face and hand). Twenty point four per cent (20.4%) related that they came in contact with the pesticide by walking through or standing in a treated field. Twelve point three per cent (12.3%) indicated that they inhaled the pesticide fumes, 6.9% and 6.3% respectively said exposure to the pesticide occurred due to defective leaking or improper covering of pesticide containers and concurrently failure to wear the necessary personal protective equipment. A small number of farmers stated they were exposed to pesticide poisoning, when eating sprayed crops, puncturing pesticide containersand applying vector control measures.

Farmers who had 3-5 incidents of poisoning gave various details of how the incident occurred however for those with a second incident, majority of the farmers (33) stated that exposure occurred while spraying with backpack or mist blower, the wind direction blew the pesticide on their skin which included face and hands.

Responses	Frequency	Percent
Pesticide applicators were: defective, leaking, over-filled and or not properly secured, which resulted in spillage, and leakage to body parts (groin/genital areas, hands, shoulder & back).	39	6.9%
Face came in contact with pesticide due to pesticide saturated respirator and constant /over use.	8	1.4%
Wore improper fitting/oversized PPEs resulted in chemical inhalation / seepage to the hands, and in eyes.	3	0.5%
Came in contact with pesticides during and after entering a treated field; while treating the field.	116	20.4%
Inhaled fumes upon opening or filling pesticide containers. Accidental spillage of pesticide on hands and feet.	25	4.4%
Puncturing pesticide container to get the fluid out resulted in burns.	1	0.2%
While applying pesticide as a vector control measure.	1	0.2%
Ate food sprayed with chemical.	1	0.2%
Transferring pesticides from hands due to poor hand washing practices (resulted in genital and other skin irritation, burning and irritation to the eye).	21	3.7%
While spraying using backpack or mist blower, the wind blew back pesticide on face, skin, and hands.	228	40.1%
Failure to wear PPEs resulted in chemical exposure to body parts.	39	6.9%
While mixing pesticides, the fumes were being inhaled or spilled on body parts (hand, groin).	71	12.5%
Used leaves or bare hand to collect chemical from buckets to apply to plants/crops.	2	0.4%
Accidentally came in contact with chemical, while another person/farmer was using pesticides e.g. spraying crops.	15	2.6%

Responses	Frequency	Percent
Total	**570**	**100.0%**

Table 13: Farmers' descriptions of incident exposures

Table 14 is a comparative view of various media through which farmers were exposed to pesticides in Jamaica and Trinidad & Tobago. Farmers experienced multiple incidents that reflected in Figure 8; however Table 14 showed results for each farmer's description of their experienced poison incident(s) in both countries. When a comparison was made between the two countries for the media through which affected farmers were exposed to pesticide poisoning, a greater proportion (168 or 41.5%) of farmers in Jamaica compared to thirty-six point four per cent (60 or 36.4%) in Trinidad & Tobago stated while spraying the field the wind direction blew the chemical on them.

Exposures which occurred from standing and while treating fields accounted for twenty point six percent (34 or 20.6%) of farmers in Trinidad & Tobago compared to twenty point two per cent (82 or 20.2%) of farmers in Jamaica. Eleven point six percent (47 or 11.6%) of farmers in Jamaica compared to fourteen point five (24 or 14.5%) of farmers in Trinidad were exposed to pesticide poisoning while mixing the pesticides.

There was a minute difference in the proportion of farmers who said exposure to pesticide poisoning was due to lack of wearing PPEs, within Jamaica six-point six percent (6.6%) compared to seven point nine percent (7.9%) in Trinidad & Tobago.

Responses	Jamaica		Trinidad & Tobago	
	No.	%	No.	%
Pesticide applicators were: defective, leaking, over-filled and or not properly secured, which resulted in spillage, and leakage to body parts (groin/genital areas, hands, shoulder & back).	25	6.2%	14	8.5%
Face came in contact with pesticide due to pesticide saturated respirator and constant /over use.	8	2.6%	0	0
Wearing improper fitting/oversized PPEs resulted in chemical inhalation / seepage to the hands and eyes.	3	0.7%	0	0
Came in contact with pesticides during and after entering a treated field; while treating the field.	82	20.2%	34	20.6%
Inhaled fumes upon opening or filling pesticide containers. Accidental spillage of pesticide on hands and feet.	17	4.2%	8	4.8%
Puncturing pesticide container to get the fluid out resulted in burns.	1	.2%	0	0
While applying pesticide as vector control measure	0	0	1	.6
Ate food sprayed with chemical	1	.2	0	0
Transferring pesticides from hands due to poor hand washing practices (resulted in genital and other skin irritation, , eye burning and irritation	17	4.2%	4	2.4%
While spraying using backpack or mist blower, the wind blew back pesticide on face, skin, and hands.	168	41.5%	60	36.4%
Failure to wear PPEs, resulted in chemical exposure to body parts.	26	6.6%	13	7.9%
While mixing pesticides, the fumes were being inhaled or spilled on body parts (hand, groin).	47	11.6%	24	14.5%
Used leaves or bare hand to collect chemical from buckets to apply to plants/crops.	2	0.5%	0	0
Accidentally came in contact with chemical, while another person/farmer was using pesticides e.g. spraying crops.	8	2.0%	7	4.2%

	Jamaica		Trinidad & Tobago	
Total	**405**	**100**	**165**	**100**

Table 14: Farmers' descriptions of incident exposures for Jamaica and Trinidad & Tobago

6.4.4 Incidents of Pesticides Poisoning

Table 15 below revealed that 405 farmers experienced a first incident of poisoning, however of the total number of farmer 54 had a second incident of poisoning, six had a third incident, two had a fourth incident and only one had five incidents of poisoning. The total number of poison incidents experienced by Jamaican farmers was 544 poison incidents.

Number of Farmers	Frequency of Incidents	Total Incidents
405	1	405
54	2	108
6	3	18
2	4	8
1	5	5
Total		544

