# Acute symptoms arising from application of herbicides among rice farmers in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri province, Thailand: a cross-sectional survey

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# อาการเฉียบพลันที่เกิดจากการใช้สารเคมีกำจัดวัชพืชในชาวนา ตำบลสองพี่น้อง อำเภอสองพี่น้อง จังหวัดสุพรรณบุรี ประเทศไทย: การศึกษาภาคตัดขวาง

น.ส.จิน ไช่

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การเกษตรกรรมเป็นหลักทางเศรษฐกิจของประเทศไทย การใช้สารกำจัดศัตรูพืชจึงถูกนำมาใช้เพื่อการเพิ่มผลผลิตทางการเกษตรและปริมาณสารกำจัดวัชพืชถูกนำเข้ามาใช้เป็นอันดับหนึ่ง ซึ่งสารกำจัดวัชพืชในปริมาณที่สูงก่อให้เกิดปัญหาต่อสุขภาพ เช่นพิษเฉียบพลันจนถึงการเสียชีวิต โดยเฉพาะอย่างยิ่ง ไกลโฟเซต พาราควอต และ ทู-โฟร์-ดี งานวิจัยนี้มีจุดประสงค์ในการศึกษาอาการพิษเฉียบพลันจากการฉีดพ่นสารกำจัดวัชพืชและหาปัจจัยที่เกี่ยวข้องจากการสัมผัสสารสารกำจัดวัชพืชในเกษตรกรนาข้าวในตำบลสองพี่น้อง อำเภอสองพี่น้อง จังหวัดสุพรรณบุรี การศึกษาชนิดภาคตัดขวาง โดยการสัมภาษณ์เกษตรกรจำนวน 133 คน พบว่า ร้อยละ 55.6 เป็นเกษตรกรเพศหญิง เกษตรกรมีอายุเฉลี่ย 45.8 ปี ร้อยละ 80% ของเกษตรกรโดยประมาณไม่ดื่มและสูบบุหรี่ ร้อยละ 48 มีระดับการศึกษาประถมศึกษา ร้อยละ 61.7 ของเกษตรกรมีระดับความรู้เกี่ยวข้องกับสารกำจัดวัชพืชในระดับสูง ร้อยละ 67.7% ของเกษตรกรมีระดับการปฏิบัติตนที่ถูกต้องในการใช้สารกำจัดวัชพืช เกษตรกรส่วนใหญ่สวมเสื้อผ้าแขนยาว กางเกงขายาว รวมทั้งอุปกรณ์ป้องกันตัวอื่นๆ ในการป้องกันสารกำจัดวัชพืชขณะฉีดพ่น ซึ่งพบว่ามีความสัมพันธ์กับอาการพิษเฉียบพลัน นอกจากนี้ พบว่าอายุ ระดับการศึกษา เพศ มีความสัมพันธ์กับอาการการพิษเฉียบพลัน ระยะเวลาในการทำงานมีความสัมพันธ์อย่างมีนัยสัมพันธ์ทางสถิติกับอาการปวดศีรษะ (p value = 0.015) ขนาดพื้นที่ถือครองของเกษตรกรมีความสัมพันธ์อย่างมีนัยสัมพันธ์ทางสถิติกับอาการคันผิวหนัง (p value = 0.042) นอกจากนี้คะแนนความรู้และคะแนนการปฏิบัติตนเองในการป้องกันสารกำจัดวัชพืชมีความสัมพันธ์กันเล็กน้อยในเชิงลบอย่างมีนัยสำคัญ (rs = -0.181, p < 0.05) แต่ คะแนนทัศนคติและการปฏิบัติตนเองในการป้องกันสารกำจัดวัชพืชมีความสัมพันธ์กันเล็กน้อยในเชิงบวกอย่างมีนัยสำคัญ (rs = 0.256, p < 0.001) นอกจากนี้งานวิจัยนี้พบว่าอาการปวดศีรษะเป็นอาการพิษเฉียบพลันที่พบสูงสุด ร้อยละ 45.1 และในการศึกษาครั้งนี้เป็นการศึกษากลุ่มตัวอย่างขนาดเล็ก การศึกษาในอนาคตควรมีการศึกษาดัชนีทางชีวภาพร่วมกับการวินิจฉัยอาการโดยแพทย์ผู้เชี่ยวชาญ

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Qin Cai : Acute symptoms arising from application of herbicides among rice farmers in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri province, Thailand: a cross-sectional survey. Advisor: Assoc. Prof. WATTASIT SIRIWONG, Ph.D.

Agriculture is a primary contributor to the Thailand economy. In order to high production, pesticide use is necessary and herbicides are the first import volume of pesticides. Meanwhile overuse of herbicide can cause adverse health effects such as acute symptoms even death, especially glyphosate, paraquat, and 2-4 D. The aim of this study is to explore acute symptoms arising from application of herbicides and to find factors associated to symptoms of herbicide exposure on rice farmers in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri province, Thailand. A cross-sectional study was investigated 133 participants through face to face interview. Of 55.6% are female and average age is 45.8 years old, around 80% participants never drinking and smoking, 48.9% have lower than primary education, 61.7% have high knowledge level of herbicides, 67.7% have good practice, most of them wear long sleeves and long pants, some personal protective equipment (PPE) showed association with some acute symptoms. Besides, there are association among age, education, gender with herbicides exposure acute symptoms. Work time showed statistically significant with headache (p value = 0.015) and farmland also appeared significant with skin rash (p value = 0.042). And Knowledge and practice score have negative correlation ($r_s$ = -0.181, $p < 0.05$). Meanwhile findings showed a positive correlation between attitude score and practice score ($r_s$ = 0.256, $p < 0.001$). Additionally, highest prevalence of acute symptom is headache 45.1%. As for this study investigated in small group, further study would better use biomarkers and doctor diagnose evaluation.

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# CHAPTER 1

# INTRODUCTION

## 1.1Background and problem statement



Agriculture is a primary contributor to the Thai economy, it is also related to Thailand sustainable develop, furthermore, more than 11 million Thai people (38%) work in agriculture (Ratana & Sakorn, 2013), almost half of all Thailand's labor workers are employed in the farming industry. Thailand agriculture sector plays an increasing and significant role from 1970s till now. Meanwhile the agricultural sector generated almost 100% of the country's export income. Now it still has the share of Thai export income of almost 30%. Thailand has the total area of 51.4 million hectares, 41% is engaged in the agriculture sector, 21% is paddy area, and 10% is for other crops, hence, Thailand has a very high proportion of labor. It is a serious problem when farmers use pesticide for harvesting, there are many types of pesticides, such as herbicide, insecticide, nematicide, pesticide, avicide, rodenticide, bactericide, fungicide (Australian Government Department of Health, 2010). Herbicide and insecticide are the most common use among rice farmers.

According to Bureau of Epidemiology, Ministry of Public Health Thailand, the morbidity rate of pesticide poisoning was 7.92 per 100,000 populations in 2017. Herbicide use is almost the first step before insecticide, fungicide and other pesticides,

especially among paddy rice farmers, meanwhile, herbicides volume of import is the top one in Thailand from 2013 to 2017 (Chetanasen et al., 2017). Overuse of herbicide by farmers which leads to increasing pesticide risked for farmers, consumers, and the environment. This is a common situation happened on farmers. Furthermore, herbicide is more toxic than other pesticides (Fishel, Ferrell, MacDonald, & Sellers, 2006).

Acute symptoms are the symptoms which occur after exposure to a single or multiple dose of herbicides, the appearance of symptoms may be sudden and dramatic, or they may be delayed few days (Milidrag, Vesna, & Slaviša, 2018). There is a plenty research (Jørs et al., 2006; Larry, Clyde, Edward, & Vitzthum, 1997; Ratana & Sakorn, 2013) about acute symptoms of herbicide in exposed people within 7 days include skin irritation, nausea, vomiting, throat, headache, dizziness and so on (Michael, Margaret, & Leon, 2010). But there are a few reports about herbicide use and acute symptom in Suphan buri province when use most common use herbicide in Thailand. Therefore, it would be worth to further study on the most common use herbicide and acute symptoms help the development of agriculture announce farmers to prevent herbicide risk.

Rice traded on world markets represents only 8-9% of total output or around 42-43 million tons of milled rice over the past decade (Workman, 2018). Currently,

the major rice-exporting countries are Thailand, India and Vietnam. Meanwhile in 27 September 2018, china signed a government to government(G2G) contract with Thailand which bought 100,000 tons' rice. This deal is good news for farmers. As of 21 September 2018, Thailand had exported 8.22million tons of rice, up to 2.9% on year earlier levels. The amount was worth 135 billion baht, up 13.6% year on year (Arunmas, 2018). Thailand is one of the biggest export rice country, in the meantime, Thailand is facing a major challenge, that is herbicide use. The more export means the more increase of herbicides use. Demanding of agriculture products leads laborers overuse herbicides. The benefits of herbicides use not only can increase food production, prevention of diseases, it can let human stay away from some toxic insects and reduce the amount of time required to manually remove weeds and pests from fields. So that farmers use a lot of herbicides, and it is also harmful for human, it can arise serious symptoms, even die (Sharma, Parmar, & Solan, 2012).

This study wants to figure out the association between demographic characteristics and acute symptoms of herbicide exposure, there are many reports shows age, gender, education, family status, self-behavior, BMI (Body Mass Index) relate with acute symptoms (Jørs et al., 2006; Ncube, Fogo, Bessler, Curtis, & Pauline, 2011). There are few studies shows farmer's income is not significant with acute symptoms of herbicide exposure (Mahaboonpeeti et al., 2018). Except demographic characteristics, this study aims to figure out association between farming

characteristics and acute symptoms. Including the length of farmer experience in agriculture and size of farmland farmers work. Working hours per week, working time. Furthermore, this study uses Knowledge Attitude and Practice (KAP) questionnaire to know the knowledge level of rice farmers. Besides, there also are herbicide exposure amount of use associations with acute symptoms, including herbicides handling frequency, farmers' handling equipment such as backpacker sprayer and manual sow (Mahaboonpeeti et al., 2018), and personal protection equipment (PPE) use. Research choose farmers used 3 type of herbicides glyphosate, paraquat, 2,4-D, these are the most imported products and he most common use herbicides in Thailand, there are many reports and researches about herbicide use and acute symptoms in Thailand, and acute symptoms happened on farmers (Milidrag et al., 2018). However, there are no previously published studies on herbicides use and acute symptoms among farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

Suphan buri Province is one of the main paddy rice production provinces in Thailand, and amount of using herbicide is the problem in this province. There are 10 districts in Suphan Buri province, Song Phi Nong district has 365 square kilometers area, and 68 villages include 20200 households (Suphanburi Provincial Agriculture Extention Office, 2018) Subdistrict Song Phi Nong subdistrict has 12,894 people("Song Phi Nong District Porpulation in 2013," 2013), which has one of the

most rice production places and farmers live places, so that this study focused on this area.

## 1.2 Research questions

a) What is the prevalence of each acute symptom related to herbicide use on farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand?

b) Is there an association between demographic characteristics and acute symptoms of herbicide exposure on farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand?

c) Is there an association between farming characteristics and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand?

d) Is there an association between herbicide exposure and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand?

## 1.3 Research Hypothesis

a) There is an association between demographic characteristics and acute symptoms of herbicide exposure on farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

b) There is an association between farming characteristics and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

c) There is an association between herbicide exposure and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

## 1.4 Objective

a) To figure out prevalence of each acute symptom on farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

b) To describe an association between demographic characteristics and acute symptoms of herbicide exposure on farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

c) To find an association between farming characteristics and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

d) To find an association between herbicide exposure and acute symptoms of herbicide exposure in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.



## 1.5 Operational definition

### 1.5.1 Independent Variables

**Demographic characteristics**

a) Age: famer age, this study focuses on adults whose age are more than 18 years old till 60 years old paddy farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand. Age of farmers was divided into different range groups, 18-30 years old, 31-40 years old, 41-50years old, and 51-60 years old.

b) Gender: farmer's gender, both male and female

c) Education: the level of education, classified into uneducated, primary school, secondary school, college graduate, bachelor's degree or higher

d) Family status: family members of farmers, and number of main rice farmers, if there are more than 1 farmer in one household, researcher used lottery

randomly selection one and interview this selected farmer.

e) Self-behavior: farmer smoking and drinking behavior during using herbicides.

f) BMI: body mass index, different BMI has different herbicide exposure(Jørs et al., 2006).



**Farming characteristics**

a) Famer experience: the years of working as a famer.

b) Working hours: hours of farmer work per day.

c) Work time: time when farmers go out to apply herbicide, early morning, morning, afternoon, evening.

d) Size of farmland: the size of farmers handling herbicides (glyphosate, paraquat,2-4D) per time.

e) Knowledge attitudes and practice: the knowledge attitudes and practice when farmers handling, storing and applying herbicides.

**Herbicide exposure amount of use**

a) Type of herbicides: the herbicide rice farmer uses and acute symptoms arising after using each of Glyphosate, Paraquat,2-4D.

b) Herbicides handling equipment: use backpacker sprayer, hand sprayer, manual sowing or others.

c) Herbicide handling frequency: frequency of farmers loading, mixing and spraying herbicides per month.

d) PPE use: use personal protective equipment, such as sleeve, gloves, boots, hats and so on to protect themselves from contacting with herbicides.



1.5.2 Dependent variable

Herbicides exposure acute symptoms connote illnesses arising after applying herbicides, it is normally a short duration, rapidly progressive and in need of urgent care, this research wants to figure out acute symptoms related with three most common use herbicides within 7 days (Bernstein, 2017; Milidrag et al., 2018; Taneepanichskul, 2012).

The ingestion of glyphosate, paraquat and 2,4-D may occur accidentally when farmers handling herbicides. The use of a spill sprayer by a famer with severe extensive dermatitis probably resulted in serious absorption of glyphosate, paraquat, 2,4-D through the damaged skin. A number of studies have demonstrated the hazard from splashing of concentrated glyphosate, paraquat and 2,4-D that come into contact with skin and eyes, result skin rash or ocular damage like blurred vision, lacrimation and so on. As for inhalation route, the inhalation of droplets in herbicide spraying does not appear to represent a significant health hazard, and the effects of occupational inhalation have possibility to *dyspnea*, wheezing, etc (Denpong, 2010). All of acute symptoms after handling herbicides, glyphosate, paraquat, 2,4-D are classified as follows

