AGROCHEMICALS AND THEIR IMPACT ON HUMAN HEALTH

An analysis of pesticide use and incidences of diseases in the region of Rincón de Santa María

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LIST OF ACRONYMS USED

ANAM: Autoridad Nacional del Ambiente

ANCON: Asociación Nacional para la Conservación de la Naturaleza

COPANIT: Comisión Panameña de Normas Industriales y Técnicas

CLICAC: Comisión de Libre Competencia y Asuntos del Consumidor

IDIAP: Instituto de Investigación Agropecuaria de Panamá

IPM: Integrated Pest Management

MICI: Ministerio de Comercio e Industrias

MIDA: Ministerio de Desarrollo Agropecuario

MINSA: Ministerio de Salud

MRL: Maximum Residue Limits

OMS: Organización Mundial de la Salud

PNUMA: Programa de las Naciones Unidas para el Medio Ambiente

PPE: Personal Protective Equipment

UNEP: United Nations Environment Programme

WHO: World Health Organization

EXECUTIVE SUMMARY

AGROCHEMICALS AND THEIR IMPACT ON HUMAN HEALTH: An analysis of pesticide use and incidences of diseases in the region of Rincón de Santa María

Host Institution: ANCON
Authors: Kesner Dabady and Pierre Tulk

Heavy use of toxic pesticides in agriculture worldwide has raised serious concerns about health issues. The World Health Organization (WHO) estimates that acute pesticide poisoning (APP) affects 3 million people and accounts for 20,000 unintentional deaths per year, with 99 percent of these fatalities believed to be in developing countries. In Panama, several diseases related to pesticide poisonings have been reported. In El Rincón de Santa María in particular, a small town in the province of Herrera surrounded by vast industrial monocultures, farmers misuse pesticides and do not follow safety procedures for application despite being informed about negative health effects of these products. Consequently, both acute and chronic cases of pesticide-induced illness are common in this area. This research project therefore aims to examine the perception, knowledge and practices associated with the use of pesticides in the area of Rincón the Santa Maria, as well as the awareness of farmworkers with regard to the possible side effects of these chemicals on human health.

This project was done over the course of four months, from January to April 2015. Several semi-structured interviews were conducted among government entities in the study area including MINSA and MIDA to obtain information pertaining to health and agriculture respectively. A survey questionnaire was also distributed among 30 farmworkers in the community to assess their knowledge, perception and awareness with regard to handling of pesticides. Out of the 30 questionnaires distributed, 20 were retrieved, for a response rate of 66%. Eleven (55%) of the respondents were men and 7 (45%) were women. The median age was

43 years (Q1= 36 years, Q3= 50 years). All of the respondents have had at least primary education, only seven (35%) had secondary education and none had attended post-secondary education.

The surveys revealed that even amongst the agricultural workers who receive training on pesticide use, there seems to be a lack of information about the potential hazards of pesticides on health. The main sources of information for the workers were the MIDA, the pesticide vendors and the MINSA. The absence of traditional media as a source of information might indicate that public-awareness campaigns using these channels might be unlikely to reach the main actors (the agricultural workers). Although there seems to be a consensus in the respondents towards the necessity of more educational workshops, further clarification is needed in regard to the contents of these workshops in order to meet the needs and concerns of the farm workers. More in-depth face-to face interviews with the producers would allow the assessment of these needs and could be the entry point towards a more participatory education. Additionally, this study did not cover the perceptions and knowledge of the producers regarding the environmental impacts on pesticides. The integration of the environmental component to this study would help in building a holistic assessment of the agricultural situation in that region.

RESUMEN EJECUTIVO

AGROQUÍMICOS Y SUS IMPACTOS EN LA SALUD HUMANA: Un análisis del uso de plaguicidas y de las incidencias de enfermedades en el Rincón de Santa María.

Institución: ANCON

Autores: Kesner Dabady and Pierre Tulk

El uso intensivo de plaguicidas en la agricultura a nivel mundial ha planteado serias preocupaciones sobre los problemas de salud. El Organización Mundial del Salud (OMS) revisó las estimaciones globales de intoxicaciones agudas por plaguicidas a 3 millones de casos, con el 99 por ciento de estas muertes ocurren en países en desarrollo. En Panamá, se han reportado varias enfermedades relacionadas con intoxicaciones por plaguicidas. En El Rincón de Santa María en particular, un corregimiento en la provincia de Herrera rodeado de extensos monocultivos industriales, los agricultores abusan de pesticidas y no siguen los procedimientos de seguridad para su aplicación a pesar de estar informado sobre los efectos negativos de estos agroquímicos en la salud humana. En consecuencia, casos agudos y crónicos de enfermedades en relación con plaguicidas son comunes en esta área. Por lo tanto, este proyecto de investigación tiene como objetivo examinar la percepción, los conocimientos y las prácticas relacionadas con el uso de plaguicidas en la zona del Rincón de Santa María, así como la sensibilización de los trabajadores agrícolas en relación con los posibles efectos secundarios de estos productos sobre la salud.

La metodología se extendió durante cuatro meses. Varias entrevistas semi estructuradas se realizaron entre las entidades gubernamentales en el área de estudio, incluyendo el MINSA y el MIDA, para obtener información relacionada con la salud y la agricultura, respectivamente. Además, se realizó una encuesta entre los trabajadores agrícolas en la comunidad para evaluar el conocimiento, la percepción y la conciencia de los campesinos con respecto a la manipulación de plaguicidas. De las 30 encuestas distribuidas, 20 fueron recuperadas, por un rato de participación de 66%. Once (55%) participantes eran hombres y 9 (45%) eran mujeres. La edad media era de 43 anos (Q1=36 anos, Q3=50 anos). Todos los participantes tenían primera educación, pero

solamente 7 (35%) tenían educación secundaria y ninguno tenía post-secundaria educación.

Las encuestas mostraron que incluso entre los trabajadores que reciben educación sobre el uso de plaguicidas, falta información sobre los efectos adversos posibles de las plaguicidas por la salud humana. Las principales Fuentes de información para los trabajadores eran el MIDA, los vendedores de plaguicidas y el MINSA. La ausencia de los medios de comunicación convencionales (televisión, radio o Internet) como fuente de información puede indicar que las campanas de sensibilización que utilizan estos canales tendrían poco éxito para llegar a los actores principales. Aunque parece que hay un consenso entre los participantes sobre la necesidad de añadir más talleres de capacitación, necesita más clarificación sobre el contenido de estas iniciativas para atender a las necesidades y preocupaciones de los productores. Más entrevistas cara a cara serían necesarias para establecer esas necesidades y podría ser un primer paso para una educación participativa. Además, sería interesante incluir una perspectiva ambiental a este estudio y medir, por ejemplo, los conocimientos y las percepciones de los productores sobre los impactos ambientales de las plaguicidas. La integración de los componentes ambientales a este proyecto permitiría un enfoque integral de la situación agrícola de esta región.

HOST INSTITUTION

The National Association for the Conservation of Nature (ANCON) is a Panamanian non-profit and non-governmental organization founded in 1985 by a group of prominent scientists, businessmen and community leaders. Its main mission is to conserve biodiversity and protect the natural resources of the country for the benefits of present and future generations. ANCON participates in the maintenance of many Panamanian national parks, such as the Parque Internacional la Amistad, the Parque Nacional Coiba, The Parque Nacional Chagres and the Parque Nacional Darien.

ANCON also promotes the development of a variety of projects in relation to environmental conservation throughout the country. The domains include reforestation, promotion of microenterprises of ecotourism, sustainable tourism in coastal and island settings, cleaning of beaches & rivers, environmental education. ANCON's field of activity includes as well advice for the realization of management plans for protected areas, rapid ecological assessments and participatory rural appraisals. The scope of these projects spans across the entire country of Panama (and Costa Rica in the case of Parque Nacional la Amistad).