Table 15: Total number of poison incidents for farmers in Jamaica

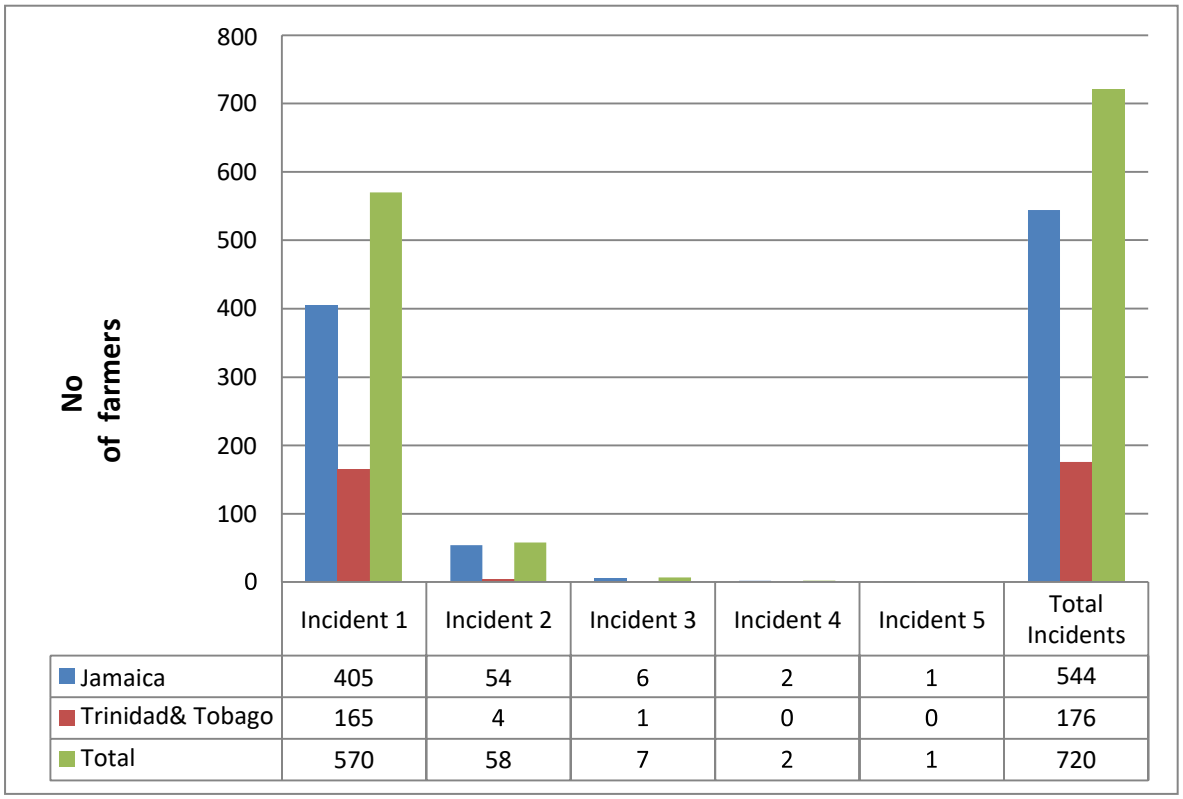
Trinidad & Tobago had 165 farmers who experienced a first incident of poisoning, while four farmers from the total experienced a second incident and only one farmer had a third incident. The total number of poison incidents that occurred among farmers was 176 as shown in Table 16 below.

Number of Farmers	Frequency of Incidents	Total Incidents
165	1	165
4	2	8
1	3	3
0	4	0
0	5	0
Total		176

Table 16: Total number of poison incidents for Farmers in Trinidad & Tobago

Of the total number (570) of farmers for both countries, 100% of farmers reported having at least one incident of pesticide poisoning, 10.2 % or 58 experienced two incidents of pesticide poisoning, 1.2% (7) of farmers experienced three incidents of poisoning; two (0.4%) farmers had four incidents while one (0.2%) farmer had five incidents.

Ten point five per cent (10.5%) of farmers in Jamaica reported two to three incidents of pesticide poisoning, two experienced three incidents and one had up to five incidents of pesticide poisoning. Trinidad & Tobago in contrast had only 2.4% of farmers reported having two incidents of pesticide poisoning. There were a total of 720 incidents of pesticide poisoning in both countries. Refer to Annexes 3-6 for details on the number of farmers poisoned per incident for each pesticide/s exposures.



	Incident 1	Incident 2	Incident 3	Incident 4	Incident 5	Total Incidents
Jamaica	405	54	6	2	1	544
Trinidad& Tobago	165	4	1	0	0	176
Total	570	58	7	2	1	720

Figure 8: Incidents of pesticide poisoning in Jamaica and Trinidad & Tobago

6.4.5 Period of adverse effect after Pesticide Exposures

In relation to the onset of adverse effects after pesticide exposures, seventy point nine per cent (404 or 70.9%) of farmers indicated they experienced adverse effects within few minutes to an hour of being exposed to the pesticides. Ninety-four (94 or 16.5%) stated they experienced the effects < 2 hours after being exposed. Forty-six (46 or 8.1%) said halfof a day while seven (7 or 1.2 %) said within two days or more.

The data indicated that adverse effects of exposure to Caratrax 5EC was felt by farmers within minutes to an hour after exposure occurred. Forty point nine per cent (233 or 40.9%) of farmers reported feeling adverse effects to Caratrax 5EC minutes to an hour after exposure, 249 or 43.6% said within half of a day, and 76 or 13.3% said after two daysor more. Farmers who were exposed to Fastac 5EC said the adverse effects felt within half of day. Some farmers indicated that adverse effects from exposure to Supertak (82 or

14.3%), Gramoxone Super (82 or 14.3%), and Round Up (82 or 14.3%) were felt two days or more after exposure.

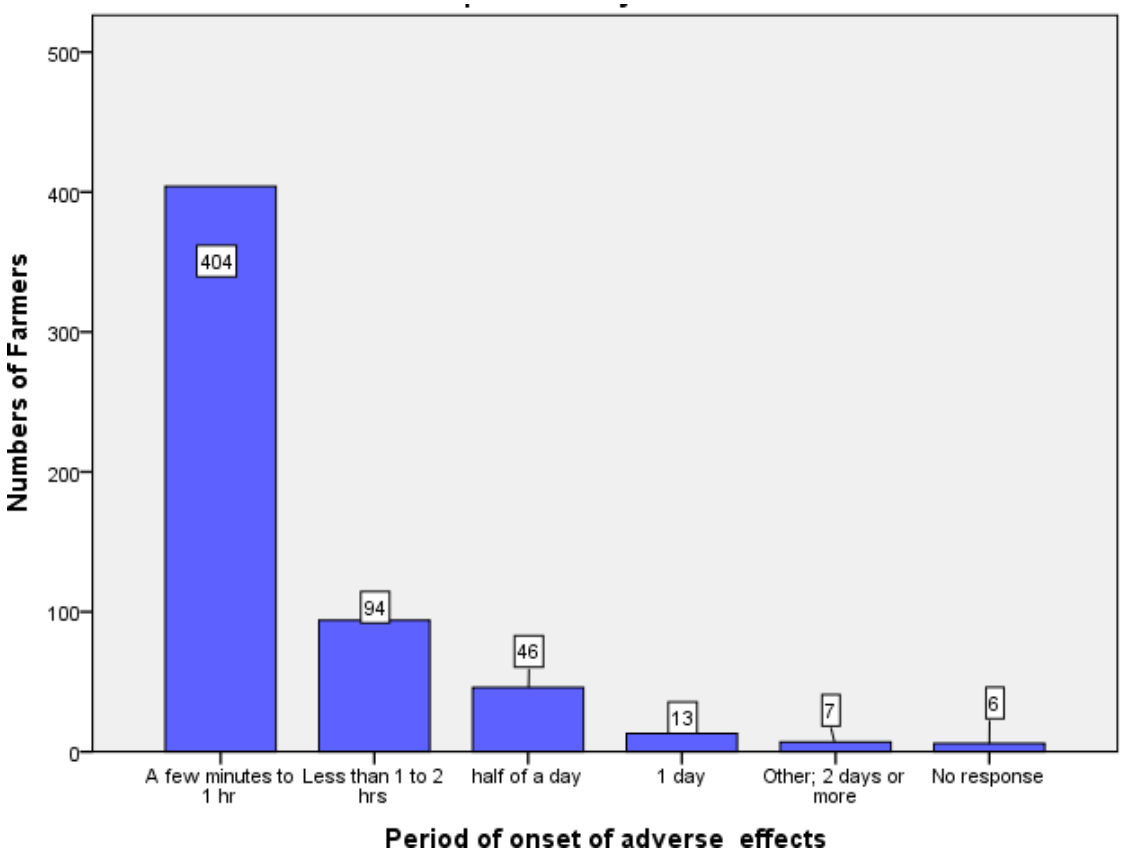


Figure 9: Adverse effect period for pesticide exposure

6.4.6 Post Exposure Actions by Farmers

Multiple actions taken after or during exposures to pesticides were reported by farmers. A larger proportion (34.1%) of farmers in Jamaica reported washing off the pesticide immediately after exposure compared to twenty-six point one per cent (26.1%) in Trinidad & Tobago. However, a larger percentage (24.8%) of farmers in Trinidad & Tobago reported washing off the pesticide after more than an hour of exposure than their Jamaican (11.8%) counterpart. More farmers (4%) in Jamaica reported seeking medical attention only after being exposed to the pesticide than those from Trinidad & Tobago (1.8%). There was no significant difference between the countries and actions taken after and during exposure to pesticide used. (P-Value .256)