*Skin Symptoms*

*-Skin rash/ itching/burning*

*-Numbness/tingling of hands*

*-Muscular twitching and cramps*

*-Bleeding*

*Eye Symptoms*

*-Blurred vision*

*-Lacrimation*

*-Irritation/itching/inflammation*

*Central Nervous System*

*-Headache/dizziness*

*-Drowsiness*

*-Irritability*

*Respiratory System*

*-Wheezing*

*-Dyspnea*

*-Shortness of Breath*

*Gastrointestinal System*

*-Vomiting/Nausea*

*-Anorexia*

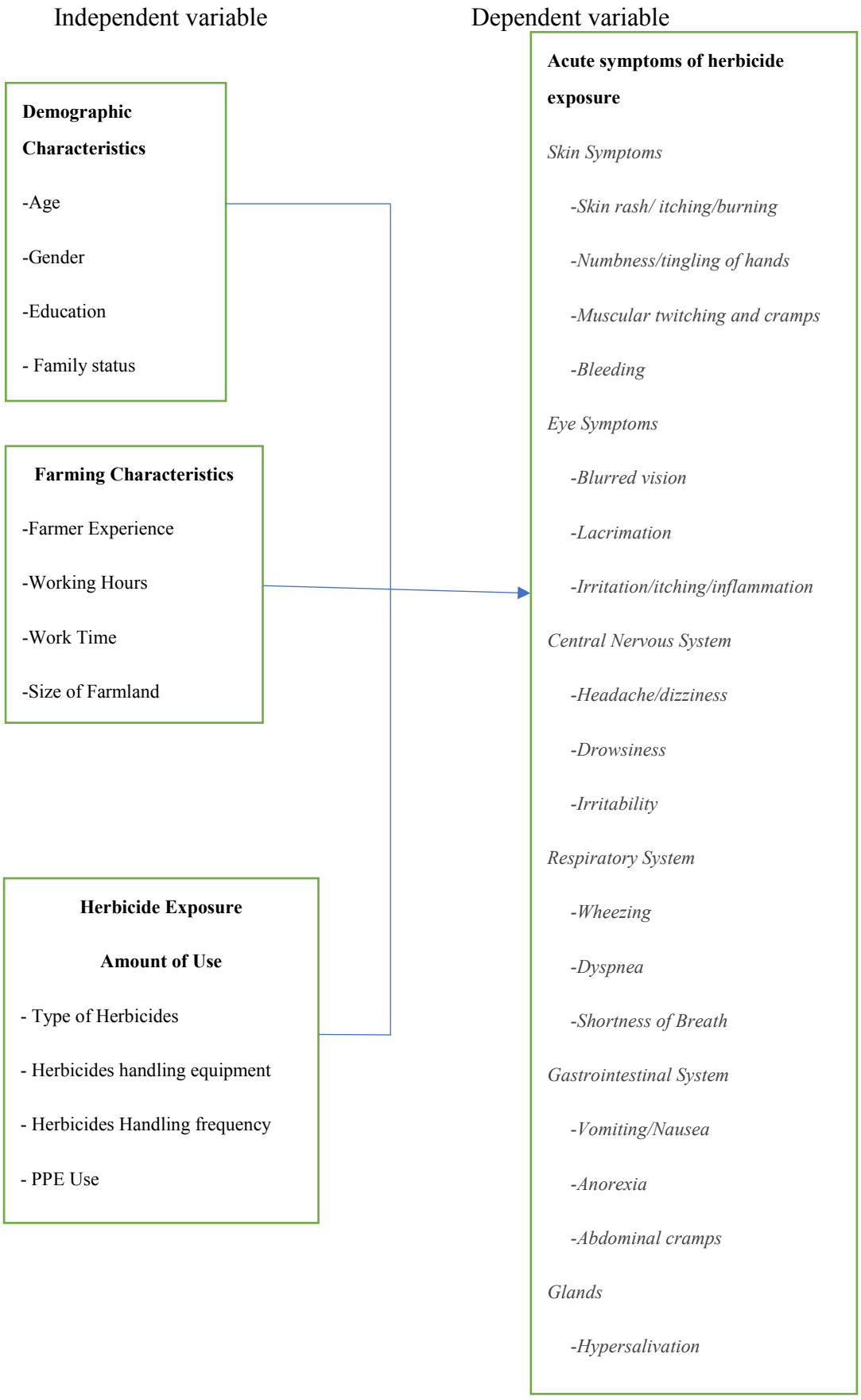
*-Abdominal cramps*

*Glands*

*-Hypersalivation*

*-Sweating*

## 1.6 Conceptual framework



## 1.7 Expect benefits

This study is about the acute symptoms arising from application of herbicide among rice farmers in in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand. There are three routes to get acute symptoms when handling herbicides or applying herbicides, and the most common route is dermal route. So that the expected benefit of this study as follows:

a) This study may help ministry of agriculture of Thailand to know the situation of their acute symptom arising from herbicides use and the knowledge attitude and practice of rice farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand as a baseline data.

b) This study can help access the measures taken by the farmers to avoid foreseen complications arising from improper ways of herbicide used during the application of herbicides.

c) It also can help people to clearly understand the acute symptoms arising from the use of herbicides and the methods the farmers use to overcome these consequences through informing farmers during investigation, research told farmers the correct answer of knowledge attitude and practice after finishing interview.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Agriculture in Thailand

Agriculture in Thailand have a very high potential developing trend(Bureau of Plant and Agricultural Materials Control, 2017), there are 2 well - known industries in Thailand, tourist industry and agriculture. Thailand rice is famous in the world, eapecially in china. Thailand is the top 2 provider of chinese imported rice, 60% of Thailand's 13 million farmers growing it on fully half of Thailand's cultivated land. Agriculture production as a whole accounts for an estimated 9% - 10.5% of Thai GDP in 2014, now it increased , one of the reason is China government and Thailand government signed a contract which ask for an enormous quantities of rice. Hence, the more demand the more rice productions, the more herbicides use. Farmers is the major and direct victim. Most of farmers always use overdose herbicide on the farmland, one of the reason is lack of education, short knowledge of herbicide, farmers do not have chance to get high education and they usually stay in rural areas, there are not standard living life like urban city, not only the medical condition but traffic condition, some of them can not get urgent care after getting exposed by herbicides, acute symptoms could transform to be chronic symptoms if without concerning on it. In addition to unconcern of reading labels before using herbicides, farmers used to appling herbicide by their experience, it could get serious symptom, especially when they overuse mix ingredient (Tawatsin, Thavara, & Siriyasatien, 2015). Forty percent of the population work in agriculture-related jobs

("Thailand Agriculture Chemical Products Import Quota," 2011). A number of the health and hazardous working conditions investigate were significantly different from farm type, rice farmers were found to have the highest prevalence of acute symptoms after pesticide use (Ratana & Sakorn, 2013).

## 2.2 Pesticide use in Thailand

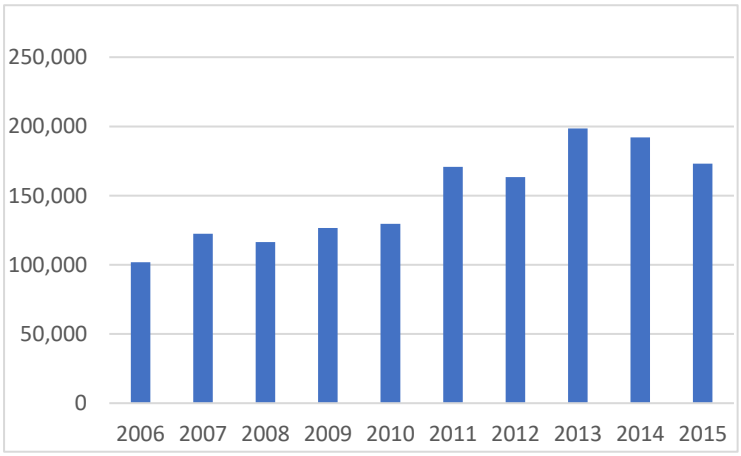



Fig.1. Quantity of pesticide imports in Thailand from 2006 to 2015

Source: The Customs Department of the Kingdom of Thailand (2015)

Fig 1 it can be seen that, there was increasing trend of pesticides imported from 2008 to 2013 and decrease from 2014, this data include herbicide imports, herbicides were the major pesticide with the highest proportion of import followed by insecticides and fungicides (Jørs et al., 2006).

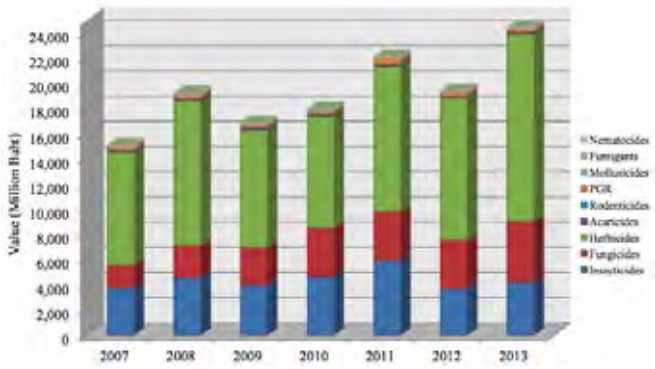



Fig 2. Value of imported pesticides into Thailand,2007-2013 (Phuong, 2016)

Fig 2 shows that farmers in Thailand paid a large amount of money for the imported pesticides, from 14,000 million Baht in 2007 to approximately 24,000 million baht in 2013. There were at least 9 types of the imported agriculture chemicals including herbicides, insecticides, fungicides, acaricides, rodenticides, plant growth regulator (PGR), nematicides and fumigants. The main amount of money are herbicides which imported 8,840-14,870 million Baht annually, insecticides imported 3,600-5,900 million Baht annually, and fungicides imported 1,800-4,800 million Baht annually. Herbicides imported value is increasing till now, most of herbicides are imported, there still some local manufactures of herbicides, however, the main market is imported herbicides in Thai market.

Table 1 top 10 herbicide use in Thailand, 2017 (Chetanasen et al., 2017)

| Number | Trade name | Quota(kg) | Value(baht) | Essence(kg) |
|---|---|---|---|---|
| 1 | glyphosate-isopropyl ammonium | 59,852,230 | 3,283,750,035.84 | 30,349,614.47 |
| 2 | paraquat dichloride | 44,501,340.20 | 3,816,070,962.33 | 17,153,131.40 |
| 3 | 2,4-D-dimethylammonium | 9,831,128.46 | 616,667,138.61 | 8,258,147.91 |
| | | | | |
| 4 | atrazine | 4,833,174.01 | 592,198,635.43 | 4,085,977.00 |
| 5 | ametryn | 4,495,505.70 | 716,911,651.87 | 3,354,814.56 |
| 6 | 2,4-D-sodium | 3,460,564.00 | 332,380,276.78 | 3,287,535.80 |
| 7 | diuron | 3,922,033.80 | 656,024,882.53 | 3,137,627.04 |
| 8 | propineb | 3,733,675.00 | 791,722,021.43 | 2,946,235.00 |
| 9 | chlorpyrifos | 3,324,805.80 | 607,459,054.31 | 2,802,150.13 |
| 10 | mancozeb | 2,773,214.60 | 284,319,239.74 | 2,218,571.68 |

Table 1. shows the top 10 pesticides use in Thailand, from 1 to 7 are herbicides, glyphosate, paraquat,2-4D is the main 3 herbicides use in Thailand. No.8 and No.10 are fungicides, while No.9 is insecticide. Herbicide is the most often use in agriculture, quantity of import is also increasing till now, which means the more amount of herbicides used in agriculture, that is the serious problem we should focus on.

Because of toxication and overuse glyphosate and paraquat, Thailand government issued documents to reduce these two herbicides use on 8th Oct 2018. Herbicide has a large marketing in Thailand, most of them are imported from other countries, furthermore, quantity of herbicide use is a vital problem in Thailand, farmers is directly victim when they are

mixing, loading and spraying herbicides. So that figure out what symptoms can be occur on farmers are very significant.

## 2.3 Demographic characteristics

### 2.3.1 Age and gender

Previous studies (Milidrag et al., 2018) have been found that most of agricultures are male, female can resist less than male (Larry et al., 1997). Meanwhile, when spraying herbicide, most of time let male do it, because of female's immunity is weaker than male's. farmers are rice farmers who age over 18 years old till 60 years old is the Thailand retirement age (Detsiri, 2017) and live in Song Phi Nong subdistrict, Song Phi Nong district, Suphan buri Province, Thailand.

### 2.3.2 Education

From previous study (Brumby, 2018), agriculture workers record higher incidences of injury, illness and work-related death than most other industries. Education is important to improve health, safety and well-being of farmers. Lack of education level could have problem for farmers to read herbicides label recommendations. Meanwhile, rural Australians experience poorer health outcomes than their urban counterpats related with herbicide exposure, without education, farmers may get high risk from herbicide exposure, they may not know the knowledge of herbicides, different types of herbicides, could cause different acute symptoms, and properly using herbicides and applying protective equipment (PPE) could reduce risk of herbicides exposrue. Farmers maybe followed experience instead of label recommendation. Moreover, apply not properly ways to protect themselves from herbicide

exposure. There was a report (Sarah, 2018) suggested farmers should get trained by government or NGOs before using herbicide, in real situation of study area, there was no traning. Most of farmers did not have good education, some of them maybe do not know the meaning of different colors on the bottle of herbicide, can affect high exposure of it (Tawatsin et al., 2015).



### 2.3.3 Family status and Body Mass Index

From literature review (Wachiraporn, 2012), main workers in agriculture of each family could undertake whole family economics, and get more exposure by herbicide than other members, which results more posibility risk. This study selected 1 main rice farmer of 1 household. Few reports show the association between body mass index, because of different height and weight has possibility contact with different body (Taneepanichskul, 2012). Researcher asked participants height and weight by verbal answer to calculate BMI index.

### 2.3.4 Self-behavior

One study (Damalas & Eleftherohorinos, 2011) shows farmers' personal behavior is also associated with acute symptoms, meanwhile, it could be confoundings as well, smoking can also relate to itchy eyes, dyspnea, wheezing, farmers used to have meals or drinks in farmland or very close to farmland. The exposure of farmers increases in the case of not paying attention to the instructions on how to use the pesticides and particularly when they

ignore basic safety guidelines on the use of personal protective equipment and fundamental sanitation practices such as washing hands after herbicide handling or before eating.

Smoking and drinking are included in farmers activities, if they smoking or drinking during working can get high exposure of herbicides. moking refers to the smoker and non-smoker paddy farmers while loading, mixing and spraying herbicides. Drinking refers to the paddy farmers drinking or non-drinking while loading, mixing and spraying herbicides.



## 2.4 Farming characteristics

### 2.4.1 Farmer Experience

Experience of farmers is also important (Banjo, Aina, & Rije, 2010), experienced farmers spent less time in spraying on the same land acreage than apprentices or less experienced persons.Furthermore rice farmers with more experience on using herbicides would get less exposure than apprentice.

### 2.4.2 Time duration break and working hours

It is reported (Sarah, 2018) that farmers rest place usually close to farmland they use herbicides, such as stay under the shade of trees or log cabin near the crop so that got less harm from herbicides than working time.

From reports, different working hours can result different herbicides efficiency o, when it is sunny day, the higher temperature, the less herbicide effect, herbicide was volatilized by

high temperature, meanwhile the windy day could increase the exposure on rice farmers (Wongwichit, Wattasit, & Mark, 2012). The amount of herbicide that is lost from the target area and the distance the herbicide moves increase as wind velocity increases, the faster of speed the more drift. Additionally, farmers who avoid mixing and spraying during windy conditions can reduce the exposure and less chance to get acute symptoms. Whereas substantial exposure to herbicides can also occur when living close to a workplace that used herbicides or even bring home contaminated goods, which may get acute symptoms like dry throat itchy eyes and so on (Damalas & Eleftherohorinos, 2011). Working hours is the time farmers using herbicides, could be early morning, morning, afternoon and evening.



### 2.4.3 Size of farmland

Many reports (Mahaboonpeeti et al., 2018; Wongwichit et al., 2012) proved size of farmland has significant relationship with acute symptoms of herbicide exposure, the bigger size of farmland means the more time and amount of herbicide exposure for farmers.

### 2.4.4 Knowledge Attitude and Practice of Herbicides

There is a report interviewed farmers (Mekonnen & Agonafir†, 2002), researcher let farmers read instruction on agriculture products packages, most of them could not read or understand. An alternative approach could have been that their immediate supervisors would explain the labels on packages to them and urge them to give attention to appropriate safety practices. According to Mr. Jallow's study (Jallow, Awadh, Albaho, Devi, & Thomas, 2017),

farmers are at a high risk of exposure to herbicides through contact with herbicides residues on treated crops, unsafe handling, storage and disposal practices, lack of protective equipment or failure to use it properly. These risks may be exacerbated by lack of information on herbicide hazards, the perception and attitude of farmers regarding risk from herbicides exposure and poor knowledge of risk associated with herbicide, while less educated farmers may be hampered in their ability to understand the hazard warnings on herbicide labels, illiteracy and lack of knowledge on the extent to which herbicides represent a hazard have been considered the most important barriers for the adoption of self- protective behaviors by rice farmers. Knowledge of herbicide need to raise the awareness of the sprayers and bring some attitudinal change towards their conventional practices. As Mr.Mekonnen (Mekonnen & Agonafir†, 2002) noted in their study, farmers reported a greater awareness of safety issues after training and successfully modified their behavior to better protect themselves.

## 2.5 Herbicide Exposure Amout of Use

**Herbicide Concept**

Herbicide is a chemical pesticide designed to control or destroy plants, weeds, or grasses (Fishel et al., 2006). Herbicides tend to have wide-ranging effects on non-target species, it also commonly known as weed killers, are chemical substances used to control unwanted plants. Selective herbicides control specific weed species, while leaving the desired crop relatively unharmed, while non-selective herbicides (sometimes called total weed killers in commercial products) can be used to clear waste ground, industrial and construction sites,

railways and railway embankments as they kill all plant material with which they come into contact. Herbicides exposure designed to the state of being exposed to contact with herbicides when spraying, mixing, loading, transporting herbicides.

### 2.5.1 Type of Herbicides

Pesticides can be grouped according to the types of pests which they kill, there are insecticides, herbicides, rodenticides, bactericides, fungicides and larvicides (Australian Government Department of Health, 2010). Herbicides are used to kill plants, this may be by killing that part of the plant which they touch, killing the plant when they are absorbed into it through the leaves, stems or roots. Besides plants, it is also harmful to human. Different type of herbicides could result different acute symptoms.