The present project is in line with ANCON's philosophy towards the importance of education and community empowerment. We aim to target the miscommunication issues that can arise in educational initiatives in regard to pesticide use, and we are doing so by actively seeking the participation of the key stakeholders of the situation. With this investigation, we hope to provide useful information for further research in the rural area of El Rincón.

GENERAL BACKGROUND ON THE PROJECT

Key Characteristics of Pesticides

Pesticides are substances widely used worldwide to control different agents, among which are insects, arthropods, animals transmitters of diseases, fungi and plants. These products are used both in horticulture and crop systems (control of insects and weeds), on livestock (pest control), and in the public health sector to control disease vectors such as mosquitoes. Pesticides are sold worldwide and used both at industrial and domestic level.

According to the latest estimates, approximately 2.36 billion kilograms of pesticides were used worldwide in 2007, producing a business worth of $40 billion USD – this is a fifty-fold rise in the amounts of pesticides used internationally since 1950 (EPA, 2011). Patterns of pesticide consumption have been shifting as well in developing countries: their global share of pesticide use has doubled in the past three decades, going from 20% of 40% (PANNA, 2006). Particularly in the seven countries of the Central American Isthmus (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama), there has been a steady increase in the use of pesticides, reaching its peak in 2001 with imports of 46 million kg of active ingredient, which are formulated in 42 plants in these countries (PAHO, 2004).

Pesticides are a vital component of modern farming. About one-third of the agricultural products in the world are produced by using pesticides (Liu et al., 2002). Nonetheless, concerns about the impacts of these products on human health have increased over the past several years (Van der Werf 1996; Wilson and Tisdell 2001; Pimentel 2005). Exposure to dangerous pesticides due to inappropriate use or protection cause a wide range of negative health effects. Among the possible outcomes, acute poisonings are the most likely to be detected and have been identified

as a major health concern in the developing world (Kishi and Ladou, 2001). Acute pesticide poisoning (APP) or clinic cases is the severe poisoning which occurs after exposure to a single dose of pesticide. The appearance of symptoms may be sudden and dramatic or they may be delayed. Reported symptoms of acute pesticide poisoning include: fatigue, headaches, body aches, skin discomfort, skin rashes, feelings of weakness, circulatory problems, dizziness, nausea, vomiting, impaired vision, cramps, etc., and in severe cases, coma and death (M.C.R. Alavanja et al., 2004). Also, there is evidence that exposure to pesticides may cause chronic effects on health such as cancer (Kristensen et al., 1996; Hardell 2003; Gilden et. Al., 2010), interference with the development of children and fetus during pregnancy (Frederick, 1995; Sanborn et al., 2007) as well as disruption of the reproductive, endocrine, immune and central nervous system (Ascherio et al., 2006; Ismail AA et al, 2012). There are currently few reliable estimates as to how many people per year suffer from pesticide-related health effects. One of the latest estimates of acute poisoning cases worldwide was done by the WHO/UNEP Working Group on Public Health Impact of Pesticides Used in Agriculture in 1990. The global estimate for pesticide-related health effect was of 3 million cases of severe poisonings, with 99 percent of these fatalities occurring in developing countries (WHO, 1990). One must keep in mind that these estimates are based on hospital admissions and probably underestimate the actual number of pesticide poisonings. In fact, in developing countries where there is insufficient regulation, lack of surveillance systems, little to no enforcement and inadequate access to information systems, the incidences are presumed to be higher (IFCS, 2003). Studies from developing areas in Central America (El Salvador and Nicaragua) have indicated an overall incidence rate of 35 per 100 000 for APP in the general population (Henao and Arbelaez, 2002).

Poisoning incidences in agriculture occur even more often as a result of careless handling of pesticides usually on the part of operator error due to wilful negligence, lack of information or lack of training (Koh and Jeyaratnam 1996; Reeves & Schafer 2003). For example, leakages from joints in the application equipment may often cause farmers to come into direct skin contact with large amounts of a pesticide. Similarly, clogged or unsuitable nozzles on the spraying equipment affect the quality of application and increase the degree of exposure. Changes in the wind speed and direction during spraying can result in pesticide absorption in the respiratory tract. Application on extremely hot and dry days promotes pesticide drift which also increases exposure. Spraying from the air can create a risk for farmers who are not involved in the operation, including the population at large. All the above situations – which are common during pesticide application – may result in direct and prolonged exposure of farmers to pesticides which may in turn affect their health.

Farmers' knowledge of the potential hazards of pesticide handling is important for the prevention of exposure to these harmful chemicals. Levels of knowledge regarding routes of exposure to pesticides and specific health effects of pesticides may vary considerably among farmers. Studies conducted in the Gaza Strip reported high levels of knowledge on the health impact of pesticides (Yassin et al. 2002). Similarly, good knowledge about the acute health effects of pesticides and their exposure routes have been found among pesticide applicators in Ecuador (Hurtig et al. 2003). Moderate or low levels of knowledge about pathways of absorption of pesticides and of potential symptoms following exposure were found among farm workers in Egypt (Stewart 1996), and Ghana (Clarke et al. 1997).

Chemical pesticides remain today the choice of many farmers despite the increase of pesticide-related diseases and the presence of alternative methods to control pest such as

biological control, genetic control and IPM, because they are cost-effective, easily available, and display a wide spectrum of bioactivity (De A. et al., 2014).

Pesticide in agriculture in Panama

The use of pesticides in agriculture in the country goes back to the 1930s, with intensive agricultural production activities such as banana production, sugar cane and livestock. The public health sector has also been making use of pesticides in vector control of tropical diseases, which began during construction of the Panama Canal in the early decades of the twentieth century (UNEP, 2000). The use of pesticides in the country particularly increased during the 1970s, when agriculture became mechanized as industrialization became more intensified (ibid.).

At the beginning of the year 2000, Panama was the leader in Central America for the usage of pesticides per inhabitant and also in the amount of pesticides used in cultivated hectares (Table 1). The country imports an estimated 700 million tonnes of pesticides per year for an agricultural usage averaging three kilograms per capita (STRI, 2006). This is an amount more than six times higher than the international average, and nearly three times that of the Central American region (ibid.).

Among the many reasons for the intensive use of pesticides in Panama, the most important are the influence of the industrial/commercial pesticides sector, the use of technology in the cultivation of monocrops, and the climatic conditions of the inter-tropical zone with high temperature and rainfall (UNEP, 2000). Crops that utilize the highest quantities of pesticides are fruits (such as banana, melon, pine and citrus), vegetables, grains (such as rice and corn), and sugar cane.

Díaz, Lamoth and Leonardo (1998) propose five other factors that explain the intense use of pesticides in the country:

1. The presence of an agricultural export model rooted in the paradigm that the restricted use of pesticide is a basis for obtaining competitive levels of productivity;

2. The political determination to be tied to the international markets, competing with the quality of exportable products, which necessarily implies an intensive use of pesticides;

3. The maintenance of high-scale banana production for exports, which requires high volumes of pesticides;

4. The increasing adoption of "non-traditional" cultures by small and medium producers, who uses agrochemicals more intensively. The author also notes that the dispersion of smaller producers, which own less than five hectares of land, makes it more difficult to implement ways of reducing pesticide hazards

5. The productive expansion of cultures for intern consuming such as rice, sugar cane, yucca, as well as the augmentation of bovine, porcine and poultry productions

In general, pesticides enter the Republic of Panama from the United States, Europe and Japan as well as from Central America, Asia and Africa. Local manufacturing also allows export of pesticide, but imports remain greater in comparison to exports.