Actions taken for exposure to a second poison incident for both countries showed that twenty-two (22 or 40.7%) farmers in Jamaica reported that they immediately washed off the pesticide after or during exposure, while only one (1or 0.6%) from Trinidad & Tobago washed off the pesticide immediately. In addition fifteen (15 or 27.7%) farmers in Jamaica reported they took no action after being exposed to the pesticide and one (0.6%) farmer from Trinidad& Tobago stated he sought medical attention only.

In the case of a third poison incident, four (4) farmers from Jamaica said they only washed the pesticides off immediately while for Trinidad & Tobago no action taken was reported by the farmer who had a third exposure (refer to Table 17 for details).

Distribution of Actions taken	Country			
	Jamaica		Trinidad & Tobago	
	Frequency	Percentage	Frequency	Percent
No action taken	96	23.2	10	6.1
Rested only	19	4.7	9	5.5
Washed pesticide off immediately only	138	34.1	43	26.1
Washed pesticide off after an hour only	48	11.9	41	24.8
Washed off immediately and administered self-treatment	27	6.7	21	12.8
Administered self-treatment only	27	6.7	8	4.8
Washed off after an hour and administered self-treatment	7	1.1	16	9.7
Rested and seek medical attention			1	0.6
Rested and administered self-treatment	13	3.2		
Washed off pesticide immediately and seek medical attention	4	1.0	7	4.2
Seek medical attention at Health Centre, Hospital or private doctor (as first response)	16	4	3	1.8
Seek medical attention and administered self-treatment	2	0.5	2	1.2
Washed chemical off immediately and rested	4	1	2	1.2
Rested and Washed pesticide off after an hour	3	1.7	2	1.2
No response	1	0.2		100
Total	**405**	**100**	165	

Table 17: Farmers' post-exposure action

6.4.7 Self-Treatment Post Pesticide Exposures

Multiple responses were given by farmers for self-treatment. The data indicated that herbal medicine, prayer and drinking lots of water were the preferred choice of self-treatment reported in the second incident of poisonings; this form of self-treatment was specified in 'Other' treatment. Farmers who had a third incident of poisoning stated that the preferential self-treatment was non-conventional to include oral treatment such as milk, coffee, charcoal, cola nut (bissy), garlic, rum, orange peel and herbal tea (refer to Table18).

Self-treatment as indicated by the farmers was grouped based on the symptom/manifestations and route of pesticide exposures. The data revealed that Trinidad & Tobago reported a larger proportion (75 or 45.4%) of farmers who administered self-treatment than those in Jamaica (60 or 14.3%).

As shown in Table 18 below, of the seventy-five (75) farmers from Trinidad & Tobago who administered self-treatment, fifty- three point eight percent (53.8%) used home based or non-conventional medicine to include charcoal, cola nut (bissy), garlic, milk and herbal tea concoction to treat symptoms of pesticide poisoning, when compared to eighteen point three per cent (18.3%) of their Jamaican counterparts. A larger percentage (8.5%) of farmers in Trinidad & Tobago used more non-conventional/home based items to self-treat dermal manifestations of pesticide exposure than Jamaican farmers (4.9%).

Of the number of Jamaican farmers who reported self-treatment, a larger percentage(33.3%) used home-based remedies to include vaseline, methylated spirit, concoction of coconut oil and turmeric, steaming of face with bleach and or alcohol with warm water to treat symptoms associated with skin exposure to pesticide in comparison to eighteen point six per cent (18.6%) of farmers from Trinidad & Tobago.

Responses Self-Treatment	Countries			
	Jamaica		Trinidad & Tobago	
	No	%	No	%
Over the counter medication				
ORALS: Sinus tabs, Paracetamol, Panadol, Histal, DPH	4	1.0	4	2.4
TOPICAL: No name rash cream, calamine, Dermovate, Hydrocortisone, sunscreen (Consulted with pharmacist, relatives or friends in obtaining some)	6	1.5	10	6.1
NASAL: Asthma spray, nasal spray , no name	4	1.0	3	1.8
OCULAR: Visine eye drop, no name eye drop	1	0.2	3	1.8
Non-conventional medicine				
ORALS: milk, coffee, charcoal, cola nut(bissy), garlic, rum, orange peel, herbal tea	11	2.7	34	20.7
TOPICALS: Vaseline, Turmeric mixed coconut oil, methylated spirit, Sulphur, baking soda, baby oil, steamed face with alcohol & warm water or bleach and warm water	20	4.9	14	8.5
NASAL: Mixed salt water, steam face over alcohol and warm water, inhale alcoh**ol**	1	0.2	1	0.2
OCULAR: wash eye in salt water, heat rags and apply to eyes	1	0.2	4	2.4
Others: herbal medicine, prayer and drink lots of water	10	2.5	6	2.4
No response	347	85.6	86	52.12
Total	**405**	**100**	**165**	**100**

Table 18: Farmers' post-exposure self-treatment

6.4.8 Healthcare Visits Post Pesticide Exposure

Health facilities visited post exposures to pesticide poisoning were Hospital, Health Centre and Private Doctors. More farmers (13) who experienced adverse effects from pesticide exposure went to private healthcare facility (Tables 20 & 21) compared to public healthcare facilities which accounted for nine (9) hospital visits (Tables 19 & 24) and six (6) Health Centre visits (Tables 22 & 23).

Of those who went to hospital in Jamaica, three made one visit each and one made two visits as shown in Table 19 below. In contrast for Trinidad & Tobago all five farmers made one visit each as shown in Table 24.

Three farmers from Jamaica who fell ill after exposure to pesticides indicated visiting the Health Centre for treatment. Two of the farmers were affected by Caratrax 5EC and one by Agrinate. However only one of them reported treatment as indicated in Table 23. For Trinidad & Tobago three farmers visited the health centre. Each indicated treatment as follows: nebulizer with IV, antibiotic skin cream and tablets as shown in Table 22. Adverse effects of Caratrax 5EC accounted for the most (3) frequent visits made to the health centre as indicated by the farmers in the Tables 22 & 23 below.

Chemicals in both countries for which health care treatment was sought were Caratrax 5EC, Diazinon 60 EC, Gramoxone Super, Agrinate, and Ethrine Plus. Chemicals for Jamaica only were Lannate, Cyro 440EC, Cocktail of Sevin & Slug Off, Paraquat Super L, Cocktail of NewMectin & M-Pede, Cocktail of Caratrax 5EC & Xentari, Cocktail-Diazinon 60EC & Pirate 24 S. Chemical for Trinidad & Tobago only were Fastac and RoundUp (refer to Tables 19-25).