According to articles ("Extension Toxicology Network Glyphosate," 1994), there are three most common commercial herbicides and the most often use in agriculture, Glyphosate is a broad-spectrum systemic herbicide and crop desiccant. It is an organophosphorus compound, oral $LD_{50}$ is 4900mg/kg (Fishel et al., 2006), the EFSA review established an overall long-term NOAEL in animals of $1.0\times10^{1}$mg/kg/day, found no genotoxic potential and no evidence of carcinogenicity. The RfD of glyphosate is 0.1mg/kg/day (Bernstein, 2017). Glyphosate is absorbed through foliage, and minimally through roots, and transported to growing points. It inhibits a plant enzyme involved in the synthesis of three aromatic amino acids: tyrosine, tryptophan, and phenylalanine. It is therefore effective only on actively growing plants and is not effective as a pre-emergence herbicide. An increasing number of

crops have been genetically engineered to be tolerant of glyphosate (e.g. Roundup Ready soybean, the first Roundup Ready crop, also created by Monsanto), which allows farmers to use glyphosate as a post-emergence herbicide against weeds. The development of glyphosate resistance in weed species is emerging as a costly problem.



Paraquat ("Extension Toxicology Network Paraquate," 1996) was manufactured by Chevron. This salt is one of the most widely used herbicides. It is quick-acting and non-selective, killing green plant tissue on contact. It is also toxic to human beings and animals due to its redox activity, which produces superoxide anions. It has been linked to the development of both acute and chronic disease and is banned in several countries. Paraquat $LD_{50}$ is 100mg/kg (Fishel et al., 2006). Paraquat is classified as non-selective contact herbicide. The key characteristics that distinguish it from other agents used in plant protection products are:

a. It kills a wide range of annual grasses and broad-leaved weeds and the tips of established perennial weeds.

b. It is very fast-acting.

c. It is rain-fast within minutes of application.

d. It is partially inactivated upon contact with soil.

2,4-Dichlorophenoxyacetic acid ("Extension Toxicology Network 2,4-D," 1993) is an organic compound with the chemical formula $C_8H_6Cl_2O_3$. It is a systemic herbicide which

selectively kills most broadleaf weeds by causing uncontrolled growth in them, but leaves most grasses such as cereals, lawn turf, and grassland relatively unaffected.

2,4-D (Fishel et al., 2006) is one of the oldest and most widely available herbicides and defoliants in the world, having been commercially available since 1945, and is now produced by many chemical companies since the patent on it has long since expired. It can be found in numerous commercial lawn herbicide mixtures and is widely used as a weed killer on cereal crops, pastures, and orchards. Over 1,500 herbicide products contain 2,4-D as an active ingredient. 2,4-D $LD_{50}$ is 666mg/kg (Fishel et al., 2006), 2,4-D is primarily used as a selective herbicide which kills many terrestrial and aquatic broadleaf weeds, but not grasses. It acts by mimicking the action of the plant growth hormone auxin, which results in uncontrolled growth and eventually death in susceptible plants.

It must be noted that some herbicides are harmful. Herbicides such as paraquat and all herbicides bottle with “Danger” signal words on the label and must be handled with great care. Therefore, it is important that all herbicides be handled carefully in a manner consistent with their labeling. Just because some herbicides are less toxic than table salt does not mean that any herbicides should be handled carelessly. On the other hand, using herbicides in accordance with the product label would not often result in personal injury or cause for alarm.

### 2.5.2 Herbicides Handling Equipment

From Mr.Kongtip (Kongtip et al., 2018) reported there are three application of herbicides ways in Thailand. There are two basic backpack sprayers, manual and battery powered

backpack sprayer, there are two type of common use battery powered backpack sprayers in Thailand, 2 stroke gasoline motor and fan and a battery-operated pump. Application of herbicides use shows the significant effect in herbicides exposure.

2.5.3 Herbicides Handling Frequency

A lot of studies show herbicides handling frequency has a significant effect to acute symptoms of herbicide exposure (Milidrag et al., 2018). Farmers who often transport, mix, load and apply formulated pesticides are normally considered to be the group that receive the greatest exposure because of the nature of their work and are therefore at highest risk for possible acute symptoms. In some situation, farmers contact herbicide accidentally in the case of not pay attention to the instructions on how to use the herbicides and particularly when they ignore basic safety guideline (Damalas & Eleftherohorinos, 2011). For example, when they fetch bottles of herbicides, sometimes will contact high concentration and toxic bottle with skin regardless. And that after getting bottles of herbicides or using herbicides, they do not have the habit to wash hands and have meals or drinks, thus, may be harmful for them both from dermal and oral way. People are affected according to the various procedures the herbicides are applied. There are several ways to apply herbicide namely battery-operated pump, two stroke gasoline motor and fan, and manual hand pump in Bangkok, most of farmers use the manual hand pump method to spray. There is high risk when they loading and mixing herbicides.

Storage herbicide properly is significant, spills and leakage can occur when containers are handled, good storage is a vital first step of handle herbicide. Farmers should keep herbicide upright in its original containers and locked in a separate location and inspect containers periodically for leaks and spills.

Mixing herbicides is more likely to be spilled, additional care needs to be practiced avoiding accidental spills. Operators should wear appropriate personal protective equipment while mixing pesticides and follow all instructions on the pesticide label. Safe mixing advice: Always read and make sure you understand label instructions for mixing before opening pesticide containers (*Safe and Effective Pesticide Use a Handbook for Commercial Spray Operators*, 2002). Farmers should wear recommended PPE when mixing pesticides and use appropriate utensils when transferring pesticides between containers and application equipment. Containers should measure volumes of concentrate accurately and allow the transfer of pesticides without spilling. Meanwhile measure and mix pesticides on a stable surface and at a comfortable height. Farmers should mix in an area with an impervious floor well-ventilated and well-lit area is needed which allows for spills to be cleaned up, not in an area where a spill could run into a storm water drain or waterbody. Using clean water for mixing is also necessary, because poor quality water can reduce pesticide performance. Farmers should not work alone if the pesticide is highly toxic. When they do mix should not combine products unless label instructions state it is appropriate to do so. Only prepare the volume of mix needed to complete the task. This avoids having to store or dispose of unused

portions (*Safe and Effective Pesticide Use a Handbook for Commercial Spray Operators*, 2002).

loading herbicides need to be careful about leaking and spilling, loading herbicide should be very careful because of high concentration of herbicide, once herbicide spilled, it is very dangerous for human, it is original herbicide while if contact with skin can make skin burning, skin irritation, there would be itching, redness swelling of skin, farmers should wear properly PPE, such as gloves, goggles. After loading, no matter it is spilled or not, farmers should do clean, rinse their equipment and PPE thoroughly, and wash their hands, eyes, be sure to shower when return home with tepid water and lots of soap (Alston, 2000).

Spraying herbicide, there are three ways to spray, there are most common spray method in Thailand, use 2 stroke gasoline motor and fan or a battery-operated pump or manual spray (Jørs et al., 2006).

Transporting herbicide Before buying or using herbicide, farmers should check whether it is leaking or not, while when transporting herbicides, care must be taken to protect users, other people and surroundings. Container of herbicide must be secure while in transit and during short-term storage at mixing sites. When transport herbicides, making sure wearing gloves or other protect equipment. Keeping a spill kit and absorbent material is also useful to prevent farmers.

In some situations, exposure to pesticides can occur from accidental spills of chemicals, faulty spraying equipment or leakages (Damalas & Eleftherohorinos, 2011).

Farmers personal behaviors drinking alcohol may also affect with exposures, such as smoking can cause coughing and vomiting, drinking alcohol can result in diarrhea(Banjo et al., 2010).

### 2.5.4 Personal Protective Equipment Use

Many studies emphases important for farmers to use Personal Protective Equipment (PPE) properly when handling herbicides. PPE is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses (Murph, 2012). Personal Protection Equipment is safety equipment and clothes use to keep human stay away from hazard and exposure, all end-use occupational use products must have the minimum baseline handler PPE of long-sleeved shirt, long pants and socks and shoes. Herbicides can pose hazards to humans. The severity of a harmful effect or poisoning depends on the herbicide's chemical makeup and formulation, its path into the body, the amount that enters the body, and the length of exposure. Wearing Personal Protective Equipment, or "PPE", can greatly reduce the potential for dermal, inhalation, eye, and oral exposure, and thereby significantly reduce the chances of a pesticide poisoning.

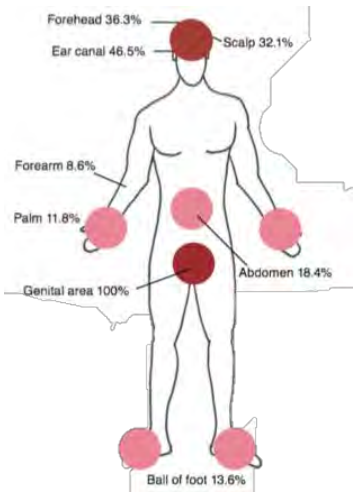



Fig3.Herbicide(%) absorbed by different parts of the body in 24 hours (Hollyer et al., 2014).

Fig 3 shows the percentage of the different parts of the body in 24 hours, the genital area is very vital protection part because of 100% absorbed probability, and head is also essential part likelihood from 32.1% to 46.5%, other parts have lower rate.

Head, arms, legs, abdomen and genital area are the mainly protective parts, once them contact herbicides got different percentage of hazard, the highest damage one is genital area, follow by head. Which are very harmful for human. Hence protection equipment is necessary for workers.

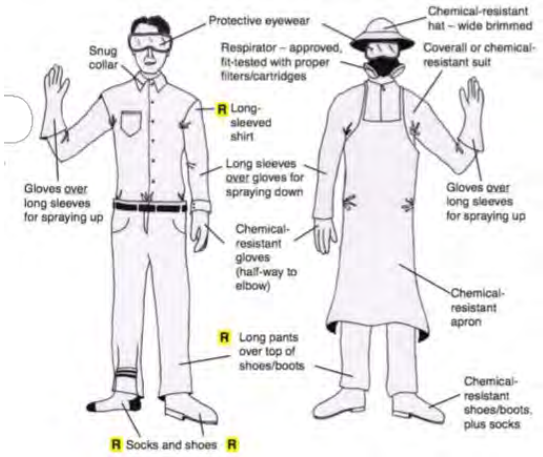



Fig 4. properly personal protective equipment (Hollyer et al., 2014)

Fig 4 is properly personal protective equipment of American standard, left one is inside of the right one, properly PPE include protective eyewear, chemical-resistant hat, respirator, long sleeved shirt, chemical-resistant suit, chemical-resistant gloves, long pants, chemical resistant boots and socks. Above are examples of PPE, four items marked with R are required for most herbicide applications.

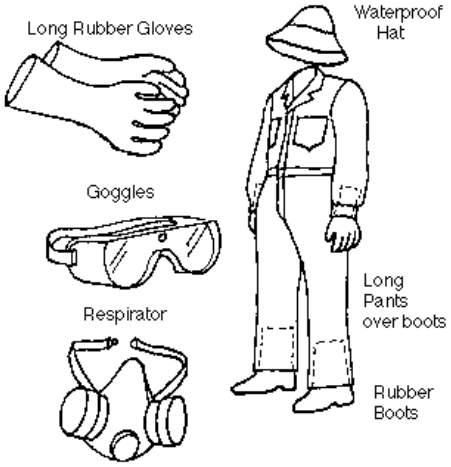



Fig 5. simple equipment (Ekarat, 2013)  Fig 6. Song Phi Nong subdistrict farmer.

Fig 5 is simple equipment fit for rice farmers in Thailand because of different culture and economic situation. Properly use protective equipment is important, some of farmers use clothes to be hat and respirator in Fig 6. It is better if farmers wear properly PPE as follows for reducing herbicide exposure when they are handling herbicides.

- Chemical resistant hat

- Goggles

- Respirator

- Waterproof apron

- Waterproof long sleeve shirt

- Waterproof gloves

- Waterproof long pants

- Waterproof boots

## 2.6 Acute symptoms of herbicide exposure

Glyphosate ("Extension Toxicology Network Glyphosate," 1994) is moderately toxic herbicide which can cause significant eye irritation. The acute oral $LD_{50}$ in the rat is 5600mg/kg. In a number of human volunteers, patch tests produced no visible skin changes or sensitization.

2,4-D ("Extension Toxicology Network 2,4-D," 1993) the oral $LD_{50}$ in the rat ranges from 375 to 666mg/kg; Symptoms of 2,4-D can be nausea, vomiting, eye irritation, headache, dizziness, and short of breath.

Paraquat ("Extension Toxicology Network Paraquate," 1996) is highly toxic via ingestion, with reported oral $LD_{50}$ values of 110 to 150 mg/kg in rats. It causes skin and eye irritation and also has caused skin sensitization in some formulations. If swallowed, burning of the mouth and throat often occurs, followed by gastrointestinal tract irritation, resulting in abdominal pain, nausea, vomiting, and diarrhea. Other toxic effects include thirst, shortness of breath. Some symptoms may not occur until days after exposure. Persons with lung problems may be at increased risk from exposure. So that this study excluded farmers who has skin disease, diabetes, hypertension, thyroid, and cardiovascular disease. Many cases of illness and/or death have been reported in humans. The estimated lethal dose (via ingestion) for paraquat in humans is 35 mg/kg. A maximum of 3.5 mg/hour could be

absorbed through the dermal or respiratory route without damage. Early symptoms of acute symptoms nausea, diarrhea, hyper salivation, abdominal cramps, sweating, muscular twitching and cramps, blurred vision, shortness of breath.

The symptoms (Sharma et al., 2012) caused by these three herbicides to the human body include vomiting, nausea, itching eyes, itchy skin, blurred vision, stomach cramps, diarrhea, faintness or dizziness, headaches, numbness, tingling in parts of body, burning skin, skin irritation, dry throat, coughing, difficulty breathing.



## 2.7 Route of exposure

There are three routes (Institute of Medicine, 2011)of entry for the herbicides into the human body: 1) Inhalation, through the respiratory pathway. 2) Dermal, entry into the eyes or the skin by unintentional contact with herbicides. 3) Ingestion might be hand-to-mouth activity and consumption of foodstuff and water contaminated with herbicides.

Inhalation of herbicides can cause significant damage to the respiratory system cause chronic disease like lung disease or acute symptoms (Ekarat, 2013), wheezing, dyspnea, shortness of breath, or glands symptoms such as hypersalivation and sweating. Particularly hot weather and windy, could accelerate particle evaporating and spreading velocity respectively.

Dermal (Ratana & Sakorn, 2013) could cause skin symptoms, eye symptoms, such as skin rash, itching, eye inflammation, lacrimation and so on. When herbicides come in touch with the eyes or skin, the chemicals get absorbed simultaneously into the dermis. There can

be a massive burning and sense of irritation sensation. When in contact with more diluted chemicals the burning sensation is much lesser. What is more central nervous system could be affected as well such as headache, dizziness, drowsiness etc.

Ingestion (Institute of Medicine, 2011) was reported to happen hand-to-mouth activity and consumption foodstuff and water contaminated with herbicides. There are many articles (Damalas & Eleftherohorinos, 2011; Saowanee, Wattasit, Sumana, & Mark, 2018) illustrated farmers' self-behaviors, smoking and drinking during using herbicides has possibility to ingest herbicides unintentionally. Furthermore, intaking herbicides is hazardous as would result in life-threatening illness and some critical diseases, if herbicide swallowed could result massive injuries. These herbicides can cause remarkable hazards to the mankind.

# CHAPTER 3

# METHODOLOGY

## 3.1 Research Design

This research was a cross-sectional study. The purpose of this study was to study the health problems of farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand.

## 3.2 Population and sample

### 3.2.1 Population

This research focused on rice farmers in Song Phi Nong Subdistrict, Song Phi Nong District, Suphan buri Province, Thailand. Suphan buri had 849,053 populations, Song Phi Nong subdistrict had total 127,411population, Song Phi Nong was subdivided into 15 subdistricts, which were further subdivided into 140 administrative villages. Song Phi Nong subdistrict had 12,894 populations, and the main industry was agriculture, there were 20200 households and 199 families are farmers in Song Phi Nong subdistrict, research randomly selected 133 families by using lottery of list at health promoting hospital. Hence, the household separated by 2 groups, selected and no selected group. while there were ineligible participants in 133 selected households, then researcher changed to randomly chose other no selected household to instead.

### 3.2.2 Sample size

Sample of study was the rice farmers live in Song Phi Nong Subdistrict Suphan buri district, central of Thailand.

Formula $n = \frac{N}{1+Ne^2}$

n: sample size

N: total rice farmers of Song Phi Nong Subdistrict Suphan buri district,199 families

e: margin of error,0.05

n=133 families

because unit of rice farmers was family, researcher choosed one of rice famer per family, if there were 2 or more main rice farmers in one family, this study used lottery choose one of them.

## 3.3 Inclusion and exclusion criteria

**Inclusion Criteria**

- Rice farmers who worked or lived in Song Phi Nong Subdistrict, Song Phi Nong district, Suphan buri Province, Thailand.

-Rice farmers age between 18-60 years old, Both male and female.