Table 1: Usage of pesticides by inhabitant and by hectare in different Latin American countries

Country	Pop.	Area (km2)	Imports (tons)	kg./person	kg./hectare
Belize	248,000	22,965	433	2.6	8.7
Costa Rica	3,604,642	51,100	9,924	4.0	16.0
El Salvador	5,839,000	20,749	6,300	1.2	7.9
Guatemala	11,090,000	108,889	9,027	1.2	7.2
Honduras	6,249,598	112,492	10,760	1.2	13.3
Nicaragua	4,923,000	131,812	9,772	2.6	15.3
Panama	2,809,000	75,517	7,505	3.1	18.8

Health hazards of pesticides in Panama

The inadequate use of pesticides may constitute one of the principal problems in public health in Panama (Díaz, Lamoth and Leonardo, 1998; Garcia, 1998). Díaz, Lamoth and Leonardo (1998) reviewed three independent studies quantifying the cases of APPs in the country: one is the Lic. Hildaura Patino on APPs registered at hospitals in the Republic in 1993 (with the exception of Bocas del Toro), another is the Mérida Diaz F. and Tristan da Brea L. 1992, which explores the APPs registered in the provinces of Chiriqui, Veraguas, Bocas del Toro and Panama during the period 1980-1989, and the last is Dr. Lucas E. Mora 1995 examining the records of the APPs in the Chiriqui province during the 1990-1994. The studies revealed that 2.577 cases of APPs were registered in the country during the period of 1970-1980. Almost 40% of cases of APPs were in the age group of 20-29 years and the male population tended to be more exposed and poisoned by pesticides (80%). The province of Chiriquí had the largest number of APPs, which was not surprising, considering the fact that agriculture is more present in that province.

Factors who determine the toxicity of the pesticide include: the dosage, the time and duration of exposition, the route of entry into the body, the chemical structure of the component, and genetic particularities (Requena, 2009). In Panama, organophosphorus pesticides are one of the most common toxic agents causing negative health effects, as they inhibit the activity of the enzyme acetilcholinesterase which regulates the transmission of nervous impulses (ibid.). The active ingredient Paraquat, found in certain herbicides, accounted for 50% of the deaths related to pesticides in the decade 1980-1990. Although this products was listed restricted by the MIDA

in 1999, 277 177 kilograms were imported between the period of 2005 – 2007 (Requena, 2009). Table 2 below shows the principal families of pesticides used in the country, as well as their effect on health.

Table 2: commonly used pesticide families in Panama and their effects on human health

Family of pesticides	Acute or chronic effect	Active ingredient	Routes of entry in the organism
Organophosphorus	Delayed neuropathy Changes in Behaviour	Terfubos, ethoprophos, methamido	Dermal, respiratory, digestive and conjunctival
Carbamate	Neurotoxicity leading to peripheral neuro Congenital diseases	Aldicarb, carbofuran, methomyl, carbaryl	Dermal, respiratory, digestive and conjunctival
Dithiocarbamate	Teratogenic and carcinogenic effects Dermatitis (contact)	Mancozeb	Dermal, respiratory and digestive
Chlorophenoxy	Decrease of fertility Peripheral neuropathy Dermatitis (contact)	2,4-D	Digestive, respiratory, sometimes c
Bipyridyl	Carcinogenic potential Dermatitis (contact) Pneumonia and pulmonary fibrosis Congenital diseases	Paraquat	Digestive, sometimes dermal

The latest data regarding cases of pesticide poisoning in Panama were published in 2004. The report, which was based on data of the programme of surveillance of APPs in Central America (PLAGSALUD[1]), shows an increase in APPs in Panama: 3366 cases were registered during the period 1992-2002 (Table 3). This number is thought to be higher considering that underreporting may exceed 80% of the cases according to statistics from (OPS / PLAGSALUD 2002-2003). The main causes of underreporting often encountered are: difficulty in accessing

[1] The project: ''Occupational and Environmental Aspects of exposure to pesticides in Central America'' (PLAGSALUD) is a project that aims to reduce acute poisoning by agrochemicals. Created in 1994, it is at the present time the only pesticide surveillance programme in Panama.

health services; lack of signs and symptoms of poisoning; misdiagnosis and administrative under-registration.

At the present time, there are no published studies on cases of chronic pesticide-related diseases in Panama, mainly because their compilation entails long term and costly epidemiological studies to clearly assess the relation between continual exposure to pesticides and potential health effects (MINSA, 2011).

Table 3: Intoxication rate, mortality and lethality associated to pesticides in Panama. 1992-2002

Year	Reported cases	Reported deaths	Total pop.	Pop. In agriculture	Intoxication rate (/100,000 habitants)	Mortality rate (/100,000 habitants)	Lethality (/100 cases)	Intoxication rate (/100,000 habitants in agr.)
1992	128	25	2.491.217	374.731	5.14	1	19.53	27.33
1993	201	30	2.538.063	377.222	7.92	1.18	14.93	42.63
1994	188	27	2.584.699	379.514	7.27	1.04	14.36	39.63
1995	185	20	2.630.993	405.975	7.03	0.76	10.81	36.46
1996	316	13	2.676.870	408.975	11.8	0.49	4.11	61.81
1997	315	21	2.722.299	449.106	11.57	0.77	6.67	56.11
1998	406	23	2.767.250	456.522	14.67	0.83	5.67	71.15
1999	448	37	2.811.714	463.857	15.93	1.32	8.26	77.27
2000	474	34	2.767.000	481.641	17.13	1.23	7.17	78.73
2001	335	18	2.939.177	494.204	11.4	0.61	5.37	54.23
2002	360	25	2.942.000	494.679	15.64	0.85	5.43	74.39

Overview of the legal context surrounding pesticides in Panama

The legislative context surrounding pesticides in Panama is of great complexity, involving several governmental and non-governmental institutions and agencies. The main government entity involved in the regulation of pesticide in the country is the Ministry of Agricultural Development (MIDA). This institution is responsible for the application of national policy on registration, distribution, storage, sale and use of pesticide, which is done through the National Directorate of Plant Protection (Act 47 of 9 July 1996) and the Directorate of Animal Health (Law 23 of July 15, 1997). There also exist a strong collaboration on the issue of pesticide disposal with the Ministry of Health (Decree 19 of April 10, 1997 on coordination between MIDA-MINSA and Decree 249 of June 3, 2008 on health standards for disposal of pharmaceutical waste and chemicals).

In 1997, because of international pressure and demand from Panamanian society, the National Directorate of Plant Protection, through Solved No. 74 of 18 September, approved to ban 61 pesticide active ingredients (see Annex). More recently, the use of Oxamyl (Solved No. 43 of 14 September 2011), of Chlorpyrifos (Solved No. 44 of 14 September 2011) and methomyl (Solved No. 41 of 13 September 2011) have also been restricted.

Additionally, with the aim of reducing the negative impacts of pesticide use, MIDA recently elaborated the Resolute and Manual which regulates the Land-Base Application of Pesticides (Solved No. 42 of 14 September 2011). The manual introduces rules for the sale of red band pesticides (toxicological class Ia and Ib) (Appendix 2). It is stated in the document some restrictions on the application during bad weather conditions, the establishment of safety zones for the protection of critical areas, and required courses for pesticide applicators.

The following is a brief list of other main government entities involved in the regulation of pesticide in the country:

- The Ministry of Health (MINSA) is mainly involved in the creation and maintenance of a national registry (*Registro Sanitario de las Especialidades Farmacéuticas y productos similares*) listing all the pesticides in the country and their toxicological information. This institution also establishes the maximum residue limits (MRLs) and produces norms for the safe use of pesticides both in domestic and industrial uses.
- The Ministry of Trade and Industry (MICI) regulates the commercialization and standardization of pesticides along with the CLICAC and the ANAM. It was also indirectly involved in the creation of specific norms in relation to the definition and classification, toxicology, sampling and preparation of analysis, labeling and packaging of pesticides.

- Last but not least, the Agricultural Research Institute (IDIAP) which regulates the introduction of new pesticides, seeds, fertilizers and other products intended for the use of the agro-food sector in the country.

The country also complies with international law on pesticide issues in regard to the resolutions and directives adopted at the Conferences of the Parties to the Stockholm and Rotterdam (ANAM 2012). The classification of pesticides in Panama also follows the recommendations of the WHO and includes 5 categories of risk according to their MRLs, as seen in Appendix 2.