No. of farmers	Type of Health facility	Pesticide exposure	Manifestations	No. of visits made	Length of stay	Self-reported Medication /treatment received from Health Centre
1	Hospital	Caratrax 5EC	Skin burn	1	1-2 days	MB powder & antibiotic (no name)
1	Hospital	Diazinon 48%	Tightness of chest	1	No response	Nebulizer and IV treatment for asthma attack
1	Hospital	Cocktail of Sevin 85.5% and Slug Off	Coughing, sneezing numb limb	1	No response	IV and injection
1	Hospital	Lannate	Dryness throat, numb lips	2	Week	IV treatment , tablets no food

Table 19: Post exposure Hospital accessed by farmers in Jamaica

No. of farmers	Type of Health facility	Pesticide exposure	Manifestations	No. of visits made	Length of stay	Self-reported Medication /treatment received from Private Doctor
1	Private Doctor	Agrinate	Pain in chest , dizzy, and unconscious	1	N/A	No treatment was indicated
1	Private Doctor	Caratrax 5EC	Blurry vision , tear production and watery eye	1	N/A	No medication was named, however, he purchased eye drop – name
1	Private Doctor	Ethrine Plus	Skin rash			Ointment – no name indicated

Table 20: Post exposure Private Doctor accessed by farmers in Trinidad & Tobago

No of farmers	Type of Health facility	Pesticide exposure	Manifestations	No. of visits made	Length of stay	Self-reported Medication /treatment received from Health Centre
1	Private Doctor	Caratrax 5EC	Skin burn, rash and irritation	1	N/A	Rash cream and injection (no name for cream)
1	Private Doctor	Gramoxone Super	Skin irritation	1	N/A	No treatment listed
1	Private Doctor	Cyro 440EC	Skin irritation, burn, and eye irritation	1	N/A	Blood test requested & Medication not named
1	Private Doctor	Paraquat Super L	Burning eye, eye irritation	1	N/A	Antibiotics, eye drop and glasses/lens recommended
1	Private Doctor	Ethrine Plus	Skin rash	1	N/A	Tablets/cream
1	Private Doctor	Cocktail-NewMectin & M-Pede	Blurry vision, eye irritation	1		Eye drop No name of eye drop indicated
1	Private Doctor	Cocktail of Caratrax 5EC & Xentari	Skin rash and irritation	1	N/A	Skin ointment – no mane indicated
1	Private Doctor	Cocktail-Diazinon 60EC & Pirate 24 S	Eye irritation, blurry vision	1	N/A	Eye glasses and lens recommended

Table 21: Post exposure Private Doctor accessed by farmers in Jamaica

No of farmers	Type of Health facility	Pesticide exposure	Manifestations	No. of visits made	Length of stay	Self-reported Medication /treatment received from Health Centre
1	Health Centre	Diazinon 48%	Coughing excessive sweating	1	N/A	Nebulisation and IV treatment started and was sent to hospital for further care
1	Health Centre	Caratrax 5EC	Skin burn, irritation	1	N/A	Antibiotic skin cream to apply to skin
1	Health Centre	Gramoxone Super	Nausea , dizziness	1	1	Tablet taken 2 times per day – no name of medication indicated

Table 22: Post exposure Health Centre accessed by farmers in Trinidad &Tobago

No of farmers	Type of Health facility	# of visits made	# reported treatment	Pesticide exposure	Manifestations	Self-reported Medication /treatment received from Health Centre
2	Health Centre	2	1	Caratrax 5EC	Skin irritation and rash	Tablets taken 2 times daily (name of tablets unknown)
1	Health Centre	1	Didn't indicate	Agrinate	coughing	Didn't indicate

Table 23: Post exposure Health Centre accessed by farmers in Jamaica

No of farmers	Type of Health facility	Pesticide exposure	Manifestations	No. of visits made	Length of stay	Self-reported Medication /treatment received from Health Centre
1	Hospital	Caratrax 5EC	Skin rash	1	1	Ointment no name indicated
1	Hospital	Roundup	Excessive sweating, diarrhoea	1	1Week	Admitted to hospital Nebulizer and IV treatment
1	Hospital	Diazinon 48%	Tightness of chest, coughing sneezing	1	No response	Nebulizer and IV treatment
1	Hospital	Fastac	Blurred vision, burning eye and irritation	1	No response	Eye drop and antibiotics
1	Hospital	Caratrax 5EC	Sneezing and coughing	1	No response	Didn't indicate treatment

Table 24: Post exposure Hospital accessed by farmers in Trinidad & Tobago

No of Farmers	Health Facility	No. Treated	No. of visits made	Length of stay in health facility			
				1 day	2 -6 days	1 week	No response
6	Health Centre	3	6	N/A	N/A	N/A	N/A
9	Hospital	7	3- made 1 visit each 1-made 2 visits 5- No response	2	2	2	4
13	Private Health Facility		11	N/A	N/A	N/A	N/A

Table 25: Distribution of farmers affected by pesticide poisoning and accessing medical care in Jamaica and Trinidad & Tobago

Exposures to Caratrax 5EC and Diazinon were the most common pesticides indicated by farmers to have caused adverse health effects resulting in them seeking medical attention (see Tables 19-24). The data collected showed that farmers who had received treatment from the different health facilities were not able to recall the names of medications received or laboratory assay done for some of the exposures.

Farmers were asked if other persons were affected in the poison incident(s), the responses were as follows: majority (437 or 76.6%) of the farmers indicated that no one else was affected, twenty point four per cent (116 or 20.4%) stated others were affected, sixteen (16 or 2.8%) of the farmers did not give a respond and one (0.2%) farmer stated he was not sure. Seventy-two point four per cent (42 or 72.4%) and 57.1 % of farmers who experienced two and three incidents of poisoning respectively stated that no one else was affected. However the only farmer who had experience five incidents of poisoning stated that someone else was affected.

7.0 Discussion

The five main pesticides (in order of highest to lowest) that were perceived by farmers to pose serious health risks were Caratrax 5EC, Gramoxone Super, Fastac 5EC, Malathion 50EC and Paraquat Super. In using Annex 1 &11 for the active ingredients of the listed chemicals above to cross check banned ingredients using the PAN international consolidated list of banned pesticides, the information showed that active ingredients for all five listed pesticides above have been banned in other countries. The active ingredients as shown in Annex 1 & 11 for each chemical are Caratrax 5EC (lambda-cyhalothrin), for which cyhalothrin is banned in twenty-eight countries, Gramoxone Super and Paraquat Super SL has similar active ingredient of paraquat dichloride for which there is a ban in forty-six countries, Fastac 5EC active ingredient is alpha cypermethrin for which there is a ban for cypermethrin, beta in twenty-eight countries, malathion is the active ingredient for Malathion 50EC which is banned in two countries (PAN,2020). The banning of pesticides is done to protect human health and the environment.