-Willing to participate investigation rice farmers.

**Exclusion Criteria**

-Farmers never used one of three herbicides, glyphosate, paraquat and 2,4-D.

-Rice farmers who had skin disease, diabetes, hypertension, thyroid, cardiovascular disease. Because this study focused on acute symptoms within 7days, underlying disease could be confounder.

-Rice farmers who had speaking disability and cannot understand words meaning.



## 3.4 Sample Design

There were 3 main rice production area, northern, central and northest in Thailand. Central Thailand mainly paddy rice area is Suphan Buri province, the good geographical advantage made Suphan buri Province be the main rice production province. While Song Phi Nong District is one of the most population from 10 districts in Suphan buri Province ("Song Phi Nong District Porpulation in 2013," 2013). It has12,894 people and 365 square kilometers area, and 68 villages included 20200 households (Suphanburi Provincial Agriculture Extention Office, 2018), researcher used lottery randomly to choose Song Phi Nong Subdistrict as research site. There were 199 families are rice farmers out of 20200 households. Researcher went to health promote hospital in Song Phi Nong sub district and used lottery randomly to select 66 households on the list of health promoting hospital to be exclude households, and interviewed 133 households on the list of health promoting hospital, if there were not eligible participants, researcher interviewed other people of exclude households.

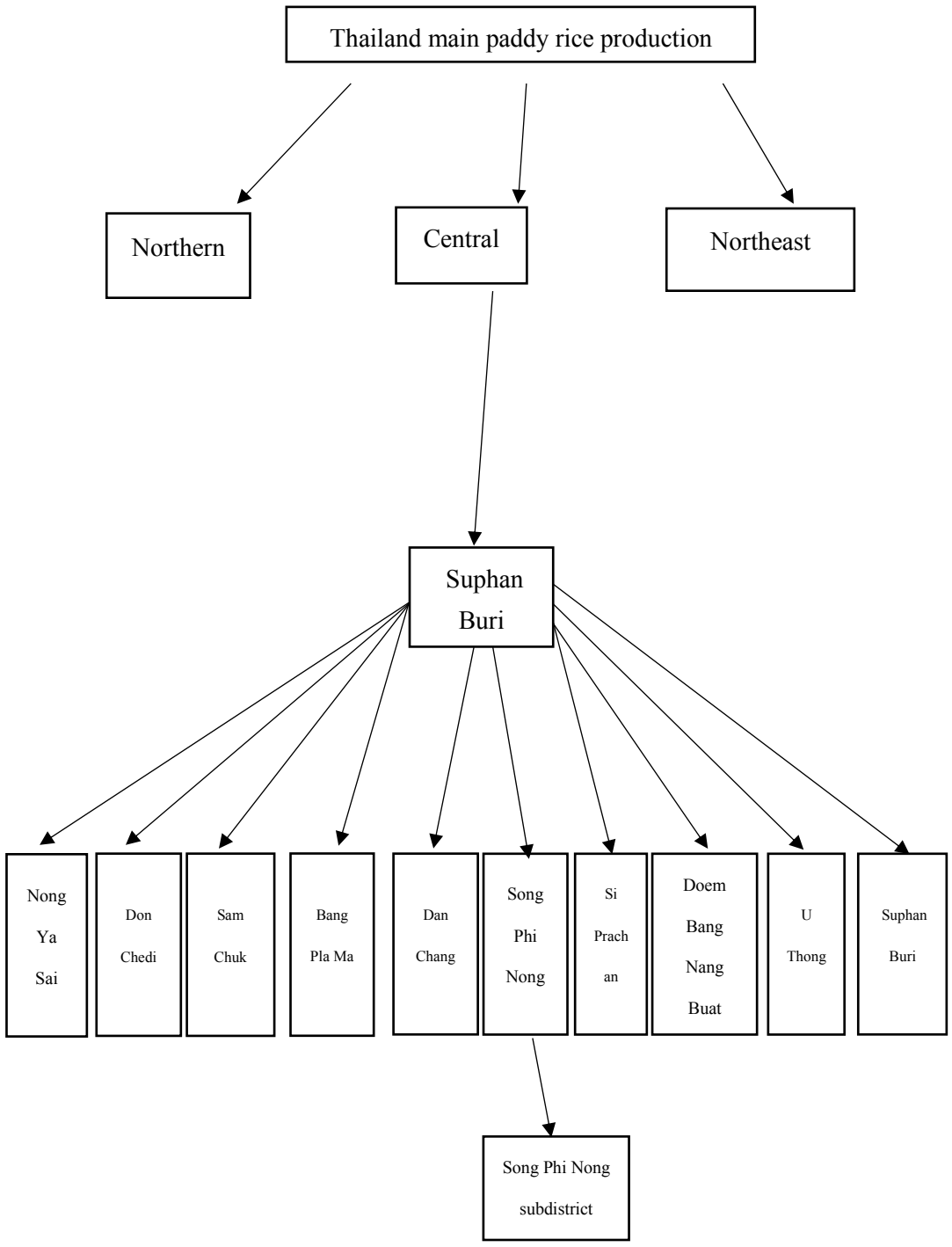



Fig 6.1 Song Phi Nong district tree diagram

3 main rice production areas respectively were northern, central, northeast. Suphan buri province was the main rice production and export province in central area, it composed by 10 districts, Song phi nong is one of the most population district, Song Phi Nong Subdistrict was randomly chosen by lottery. There were 140 administrative villages in this subdistrict. And total households were 199 households in this area.


Fig 6.2 Song Phi Nong district location on google map

This study researched in Song Phi Nong subdistrict, from Fig 6.2 Suphan buri district located the north of capital city, it is one of the main paddy rice production subdistricts in Suphan Buri Province.

Fig 7. Researcher interviewing participants at Song Phi Nong subdistrict

Researcher interviewed one of Song Phi Nong subdistrict rice farmer, during investigation research found there were more than one main rice farmers in one household, so that used lottery randomly chose one rice farmer to interview, besides, there were ineligible rice farmers of whole household, researcher interviewed eligible participants of 199 households in Song Phi Nong subdistrict.



## 3.5 Measurement Tool

In this study a questionnaire was design in Thai language and was checked by 2 Thailand experts who were professional in agriculture field. The questionnaire included closed and open questions and pre-test by randomly interview 30 rice farmers in Ban Mo district, Sara Buri province, Bangkok. Result did not include pre-test data. The closed questions were in a multiple-choice format so that interviewer can select more than one answer. There were four parts of questionnaire.

Part 1 Demographic Characteristics composed of age, gender, education level, family status, self-behavior and body mass index, moreover BMI asked participants by verbal answer.

Part 2 Knowledge and attitude, there were 5 items in this part. Farmer experience, time duration break, working hours, size of farmland and knowledge attitude and practice. The knowledge attitude used previous questionnaire (Saowanee et al., 2018) to observe knowledge level of rice farmers. Knowledge part had 6 questions, a correct answer was given 1 score and 0 score for wrong answer. The scores were varied from 0-6 points and classified into 3 levels used bloom's cut off pint (Yimer, Abera, Mulu, & Bezabih, 2013) as follows on

table 3.5.1. Attitude used Likert's scale (McLeod, 2008) as Table 3.5.2 to express how much they agree or disagree with a particular statement, while scores was classified by Mean ± SD into 3 levels as Table 3.5.3.

Part 3 Herbicide Exposure Amount of use, there was yes or no type to measure PPE use. Then used open questions to know handling equipment and frequency. There were 7 questions of practicing herbicides, practice part was classified by Mean into 2 levels (Yimer et al., 2013). To describe 8 statements of herbicide practicing frequency research followed the previous study (Saowanee et al., 2018) showed on Table 3.5.4. the score was summed up from 7 to 28 as Table 3.5.5.

Part 4 Acute Symptoms of Herbicide Exposure was classified into 6 parts and used yes or no type to figure out acute symptoms of farmers after using herbicides. Symptoms. Respondent can choose multiple answers because herbicide exposure could happen on many systems of body.

This questionnaire used previous questionnaire("Cwend GeoHealth Hub for Occupational and Environmental Health Research in Southeast Asia (SEAsia) ", 2018). What is more, this study used questionnaire of chili farmers' KAP (Saowanee et al., 2018) to evaluate farmers knowledge attitude and practiced which exist in part 2 and part 3.

Table 3.5.1 levels of knowledge

| Scores | Descriptions |
|---|---|
| 0-4 (less than 60%) | Low level |
| 4.8 (60%-80%) | Moderate levels |
| 6 (91%-100%) | High levels |

Table 3.5.2 statement of Likert's scale

| Positive statement | | Negative statement | |
|---|---|---|---|
| Choice | Scores | Choice | Scores |
| Strongly agree | 5 | Strongly agree | 1 |
| Agree | 4 | Agree | 2 |
| Neural | 3 | Neural | 3 |
| Disagree | 2 | Disagree | 4 |
| Strongly disagree | 1 | Strongly disagree | 5 |

Table 3.5.3 levels of attitude

| Scores | Descriptions |
|---|---|
| 29 - 46 | Not concern attitude |
| 47 - 60 | Neutral attitude |
| 61 -70 | Concern attitude |

Table 3.5.4 statement of herbicide practicing frequency

| Positive statement | | Negative statement | |
|---|---|---|---|
| Choice | Scores | Choice | Scores |
| Usually | 4 | Usually | 1 |
| Sometimes | 3 | Sometimes | 2 |
| Rarely | 2 | Rarely | 3 |
| Never | 1 | Never | 4 |

Table 3.5.5 levels of herbicide practicing frequency

| Scores | Descriptions |
|---|---|
| 17-25 | Poor practice |
| 26-28 | Good practice |

## 3.6 Validity and Reliability

This study used the same questionnaire to do pre-test in Lak Si district, Bangkok, and face to face interview 30 rice farmers.

The questionnaire was validated by three professional experts and committee members, this questionnaire for acute symptoms were prepared and modified by literature reviewing on previous studies relevant to this study. This questionnaire which were taken from already validated questions in previous literature and pre tested at Moo Ban 4, Sara Buri province, all questions were revised item objective congruence (IOC) by three professionals' experts. After validating the questionnaires, IOC scores by three experts was summed up and divided by three. The total question was 0.88 and revised according to committee members and other experts' comments and advice. Each question was more than 0.5.

This questionnaire was matched with the conceptual framework, and interviewed 30 participants at Moo Ban 4, Sara Buri province. Data was collected and analyzed by Cronbach's Alpha to test the reliability of questionnaire in SPSS vision 22, according to results, results must be more than 0.7 means 70% of the variance in the scores is reliable variance so that some questions were revised or modified after pre-test. while this study got 0.72 reliability of Cronbach's Alpha in SPSS vision 22 after revised questionnaire.

## 3.7 Data collection

This study used face to face interview to ask eligible respondent's questionnaires.

1. Questionnaire wrote in Thai language.

2. The research questionnaire applied for approve from Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University.

3. Researcher took approval form from Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University to request a permission from health promoting hospital in Song Phi Nong Subdistrict, Song Phi Nong Subdistrict, Suphan Buri Province, and illustrate them this study objective.

4. Research took approval documents to health promoting hospital, and hospital arranged one volunteer to take researcher to farmers' households. Total population was 133 families, researcher found there were more than 1 rice farmers in one household during interviewing and used lottery to choose one of them.

5. Before interview, researcher showed participants consent form and made sure they understand. Then after they signed on it, researcher started to interview.

6. During interview, researcher explained every question to participant, and made sure they understand.

7. After finishing interview, participants were informed the corrected information about herbicides handling and recommended the use of PPE by researcher follow the questionnaire knowledge attitude and practice parts.

## 3.8 Data Analysis

This research analyzed data through SPSS (vision 22). Used descriptive statistics analysis data through Mean, SD, Min, Max for quantitative variables to find out associations among demographic characteristics, farming characteristics, herbicide exposure amount of use and acute symptoms of herbicide exposure.

Used Chi square and Fisher's exact test to analyze independent variables and dependent variables data to figure out relation between demographic characteristics and acute symptoms of herbicide exposure, farming characteristics and acute symptoms of herbicide exposure, herbicide exposure amount of use and acute symptoms of herbicide exposure. Besides, researcher used Spearman correlation to find out correlation among KAP.

## 3.9 Ethical Consideration

1. This study was submitted to Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University before proceeding with data collection and got COA No.163/2019.

2. Before participating in the study, researcher informed the objectives of the study, data collection and benefits gained from taking participate in the study.

3. Participants volunteer to the research and signed consent form to researcher.

4. In order to maintain the confidentiality of study subjects, the signed consent form and questionnaires was not disclosed. Information of study subjects would not be revealed or present in public. Furthermore, the information that not related with research was not

disclosed and after the research completed, the data was destroyed by a paper shredder after analyzing.

5. Participants had the right to withdraw from the study at any time without any dam, and the withdraw has no impact on the participants.

# Chapter 4

# Results

This chapter presented a detailed description and association of results obtained from the analysis of survey. Data collection spent 3 days, researcher interview coincided with farmer spraying herbicide, it started with demographic characteristics, described the basic information of rice farmers in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri province, ended with acute symptoms arising after farmer applying herbicides. Researcher asked for consent from every participant, all participants were explained thoroughly about this study. Questionnaires were collected by researcher accompanied with health promoting hospital volunteers use face to face method.

## 4.1 Demographic Information

The total participants are 133 people. Participants in this study composed of both 59 men and 74 women, most of participants were 51 to 60 years old while average age (±SD) was 45.8 ± 10.1, most of them have lower than primary school education (48.9%), participants who finished primary school had 12 persons, majority of farmers did not have much high education level. But they had good behavior, 82% participants did not smoke, what is more, 75.9% participants did not drink alcohol. More than half of participants at Song Phi Nong subdistrict had normal weight (57.9%), average BMI is 24.4± 4.5 kg/m$^2$, additionally, through investigate, research had found Song Phi Nong subdistrict is famous

with marathon race, there are marathon races every year. Whether Participants good BMI related with running habit or not was considerable.

Table 4.1 Demographic characteristics of study population(N=133)

| Characteristics | Number | Percentage (%) |
|---|---|---|
| **Age (year)** | | |
| 18-30 | 15 | 11.3 |
| 31-40 | 23 | 17.3 |
| 41-50 | 45 | 33.8 |
| 51-60 | 50 | 37.6 |
| Mean ± SD = 45.8 ± 10.1 | | |
| Median 48 | | |
| Min 20 Max 60 | | |
| **Gender** | | |
| Female | 74 | 55.6 |
| Male | 59 | 44.4 |
| **Education** | | |
| lower than primary school | 65 | 48.9 |
| primary school | 12 | 9 |
| senior high school | 30 | 22.6 |
| higher than senior high college | 26 | 19.5 |
| **Smoke** | | |
| yes | 24 | 18 |
| no | 109 | 82 |
| **Drink Alcohol** | | |
| yes | 32 | 24.1 |
| no | 101 | 75.9 |
| **BMI ($kg/m^2$)** | | |
| <18 | 4 | 3 |
| 18-24.9 | 77 | 57.9 |
| 25-29.9 | 40 | 30.1 |
| ≥30 | 12 | 9 |
| Mean ± SD = 24.4 ± 4.5 | | |
| Median 23.7 | | |
| Min 17 Max 50 | | |

## 4.2 Farming Characteristics

Rice farmers with 10 – 25 years was the majority participants (36.8%), only 5 people had experience more than 40 years; 78.2% farmers used to work during morning 12pm - 12am and worked around 10 – 25 hours per week, while average work hours were 27.6 ± 17.8, most of farmers had 10 – 25 rais farmland, 24.2 rais were average farmland of all participants, according to summarize scores of knowledge attitude and practice of herbicides, knowledge of herbicide level of rice farmers were low level (38.3%), moderate level (28.6%), high level (33.1%); attitude were divided into three parts, not concern attitude (11.3%), neutral attitude (29.6%), concern attitude (39.1%); Even rice farmers had lower knowledge and attitude of herbicides, they had good practice (89.5%).), only 8.3% and 2.3% participants were fair practice and poor practice respectively.