Rincón de Santa María case study

Various cases of agrochemical-induced diseases have recently been reported in Rincón de Santa María, Herrera. In 2010, several children and teachers from this town had to be brought to the emergency of the hospital in Chitré because they were exposed to an aerial spraying of chemicals on a field of rice in Rincon (La Estrella, 2010). More recently, in 2014, the contamination of the *Rio Villa* with the pesticide atrazine, due to the negligence of the bio-ethanol company Campos de Pesé caused an uproar in the region after the water was declared undrinkable for a couple of days. Even though the chemical spill was declared accidental, the incident shed light on the lack of knowledge of the population regarding pesticides; several producers from the Herrera province admitted that they knew very little about safe methods of pesticide use (PanamaAmerica, 2014). El Rincón was therefore a zone of interest to measure the knowledge and perceptions of the farm workers towards pesticides.

Furthermore, during our preliminary investigation in the field, we frequently witnessed farm workers misusing pesticides on the field and/or not following safety procedures for

application. Many were applying pesticides without personal protective equipment (PPE) such as gloves, waterproof pants and jackets, safety masks, etc.

STUDY OBJECTIVES

General objectives

This project research aims to examine the perception, knowledge and practices associated with the use of pesticides in the area of Rincón de Santa Maria, as well as awareness of farmworkers with regard to the possible side effects of these products on health.

Specific objectives

1- Do a general overview of agriculture in Rincón

2- Document the health status with regard to pesticides in the area

3- Conduct a survey on the use of pesticide among farmworkers in the community

METHODOLOGY

Study Site

El Rincón is a corregimiento of the district of Santa María located north in the province of Herrera, at 225 km from Panama City. It is a small rural town (population of 1712 habitants according to the 2010 census) bordered by the lower reaches of the Rio Santa María. An estimated 90% of the inhabitants of El Rincón are involved in agriculture, either working for agricultural enterprises or for subsistence (Diaz L. Pers. Comm.). The territory is divided in many sub-localities including El Torno, Rodeo, Rio Escorto; and has a total area of 4000 hectares (INEC, 2010). The majority of the population lives along the main road and surrounded

by large industrial agricultural production. The main road is the only paved road, but several smaller dirt roads and tracks exist throughout the area.

Preparatory work

We conducted a preliminary press and literature review in order to familiarize ourselves with the context of the region in relation to pesticide use. Our first visit on the field took place in the end of January 2015 and had for objectives [1] to make a first assessment of the field conditions, [2] to elaborate a contact list for the following working sessions on the field and [3] to further develop the objectives and scope of the project. Introductory meetings were held during with several government authorities in order to present the research project and seek collaboration. We introduced ourselves at the offices of MIDA, MINSA and ANAM in Divisa, Santa Maria, El Rincón and Chitré, as they were thought to have the most access to farmers, as well as related information; they also served as a link to reach the community of our study site. We then visited a farm in El Rincón to established contact with the producers, and had the opportunity to interact with three farm workers. These interactions took the form of simple conversations and, in some cases, semi-structured. From this preliminary trip, we were able to define the main objectives of the project research and to create a list of contacts for further visits in the region.

Data collection

Agricultural and Health information

Semi-structured interviews were conducted with agricultural technicians from the MIDA office in Divisa throughout the project. Since these individuals worked closely with farmers in Rincón, they were thought to be a good resource for learning about everyday issues and

challenges that occur in the area. The offices of MIDA in Chitré provided us with additional information pertaining to agricultural practices and pesticide use in the Rincón. Lastly, semi-structured interviews were conducted with the personal of both the *Centro de Salud* in Santa Maria and Rincón, as well as in the regional office of MINSA in Chitré. This allowed us to obtain general information and statistical data on health status of the population living in our study site.

Survey design

The survey (Appendix 3) aimed to describe the knowledge, attitudes and practices held by producers on the application of pesticides in the area, taking into account also some other parameters of interest for the study. It contained 48 questions that probe different aspects in order to assess basic knowledge about pesticides, preparation and application, as well as overall perceptions/opinions of pesticide application conditions. We presented the survey to our host organization for final reviewing before distributing it on the field.

The survey questionnaire was distributed among 30 farmworkers. Since we did not have a complete map of the farms on the study site, and because farms are difficult to access (long distances from the main road), we were helped by some technicians at the MIDA in Divisa to reach the farmers and distribute the survey questionnaire. These surveys were given to the farm workers for self-completion and retrieved three weeks later; we found that method to be the best way to ensure neutrality in the answers (by avoiding the presence of MIDA representatives during completion) given our time restrictions.

Data analysis

The information recorded in the questionnaires was coded in order to facilitate computer entry. The data collection was done using the software Data Cracker, which is a web-based tool for analyzing survey data. We chose this tool for its ease of use, it's clarity for sharing the results, and because it did not require to pay a licence (as opposed to other tools such as SPSS). Descriptive statistics (frequency tables, bar graphs and pie charts) are used to present the findings and were compiled using a Microsoft Excel 2003 spreadsheet. Themes in the responses to the questions were identified and recommendations are made based on the findings within these themes.

Ethical considerations

Ethical considerations were taken into account in the development and application of our research project. We followed the *McGill code of conduct* as stated in the Policy on the ethical conduct of research involving human subjects. Before handing the survey questionnaires, the objectives of the study were communicated to the participants. In addition to the consent form, the participants were orally informed of their rights – their rights to ask questions before, after and during the interview/survey, to withdraw their participation at any time and to decline to answer any of the questions. Contact information of the interviewers and the host institution was provided to the participants in case they had additional questions, wanted to provide more information, or wanted to withdraw from the research project. Moreover, we made sure that the information about each participant's identity and other information gathered from the survey and interviews remained confidential.

RESULTS AND DISCUSSION

Overview of agriculture in Rincón de Santa María

Short history

Five decades ago, agrochemicals were not in use in cultivation of crops in Rincón Santa María. Farmers were only dependent on internal resources, recycling of organic matter, built-in biological control mechanisms and rainfall patterns in order to produce food. Agricultural yields were modest, but stable. Production was safeguarded by growing more than one crop or variety in space and time in a field as insurance against pest outbreaks or severe weather. Inputs of nitrogen were gained by rotating major field crops with legumes. In turn rotations suppressed insects, weeds and diseases by effectively breaking the life cycles of these pest. Pests were relatively low and not a big concern. All in all, agriculture was ‘’organic’’ and subsistent.

Then started in the late 1960’s the establishment of large fields under a single crop production - sugar cane, for which thousands of trees were cut down. Agrochemicals began to be perceived as essential agricultural inputs in the region in order to respond the increasing occurrences of pest problems and to increase general productivity.

Land distribution

Agricultural lands in use in El Rincon totals approximately 3500 hectares (Diaz L. pers. comm.), of which 65% accounts for horticulture, rice and sugar cane; 25% for pasture land and 10% of other uses. Four major companies share the majority of the lands including: Agro Export Pacific S.A, Agro Comercial Santa Rosa S.A, La Estrella, Finca Las Cabras S.A and CEGRACO S.A. The rest of the producers are either independent or regrouped in associations. The independent farmers lease land plots every season to cultivate different crops. The produce are

retailed to the major companies and/or sold in local market. Among the four main crops cultivated in El Rincón (rice, *sandía*, corn and melon), rice occupies more land, totaling 2,600 hectares (Diaz L. pers. comm). From this number, 2000 hectares are used for cultivation of irrigated rice and mostly by the company called CEGRACO. On the other hand, the 600 hectares balance is rain-dependent and therefore is cultivated only during the rainy season, and mostly by small farmers.