Caratrax was perceived as posing a very serious risk to one's health in both countries. Notably it was the chemical with a high frequency of usage and associated with majority of the pesticide poison exposures. Caratrax was associated with dermal, ocular, respiratory and nervous system manifestation; along with Diazinon (which was banned in 32 countries) they were the two most common pesticides indicated by farmers to have caused adverse health effects resulting in access to medical treatment in both countries. Also of importance was the associated haemoptysis (coughing of blood) with Caratrax 5EC and induced excessive sweating which was also seen from exposure to Fastac 5EC which was one of the main chemical associated with health care treatment in Trinidad & Tobago. A study on pyrethroid illnesses in California USA had shown respiratory irritation symptoms with the use of the active ingredient lambda-cyhalothrin (Spencer, 2006). A study done fourteen years earlier had postulated that apart from lambda-cyhalothrin being a nuisance to the skin there were no risk to workers (Chester, 1992). In comparing the two studies done, it is evident that associated health risk with the use of pesticides can occurred after a long period. A recent research which looked at cypermethrin showed an induced change in the nervous system with its use (Kumar, 2012). The manifestations/symptoms exhibited by farmers throughout this study have the potential to cause long term health impact with continuous exposures.

Majority of the farmers had PPEs; however this was not effective during climatic changes such as a windy day when pesticide exposure was inevitable. Twenty nine percent (165 or 29%) of farmers indicated that they did not wear appropriate and adequate personal protective equipment because they thought it was unnecessary, 12.7% said they were uncomfortable , while 8.1% and 7.2% respectively said they were too expensive and too warm. The non-compliance to PPEs was associated with economical cost, comfort to wear in terms of the warm temperature for countries of the tropics and also that some farmers did not see the necessity for protection with the perception that their body had adjusted to the pesticides after prolong usage.

The use of inappropriate materials such as handkerchief and plastic wrap around the body could be as a result of the inability to afford the correct gears. Similar practices were also true for other studies done. A study in Palestine showed the reasons for not using PPE were due to discomfort from hot weather and that it hampered work, and also, farmers stated

that PPEs were unnecessary, costly, or unavailable (Issa, 2010). In this study there was no significance in compliance to PPE for the age group < 20 who wore protective gears in comparison to 41 to 60 years age group who did not wear protective gears. Importantly to note that the age group of 41 to 60 years would have a longer life period of exposure to pesticides in farming in comparison to the < 20 years group therefore further research should be done to look at chronic poisoning which was not the focus for this research.

Of the farmers who wore PPEs (450 or 79.12%) sixty-five per cent (371 or 65%) were exposed to pesticide through application in the field and twenty-one per cent (119 or 21%) of the farmers who would be considered "veteran farmers" (numerous years of experience in farming) who did not wear protective gears during pesticide poison exposure. Apart from non-compliance to PPE, some of the gears were not appropriate for their purpose such as the use of dust mask and handkerchief for covering of the nose instead of respirators. Findings from a study showed similarity in the use of inappropriate PPEs where most (4 out of 6) respirators reportedly used by the farmers were actually disposable dust masks unsuitable as PPEs to prevent inhalation of pesticide droplets (Lekei, 2014). The non-compliance to PPEs and their inappropriate use contributed to most of the pesticide exposures experienced by farmers.

Self treatment was mostly practiced for treating adverse effect, with only a small number (28 or 4.9%) of farmers reported to have accessed health facilities for treatment. Items use for self-treatment included milk, herbs, over the counter drugs and skin cream. A research done in Ethiopia detailed self treatment practice to be that of home-based care which included drinking milk, applying local creams on the affected area and washing the affected area (Gesesew, 2016). The cultural practice of not accessing formal healthcare by the farmers could undermine the extent of health issues that are associated with the use of pesticides in farming.

The practice of mixing two to four chemicals at any one time was done among a few farmers (102 or 17.8%). Even though majority of the farmer 72.9% stated that they were able to read the label, it could be inferred from the practice of cocktails/ chemical mixtures that instructions on the labels were not followed for mixing application. This practice of

numerous chemical mix predisposed farmers to higher level of chemical toxicity as a result of the synergistic effects from the combination of chemicals.

Dermal contact was the most (311 or 54.6%) frequent single route of exposure recorded among the farmers. It was noted that one hundred and forty-two (142 or 25%) single route of exposure was through inhalation, and ingestion was the least (3 or 0.5%). There was a significant relationship between pesticides usage and dermal exposure, for majority of poison incidents. This will add to the body of information on pesticide poisoning where there are scarce studies on health outcomes for dermatologic effects (Wesseling C,1997). Apart from dermal, other routes of exposures were respiratory and nervous system which were similar in other studies; where the commonest reported symptoms experienced by the victims included headache, nausea and vomiting, skin rash and irritation also abdominal pain (Gesesew, 2016). According to the Centre for Disease Control (CDC) dermalexposure is the most significant exposure pathway that can result in systemic toxicity and cause health problems away from the site of exposure. This is so because dermal absorption of hazardous chemicals often times goes unnoticed and can result in a variety ofdiseases and disorders that might not be directly related to the skin.

The application methods that were associated with most pesticide exposures in both countries were the backpack sprayer and mist blower. The exposures occurred mostly in the field. The onset of adverse effect for most exposure was within the acute poisoning time range of few minutes to an hour. Most farmers experienced pesticide poisoning within the last six months pre-interviewed. Male accounted for majority (470 or 82%) of the farming population for both countries. Poisoning occurred within different age groups;however special note should be taken of the female age group of 21-40 years, which arethe reproductive /childbearing age. Consideration should be given on the impact poisoningcan have to high risk females in this age group.

It is important to note that the main chemicals associated with pesticide poisoning and health care treatment in this study were Caratrax, Fastac, Diazinon, Paraquat, Round Up, Gramoxone, Ethrine Plus, Lannate, New Mectin and M-Pede.

8.0 Conclusions

The findings from the study suggested that the causes for pesticide poisoning within the farming communities of Jamaica and Trinidad & Tobago were: non-compliance to PPEs, climatic conditions associated with wind direction when applying pesticides, the inappropriate handling of chemicals, farmers did not follow instruction on labels and some did not have the capacity to understand the pesticides labels. Dermal absorption was the main route of exposure. Due to the potential for unnoticeable absorption of chemical through the skin, systemic toxicity can result making it possible for farmers to be presentedwith diseases and illnesses overtime.

9.0 Recommendations

The following recommendations are a call for action from the relevant authorities, manufacturers and users of pesticides.

9.1 Pesticides Regulating Authorities

Review the registration criteria for pesticides according to Highly Hazardous Pesticides (HHP) criteria for the following pesticides: Caratrax, Fastac, Diazinon, Paraquat, Round Up, Gramoxone, Ethrine Plus, Lannate, New Mectin and M-Pede.

Enforce Pesticide Legislation to strengthen and to prevent illegal production, importation, trade and use of HHP.

Enforce the use of the Globally Harmonized System (GHS) to be applied to the label for all pesticides product entering both countries.

Implement a surveillance system to monitor the use of pesticides and the effectiveness of risk mitigation to ensure compliance.

9.2 Ministry of Agriculture

Develop and implement an extensive farmers' training programme to include a monitoring and evaluation component. The training programme such include but not limited to: the importance of PPEs to mitigate against pesticide poisoning, demonstration of PPEs fit, approved PPEs to use as barriers for routes of exposure, an appreciation for pesticides labels and Material Safety Data Sheet and application of instructions from pesticides labels. The training should involve inter-sectoral collaboration with the Education Ministrylocally, to ensure that training materials and activities are in line with andragogy learning.

Develop a comprehensive Agro-ecology programme that will utilize new technologies, conservation farming and insect as biological control traps, to decrease the use of pesticides.