Table 4.2 Farming Characteristics

| Characteristics | Number (N=133) | Percentage (%) |
|---|---|---|
| **Farmer Experience (year)** | | |
| <10 | 35 | 26.3 |
| 10-24 | 49 | 36.8 |
| 25-40 | 44 | 33.1 |
| >40 | 5 | 3.8 |
| Mean ± SD = 21.59 ± 12.0 | | |
| Median 20 | | |
| Min 1 Max 50 | | |
| **Work Time** | | |
| 12pm-12am | 104 | 78.2 |
| 12am-5pm | 3 | 2.3 |
| 5pm-12pm | 2 | 1.5 |

Table 4.2 Farming Characteristics conti.

| Characteristics | Number N=133 | Percentage (%) |
|---|---|---|
| Work Hour per Week | | |
| <10 | 28 | 21.1 |
| 10-24 | 41 | 30.8 |
| 25-40 | 29 | 21.8 |
| >40 | 35 | 26.3 |
| Mean ± SD = 27.6 ± 17.8 | | |
| Median 24.0 | | |
| **Farmland (rai)** | | |
| <10 | 40 | 30.1 |
| 10-24 | 48 | 36.1 |
| 25-40 | 19 | 14.3 |
| >40 | 26 | 19.5 |
| Mean ± SD = 24.2 ± 18.5 | | |
| Median 20.0 | | |
| Min 1 Max 100 | | |



Knowledge attitude and practice results showed on table 4.2.1. There was low knowledge level 38.3%; more than half had high knowledge level 61.7%; 72.2% of participants showed neutral attitude and 12.8% had concern attitude. Most of participants had good practice 67.7%.

Table 4.2.1 knowledge attitude and practice

| **Characteristics** | **Number (N=133)** | Percentage(%) |
|---|---|---|
| **Knowledge Level** | | |
| Low Level | 51 | 38.3 |
| Moderate Level | 0 | 0 |
| High Level | 82 | 61.7 |

| Characteristic | Number N=133 | Percentage% |
|---|---|---|
| **Attitude Level** | | |
| Not Concern Attitude | 20 | 15 |
| Neutral Attitude | 96 | 72.2 |
| Concern Attitude | 17 | 12.8 |
| **Practice Level** | | |
| Poor Practice | 43 | 32.3 |
| Good Practice | 90 | 67.7 |

Most of participants had high knowledge level (61.7%), in Table 4.2.2 results showed participants had high correct answer percentage on question 3 to 5. No.2 (46.6%) and No. 6 (58.6%) questions had lower correction rates.

Table 4.2.2 Number and percentage of herbicides knowledge.

| Knowledge Items | Correct | |
|---|---|---|
| | Number | Percentage (%) |
| 1.How to use herbicide properly? | 102 | 76.7 |
| 2.What will you consider when you buy herbicides? | 62 | 46.6 |
| 3. What is properly practice when spraying herbicide? | 132 | 99.2 |
| 4. What is properly practice after applying herbicide? | 130 | 97.7 |
| 5. How to storage herbicide product? | 120 | 90.2 |
| 6. What is the symptom of long-term herbicide exposure? | 78 | 58.6 |

In table 4.2.3, question no.1 had 41.4% persons showed strongly disagree, that's the negative statement, there were still 3.8% participants believe herbicide is not harmful to human in question no.2. while there were still high percentage between question no.3 and no.6 of misunderstanding overuse herbicides effections, while people under disagree level are 33% and 39.1% respectively. 20.3% participants thought mixing various herbicides can increase effectiveness without any disadvantage. 80.4% of participants think people should

wear PPE in question no.7. Surprisingly, 81.9% participants think herbicides are not harmful to human and the environment. As to question no.9 it showed similar with agree and disagree answers, most of had neutral opinion, this is a negative statement. However, on question 10, it is similar with no.9, but changed to be water, thus also get similar percentage 29.3% agree and 28.6% disagree. As for question 11, there were 88.7% participants corrected. Herbicides can residue in agriculture products and its harmful to consumers, there were only 10.5% corrected. In the question 13, herbicide price and effectiveness, 57.1% were right. Last question there were 12.8% correct.

Table 4.2.3 Number and percentage of herbicides attitude.

| Attitude Items | Strongly Agree (%) | Agree (%) | Neutral (%) | Disagree (%) | Strongly Disagree (%) |
|---|---|---|---|---|---|
| 1. Herbicide can get into body only ingestion route. | 1.5 | 5.3 | 8.3 | 43.6 | 41.4 |
| 2. Herbicides are only harmful to pests. Not harmful to humans in any way. | 3.8 | 3.8 | 3 | 45.1 | 44.4 |
| 3. Increasing amount of herbicides (rather than label recommendations) can prevent drug resistance | 4.5 | 19.5 | 9 | 48.9 | 18 |
| 4. Mixing various herbicides can increase effectiveness and no disadvantage. | 3 | 17.3 | 19.5 | 39.8 | 20.3 |
| 5. Using wooden stick to mix herbicides is safer than hands. # | 1.5 | 4.5 | 6 | 27.8 | 60.2 |
| 6. Mixing of herbicides more than label recommendation may make high crop yields. | 9.8 | 14.3 | 15 | 43.6 | 17.3 |

Table 4.2.3 Number and percentage of herbicides attitude conti.

| Attitude Items | | Strongly Agree (%) | Agree (%) | Neutral (%) | Disagree (%) | Strongly Disagree (%) |
|---|---|---|---|---|---|---|
| 7. Spraying herbicides windward no need to use personal protective equipment. | 3.8 | 6 | 9.8 | | 43.6 | 36.8 |
| 8. Herbicides are harmful to human health and the environment. # | 3 | 5.3 | 9.8 | | 30.8 | 51.1 |
| 9. Drinking coconut water after exposing herbicides to detoxify. | 2.3 | 12.8 | 52.6 | | 17.3 | 15 |
| 10. Drinking water after exposing herbicides to detoxify. # | 10.5 | 18.8 | 42.1 | | 15.8 | 12.8 |
| 11. Do not wear clothes when spraying herbicides because it's uncomfortable. | 2.3 | 6.8 | 2.3 | | 33.8 | 54.9 |
| 12. Herbicides can residue in agriculture products and it is harmful to consumers. # | 3 | 7.5 | 14.3 | | 36.8 | 38.3 |
| 13. Expensive herbicide is more effective than cheap one. | 4.5 | 21.8 | 16.5 | | 35.3 | 21.8 |
| 14. If spraying herbicides did not wear protective equipment, must have a shower immediately as a preventive alternative. # | 5.3 | 7.5 | 3 | | 27.8 | 56.4 |

# positive statement

On table 4.2.4 showed participants practice, 67.7% had good practice. 91% people never inhaling herbicides to check if it is real or fake. 95.5% had good habits that never smoking or drinking while spraying herbicides. 81.2% participants never spray herbicides while windy. 27% farmers stand windward direction while spraying herbicides without PPE, and 16.5% people rarely did. 95.5% farmers never dispose herbicides containers in the river after using.

77.4% keep herbicides bottles in cabinet. And 94.7% farmers washed hands and face with soap before eating.

Table 4.2.4 Number and percentage of herbicide practice.

| Practice Items | Usually (%) | Sometimes (%) | Rarely (%) | Never (%) |
|---|---|---|---|---|
| 1. Before spraying, inhaling herbicides to check to see if it is real or fake. | 0.8 | 6 | 2.3 | 91 |
| 2. Smoking or drinking water while spraying herbicides. | 0.8 | 3 | 0.8 | 95.5 |
| 3. Spraying herbicides while windy. | 1.5 | 3.8 | 13.5 | 81.2 |
| 4. Standing windward direction while spraying herbicides without protective equipment. | 12 | 15 | 16.5 | 56.4 |
| 5. Dispose herbicides containers in the river after using. | 0.8 | 2.3 | 1.5 | 95.5 |
| 6. Store herbicides in the cabinet.# | 77.4 | 10.5 | 3.8 | 8.3 |
| 7. Washing hands and face with soap before eating.# | 94.7 | 2.3 | 0 | 3 |

# positive statement

## 4.3 Herbicide Exposure amount of Use

All participants wore long sleeves to apply herbicides, almost all wore long pants (97.8%) to work, the same participants used hat and gloves were 74.4%, most of farmers used cloth to cover their mouths and noses, they did not use standard (Fig. 4) respirator. Less people used boots (44.4%), because of incorrect data, total participants of using respirator, goggles and apron are 120 persons, while very less people use googles (12%) and apron

(9.8%) and using respirator people are 38.3%. Most of them us spread 1 day per month (59.4%), sometimes 2-3 days per month (26.3%), very few people handled herbicides 1 day more than 1 month (others 2.3%), almost all participants use backpacker sprayer (92.5%), farmers sowed by hands had 4 people, and others (4.5%) used car sprayer.



Table 4.3.1 Herbicide exposure amount of use

| Characteristics | Number (N=133) | Percentage (%) |
|---|---|---|
| **PPE USE** | | |
| Hat | 99 | 74.4 |
| Respirator[a] | 51 | 38.3 |
| Long Sleeves | 133 | 100 |
| Long Pants | 130 | 97.8 |
| Gloves | 99 | 74.4 |
| Boots | 59 | 44.4 |
| Goggles[a] | 16 | 12 |
| Apron[a] | 13 | 9.8 |
| **Handling Frequency** | | |
| 1day/month | 79 | 59.4 |
| 2-3days/month | 35 | 26.3 |
| 4-7days/month | 16 | 12 |
| others | 3 | 2.3 |
| **Handle Equipment** | | |
| Backpacker sprayer | 123 | 92.5 |
| Battery powered backpack sprayer | 1 | 0.8 |
| Manual sow | 3 | 2.3 |
| Others | 6 | 4.5 |

a: total population N=120

## 4.4 Acute Symptoms Arising after Applying Herbicides and Prevalence

It reported acute symptoms related to herbicide exposure after applying 7 days were recalled from rice farmers (Table 4.4). Most of participants had headache (45.1%), in central nervous system, 17 participants had drowsiness, while 6.8% of total population had irritability. Findings showed there were 35.3% participants had eye irritation/itching/inflammation, lacrimation and blurred vision had 17.3%, 13.5% respectively. As for skin symptoms, most common happened was skin rash/itching/burning, 27.1% participants used had this acute symptom, numbness, muscular twitching, bleeding were 9.8%, 12.8% and 3% respectively. There were 17 participants had wheezing symptom before, dyspnea and breath shortness had 15.8% and 14.3%. There were more participants had sweating than hypersalivation, while vomiting, anorexia and abdominal cramps were 20.3% 9.8% and 12%.

Table 4.4 Acute symptoms arising after applying herbicides (N=133)

| Characteristics | Number | Percentage (%) |
|---|---|---|
| **Skin Symptoms** | | |
| Skin rash/ itching/burning | 36 | 27.1 |
| Numbness/tingling of hands | 13 | 9.8 |
| Muscular twitching and cramps | 17 | 12.8 |
| Bleeding | 4 | 3.0 |
| **Eye Symptoms** | | |
| Blurred vision | 18 | 13.5 |
| Lacrimation | 23 | 17.3 |
| Irritation/itching/inflammation | 47 | 35.3 |
| **Central Nervous System** | | |
| Headache/dizziness | 60 | 45.1 |
| Drowsiness | 17 | 12.8 |
| Irritability | 9 | 6.8 |

Table 4.4 Acute symptoms arising after applying herbicides conti.

| Characteristics | Number(N=133) | Percentage (%) |
|---|---|---|
| **Respiratory System** | | |
| Wheezing | 17 | 12.8 |
| Dyspnea | 21 | 15.8 |
| Shortness of Breath | 19 | 14.3 |
| **Gastrointestinal System** | | |
| Vomiting/Nausea | 27 | 20.3 |
| Anorexia | 13 | 9.8 |
| Abdominal cramps | 16 | 12.0 |
| **Glands** | | |
| Hypersalivation | 19 | 14.3 |
| Sweating | 39 | 29.3 |

4.5 Association between Demographic Characteristics and Acute Symptoms

Association between demographic characteristics and acute symptoms arising after applying herbicides analyzed as Table 4.5, results showed age, gender and education was associated with acute symptoms. Education was significant with skin bleeding (p = 0.005), gender was associated with skin rash (p=0.035), drowsiness (p=0.014) and sweating (p=0.014).

Table 4.5 Association between demographic characteristics and acute symptoms

| Characteristics | Age | | Gender | | Education | | Smoke | | Drink | | BMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Skin Symptoms** | | | | | | | | | | | | |
| Skin rash/ itching/burning | 4.324 | 0.228 | 5.795 | 0.035*[b] | 2.613 | 0.455 | 0.582 | 0.454 | 3.923 | 0.067 | 5.782 | 0.071[b] |
| Numbness/tingling of hands | 4.039 | 0.198[b] | 3.644 | 0.170[b] | 1.059 | 0.787[b] | 0.069 | 1.000[b] | 1.636 | 0.302[b] | 2.387 | 0.444[b] |
| Muscular twitching and cramps | 0.843 | 0.771[b] | 3.328 | 0.228[b] | 2.209 | 0.530[b] | 0.002 | 1.000[b] | 0.306 | 0.555[b] | 7.163 | 0.093[b] |
| Bleeding | 7.27 | 0.040*[b] | 5.173 | 0.067[b] | 12.577 | 0.006**[b] | 0.908 | 1.000[b] | 0.002 | 1.000[b] | 2.999 | 0.469[b] |
| **Eye Symptoms** | | | | | | | | | | | | |
| Blurred vision | 3.362 | 0.358[b] | 2.444 | 0.309[b] | 5.005 | 0.171[b] | 0.246 | 0.741[b] | 0.157 | 0.768[b] | 1.43 | 0.647[b] |
| Lacrimation | 5.631 | 0.143[b] | 0.844 | 0.580[b] | 4.469 | 0.215[b] | 0.257 | 0.565[b] | 0.063 | 1.000 | 4.725 | 0.241[b] |
| Irritation/itching/inflammation | 7.929 | 0.047* | 2.642 | 0.293[b] | 3.922 | 0.270[b] | 0.513 | 0.487 | 3.964 | 0.057 | 6.421 | 0.083[b] |

Table 4.5 Association between demographic characteristics and acute symptoms conti.

| Characteristics | Age | | Gender | | Education | | Smoke | | Drink | | BMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Central Nervous System** | | | | | | | | | | | | |
| Headache/dizziness | 4.584 | 0.207 | 2.081 | 0.334[b] | 4.438 | 0.218 | 0.14 | 0.822 | 0.032 | 1.000 | 2.268 | 0.517[b] |
| Drowsiness | 1.062 | 0.723[b] | 8.169 | 0.014*[b] | 3.233 | 0.357[b] | 0.52 | 0.737[b] | 0.306 | 0.555[b] | 2.89 | 0.588[b] |
| Irritability | 2.572 | 0.527[b] | 4.379 | 0.140[b] | 2.885 | 0.410[b] | 0.314 | 1.000[b] | 0.454 | 0.449[b] | 1.324 | 1.000[b] |
| **Respiratory System** | | | | | | | | | | | | |
| Wheezing | 1.599 | 0.605[b] | 1.733 | 0.386[b] | 1.462 | 0.691[b] | 0.52 | 0.737[b] | 1.346 | 0.241[b] | 2.678 | 0.608[b] |
| Dyspnea | 0.45 | 0.904[b] | 3.199 | 0.240[b] | 0.209 | 0.976[b] | 0.238 | 0.765[b] | 1.174 | 0.404 | 2.366 | 0.677[b] |
| Shortness of Breath | 1.39 | 0.641[b] | 0.232 | 0.836[b] | 5.234 | 0.155[b] | 0.847 | 0.524[b] | 0.11 | 1.000[b] | 1.351 | 0.896[b] |
| **Gastrointestinal System** | | | | | | | | | | | | |
| Vomiting/Nausea | 6.051 | 0.123[b] | 4.864 | 0.077[b] | 1.844 | 0.605 | 1.101 | 0.405[b] | 0.063 | 1.000 | 4.308 | 0.171[b] |
| Anorexia | 0.515 | 0.900[b] | 1.775 | 0.319[b] | 2.222 | 0.528[b] | 3.172 | 0.124[b] | 0.594 | 0.733[b] | 7.081 | 0.100[b] |
| Abdominal cramps | 1.762 | 0.585[b] | 4.427 | 0.122[b] | 4.539 | 0.209[b] | 0.006 | 1.000[b] | 0.515 | 0.535[b] | 5.232 | 0.066[b] |
| **Glands** | | | | | | | | | | | | |
| Hypersalivation | 1.648 | 0.649[b] | 5.253 | 0.066[b] | 2.375 | 0.498[b] | 0.847 | 0.524[b] | 0.11 | 1.000[b] | 3.181 | 0.299[b] |
| Sweating | 3.225 | 0.361 | 7.779 | 0.014*[b] | 2.146 | 0.543 | 2.153 | 0.214 | 2.597 | 0.122 | 2.058 | 0.561 |

**significant at 0.05 probability level **significant at 0.01 probability level b: Fisher's exact test *Age, Education, BMI were divided into 2 groups by mean*

## 4.6 Association between Farming Characteristics and Acute Symptoms

This result analyzed association between farming characteristics and acute symptoms arising after applying herbicides within 7 days, , farmland was significant with skin rash (p = 0.042). herbicide handling frequency associated with headache (p value = 0.007), while glands system was significant as well, hypersalivation and sweating p value equal to 0.017 and 0.024 respectively. As for work time, result showed significant with headache (p value = 0.015).