Agricultural issues

Years of intensive agriculture production had severely impacted the environment of the region of Rincón Santa María, and in return, agriculture. First, deforestation of land to establish monocultures can be considered as a weakness for agricultural practices in the area. There are almost no big trees remaining in El Rincón, with the exception of a few ones found in the backyard of several houses in the community; as well as in the 2000 hectares protected area of the Las Macañas marshes, of which 1200 ha are just water that floods the area. Tree covers may bring many advantages for agriculture. Forest reduces summer temperature extremes by providing shade and the cooling effects of evapotranspiration (Akbari et al., 1997). It reduces erosion and increase crop and livestock productivity and soil sustainability by sheltering fields with windbreaks (Fierce F.J., 1991). Also, forest can allow substantial agricultural benefits such as pest control. Forests offer a habitat for a large number of insects and animal species including bees, flies, moths, bats and birds which can provide pest pressures services to crops (Killebrew and Wolff, 2010).

Secondly, the dominance of monocultures negatively impact land quality (Marais A. et al., 2012). Very large industrial-scale lands dedicated to one single crop production crosses the region of Rincón Santa María. In spite of maximization of profits from the growing of high gross

margin crops, monoculture has many adverse impacts on agriculture as well as on environment on the whole in the region. A part from the clearing of land to convert into farming, exposing as a result the soil to the battering action of rain and wind, poor soil fertility as a consequence of monoculture has allowed more and more use of agrochemicals. Thousands and thousands of tonnes of agrochemicals are indeed applied in the soil of El Rincón on a daily basis said the technician to the health of plants at the MIDA's office in Divisa, Sesal Osorio (Osorio S. Pers. Comm.). Also, the long list of required agrochemicals that each producer regrouped in association is obliged to buy gives an idea on the amount and prices of agrochemicals use in the study site (Photo 1). In the case of chemical pesticides, which are used in the goal of reducing the abundance of species of pests (that is, the "targets") to below a level of acceptable damage, dependence can be problematic. As managers increase pesticide quantities/ frequency in response to resistance, this can allow the pest population to expand, requiring again more pesticide (Gut et al., 2007). This is sometimes referred to as pesticide trap, or pesticide treadmill, since farmers progressively pay more for less benefit (Gerry, 2007).

Lastly, excessive use of agrochemicals in agriculture can accumulate in soils, where it may filter into ground or surface water and prove toxic to micro-organisms, aquatic animals etc. Less than 0.1% of pesticides applied to crops actually reach the intended pest (Arias- Estevez et al., 2008). In our investigation, we were not able to get a copy of a water quality test for the Rio de Santa María that runs throughout the district, but we think that this river may be contaminated due to its closeness to the landfill, as well as installation on its banks of several enterprises of pig, poultry and livestock (Prensa, 2014).

Crop health

Poor environmental quality had also impacted crop health in the area of El Rincón. Yields are not the same anymore as back in the day reported several farmers; production had decreased. The crops are subject to intense pest problems. Table 4 shows the common pest insects associated with the four main crops cultivated in the region. Pest problems are felt the most during the summer time (dry season) than the winter time (wet season). Similar results were found in a study conducted in Lagos (Adedayo V. et al., 2014). During the dry season, higher temperature stimulates pest attack on crops. Also, reduced vegetation consequently allows pest to feed mostly on the crops, thus increasing crop damage (Soliz J. Pers. Comm.).

Table 4: Main crops cultivated in the Rincon along with their associated pests

Crops	Most common pests
Rice	Piritularium
	Sogata
	Chinche Blissus
	Gusano elotero
	Carbon
Sandia and Melon	Miwum
	Fusarium
	Thrips
	Pulgon
Corn	Gusano
	Chinia
	Cochinia
	Chinche

The level of crop damage also varies with the amount of capital of the producers. Crops under the cultivation of the major companies tend to look healthier while the independent famers which have the least access to capital experience more crop losses. These latter farmers do not have access to crop insurance and worst, since they are retailing their produce to major companies they are obliged to give their best quality produce that respect the companies' food standards. Years after years, farm inputs cost continues to rise and farmers are going out of business because their farms are not viable.

Organic agriculture initiatives

An association of producers promoting organic agriculture currently exists in the Rincon. To this day, the total lands own for that purposes covers a small area of only 600m^2 (Soliz J. Pers. Comm). The most cultivated crops are tomatoes, lettuce, cabbage, and onions. Shifting towards organic agriculture could be considered as a good alternatives to reduce pesticide use in the region since organic farming aims for no use of agrochemicals in the system.

Health aspects with regards to use of pesticide in El Rincón

Following our visit at the Health Center of Chitre, we were able to retrieve raw data on reported cases of APP in Rincón de Santa Maria for the time period of 2010-2013. A total record of 12 cases were registered in the year of 2010 compared to the subsequent years. This high registration may be explained by the major pesticide incidence that happened in the area in 2010. One must keep in mind that reporting of pesticide poisoning is rare. Indeed, one of the main challenges for the assessment of the health impacts of pesticides in the region of El Rincón was found to be the persistent under-reporting of diseases. According to Dr. Meza, head epidemiologist of the province of Herrera, 90% of the affected population of El Rincón do not seek medical attention for their problems. This is consistent to what can be found in the literature. A study conducted in the scope of the project PLAGSALUD estimated an under-reporting rate of APPS of about 93,6% in Panama (los paises del Istmo Centroamericano, 2001).

Some factors that explain APPs under-reporting in El Rincon according to Dr. Meza are:

- The lack of knowledge about the signs and symptoms of pesticide intoxication, which can be similar to other benign diseases. That being said, individuals that are intoxicated

usually would not seek to be consulted by a doctor but would rather rely on traditional medication such as tea to soothe their illness.

- The difficulty of access to health care services. Although there is a health service unit (*Puestro de Salud*) in town, the presence of an epidemiologist in place and/or appropriate medication may be rare. The nearest hospitals are situated in Chitré, which is at 30 km from El Rincon. In case of an incidence, since most of the inhabitants of the region do not own a car and public transportation in unreliable, the individual in question with tend more to stay at home and again rely on traditional medications.
- The fear of losing employment. Dr. Meza highlighted that in some cases, the safety practices prescribed by law are not enforced by the agricultural companies, while according to the article 284 of the Work Code of Panama, the employers have the legal obligation to provide the workers to all the necessary equipment and clothing for safe application of pesticides. Also, employers are required to train the employees on the hazards associated with the misuse of this equipment (article 286 of the Work Code of Panama). That being said, a worker that reports such conditions to an external institution may see its job threaten.
- Errors in diagnostics. It is difficult to diagnose for instance chronic cases of pesticide poisoning because the diseases which may arise after a long term exposure to pesticides can also have confounding factors such as smoking habits.

In the case of the Rincón, indirect exposure to pesticides is insidious and potentially due to the proximity of the population to large agricultural fields, where fumigation is sometimes done by using aircrafts. Women and children are at risk even if they do not work in the field themselves as water and soil contamination can occur; for instance, many inhabitants reported swimming

and washing their clothing in the Rio Santa Maria, which borders a number of large-scale productions in the city.

Survey

Demographics and general information

Out of the 30 questionnaires distributed, 20 were retrieved, for a response rate of 66%. Table 5 shows the general profile of the 20 farmers interviewed in the study. All of the respondents stated that they were working, or had been working for an agricultural production that uses pesticides. 11 (55%) of the respondents were men and 9 (45%) were women. The median age was 43 years ($Q_{1=}$ 36 years, $Q_{3=}$ 50 years). All of the respondents have had at least primary education, only seven (35%) had secondary education and none had attended post-secondary education. Low levels of education might result in an inability to properly read the instructions related to pesticide usage, especially if they were not written in Spanish, which is the native language of the farm workers.