9.3 Pesticide Industry

Manufacture pesticide products that have low toxicity with a minimal adverse effect on health. Create a Public- Private Partnership alliance with Government agencies, and farmers, in providing financial support for farmers' training and PPEs procurement. Redesign PPEs to suit climatic condition within the tropical region.

Create pesticides labels that are simple and understandable to farmers from different educational backgrounds.

9.4 Pesticide Users

Read all labels and follow instructions accurately before the application of pesticides. Wear required PPEs when handling pesticides. Apply pesticides during the parts of the day that are coolest that is morning and evening. Record weather forecast information to plan application time for pesticides. Information recorded should include atmospheric stability, general wind speed, direction and turbulence, local wind flows, temperature of air surface and humidity.

References

1. Calvert GM, Karnik J, Mehler L, Beckman J, Morrissey B, Sievert J, Barrett R, Lackovic M, Mabee L, Schwartz A, Mitchell Y, Moraga-McHaley S. Acute pesticide poisoning among agricultural workers in the United States, 1998-2005. Am J Ind Med. 2008 Dec;51(12):883-98. doi: 10.1002/ajim.20623. PMID: 18666136. https://pubmed.ncbi.nlm.nih.gov/18666136/

2. CDC, 2013, Skin Exposures and Effects, https://www.cdc.gov/niosh/topics/skin/default.html

3. Chester, G., Sabapathy, N. N., & Woollen, B. H. (1992). Exposure and health assessment during application of lambda-cyhalothrin for malaria vector control in Pakistan. Bulletin of the World Health Organization, 70(5), 615–619.

4. Gesesew, H. A., Woldemichael, K., Massa, D., & Mwanri, L. (2016). Farmers Knowledge, Attitudes, Practices and Health Problems Associated with Pesticide Use in Rural Irrigation Villages, Southwest Ethiopia. PloS one, 11(9), e0162527. https://doi.org/10.1371/journal.pone.0162527

5. Issa, Y., Sham'a, F.A., Nijem, K. et al. Pesticide use and opportunities of exposure among farmers and their families: cross-sectional studies 1998-2006 from Hebron governorate, occupied Palestinian territory. Environ Health 9, 63 (2010). https://doi.org/10.1186/1476-069X-9-63

6. Jeyaratnam J. 1990, Acute pesticide poisoning: a major global health problem. World Health Stat Q. 1990;43(3):139-44. PMID: 2238694. https://pubmed.ncbi.nlm.nih.gov/2238694/

7. JIS, 2017, Farmers Urged not to overuse pesticides, https://jis.gov.jm/farmers-urged-not-overuse-pesticides/

8. JIS, 2019, Farmers Adhering to Int'l Pesticide Standards, https://jis.gov.jm/farmers-adhering-to-intl-pesticide-standards/

9. KumarSingh A. Nath M. Prakish O. PratapSingh M. 2012, A current review of cypermethrin induced nerotoxicity and nigrostriatal doapminergic neurogeneration Current Neuropharmacology, Volume 10, Number 1, 2012, pp. 64-71(8)**Publisher:** Bentham Science Publishers **DOI:** https://doi.org/10.2174/157015912799362779

10. Lekei EE, Ngowi AV, London L. 2014. Farmers' knowledge, practices and injuries associated with pesticide exposure in rural farming villages in Tanzania. BMC Public Health. 2014 Apr 23;14:389. doi: 10.1186/1471-2458-14-389. PMID: 24754959; PMCID:PMC3999359.https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-389

11. Maroni M, Fanetti AC, Metruccio F. Risk assessment and management of occupational exposure to pesticides in agriculture. Med Lav. 2006 Mar-Apr;97(2):430-7. PMID: 17017381https://pubmed.ncbi.nlm.nih.gov/17017381/

12. Moses M. Pesticide-related health problems and farmworkers. AAOHN J. 1989 Mar;37(3):115-30. PMID: 2647086. https://pubmed.ncbi.nlm.nih.gov/2647086/

13. New Agriculturist, 2013, Country profile - Trinidad and Tobago http://www.new-ag.info/en/country/profile.php?a=3023

14. Ncube, N. M., Fogo, C., Bessler, P., Jolly, C. M., & Jolly, P. E. (2011). Factors associated with self-reported symptoms of acute pesticide poisoning among farmers in northwestern Jamaica. Archives of environmental & occupational health, 66(2), 65–74. https://doi.org/10.1080/19338244.2010.506495

15. PAN, 2016, Stop Pesticide Poisonings, A time travel through international pesticide policies, 3rd Edition, Germany

16. PAN, 2020, PAN International Consolidated list of Banned Pesticides, http://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/

17. Perry, Melissa J. MHS, ScD; Layde, Peter M. MD, MSc Sources, Routes, and Frequency of Pesticide Exposure Among Farmers, Journal of Occupational & Environmental Medicine: August 1998 - Volume 40 - Issue 8 - p 697-701 1 May 2001https://doi.org/10.1289/ehp.01109533

18. Pinto Pereira LM, Boysielal K, Siung-Chang A. Pesticide regulation, utilization, and retailers' selling practices in Trinidad and Tobago, West Indies: current situation and needed changes. Rev Panam Salud Publica. 2007 Aug;22(2):83-90. doi:10.1590/s1020-49892007000700002.PMID:17976274. https://pubmed.ncbi.nlm.nih.gov/17976274/

19. RADA,2020, Agricultural Business Information System https://abisjamaica.com.jm/

20. Rathinam X, Kota R, Thiyagar N. Farmers and formulations--rural health perspective. Med J Malaysia. 2005 Mar;60(1):118-24; quiz 125. PMID: 16250298. https://pubmed.ncbi.nlm.nih.gov/16250298/

21. Spencer J, O'Malley M. 2006, Pyrethroid illnesses in California, 1996-2002. Rev Environ Contam Toxicol. 2006;186:57-72. PMID: 16676901.

22. https://pubmed.ncbi.nlm.nih.gov/16676901/

23. Tagwireyi D, Ball DE, Nhachi CF. Toxicoepidemiology in Zimbabwe: pesticide poisoning admissions to major hospitals. Clin Toxicol (Phila). 2006;44(1):59-66. doi: 10.1080/15563650500394878. PMID: 16496495. https://pubmed.ncbi.nlm.nih.gov/16496495/

24. UNEP, 2010, Status of Ratification, Rotterdam Convention http://www.pic.int/Countries/Statusofratifications/tabid/1072/

25. UNEP, 2010, Chemicals recommended for listing in Annex http://www.pic.int/TheConvention/Chemicals/Recommendedforlisting/tabid/1185/language/en-US/Default.aspx

26. Wesseling, C., McConnell, R., Partanen, T., & Hogstedt, C. (1997). Agricultural Pesticide Use in Developing Countries: Health Effects and Research Needs. International Journal of Health Services, 27(2), 273–308. https://doi.org/10.2190/E259-N3AH-TA1Y-H591

27. Josef G Thundiyil a, Judy Stober b, Nida Besbelli c, Jenny Pronczuk d Acute pesticide poisoning: a proposed classification tool , WHO Pesticide Poisoning https://www.who.int/bulletin/volumes/86/3/07-041814/en/