In terms of knowledge attitude and practice of herbicides, attitude was not significant with any acute symptom, while knowledge was significant with eye symptoms, while lacrimation and eye irritation p value were 0.016 and 0.003 respectively, what is more, it was also significant with central nervous system (irritability) and respiratory system (shortness of breath) p value were 0.043 and 0.021respectively. Farmers practice level was only significant with sweating (p = 0.041). Additionally, work time was significant with headache (p = 0.015).

Table 4.6.1 Association between farming characteristics and acute symptoms

| Characteristics | Experience | | Work Hour | | Farmland | | Work Time | |
|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Skin Symptoms** | | | | | | | | |
| Skin rash/ itching/burning | 0.076 | 0.783 | 0.016 | 0.900 | 4.141 | 0.042* | 2.38 | 0.573[b] |
| Numbness/tingling of hands | 2.470 | 0.116 | 0.538 | 0.463 | 1.058 | 0.304[b] | 2.434 | 0.670[b] |
| Muscular twitching and cramps | 0.094 | 0.759 | 0.009 | 0.925 | 0.005 | 0.942 | 4.614 | 0.247[b] |
| Bleeding | 3.189 | 0.132[b] | 0.883 | 0.620[b] | 0.220 | 1.000[b] | 1.15 | 1.000[b] |
| **Eye Symptoms** | | | | | | | | |
| Blurred vision | 0.189 | 0.664 | 0.461 | 0.497 | 0.071 | 0.790 | 8.125 | 0.176[b] |
| Lacrimation | 0.881 | 0.348 | 0.24 | 0.624 | 0.021 | 0.886 | 7.047 | 0.178[b] |
| Irritation/itching/inflammation | 0.834 | 0.361 | 0.05 | 0.823 | 1.316 | 0.251 | 3.036 | 0.601[b] |
| **Central Nervous System** | | | | | | | | |
| Headache/dizziness | 0.168 | 0.682 | 0.155 | 0.694 | 0.724 | 0.395 | 10.341 | 0.015* [b] |
| Drowsiness | 0.548 | 0.459 | 0.009 | 0.925 | 1.017 | 0.313 | 3.332 | 0.435[b] |
| Irritability | 0.560 | 0.503[b] | 0.052 | 1.000[b] | 0.292 | 0.589[b] | 2.692 | 0.637[b] |

Table 4.6.1 Association between farming characteristics and acute symptoms conti.

| Characteristics | Experience | | Work Hour | | Farmland | | Work Time | |
|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Respiratory System** | | | | | | | | |
| Wheezing | 0.047 | 0.829 | 0.376 | 0.540 | 0.005 | 0.942 | 2.753 | 0.368[b] |
| Dyspnea | 0.308 | 0.579 | 0.181 | 0.670 | 1.437 | 0.231 | 1.692 | 0.842[b] |
| Shortness of Breath | 1.305 | 0.253 | 0.321 | 0.571 | 0.348 | 0.555 | 1.724 | 0.807[b] |
| **Gastrointestinal System** | | | | | | | | |
| Vomiting/Nausea | 0.100 | 0.922 | 0.000 | 0.997 | 1.025 | 0.311 | 1.373 | 0.704[b] |
| Anorexia | 0.155 | 0.694 | 0.538 | 0.463 | 0.633 | 0.545[b] | 0.944 | 1.000[b] |
| Abdominal cramps | 0.276 | 0.599 | 0.139 | 0.709 | 0.463 | 0.496 | 3.155 | 0.322[b] |
| **Glands** | | | | | | | | |
| Hypersalivation | 0.127 | 0.721 | 0.005 | 0.944 | 0.348 | 0.555 | 2.214 | 0.728[b] |
| Sweating | 2.352 | 0.125 | 2.604 | 0.107 | 3.815 | 0.051 | 5.454 | 0.202[b] |

**significant at 0.05 probability level*

***significant at 0.001 probability level*

*b: fisher' exact test*

**Experience, Work hour, Farmland, Work time were classified by mean into 2 groups.*

## 4.7 Association among Knowledge Attitude and Practice and Acute Symptoms

Findings showed there were association among knowledge, attitude, practice of herbicides and acute symptoms. Farmers knowledge associated with 3 systems, especially eye system, it showed statistically significant with lacrimation (p value = 0.006) and eye irritation (p value = 0.001). For respiratory system, p value of shortness of breath is 0.007, while for gastrointestinal system, abdominal cramps p value is 0.023. Results appeared association between attitude and sweating (p value = 0.004). This study found skin numbness had strongly significant with farmers practice herbicides which p value is 0.001, besides, skin rash has association as well which p value is 0.025.

Table 4.7.1 Association among Knowledge Attitude and Practice and Acute Symptoms

| Characteristics | Knowledge | | Attitude | | Practice | |
|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Skin Symptoms** | | | | | | |
| Skin rash/ itching/burning | 2.332 | 0.127 | 2.271 | 0.486 | 5.003 | 0.025* |
| Numbness/tingling of hands | 0.350 | 0.766[b] | 0.929 | 0.639[b] | 13.096 | 0.001**[b] |
| Muscular twitching and cramps | 0.658 | 0.594 | 1.101 | 0.610[b] | 1.933 | 0.164 |
| Bleeding | 0.311 | 1.000[b] | 1.035 | 0.631[b] | 0.589 | 0.594[b] |
| **Eye Symptoms** | | | | | | |
| Blurred vision | 2.289 | 0.130 | 2.696 | 0.245[b] | 1.396 | 0.237 |

Table 4.7.1 Association among Knowledge Attitude and Practice and Acute Symptoms conti

| Characteristics | Knowledge | | Attitude | | Practice | |
|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| Lacrimation | 7.531 | 0.006** | 3.665 | 0.185[b] | 1.58 | 0.209 |
| Irritation/itching/inflammation | 11.33 | 0.001** | 1.602 | 0.449 | 3.472 | 0.062 |
| **Central Nervous System** | | | | | | |
| Headache/dizziness | 1.150 | 0.284 | 0.257 | 0.879 | 0.022 | 0.882 |
| Drowsiness | 1.810 | 0.179 | 4.838 | 0.089[b] | 0.078 | 0.780 |
| Irritability | 0.103 | 1.000[b] | 1.374 | 0.503 | 0.451 | 0.718[b] |
| **Respiratory System** | | | | | | |
| Wheezing | 1.810 | 0.179 | 1.101 | 0.610[b] | 3.784 | 0.052 |
| Dyspnea | 1.008 | 0.315 | 0.055 | 0.973[b] | 2.664 | 0.103 |
| Shortness of Breath | 7.256 | 0.007* | 3.726 | 0.207[b] | 2.291 | 0.130 |
| **Gastrointestinal System** | | | | | | |
| Vomiting/Nausea | 1.089 | 0.297 | 2.852 | 0.277[b] | 1.095 | 0.295 |
| Anorexia | 3.213 | 0.130[b] | 4.39 | 0.167 | 1.258 | 0.349[b] |
| Abdominal cramps | 5.139 | 0.023* | 6.26 | 0.075[b] | 1.084 | 0.298 |
| **Glands** | | | | | | |
| Hypersalivation | 2.804 | 0.094 | 3.812 | 0.198[b] | 0.206 | 0.650 |
| Sweating | 0.14 | 0.708 | 10.808 | 0.004** | 0.429 | 0.512 |

**significant at 0.05 probability level **significant at 0.001 probability level*

*b: fisher' exact test knowledge attitude and practice were classified followed table 4.2.*

***Table 4.7.2 correlations among KAP***

| | | | Practice | Attitude | Knowledge |
|---|---|---|---|---|---|
| Spearman's rho | Practice | Correlation Coefficient | 1.000 | .256** | -.181* |
| | | Sig. (2-tailed) | . | .003 | .037 |
| | | N | 133 | 133 | 133 |
| | Attitude | Correlation Coefficient | .256** | 1.000 | -.055 |
| | | Sig. (2-tailed) | .003 | . | .529 |
| | | N | 133 | 133 | 133 |
| | Knowledge | Correlation Coefficient | -.181* | -.055 | 1.000 |
| | | Sig. (2-tailed) | .037 | .529 | . |
| | | N | 133 | 133 | 133 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

A spearman's correlation (Table 4.7.2) was run to determine the relationship among Knowledge, Attitude and Practice. There was a very weak, negative correlation between knowledge and practice ($r = -0.181$, $N = 133$, $p < 0.05$). Meanwhile there was a weak, positive correlation between attitude and practice ($r = 0.256$, $N = 133$, $p < 0.001$).

## 4.8 Association between Personal Protective Equipment (PPE) and Acute Symptoms

These results illustrated association between PPE use and acute symptoms arising after applying herbicides within 7 days, including hat had significant association with gastrointestinal system anorexia (p value = 0.038); gloves had association with two acute symptoms, it was significant with dyspnea (p = 0.038) and sweating (p = 0.034), while boots were significant with skin rash (p = 0.034) and sweating (p =0.021). Because of missing data, total participants of using respiratory, goggles and apron are 120 people. The results showed respiratory was significant with skin bleeding (0.03), anorexia (0.038) and sweating (0.033). Besides, there were more association on googles, such as skin numbness (0.015), skin bleeding (0.007), drowsiness (0.029), also in respiratory system and gastrointestinal system, p value is 0.039 and 0.015 respectively. Findings showed there were strong significant between apron and sweating, p value = 0.01, meanwhile, vomiting appeared statistically significant with using apron as well. However, statistical analysis was found there was not significant among long sleeve, long pants with acute symptom.

Table 4.8 Association between Personal Protective Equipment (PPE) and acute symptoms

| Characteristics | Hat | | Respiratory | | Long Sleeve | | Long Pants | | Gloves | | Boots | | Goggles | | Apron | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Skin Symptoms** | | | | | | | | | | | | | | | | |
| Skin rash/ itching/burning | 2.053 | 0.184 | 0.342 | 0.559 | 2.715 | 0.271[b] | 2.787 | 0.402[b] | 2.715 | 0.404[b] | 0.000 | 1.000 | 0.198 | 0.762[b] | 0.096 | 1.000[b] |
| Numbness/tingling of hands | 0.047 | 1.000[b] | 0.080 | 0.778 | 0.109 | 1.000[b] | 0.447 | 1.000[b] | 0.300 | 0.765[b] | 0.203 | 0.773 | 7.967 | 0.015*[b] | 0.313 | 0.632[b] |
| Muscular twitching and cramps | 3.968 | 0.07[b] | 3.022 | 0.082 | 6.875 | 0.128b | 7.280 | 0.166[b] | 7.150 | 0.106[b] | 0.581 | 0.602 | 2.175 | 0.226[b] | 0.401 | 1.000[b] |
| Bleeding | 1.416 | 0.572[b] | 5.598 | 0.03*[b] | 0.031 | 1.000[b] | 0.128 | 1.000[b] | 1.308 | 0.295[b] | 1.569 | 0.322[b] | 13.617 | 0.007*[b] | 0.503 | 1.000[b] |
| **Eye Symptoms** | | | | | | | | | | | | | | | | |
| Blurred vision | 0.054 | 0.778[b] | 0.884 | 0.347 | 0.158 | 1.000[b] | 0.646 | 1.000[b] | 2.049 | 0.346[b] | 0.268 | 0.620 | 0.319 | 0.699[b] | 2.406 | 0.210[b] |
| Lacrimation | 0.976 | 0.434 | 3.008 | 0.083 | 0.211 | 1.000[b] | 0.862 | 1.000[b] | 0.531 | 0.672[b] | 3.071 | 0.106 | 0.058 | 0.730[b] | 0.845 | 0.693[b] |
| Irritation/itching/inflammation | 1.572 | 0.222 | 0.693 | 0.405 | 0.551 | 1.000[b] | 0.558 | 1.000[b] | 3.179 | 0.169[b] | 0.616 | 0.469 | 0.051 | 0.822 | 0.911 | 0.539[b] |
| **Central Nervous System** | | | | | | | | | | | | | | | | |
| Headache/dizziness | 1.13 | 0.322 | 0.431 | 0.512 | 1.226 | 0.451[b] | 1.824 | 0.402[b] | 1.455 | 0.545[b] | 0.047 | 0.862 | 0.046 | 0.830 | 0.011 | 0.918 |
| Drowsiness | 1.95 | 0.236[b] | 0.122 | 0.727 | 0.148 | 1.000[b] | 0.604 | 1.000[b] | 1.082 | 0.456[b] | 0.057 | 1.000 | 5.934 | 0.029*[b] | 0.308 | 1.000[b] |
| Irritability | 3.315 | 0.111[b] | 0.088 | 0.767 | 0.073 | 1.000[b] | 0.299 | 1.000[b] | 1.849 | 0.287[b] | 0.476 | 0.731[b] | 1.010 | 0.289[b] | 1.041 | 0.597[b] |
| **Respiratory System** | | | | | | | | | | | | | | | | |

Table 4.8 Association between Personal Protective Equipment (PPE) and acute symptoms conti.

| Characteristics | Hat | | Respiratory | | Long Sleeve | | Long Pants | | Gloves | | Boots | | Goggles | | Apron | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P-value | $\chi^2$ | P- value | $\chi^2$ | P-value | $\chi^2$ | P-value | $\chi^2$ | P-value | $\chi^2$ | P-value | $\chi^2$ | P-value | $\chi^2$ | P-value |
| Wheezing | 0.642 | 0.558[b] | 1.428 | 0.232 | 0.148 | 1.000[b] | 1.300 | 0.425[b] | 1.082 | 0.456[b] | 1.652 | 0.296 | 5.129 | 0.039*[b] | 0.053 | 0.684[b] |
| Dyspnea | 0.556 | 0.590 | 0.061 | 0.804 | 0.189 | 1.000[b] | 0.773 | 1.000[b] | 6.469 | 0.038*[b] | 0.107 | 0.813 | 2.827 | 0.141[b] | 0.017 | 1.000[b] |
| Shortness of Breath | 2.634 | 0.155[b] | 0.113 | 0.737 | 0.168 | 1.000[b] | 1.067 | 0.464[b] | 0.172 | 1.000[b] | 0.046 | 1.000 | 0.204 | 0.707[b] | 0.746 | 0.411[b] |
| **Gastrointestinal System** | | | | | | | | | | | | | | | | |
| Vomiting/Nausea | 0.294 | 0.624 | 0.054 | 0.816 | 3.956 | 0.203[b] | 4.692 | 0.288[b] | 4.661 | 0.159[b] | 0.180 | 0.829 | 2.382 | 0.194[b] | 4.233 | 0.039*[b] |
| Anorexia | 4.948 | 0.038*[b] | 4.263 | 0.039* | 0.109 | 1.000[b] | 0.447 | 1.000[b] | 0.164 | 1.000[b] | 1.722 | 0.244 | 7.967 | 0.015*[b] | 1.771 | 0.356[b] |
| Abdominal cramps | 0.003 | 1.000[b] | 0.425 | 0.514 | 7.368 | 0.120[b] | 7.742 | 0.154[b] | 7.851 | 0.090[b] | 0.003 | 1.000 | 2.175 | 0.226[b] | 2.243 | 0.212[b] |
| **Glands** | | | | | | | | | | | | | | | | |
| Hypersalivation | 1.113 | 0.399[b] | 0.168 | 0.682 | 6.045 | 0.143[b] | 6.512 | 0.189[b] | 6.647 | 0.095[b] | 0.081 | 0.807 | 4.431 | 0.051[b] | 2.406 | 0.21[b] |
| Sweating | 0.179 | 0.828 | 4.561 | 0.033* | 2.429 | 0.293[b] | 3.656 | 0.180[b] | 5.820 | 0.034*[b] | 5.835 | 0.021* | 0.014 | 1.000[b] | 6.248 | 0.01**[b] |

**significant at 0.05 probability level*

***significant at 0.001 probability level*

*a:Total population N=122*

*b:Fisher's exact test*

## 4.9 Association between Herbicides Handling and Acute Symptoms

Handle equipment did not show significant with acute symptoms. But handle frequency was significant with acute symptoms, headache of central nervous system got p value 0.007, and glands were found significance as well, hypersalivation and sweating got 0.017 and 0.024 respectively.