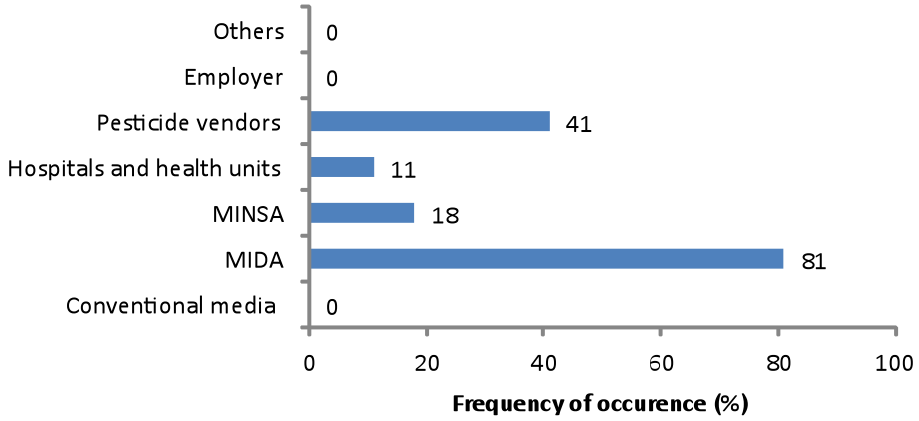
Table 5: Demographic information of the participants

Variable	No. of participants (n=20)	% of participants per total sample
Age		
< 20	1	5
20-35	3	16
36-50	12	58
> 50	4	21
Education levels		
Primary	13	65
Secondary	7	35
University (incomplete)	0	0
University (completed)	0	0
Gender		
Male	11	55
Female	9	45
Experience in the agricultural sector		
0-6 months	5	25
7 months- 5 years	4	20
6-15 years	5	25
>16 years	6	30

Knowledge and awareness regarding health effects

All of the respondents declared being aware that pesticides can have detrimental effects on health, and 82% indicated that they had received information on that matter in the last six months. MIDA was the most frequently listed source of information in regards to pesticide hazards (selected by 81% of respondents), followed by pesticides vendors (41%), the MINSA (18%) and the hospitals and health units (11%). It appeared that none of the respondents received information on pesticide use from their employers, nor by conventional media channels (such as television, radio and newspapers) (Figure 1). The fact that none of the respondents selected their employer as a source of information is intriguing and needs further investigation since the Article 5 of the Executive Decree 386 of September 4th, 1997 stipulates that each person (working in an private enterprise) involved in the application of pesticides must follow a basic course on the adequate use of the products dictated by the MINSA.

Figure 1: Principal sources of informations on pesticide's effects on health



Health impacts and safe use of pesticides

The surveys showed that six individuals (32%) indicated that they have suffered or saw a household member suffering from illnesses possibly linked with pesticides; nausea, vomiting and skin burns were the most common. Table 6 shows that the majority of participants followed safe practices of pesticide application, although 33% indicated that they often apply pesticides more than prescribed.

Table 6: Agricultural practices of the participants

Agricultural practices	% of participants		
	Si	No	A veces
¿Sigue instrucciones para su aplicación?	100	0	0
¿Los mezclan en su casa?	0	100	0
¿Los aplica mayor número de veces a la indicada?	33	60	7
¿Se lava las manos después de aplicarlos y antes de comer, fumar o realizar otra actividad?	100	0	0
¿Se baña después de aplicarlos?	100	0	0
¿Se cambia de ropa después de su aplicación?	94	6	0
¿Entran en lugares donde se están aplicando?	22	78	0
¿Deja que los niños permanezcan en las áreas donde se puedan entrar en contacto con las plaguicidas?	0	100	0
¿Los aplica sin equipo de equipo de protección?	17	83	0
¿Guarda todo el equipo después de usarlo?	100	0	0
¿Utiliza ropa que cubra la mayor parte de su cuerpo cuando lo mezclan o aplican?	100	0	0
¿Utiliza guantes para mezclarlos?	88	11	6
¿Lee la etiqueta y siguen las instrucciones de uso?	94	0	6
¿Los aplica en cultivos aunque sople viento fuerte?	0	94	6
¿Advierten a sus vecinos cuando hacen rociamiento?	78	17	6
¿Los utilizan bajo indicaciones de técnico autorizado?	94	6	0
¿Aplican las dosis indicadas en las instrucciones?	94	6	0

Opinion based questions

Figure 2 displays some of the key answers obtained from opinion-based questions. Almost the totality of respondents (88%) agreed or totally agreed that pesticides were “essential in agriculture”, and a majority (70%) felt that they were receiving adequate information on the safe use of pesticides. However, this proportion decreases when we look at the health component; only half (49%) of the respondents thought that they were receiving enough information on the potential hazards of pesticides on their health. Moreover, the participants

believed that the majority of farm workers in their region do not wear the required equipment for fumigation (77%), and were generally not using pesticides in a safe way (82%). The finding that most farm workers did not use personal protective equipment when using pesticides concurs with those obtained by Ntow et al. (2009) in Ghana, Salameh et al. (2004) in Lebanon, Chitra et al. (2006) in South India, and Williamson et al. (2008) in Senegal. Clearly more could be done to raise the awareness of farm workers and also farm owners about the dangers of pesticides so that the use of protective clothing and equipment increases.

Furthermore, the majority of the respondents reported that the lack of consciousness and education towards pesticide hazards in the region was a concerning issue. Sixteen respondents mentioned that more training workshops (either from the employers or from MIDA) would improve general knowledge about pesticides. Also, many respondents pointed out that the lack of laws that sanction the bad use of pesticides was problematic and could explain why the farmers in the region do not wear the required equipment. Others mentioned that the proper equipment might not be affordable for smaller producers and subsistence farmers, who need to buy the accessories themselves (whereas the farming companies are required by law to provide the equipment for their employees [Decree 386 of September 4, 1997]).

Lastly, our survey revealed that only 6% of the respondents disagreed with the proposition that pesticides were indispensable in agriculture. Two of the participants indicated that educational initiatives on alternative methods of crop protection and diminution of agrochemicals sales would improve the current situation. Organic agriculture is one of the promising methods in such regards and therefore should receive more consideration in the region. Organic agriculture has the potential to increase agricultural productivity and restore the natural resources base, especially in low-input traditional systems. However, the challenge for

developing countries will be to establish organic agricultural policies that combine income generation and improved domestic food production (Scialabba, 2000). For smaller agricultural communities like in the Rincón, the adoption of organic agriculture will therefore require more support from both governmental institutions and other organizations in order to raise productivity and maximizing the use of local resources. In the long term, this could ensure a more sustainable and healthier form of agriculture for all the community.

Organic agriculture is one of the most rapidly developing sectors in the agro-food industry and is now present in more than 120 countries of the world, with its share of agricultural land and farms continuously growing in many countries. This growth rate is also palpable in Latin America although the level of development of the organic sector varies widely through the countries (Scialabba, 2000). Most organic initiatives in Latin American countries are bottom-up, in the sense that they have developed through public pressure rather than governmental initiatives (IFOAM, 2000). In Panama, organic farming is something perceived as "a return to the roots", as traditional subsistence farming involved little to no chemical products (La Estrella, 2014). Although the Panamanian government does not currently offer support nor economic subsidies for organic producers (as it is the case for most Latin American countries [Willer, H., Yussefi, M., & Sorensen, N., 2010]), organic farming is protected and defined by law in the country (Law No.8 of January 2002). According to Dr. Jose Alberto Yau Quintero, agricultural researcher at IDIAP, the Panamanian government is working on the development of a national certification in the next years.