28. World Bank, 2020, The World Bank in Jamaica https://www.worldbank.org/en/country/jamaica/overview

Annex 1: Pesticides Reported in Farmers' Poisoning Survey, Jamaica 2020

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
2,4-D	2,4-D Amine 480 G/L	48%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
2,4-D	Amine 6D	72%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
2,4-D + ioxynil	Actril DS 70 EC	2,4-D 60%, ioxynil 10%	Emulsifiable Concentrate (EC)	Bayer CropScience	registered
abamectin	NewMectin 1.8% EC	1.80%	Emulsifiable Concentrate (EC)	Marketing Arm, Panama	registered
acetamiprid	Caprid 20 SL	20%	soluble concentrate	Agro-Care Chemicals, China	registered
chlorothalonil	Bravo 720 SC	72%	suspension concentrate (SC)	Syngenta	registered
cypermethrin	Supermethrin 5% EC	5%	Emulsifiable Concentrate (EC)	Latin American Exporters Limited, Jamaica	registered
deltamethrin	Definite 2.5 EC	2.50%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
diazinon	Diazinon 48% EC	48%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
dimethoate	Dimethoate 40 EC	40%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
ethoprophos	MoCap 15G	15%	Granule (G)	Amvac Chemical Corporation	registered
fenpropathrin	Danitol 10 EC	10%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
glyphosate	Glyphosate 41% SL	41%	soluble concentrate	H&L Agro, Jamaica	registered
glyphosate	RoundUp Ultra	41%	Emulsifiable Concentrate (EC)	Montsanto	registered
indoxacarb	Indo-X 15 SC	15%	soluble concentrate	Nanjing Red Sun Co., China	registered
lambda-cyhalothrin	Caratrax 5 EC	5%	Emulsifiable Concentrate (EC)	Agro-Care Chemicals, China	registered
lambda-cyhalothrin	Karate Zeon 5 SC	4.90%	capsule suspension	Syngenta Chemicals B.V., Belgium	registered
lambda-cyhalothrin	Obulus 5 EC	5%	Emulsifiable Concentrate (EC)	Jiangsu Rotam Chemistry, China	registered
malathion	Malathion 50 EC	50%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
mancozeb	Dithane M-45	80%	Wettable Powder (WP)	Dow Agrosciences, USA	registered
methomyl	Lannate	90%		DuPont, USA	not registered
metribuzin	Carzone 75 DF	75%	Dry flowable (DF)	Ag Chem Plant, Jamaica	registered
paraquat dichloride	Gai-Quat 200	27.60%	Emulsifiable Concentrate (EC)	H&L Agro, Jamaica	registered
paraquat dichloride	Gramoxone Super	27.60%	Emulsifiable Concentrate (EC)	Syngenta, Columbia	registered
paraquat dichloride	Paraquat Super SL	27.60%	soluble concentrate	Ag Chem Plant, Jamaica	registered

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
paraquat dichloride	Scorcher	27.60%	soluble concentrate	Ag Chem Plant, Jamaica	registered
profenofos	Selecron 500 EC	50%	Emulsifiable Concentrate (EC)	Syngenta	registered
thiamethoxam	Actara 25 WG	25%	Water dispersable Granule (WG)	Syngenta	registered

Total Active Ingredients: 21

Total Pesticide Products: 28

Annex 2: Pesticides Reported in Farmers' Poisoning Survey, Trinidad and Tobago 2020

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
2,4 dichloro-phenoxyacetic acid	2, 4 D Amine	48%	soluble liquid (SL)	Caribbean Chemicals/Ag Chem Plant, Jamaica	registered
abamectin + acetamiprid	Bemisan 1.8 me Plus	abamectin 0.3%, acetamiprid 1.5%	micro-encapsulated	Hebei Veyong Biochemical Co. Ltd., China	registered
acetamiprid	Caprid 20 SL	20%	soluble concentrate	Agro-Care Chemical Industry Group, China	registered
alpha cypermethrin	Supertak 10 EC	10%	Emulsifiable Concentrate (EC)	VAPCO, Jordan	registered
alpha cypermethrin	Fastac 5 EC	5%	Emulsifiable Concentrate (EC)	BASF (American Cyanamid), Colombia	registered
bromoxynil	Broadtril EC	22.50%	Emulsifiable Concentrate (EC)	Agro-Care Chemical Industry, China	registered
carbaryl	C'vin 85 WP	85%	wettable powder (WP)	Nanjing Boost Ind. & Trading Co. Ltd., China	registered
carbaryl	Sevin 85 S	85%	wettable powder (WP)	Bayer Cropscience, USA	registered
carboxilfon	Bright 25% EC	25%	Emulsifiable Concentrate (EC)	VAPCO, Jordan	registered

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
cypermethrin	Cypertick	10%		Intersol Ltd., Trinidad	registered
cypermethrin	Pestac 5 EC	5%	Emulsifiable Concentrate (EC)	Hockley International Ltd., UK for Marman, USA	registered
cypermethrin + ethion	Ethrine Plus	cypermethrin 5%, ethion 40%	Emulsifiable Concentrate (EC)	Modern Insecticides, India	registered
cypermethrin + profenofos	Cypro 440 EC	cypermethrin 4%, profenofos 40%	Emulsifiable Concentrate (EC)	Calliope, France	registered
diafenthiuron	Pegasus 500 SC	50%	soluble concentrate	Syngenta Ltd. (Novartis), Colombia	registered
diazinon	Diazinon 48% EC	48%	Emulsifiable Concentrate (EC)	Ag Chem Plant, Jamaica	registered
dimethoate	Rogor 40 EC	40%	Emulsifiable Concentrate (EC)		**not registered**
fipronil	Regency 200 EC	20%	Emulsifiable Concentrate (EC)		registered
glufosinate ammonium	Carista 20 SL	20%	soluble liquid	Agro Care Chemicals, China	registered

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
glyphosate	AlGrass	48%	soluble liquid	Goldchance Industry Co. Ltd., China	registered
glyphosate	Roundup Ultra	41%	Emulsifiable Concentrate (EC)	Monsanto Co., USA	registered
glyphosate isopropylamine	Swiper 480+ Herbicide	41%		Drexel Chemical Co., USA	registered
lambda-cyhalothrin	Caratrax 5 EC	5%	Emulsifiable Concentrate (EC)	Agro-Care Chemicals, China	registered
methomyl	Agrinate	90%	water soluble powder (SP)	VAPCO, Jordan	registered
oxamyl	Vydate L	24%	water soluble liquid	Du Pont, USA	registered
paraquat dichloride	D' Paraquat 27 AS	27.60%	soluble liquid	Penzeal Industry Co. Ltd.	registered
paraquat dichloride	Gramoxone Super 20 SL	27.60%	Emulsifiable Concentrate (EC)	Syngenta, Columbia	registered
paraquat dichloride	Paraquat 27.6	27.60%	soluble concentrate (SC)	Shenzhen King Quenson Industry Co. Ltd	registered
paraquat dichloride	Sunquat 27	28.0%		Nanjing Pest. Factory, Red Sun Gp., China	registered

Active ingredient	Pesticide (Trade name)	% Active Ingredient	Formulation	Name of Producer	Registration Status 2020
paraquat dichloride	Weedless 27.6% L	27.60%	water soluble liquid	Hubei Sanonda, China	registered
thiodicarb	Thiolarv 37.5% SC	37.5%	soluble concentrate (SC)		registered
zeta cypermethrin + bifenthrin	Hero	cypermethrin 3.75%, bifenthrin 11.25%		FMC Corporation, USA	registered