Table 4.9 Association between herbicides handling and acute symptoms

| Characteristics | Handle Equipment | | Frequency | |
|---|---|---|---|---|
| | $\chi^2$ | P- value | $\chi^2$ | P- value |
| **Skin Symptoms** | | | | |
| Skin rash/ itching/burning | 0.047 | 1.000[b] | 0.047 | 1.000[b] |
| Numbness/tingling of hands | 0.001 | 1.000[b] | 0.001 | 1.000[b] |
| Muscular twitching and cramps | 1.585 | 0.360[b] | 1.585 | 0.360[b] |
| Bleeding | 0.335 | 1.000[b] | 0.335 | 1.000[b] |
| **Eye Symptoms** | | | | |
| Blurred vision | 0.386 | 0.625[b] | 0.386 | 0.625[b] |
| Lacrimation | 0.055 | 0.683[b] | 0.055 | 0.683[b] |
| Irritation/itching/inflammation | 1.017 | 0.323[b] | 1.017 | 0.323[b] |
| **Central Nervous System** | | | | |
| Headache/dizziness | 0.968 | 0.346[b] | 0.968 | 0.346[b] |
| Drowsiness | 0.075 | 1.000[b] | 0.075 | 1.000[b] |
| Irritability | 0.785 | 1.000[b] | 0.785 | 1.000[b] |
| **Respiratory System** | | | | |
| Wheezing | 0.075 | 1.000[b] | 0.075 | 1.000[b] |
| Dyspnea | 0.273 | 1.000[b] | 0.273 | 1.000[b] |
| Shortness of Breath | 1.802 | 0.356[b] | 1.802 | 0.356[b] |
| **Gastrointestinal System** | | | | |
| Vomiting/Nausea | 0.709 | 0.686[b] | 0.709 | 0.686[b] |
| Anorexia | 1.171 | 0.597[b] | 1.171 | 0.597[b] |
| Abdominal cramps | 0.042 | 1.000[b] | 0.042 | 1.000[b] |

Table 4.9 Association between herbicides handling and acute symptoms conti.

| Characteristics | Handle Equipment | | Frequency | |
|---|---|---|---|---|
| | $\square^2$ | P- value | $\square^2$ | P- value |
| **Glands** | | | | |
| Hyper salivation | 0.162 | 1.000[b] | 0.162 | 1.000[b] |
| Sweating | 1.948 | 0.280[b] | 1.948 | 0.280[b] |

**significant at 0.05 probability level*

*b: Fishers' exact test*

*handle equipment was classified by using backpacker sprayer and not; frequency was classified into 1day/month and others.*

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# Chapter 5

# Discussion

The findings of this study suggested that demographic characteristics, farming characteristics, and herbicide exposure in use had associated with acute symptoms of during the application of herbicide. Based on the results of questionnaire investigation all participants used one of three herbicides (glyphosate, paraquat, and 2,4-D) (Ratana & Sakorn, 2013) exhibited less prevalence to have skin disease, diabetes, hypertension, thyroid, cardiovascular disease, in particular, for most of participants whose age under 60 years old.

## 5.1 Demographic Characteristics

There were many articles shows statistically significant effect of demographic characteristics and herbicides exposure acute symptoms, somewhat surprisingly, in this study, there were no significant among, BMI, smoke, drink and acute symptoms (Jørs et al., 2006; Ncube et al., 2011). The majority of rice farmers in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri Province female was more than male, more than half of participants were female. Gender also appeared association with skin rash, headache, drowsiness and sweating, female is more suffering with skin rash because of female skin is softer than male, while only 38.3% participants apply respiratory, herbicides exposure could result headache and drowsiness through inhalation route, it is similar with other articles, male had more perspiration than female (Kuwahara et al., 2010). The average age of farmers in this study was 45.8 years old, ranging from 18 - 60 years old. Additionally, age showed association with acute symptoms, median age was 48 years old, findings showed statistically significant on skin bleeding and eye irritation, during interview, most of participant did not wear goggles, few of them wore sunglasses, it cannot protect eyes properly, which was similar to other studies conducted in Thailand. And herbicides could result skin bleeding if contact directly (Michael et al., 2010).

It was found in other reports that agriculture labors had low education level, the same with this study (Saowanee et al., 2018), most of rice farmers did not finish primary school (48.9%), and there was association with skin bleeding, if farmers lack of education, they maybe do not know how to protect themselves well, so that resulting in skin bleeding when they were exposing with herbicides. Researcher found that most of people in Song Phi Nong subdistrict had habits to run, there were famous of marathon running races every month, the study showed rice farmers BMI most were normal range 18 - 24.9, meanwhile, most of participants never drink (75.9%) or smoke (82%) and also showed non-significance with acute symptoms.



## 5.2 Farming Characteristics and KAP

In previous literature review (Banjo et al., 2010; Milidrag et al., 2018; Saowanee et al., 2018), it appeared relevant among farmer experience, working hours per day, farmland size, work time, knowledge attitude and practice of herbicides with acute symptoms. Quite surprisingly, in this study farmers experience and work hour per week were not statistically significant with herbicide exposure acute symptoms, during investigation, even most of participants had more than 20 years' experience, they followed their experience to apply herbicides instead of following labels of herbicides or government announcement. Working hours also showed no significant with acute symptoms, average working hours are 27.6 hours, but it was not continuous time to contact herbicides, they could do other jobs such as fertilize crops. Size of farmland they sprayed showed statistically significant, it was similar with other reports (Saowanee et al., 2018).

Knowledge attitude and practice showed statistically significant with acute symptoms; it is similar with other articles (Wongwichit et al., 2012). Researcher found there were 41.4% did not know long term symptoms caused by herbicides. and only 46.6% participants knew what should consider when buying herbicides. Approximately half of participants did not know overuse herbicides is not good for effectiveness, while less participants think drink

water can detoxify herbicides and herbicides could residue on its products. Furthermore, if spraying herbicides without PPE, take a shower is useful to detoxify herbicides. 67.7% had good practice, around 50% standing windward direction while spraying herbicides without protective equipment.

Knowledge appeared more associations with acute symptoms, attitude had association with sweating, it could because farmers think the weather cause sweating instead of using herbicides. There were association between skin system and acute symptoms, skin contact is one of the easiest route for applying herbicide (Michael et al., 2010). Besides, knowledge and practice had a very weak negative correlations between them, the more knowledge of herbicides rice farmers know had 0.181 times possibility to decrease their practice properly. On the contrary, attitude and practice had weak positive correlations, the more rice farmers concern about herbicides, they would practice better.

## 5.3 Herbicides amount of use

Other reports (Jørs et al., 2006) illustrated significance relation between using PPE and acute symptoms, especially hat, respiratory, long sleeve, long pants, however, long sleeve and long pants (Okonya & Kroschel, 2015) showed none statistically significant with acute symptoms in this study, maybe because all 133 participants wear long sleeve and long pants. Besides, other equipment such as hat, respiratory, gloves, boots, glassed and apron indicated statistically significance with some acute symptoms, furthermore, total participants of using respiratory, glasses and apron were 120 participants because of missing data. Rice farmers did not use hat and respiratory could result anorexia, because herbicides can be absorbed by skin and inhalation then suffer from gastrointestinal system. Without respiratory or not properly use it could result skin bleeding and sweating, face is one of the soft parts in our body, it could contact herbicides directly when applying herbicides, while inhale herbicides could result sweat a lot for some people. It is similar with Australian government documents (Michael et al., 2010). Gloves had association with respiratory and glands system, rice

farmers maybe not wash hands properly and close to face, then herbicides had probability to be inhaled or contacted with human body. Goggles had more association with acute symptoms, while eye is the weak part of human body, herbicides could be residue near eyes and absorbed into body. Additionally, apron could protect our stomach part better, results showed it had association with gastrointestinal system and glands system. Most of farmers did not apply apron, only one thin and simple shirt, herbicides could residue on cloth and get inside of body.

Previous reports showed herbicides handling equipment and herbicides frequency were significant with acute symptoms (Milidrag et al., 2018). However, in this study there is no association among handle equipment and handle frequency. Most of participants use backpacker sprayer, very few of them used other spray ways such as manual sow or sprayer car. And 59.4% participants handling herbicides 1 day per months, it is not quite often to apply herbicides.

## 5.4 Prevalence of Herbicides Exposure acute symptoms

This study aimed to figure out how many rice farmers had acute symptoms in total population, rice farmers can choose multiple acute symptoms, while researcher want to find out how many percentages of each acute symptom. The finding showed the similar result with previous review(Ekarat, 2013; Wachiraporn, 2012), Headache is one of the most common acute symptoms in this study and showed at a very high risk of central nervous system during rice farmers exposed to herbicides regularly. Then followed by eye irritation, eyes system can get directly exposure of herbicides, and most of them did not use properly goggles. Moreover, they maybe touch or rub their eyes after applying herbicides with unwashed hands, it can result eyes itch, blurred vision, or lacrimation. The response rate in the study was substantially lower than some articles (Wachiraporn, 2012). Skin irritation also had higher prevalence than other symptoms, because skin contact is easier to absorb than oral and

inhalation route. While for respiratory, gastrointestinal and glands systems had lower prevalence in this study. It was similar with other research (Wachiraporn, 2012).

## 5.5 Conclusion

This investigation was a cross-sectional study aimed to find associations among demographic characteristics, farming characteristics, herbicide exposure amount of use with herbicide exposure acute symptoms conducted in Song Phi Nong subdistrict, Song Phi Nong district, Suphan Buri province, Thailand.

It was completely interviewed 133 rice farmers through face to face. Overall, 55.6% participants are female, and average age was 45.8, 57.9% rice farmers had normal BMI, and 48.9% had lower than primary education level. Around 80% participants did not smoke and drink alcohol. Findings indicated that BMI, smoking, drinking were not significantly in relating to acute symptoms. Rice farmers' average farming experience was 21.59 years, and average work hours per week were 27.6 hours, moreover they used to work during 12pm to 12am. 36.1% participants had 10 -25 rais farmland. 61.7% participants had high knowledge level of herbicides, 72.2% had neutral concern attitude of herbicides, moreover, good practice level had 67.7% participants. Except farmers' farming experience and working hours were not significantly related with acute symptoms. Farmland, work time, knowledge attitude and practice of herbicides showed significant with some acute symptoms. Besides, almost all participants wear long sleeves and long pants, nevertheless this two equipment did not show statistically significant with acute symptoms, as to other equipment had association with some acute symptoms. This study found that around 5% of the farmer had used sprayer car for herbicide spreading. In Thailand, the common herbicide handling equipment for rice farmers were backpacker sprayers and battery powered backpack sprayers. As for applying herbicides frequency normally was 1day per month (59.4%). However, there were no association among herbicide handling equipment and herbicide frequency. The most common symptom was headache which was found on eye system and central nervous system.

In general, this study found associations among demographic characteristics, farming characteristics and herbicide exposure amount of use with herbicide exposure acute symptoms.

## 5.6 Limitation

1. The total amount of sample size in this study was considered small group.

2. Recall bias of rice farmers, this study did not consult doctor diagnose evaluation, all data depended on participants' memory, and also subjective sign and symptoms, some of symptoms caused is not same as doctors diagnose.

3. This study did not investigate during applying herbicides season, there was no biomarker in this study.

## 5.7 Recommendation

As to prevent farmer from the risk of herbicides exposure, properly wearing personal protective equipment is necessary. For reducing herbicide exposure, it is considerable that the automatically spreading herbicide equipment can be applied to the rice farming. Except that agriculture's knowledge attitude and practice is also important to prevent herbicide exposure. Informing farmers knowledge about symptoms could happen after applying herbicides is necessary, meanwhile increasing farmers concern on residue of herbicides and drink water can detoxify herbicides are important. Besides good practice is meaningful as well, informing farmers about properly way to store, dispose herbicides container and PPE use could be considerable.

In this study, researcher did not find association between herbicides concentration and acute symptoms, since this investigation was conducted on a small group of rice farmers within a short period of time, further in-depth investigation is needed to verify the acute symptom caused by application of herbicide for a long-term practice and under doctor diagnosis evaluation. As to increase the reliability of the human toxicity due to herbicide application, biomarker can be involved in conducting such evaluation.

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# Appendix A

แบบสอบถาม

เครื่องมือนี้เป็นส่วนหนึ่งของโครงการวิจัย เรื่อง อาการเฉียบพลันที่เกิดจากการใช้สารเคมีกำจัดวัชพืชในกลุ่มของชาวนา ตำบลสองพี่น้อง อำเภอสุพรรณบุรี จังหวัดสุพรรณบุรี ประเทศไทย: การศึกษาภาคตัดขวาง



คาชี้แจง จงเติมคำตอบลงในช่องว่างหรือทำเครื่องหมาย√ ในวงเล็บ

แบบสอบถามประกอบด้วย

คำถามคัดกรอง 4 ข้อ

ส่วนที่ 1 ข้อมูลส่วนบุคคล

ส่วนที่ 2 ความรู้ ทัศนคติ

ส่วนที่ 3 การใช้สารเคมีกำจัดวัชพืช

ส่วนที่ 4 ข้อมูลผลกระทบทางสุขภาพของหลังจากฉีดพ่นสารเคมีกำจัดวัชพืชภายในช่วง7 วันที่ผ่านมา

**คำถามคัดกรอง**

1. ท่านเคยได้รับการวินิจฉัยจากแพทย์/กาลังรักษาโรค
   ( )1.เบาหวาน ( ) 2.ความดันโลหิตสูง ( ) 3.ไทรอยด์ ( ) 4.โรคหัวใจ ( ) 5.โรคผิวหนัง ( ) 6.ไม่เคย
2. ท่านใช้สารเคมีกำจัดวัชพืชอะไร
   ( ) 1.เคยใช้ไกลโฟเซต หรือ พาราควอต หรือ ทู โฟร์-ดี ( ) 2.ไม่เคยใช้ทั้งสามตัว
3. ครอบครัวของท่านมีผู้ประกอบอาชีพเกษตรกรเป็นหลักจำนวน....คน
4. ท่านปลูกพืชในชนิดใด
   ( )1 ข้าว ( ) 2 อื่น ๆ.....

**ส่วนที่ 1 ข้อมูลส่วนบุคคล**

1. เพศ ( ) 1.ชาย ( )2.หญิง

2. น้ำหนักปัจจุบัน.....กิโลกรัม ส่วนสูง.....เซนติเมตร

3. อายุ ..... ปี

4. ระดับการศึกษาสูงสุด (ไม่รวมระดับการศึกษาที่ยังไม่สำเร็จการศึกษา)

( ) 1.ประถมศึกษาหรือต่ำกว่า ( ) 2.มัธยมศึกษาตอนต้น ( ) 3.มัธยมศึกษาตอนปลาย ( ) 4.อนุปริญญา

( ) 5.ปริญญาตรีหรือเทียบเท่า ( ) 6.สูงกว่าปริญญาตรี ( ) 7.ไม่ได้รับการศึกษา

5. ท่านสูบบุหรี่หรือไม่

( ) 1.ไม่เคยสูบ ( ) 2.เคยสูบ แต่เลิกได้แล้ว ..... ปี ..... เดือน ( ) 3.สูบอยู่ จำนวน.....มวน/วัน สูบมานาน.....ปี

6. ท่านดื่มสุรา เบียร์ หรือเครื่องดื่มที่มีแอลกอฮอล์หรือไม่

( ) 1.ไม่เคยดื่ม ( ) 2.เคยดื่ม แต่เลิกได้แล้ว ..... ปี ..... เดือน

( ) 3.ดื่มอยู่ ระบุประเภทเครื่องดื่มปริมาณ.....แก้ว/ครั้ง

6.1 ความถี่ในการดื่ม ( ) 1.น้อยกว่า 1 ครั้ง/สัปดาห์ ( ) 2.ดื่มอยู่ 2-3 ครั้ง/สัปดาห์

( ) 3.ดื่มอยู่มากกว่า 3 ครั้ง/สัปดาห์ ( ) 4.อื่น ๆ ระบุ.....

**ส่วนที่ 2 ความรู้ ทัศนคติ**

1.ท่านทำอาชีพเกษตรกรรมมา ..... ปี

2.ระยะเวลาทำงานในนาข้าวโดยเฉลี่ย ..... ชั่วโมงต่อวัน .....วันต่อสัปดาห์

3.ปัจจุบันคุณมีพื้นที่ในการปลูกข้าว ..... ไร่

4.ท่านทำการฉีดพ่นสารเคมีกำจัดวัชพืชเวลาใด

( )1. เช้าตรู่.....น.

( )2. เที่ยงวัน.....น.

( )3. ตอนเย็น.....น.