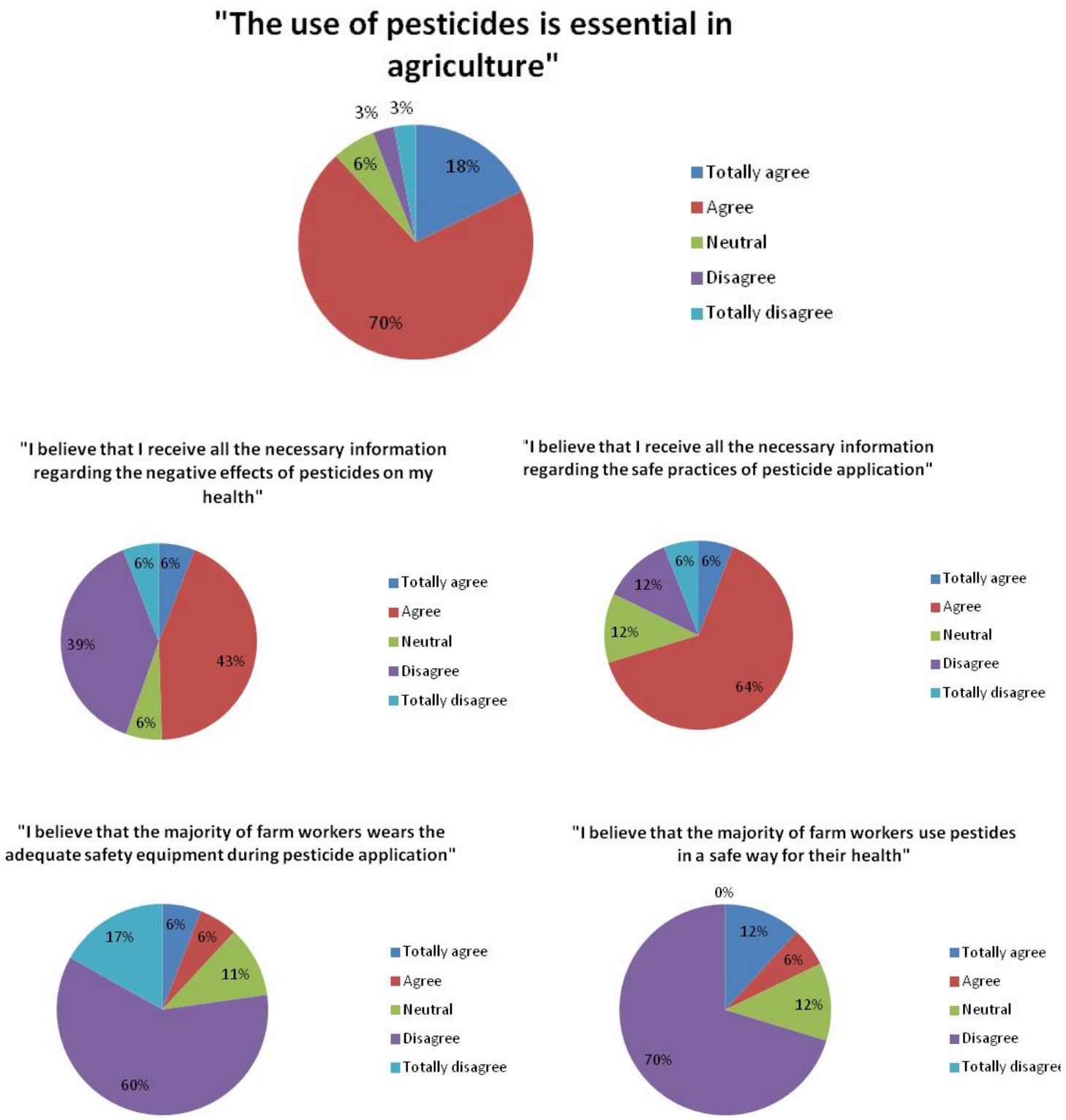


Figure 2: Sample of answers for opinion-based questions

Limitations and future recommendations

Although we tried to avoid the presence of bias in the design of the surveys, it is important to put certain answers into context. Due to the limited field time available for the project and our lack of familiarity with the region, we only relied on the collaboration with technicians at MIDA's office in Divisa in order to reach the respondents of the questionnaire. This may have had affected our results in some ways. Also, due to our small sample size, some of the results obtained from the surveys might not be entirely representative of all the producers in the region, especially in regard to the amount of training received and the safe practices of pesticide use.

The results found in this study bring interesting perspectives for further investigation. The fact that almost half of the respondents answered that they did not know enough about the adverse effects of pesticides on their health (despite their training that they received) could be an indication that the current educational initiatives by the MIDA or the pesticide vendors lack this kind of information. Moreover, in spite of the discernible efforts of the MIDA to reach the associations of producers on the field, the fact that the respondents thought that the majority of the workers in the region do not apply pesticides in a safe manner might indicate that many producers in the region do not have the same access to training. This could possibly be explained by a lack of personal in that region (especially field technicians and agronomists). These points could have been further developed with face-to-face interviews with the members of the community and, constitute an important opportunity for research towards participatory education. By assessing who has access to training and what is currently being taught, it will be possible to align the institutional education's agenda and the needs of the producers in the region.

CONCLUSION

This study intended to shed light on the gap between the presence of information regarding good pesticide handling and the apparent misuse of pesticides by the population of Rincón de Santa Maria. We found that the absence of clear legal norms that regulates land-base application of pesticides and sanctions inadequate use was a decisive factor in the control of agrochemical use in the region. It was also found that under-reporting of acute and chronic pesticide poisoning was recurrent in the study site due to a variety of reasons, including difficulty of access to health institutions, lack of knowledge of specific signs and symptoms, cultural patterns and administrative failure to compile the data. The lack of availability of the necessary protective equipment to smaller subsistence farmers, as well as the inadequacy of the equipment for hot and dry climates, were identified as potential factors which could explain the low number of farm workers wearing the necessary equipment during pesticide application. Furthermore, the survey revealed that even amongst the agricultural workers who receive training on pesticide use, there seems to be a lack of information about the potential hazards of pesticides on health. The main sources of information for the workers were the MIDA, the pesticide vendors and the MINSA. Although there seems to be a consensus among the respondents towards the necessity of more educational workshops, further clarification is needed in regard to the contents of these workshops in order to meet the needs and concerns of the farm workers. More in-depth face-to face interviews with the producers would allow the assessment of these needs and could be the entry point towards a participatory education. It should be noted that this study did not cover the perceptions and knowledge of the producers regarding the environmental impacts on pesticides. The integration of the environmental component to the project would help building a holistic assessment of the agricultural situation in that region.

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APPENDIX 1 –Logistics of the internsip

Time allocation

Month	Hours of work in Herrera	Hours of work in Panama	Total of hours of work
January	12	20	32
February	0	20	20
March	25	16	41
April	8	60	68
Semester	45	116	161

*****Hours of work do not include travel time required to go to the study site in Herrera (approximately 4 hours each way)

Housing and transportation costs

Month	Transportation costs	Housing costs	Total costs
January	55	30	85

February	5	0	5
March	50	90	140
April	15	36	51
Semester	125	156	281

*Transportation and housing costs are for a single person

APPENDIX 2– WHO pesticide classification. Image taken from:

[www.stewardshipcommunity.com/stewardship-in-practice/human-health/hazard-risk-human-health-and-pesticides/hazard-profile-and-risk-assessment.html]

WHO Hazard Class	Information to appear on the label			Acute LD50 (rat) of formulation (mg/kg)			
	Hatard statement	Band colour	Hazard symbol	Oral		Dermal	
				Solid	Liquid	Solid	Liquid
Ia Extremely hazardous	**VERY TOXIC**			< 5	< 20	< 10	< 40
Ib Higly hazardous	**TOXIC**			5 - 50	20 - 200	20 - 100	40 - 400
II Moderately hazardous	**HARMFUL**			50 - 500	200 -- 2000	100 - 1000	400 - 4000
III Slightly hazardous	**CAUTION**			> 500	> 2000	> 1000	>4000
Unlikely to present a hazard in normal use				> 2000	> 3000		

APPENDIX 3- Blank copy of the survey questionnaire

Encuesta sobre plaguicidas

Información general

*****En este cuestionario, el término "plaguicidas" incluye productos químicos como los insecticidas, los fungicidas y los herbicidas. No se incluyen los abonos o fertilizantes químicos *****