Total active ingredients: 24 **Total Pesticides Product: 31**

Annex 3: Number of Farmers Poisoned per incident exposure for single use pesticides in Jamaica

Number of Farmers Poisoned per incident exposure					
	Incidents				
Names of pesticides	Incident #1	Incident #2	Incident #3	Incident #4	Incident #5
Caratrax 5Ec	220	21	0	0	0
Gramoxone Super 20 SL	26	1	1	0	0
Paraquat Super	17	0	0	0	1
Malathion 50 EC	14	6	0	0	0
Diazinon 48% EC	13	5	0	0	0
Roundup	9	1	0	0	0
Karate Zeon 5 SC	8	2	2	0	0
Definite 2.5 EC	6	1	0	0	0
MoCap 15 G	5	0	0	0	0
Supermethrin5% EC	4	3	0	0	0
Selecron	4	1	0	0	0
Glyphosate 41% SL	4	2	0	1	0
Dithane	3	0	0	0	0
2,4 D Amine	3	2	0	0	0
Caprid 20 SL	3	1	0	0	0
Dimethoate 40 EC	2	0	0	0	0
Mancozeb	2	1	0	0	0
Indox	2	0	0	0	0
Actril DS	2	0	0	0	0
Match	1	0	0	0	0

Number of Farmers Poisoned per incident exposure						
		Incidents				
	Bravo	1	0	0	0	0
	NewMectin	1	1	0	0	0
	Lannate	1	0	0	0	0
	Agrinate	1	0	0	0	0
	Scorcher	1	0	1	0	0
	Actara 25 WG	1	0	0	0	0
	Corazon (Organic)	1	0	0	0	0
	Ethrine Plus	1	1	0	0	0
	Obulus	1	1	0	0	0
	Qai-Quat	0	2	1		0
	Pegasus	0	0	0	1	0
	Total	**355**	**52**	**5**	**2**	**1**

Annex 4: Number of Farmers Poisoned per incident exposure for cocktail mixture of pesticides in Jamaica

Number of Farmers Poisoned per incident exposure					
	Names of Pesticides	Incident # 1	Incident # 2	Incident # 3	Incident # 4
	Caratrax 5 EC & Caprid	7	0	0	0
	Caratrax 5 EC & Selecron	2	0	0	0
	Caratrax 5 EC, Caprid & Mancozeb	2	0	0	0
	Caratrax 5 EC & Moncozeb	2	0	0	0
	Caratrax 5 EC & Malathion	2	0	0	0
	Definite, Glyphosate & Malathion	2	0	0	0
	Malathion , Tracer & Cure	2	0	0	0
	NewMectin , & M-Pede	2	0	0	0
	Diazinon, Caratrax, Cure	1	0	0	0
	Caratrax 5 EC, Cure & Fungicide	1	0	0	0
	Gramoxone & Caratrax 5 EC	1	0	0	0
	Diazinon, Selecron & Gramoxone	1	0	0	0
	Caratrax 5 EC & Karate Zeon	1	1	0	0
	Trivia, Tracer& Oberon	1	0	0	0
	Caratrax 5 EC & Dithane	1	0	0	0
	Caratrax 5 EC & Diazinon	1	0	0	0
	Diazinon, & Malathion	1	0	0	0
	Caratrax 5 EC & Cure	1	0	0	0
	Caratrax 5 EC , NewMectin & Cure	1	0	0	0

	Caprid & Diazinon	1	0	0	0
	Sevin & Slug off	1	0	0	0
	Caratrax 5 EC, Selecron and Pegasus	1	0	0	0
	Diazinon, Malathion, and Moncozeb	1	0	0	0
	Karate and Pegasus	1	0	0	0
	Karate & Caprid	1	0	0	0
	Karate & Diazinon	1	0	0	0
	Caratrax 5 EC, Cure, Grammoxone & Alverde	1	0	0	0
	Gai--Quat & Grammoxone	1	0	0	0
	Caratrax 5 EC, Tracer & Ferstrike	1	0	0	0
	Caratrax 5 EC & Xentari	1	0	0	0
	Caprid, Gramoxone, & Glyphosate	1	0	0	0
	Ethrel & Gramoxone	1	0	0	0
	Bausidim, Kodicide & Malathion	1	0	0	0
	Caratrax 5 EC & Enamel	1	0	0	0
	Caratrax 5EC, Indox 15 SC & Selecron	1	0	0	0
	Gramoxone & Reglone	0	1	0	0
	Caratrax 5 EC & Paraquat	0	0	1	0
	Total	**50**	**2**	**1**	**0**

Annex 5: Number of Farmers Poisoned per incident exposure for single use pesticides in Trinidad & Tobago

Number of Farmers Poisoned per incident exposure				
		Incidents		
Names of Pesticide		Incident # 1	Incident #2	Incident # 3
	Fastac 5 EC	48	1	0
	Gramoxone Super	11	2	0
	Diazinon 48% EC	10	0	0
	Cypro 440 EC	8	0	0
	Caratrax 5EC	7	0	0
	Agrinate	7	0	0
	Supertak 10 EC	7	0	0
	2,4- D Amine	7	0	1
	Sevin 85 S	5	0	0
	Paraquat Super	4	0	0
	Ethrine Plus	4	0	0
	Sunquat 27	4	0	0
	Hero	3	0	0
	Caprid 20 SL	3	0	0

Number of Farmers Poisoned per incident exposure				
		Incidents		
	Thiolarve 37.5% L	2	0	0
	Bemisan 1.8 me Plus	2	0	0
	Glyphosate	2	0	0
	Match	1	0	0
	Lannate	1	0	0
	Ferulon	1	0	0
	Weedless 27.6% L	1	0	0
	Obulus	1	0	0
	Pegasus 500 SC	1	0	0
	Regency 200 EC	1	0	0
	Nutrex	1	0	0
	Vydate L	1	0	0
	Swiper	1	0	0
	Actara 25 WG	1	0	0
	Pestac 5EC	1	0	0
	Algrass	1	0	0
	Malathion	1	0	0
	Carista 20 SL	1	0	0
	Rogor	1	0	0
	Bright	1	0	0

Number of Farmers Poisoned per incident exposure				
		Incidents		
	Broadtril EC	1	0	0
	Ballis	1	0	0
	Selecron	0	1	0
	Total	**153**	**4**	**1**

Annex 6: Number of Farmers Poisoned per incident exposure for cocktail mixture of pesticides in Trinidad & Tobago

-

-

Number of Farmers Poisoned per incident exposure				
	Incidents			
	Incident #1	Incident #2	Incident #3	Incident #4
Diazinon, Caratrax & Cure	1	0	0	0
Caratrax 5 EC & Malathion	1	0	0	0
Caratrax 5 EC & Dithane	1	0	0	0
Fastac & Nutrex	1	0	0	0
Protox & Pegasus	1	0	0	0
Diazinon & Pirate	1	0	0	0
Algrass & Sunquat	1	0	0	0
Fastac & Caprid	1	0	0	0
Agromil & Regency	1	0	0	0
Agrinate , Sunquat & Gramoxone	1	0	0	0
Diazinon & Hero	1	0	0	0
Gramoxone & Fastac	1	0	0	0
Total	**12**	**0**	**0**	**0**