1. ¿Alguna vez has oído hablar de los plaguicidas?
   - oSI
   - oNO
2. ¿Trabaja o ha trabajado en una producción agrícola que usa plaguicidas?
   - o SI
   - o NO
3. ¿Por cuánto tiempo usted lleva trabajando en el sector agrícola?
   - o 0 - 6 meses
   - o 7 meses - 5 anos
   - o 6 - 15 anos
   - o 16 años y mas

Información demográfica

1) Edad o Menor de 20 anos o De 20 a 35 anos o De 36 a 50 anos o Más de 50 anos	2) Género o Masculino Femenino
3) Último grado que estudio o Primaria o Secundaria o Universidad incompleta Universidad completa más	4) Zona en donde vive _____ _____

Conocimientos sobre plaguicidas

1. ¿Sabe que los plaguicidas pueden hacer daño a la salud humana?
   - o SI
   - o NO
2. ¿Recibe información sobre los efectos adversos del mal uso de los plaguicidas sobre la salud?
   - o SI
   - o NO
3. ¿Cuándo recibió este información?
   - o En los 6 últimos meses
   - o En el último año

- En los 3 últimos años

4. ¿Cuáles son las principales fuentes de información sobre los efectos adversos de los plaguicidas sobre la salud (seleccione todos los que se correspondan)?
   - Medios convencionales (televisión, radio, prensa, etc.)
   - Ministerio de Desarrollo Agropecuario (MIDA)
   - Ministerio de Salud de la República de Panamá (MINSA)
   - Puestos de salud, hospitales
   - Vendedores de productos agrícolas
   - Empleador
   - Otras: _____

5. ¿De qué manera recibe esta información (ej. folletos, talleres de capacitación, etc.)?
   _____
   _____
   _____

6. ¿Cuáles son, en su opinión, las principales razones del uso de plaguicidas en la agricultura? (Seleccione todos los que se correspondan)
   - Mejor rendimiento de los cultivos
   - Menos mano de obra necesaria
     Estabilidad de la producción (protección contra los insectos, malezas, etc.)
   - Otras: _____

7. Cuál es su posición al respecto de la afirmación siguiente: "Yo creo que recibo toda la información necesaria al respecto de los efectos adversos del mal uso de los plaguicidas sobre mi salud."
   - Totalmente de acuerdo
   - De acuerdo
   - Neutral
   - En desacuerdo
   - Totalmente en desacuerdo

8. Cuál es su posición al respecto de la afirmación siguiente: "Yo creo que la mayoría de los trabajadores agrícolas utilizan los plaguicidas de forma segura"
   - Totalmente de acuerdo
   - De acuerdo
   - Neutral
   - En desacuerdo
   - Totalmente en desacuerdo

9. ¿En su opinión, qué medios se podrían utilizar para mejorar los conocimientos de los trabajadores agrícolas sobre los riesgos de los plaguicidas sobre la salud humana? (ej. talleres de capacitación entre los productores, distribución de información por parte del MINSA, etc.)
   _____
   _____
   _____

Incidencia de uso

1. Cuál es su posición al respecto de la afirmación siguiente: “El uso de plaguicidas es esencial para la agricultura”.
   - Totalmente de acuerdo
   - De acuerdo
   - Neutral
   - En desacuerdo
   - Totalmente en desacuerdo

2. ¿Recibe alguna capacitación específica sobre la manipulación adecuada de los plaguicidas en el campo?
   - SI (pase a la siguiente pregunta)
   - NO (pase a la pregunta 6)

3. ¿De qué manera recibe esta capacitación? (Seleccione todos los que se correspondan)
   - A través los vendedores de productos agrícolas
   - A través un agrónomo o técnico de producción
   - A través de talleres de capacitación
   - A través del personal de la MIDA
   - Otras: _____

4. Cuál es su posición al respecto de la afirmación siguiente: “Yo creo que recibo toda la información necesaria al respecto de la aplicación segura de los plaguicidas en el campo”.
   - Totalmente de acuerdo
   - De acuerdo
   - Neutral
   - En desacuerdo
   - Totalmente en desacuerdo

5. ¿Si usted considera que no tienen la información necesaria al respecto del uso seguro de los plaguicidas, cuál es la razón de su opinión?
   _____
   _____
   _____

6. ¿En esta región, alguna vez había visto trabajadores agrícolas que no utilizaban mascarillas de seguridad, guantes de látex y ropa impermeable al manipular plaguicidas?
   - SI

- NO

7. Cuál es su posición al respecto de la afirmación siguiente: “Yo creo que la mayoría de los trabajadores agrícolas utilizan el equipo de protección adecuado durante la fumigación con plaguicidas.”
   - Totalmente de acuerdo
   - De acuerdo
   - Neutral
   - En desacuerdo
   - Totalmente en desacuerdo

8. ¿Si se ha respondido “En desacuerdo” o “Totalmente en desacuerdo” a la pregunta anterior, por qué, en su opinión, los trabajadores agrícolas no siguen los estándares de seguridad para el uso de plaguicidas?

   _____
   _____
   _____

9. ¿En su opinión, qué medios se podrían utilizar para mejorar los conocimientos de los trabajadores agrícolas sobre los estándares de seguridad para el uso de plaguicidas? (Ejemplos de respuestas: talleres de capacitación obligatorios para los empleados, mejor equipo de seguridad, más instrucciones sobre los productos químicos, etc.)

   _____
   _____
   _____

10. ¿Alguna vez usted o un miembro de su familia ya han sufrido de una enfermedad posiblemente causada por la exposición a los plaguicidas?
    - SI
    - NO

11. ¿Si se ha respondido “SI", de qué enfermedad se trataba?

    _____

Manipulación de pesticidas

****Las siguientes preguntas solamente se dirigen a los participantes que trabajan o han trabajado en producciones agrícolas que utilizan plaguicidas. Si esto no aplica a usted, por favor pase a la siguiente sección. ****

	SI	NO	ALGUNAS VECES	NO APLICABLE
¿Sigue instrucciones para su aplicación?				
¿Los mezclan en su casa?				
¿Los aplica mayor número de veces a la indicada?				
¿Se lava las manos después de aplicarlos y antes de comer, fumar o realizar otra actividad?				
¿Se baña después de aplicarlos?				
¿Se cambia de ropa después de su aplicación?				
¿Entran en lugares donde se están aplicando?				
¿Deja que los niños permanezcan en las áreas donde se puedan entrar en contacto con las plaguicidas?				
¿Los aplica sin equipo de equipo de protección?				
¿Guarda todo el equipo después de usarlo?				
¿Utiliza ropa que cubra la mayor parte de su cuerpo cuando lo mezclan o aplican?				
¿Utiliza guantes para mezclarlos?				
¿Lee la etiqueta y siguen las instrucciones de uso?				
¿Los aplica en cultivos aunque sople viento fuerte?				
¿Advierten a sus vecinos cuando hacen rociamiento?				
¿Los utilizan bajo indicaciones de técnico autorizado?				
¿Aplican las dosis indicadas en las instrucciones?				

Opiniones generales sobre el uso de plaguicidas

1. En el pasado, varios productores agrícolas en la región mencionaron que desconocieron muchos de los componentes que poseen los agroquímicos que utilizan, ya que los mismos son de venta libre en la región y su uso es común en distintos tipos de cultivo. ¿En su opinión, este sigue siendo el caso hoy?

_____

2. ¿Si se ha respondido afirmativamente a la pregunta anterior, en su opinión, por qué los trabajadores no conocen las buenas prácticas para utilizar los plaguicidas?

_____
_____
_____

3. ¿En pocas palabras, que serían en su opinión las soluciones posibles para mejorar este problema?

_____
_____
_____

4. ¿Tiene algunos más comentarios o preguntas en relación a este cuestionario?

_____
_____
_____

Fin del cuestionario. ¡Muchas gracias por su participación!