( )4. ไม่แน่นอนตามความเวลาที่สะดวก คือ _____

5.ความรู้เรื่องการใช้สารเคมีกำจัดวัชพืช(เลือกได้1ข้อ)

5.1 ท่านมีวิธีการเลือกใช้สารเคมีกำจัดวัชพืชอย่างไร

( )1 เลือกให้ตรงกับชนิดของวัชพืช ( )2 เลือกโดยเพื่อนบ้านแนะนำ

( )3 เลือกชนิดที่สามารถสารเคมีกำจัดวัชพืชได้หลายชนิด ( )4 เลือกชนิดที่มีการโฆษณา

( )5 เลือกชนิดที่ราคาถูกกว่า

5.2 การเลือกซื้อสารเคมีกำจัดวัชพืช ท่านควรพิจารณาองศ์ประกอบของผลิตภัณฑ์อย่างไรบ้าง

( )1 ดูวัน เดือน ปี ที่ผลิต และหมดอายุ ( )2 เลือกซื้อให้ตรงประเภทที่ต้องการใช้

( )3 เลือกสารเคมีชนิดที่สามารถกำจัดวัชพืชได้หลายประเภท ( )4 ถูกทั้งข้อ 1 และ 2

5.3 ขณะฉีดพ่นสารเคมีกำจัดวัชพืช การปฏิบัติตัวที่ถูกต้องควรทำอย่างไร

( )1 ใช้ผ้าปิดจมูก สวมถุงมือ เสื้อผ้ามิดชิดและใส่รองเท้าบูท

( )2 สูบ บุหรี่พ่นควันออกมาก ๆ เพื่อป้องกันสารสูดหายใจรับสารเคมีเข้าไป

( )3 ฉีดใต้ลม โดยไม่ต้องสวมใส่เครื่องป้องกันใด ๆ

( )4 ฉีดพ่นไม่ต้องสวมใส่เครื่องป้องกัน ใด ๆ

5.4 หลังฉีดพ่นสารเคมีกำจัดวัชพืชท่านปฏิบัติตนอย่างไร

( ) 1 ล้างภาชนะอุปกรณ์ในแม่น้ำ ลำคลองที่อยู่ใกล้ทันที

( ) 2 ล้างภาชนะด้วยผงซักฟอก อาบน้ำ สระผมเปลี่ยนเสื้อผ้าใหม่ทันที

( ) 3 อาบน้ำ ใส่เสื้อผ้าชุดเดิม ทำงานอื่นต่อ

( ) 4 ไม่อาบน้ำ เปลี่ยนเสื้อผ้าใหม่ทันที ทำงานอื่นต่อ

5.5 สารเคมีกำจัดวัชพืช ที่เหลือจากการใช้แล้วควรเก็บอย่างไร

( ) 1 เก็บไว้ในห้องครัว

( ) 2 เก็บไว้ในตู้ยาสามัญประจำ บ้าน

( ) 3 เก็บไว้บริเวณเพาะปลูก

( ) 4 แยกเก็บใส่ตู้เก็บสารเคมีโดยเฉพาะล๊อคกุญแจ

5.6 ผู้ที่ได้รับพิษสารเคมีกำจัดวัชพืช สะสมนาน ๆ จะมีอาการอย่างไร

( ) 1 กะวนกะวาย

( ) 2 ปวดท้อง

( ) 3 เวียนศีรษะ

( ) 4 ถูกทุกข้อ 1 2 และ 3

6 ทัศนคติและความเชื่อในการใช้สารเคมีกำจัดวัชพืช

| ข้อ | ข้อคำถาม | เห็นด้วยอย่างยิ่ง | เห็นด้วย | ไม่แน่ใจ | ไม่เห็นด้วย | ไม่เห็นด้วยอย่างยิ่ง |
|---|---|---|---|---|---|---|
| 6.1 | ฉันคิดว่าสารเคมีกำจัดวัชพืชเข้าสู่ร่างกายคนเราได้โดยการกินเท่านั้น | | | | | |
| 6.2 | ฉันคิดว่าสารเคมีกำจัดวัชพืชเป็นอันตรายต่อแมลงที่เป็นศัตรูพืชเท่านั้น ไม่เป็นอันตรายต่อมนุษย์แต่อย่างใด | | | | | |
| 6.3 | ฉันคิดว่าการใช้สารเคมีกำจัดวัชพืชบ่อยครั้งจะต้องเพิ่มปริมาณ(มากกว่าคำแนะนำในฉลาก)มากขึ้นเรื่อย ๆป้องกันการดื้อยา | | | | | |
| 6.4 | ฉันคิดว่าการผสมสารเคมีกำจัดวัชพืชหลาย ๆ ชนิด(มากกว่าคำแนะนำในฉลาก)เข้าด้วยกันทำให้การกำจัดวัชพืชได้ผลดียิ่งขึ้น และไม่มีผลเสียแต่อย่างไร | | | | | |
| 6.5 | ฉันคิดว่าการใช้ไม้คนสารเคมีกำจัดวัชพืชแทนการใช้มือทำให้ปลอดภัยจากการสัมผัสสารเคมีมากขึ้น | | | | | |
| 6.6 | ฉันคิดว่าการผสมสารเคมีกำจัดวัชพืชในปริมาณที่มากกว่าที่ฉลากกำหนดทำให้ได้ผลผลิตพืชสูง | | | | | |
| 6.7 | ฉันคิดว่าถ้าฉีดพ่นสารเคมีกำจัดวัชพืชเหนือทิศทางลมไม่ต้องใช้อุปกรณ์ป้องกันส่วนบุคคล | | | | | |
| 6.8 | ฉันคิดว่าสารเคมีกำจัดวัชพืชเป็นอันตรายต่อสิ่งมีชีวิตและสิ่งแวดล้อม | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6.9 | ฉันคิดว่าถ้าได้รับสารเคมีกำจัดวัชพืชเข้าสู่ร่างกาย ควรดื่มน้ำมะพร้าวเพื่อขับพิษสารเคมีกำจัดวัชพืชออกจากร่างกาย | | | | | |
| 6.10 | ฉันคิดว่าควรดื่มน้ำมาก ๆหลังจากสัมผัสสารเคมีกำจัดวัชพืชเพื่อให้พิษของสารเคมีกำจัดวัชพืชหมดไปจากร่างกาย | | | | | |
| 6.11 | ฉันคิดว่าขณะพ่นสารเคมีกำจัดวัชพืชไม่ควรสวมเสื้อเพราะอึดอัด | | | | | |
| 6.12 | ฉันคิดว่าสารเคมีกำจัดวัชพืชสามารถตกค้างในผลผลิต และเป็นอันตรายต่อผู้บริโภค | | | | | |
| 6.13 | ฉันคิดว่าสารเคมีราคาแพงมีประสิทธิภาพในการกำจัดแมลงได้ดีกว่า | | | | | |
| 6.14 | ฉันคิดว่าหากฉีดพ่นสารเคมีกำจัดวัชพืชโดยไม่สวมอุปกรณ์ป้องกัน ต้องอาบน้ำทันทีหลังจากฉีดพ่นเป็นการป้องกันตัวอีกวิธีหนึ่ง | | | | | |

**ส่วนที่ 3 การใช้สารเคมีกำจัดวัชพืช**

1. ท่านใช้สารเคมีกำจัดวัชพืชที่ในการดูแลพืชบ่อยแค่ไหน(เลือกได้1ข้อ)

(  )1. 1 วัน/ เดือน (  )2. 2-3 วัน/ เดือน (  )3. 4-7 วัน/ เดือน (  )4.อื่น ๆ .....

2. เมื่อท่านผสมสารเคมีกำจัดวัชพืช ท่านผสมสารเคมีกำจัดวัชพืชปริมาณเท่าใดต่อครั้ง(เลือกได้1ข้อ)

(  )1. 1/2 ลิตร

(  )2. 3/4 ลิตร

(  )3. 1 ลิตร

(  )4. อื่น ๆ ……

3. เมื่อท่านผสมสารเคมีกำจัดวัชพืช ใช้น้ำผสมสารเคมีกำจัดวัชพืชปริมาณครั้งล่ะเท่าไหร่(เลือกได้1ข้อ)

(  )1. 10 ลิตร (  )2. 15 ลิตร (  )3. 20 ลิตร (  )4. อื่น ๆ ……

4. ท่านฉีดพ่นสารเคมีกำจัดวัชพืชด้วยวิธีใด(เลือกได้1ข้อ)

(1) ใช้ถังสะพายหลังในการฉีดพ่น (2) ใช้เรือฉีดพ่น

(3) ใช้มือหยิบ/ ตัก (4) อื่น ๆ ระบุ.....

5. การใช้อุปกรณ์ป้องกันตัวส่วนบุคคล


| อุปกรณ์ | อุปกรณ์ที่ใส่ถูกต้อง | |
|---|---|---|
| | ใช่ | ไม่ใช่ |
| 5.1.หมวกป้องกันสารเคมี | | |
| 5.2.หน้ากากกรอง | | |
| 5.3. เสื้อเชิ้ตแขนยาว (พลาสติกหรือผ้า)กันน้ำ | | |
| 5.4.กางเกงขายาว (พลาสติกหรือผ้า)กันน้ำ | | |
| 5.5.ถุงมือ (พลาสติกหรือผ้า)กันน้ำ | | |
| 5.6.รองเท้าบูทกันน้ำ | | |
| 5.7.แว่นตากันลม/ฝุ่น | | |
| 5.8.ผ้าคลุม (หรือพลาสติก) | | |

6. การปฏิบัติตัวในการใช้สารเคมีกำจัดวัชพืช

| ข้อ | ข้อคำถาม | ทำเป็นประจำ | ทำเป็นบางครั้ง | ทำน้อยครั้ง | ไม่ทำเลย |
|---|---|---|---|---|---|
| 6.1 | ก่อนฉีดพ่น สูดดมสารเคมีกำจัดวัชพืชเพื่อตรวจเช็คดูว่าเป็นของจริงหรือของปลอม | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6.2 | สูบบุหรี่หรือดื่มน้ำขณะฉีดพ่นสารเคมี | | | | |
| 6.3 | พ่นสารเคมีกำจัดวัชพืช ขณะลมแรง | | | | |
| 6.4 | ยืนอยู่เหนือทิศทางลม ขณะพ่นสารเคมีไม่ใช้อุปกรณ์ป้องกัน | | | | |
| 6.5 | หลังฉีดพ่น ทิ้งภาชนะบรรจุสารเคมีกำจัดวัชพืชลงในแหล่งน้ำ | | | | |
| 6.6 | หลังฉีดพ่น เก็บสารเคมีในตู้สำหรับเก็บสารเคมีนอกบ้านและล๊อคไว้ | | | | |
| 6.7 | หลังฉีดพ่น ล้างมือและหน้า ด้วยสบู่ก่อนรับประทานอาหาร | | | | |

**ส่วนที่ 4 ข้อมูลผลกระทบทางสุขภาพของหลังจากฉีดพ่นสารเคมีกำจัดวัชพืชภายในช่วง 7 วันที่ผ่านมา**

| ผลกระทบทางสุขภาพ | ใช่ | ไม่ใช่ |
|---|---|---|
| **อาการทางผิวหนัง** | | |
| - คัน/ผื่นขึ้น/มีรอยไหม้ | | |
| - มือชา | | |
| - กล้ามเนื้อกระตุกหรือเป็นตะคริว | | |
| - เลือดไหล | | |
| **อาการทางตา** | | |
| - มองภาพไม่ชัดเจน | | |
| - น้ำตาไหล | | |
| - ระคายเคืองตา/อาการคัน / อักเสบ | | |
| **ระบบประสาท** | | |
| - ปวดหัว/เวียนศีรษะ | | |
| - ว่างและซึมเซา | | |

| | | |
|---|---|---|
| - หงุดหงิดง่าย | | |
| **ระบบทางเดินหายใจ** | | |
| - หายใจมีเสียงวี้ด | | |
| - หายใจลำบาก | | |
| - หายใจเป็นจังหวะสั้น ๆ | | |
| **ระบบทางเดินอาหาร** | | |
| ***- อาเจียน*** | | |
| - เบื่ออาหาร | | |
| - ปวดเกร็งท้อง | | |
| **อวัยวะคัดหลั่ง** | | |
| - มีน้ำลายมากกว่าปกติ | | |
| - เหงื่อออกมากกว่าปกติ | | |

# Appendix B

Administration Cost

| No. | Item | Price (BAHT) | Amount | Total Price (BAHT) |
|---|---|---|---|---|
| | Data Collection (Bangkok – Suphan Buri) | | | |
| 1 | Car rental and fuels | 1500 | 10 days | 15,000 |
| 2 | Accommodation | 1000 | 10 nights | 10,000 |
| 3 | Photocopy Questionnaires | 1 | 1500 papers | 1,500 |
| 4 | Stationery | 100 | 5 tool boxes | 500 |
| 5 | Participant Incentive | 50 | 150 persons | 7,500 |
| | | | | 34,500 |
| | Pre-testing (Bangkok- Ban Mo Subdistrict) | | | |
| 1 | Car rental and fuels | 1500 | 7 days | 10,500 |
| 2 | Photocopy Questionnaires | 1 | 500 papers | 500 |
| 3 | Stationery | 100 | 3 tool boxes | 300 |
| 4 | Participant Incentive | 50 | 35 persons | 1,750 |
| | | | | 13,050 |
| **Total** | | **47,550** | | |

# Appendix C

Schedule Activities

| Order | Timeline | Time Frame (Month) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2018 | | | | | 2019 | | | | | | |
| | | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | Literature Review | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| 2 | Questionnaire | | | | | | ■ | ■ | ■ | ■ | | | |
| 3 | Ethical Consideration | | | | | | | | ■ | ■ | ■ | | |
| 4 | Data Collection | | | | | | | | | | ■ | | |
| 5 | Data Analysis | | | | | | | | | | ■ | ■ | |
| 6 | Discussion | | | | | | | | | | | ■ | ■ |
| 7 | Re-check | | | | | | | | | | | | ■ |
| 8 | Finalize | | | | | | | | | | | | ■ |

# Appendix D

AF 02-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University

Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand.
Tel/Fax: 0-2218-3202, 0-2218-3409 E-mail: eccu@chula.ac.th

COA No. 163/2019

## Certificate of Approval

**Study Title** No. 093.1/62 : ACUTE SYMPTOMS ARISING FROM APPLICATION OF HERBICIDES AMONG RICE FARMERS IN SONG PHI NONG SUBDISTRICT, SONG PHI NONG DISTRICT, SUPHAN BURI PROVINCE, THAILAND: A CROSS-SECTIONAL SURVEY

**Principal Investigator** : MISS QIN CAI

**Place of Proposed Study/Institution** : College of Public Health Sciences, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with Belmont Report 1979, Declaration of Helsinki 2013, Council for International Organizations of Medical Sciences (CIOM) 2016, Standards of Research Ethics Committee (SREC) 2013, and National Policy and guidelines for Human Research 2015.

Signature: ..... Signature: .....

(Associate Prof. Prida Tasanapradit, M.D.)
Chairman

(Assistant Prof. Nuntaree Chaichanawongsaroj, Ph.D.)
Secretary

Date of Approval : 20 June 2019 Approval Expire date : 19 June 2020

**The approval documents including:**

1) Research proposal
2) Participant Information Sheet and Consent Form
3) Researcher
4) Questionnaire

093.1/62
20 JUL 2019
19 JUL 2020

*The approved investigator must comply with the following conditions:*

1. *The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.*
2. *Strictly conduct the research/project activities as written in the proposal.*
3. *Using only the document's that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).*
4. *Report to the RECCU for any serious adverse events within 5 working days.*
5. *Report to the RECCU for any change of the research/project activities prior to conduct the activities.*
6. *Final report (AF 02-14) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.*
7. *Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.*

# Appendix E

**บันทึกข้อความ**

**ส่วนงาน** คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 โทร.0-2218-3202,3409
**ที่** จว 543 /2562 (อ) **วันที่** 24 มิถุนายน 2562
**เรื่อง** แจ้งผลผ่านการพิจารณาจริยธรรมการวิจัย

**เรียน** คณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข

**สิ่งที่ส่งมาด้วย** เอกสารแจ้งผ่านการรับรองผลการพิจารณา

ตามที่นิสิต/บุคลากรในสังกัดของท่านได้เสนอโครงการวิจัยเพื่อขอรับการพิจารณาจริยธรรมการวิจัย จากคณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย นั้น ในการนี้ กรรมการผู้ทบทวนหลักได้เห็นสมควรให้ผ่านการพิจารณาจริยธรรมการวิจัยได้ ดังนี้

โครงการวิจัยที่ 093.1/62 เรื่อง อาการเฉียบพลันที่เกิดจากการใช้สารเคมีกำจัดวัชพืชในกลุ่มของชาวนา ตำบลสองพี่น้อง อำเภอสองพี่น้อง จังหวัดสุพรรณบุรี ประเทศไทย (การศึกษาภาคตัดขวาง) (ACUTE SYMPTOMS ARISING FROM APPLICATION OF HERBICIDES AMONG RICE FARMERS IN SONG PHI NONG SUBDISTRICT, SONG PHI NONG DISTRICT, SUPHAN BURI PROVINCE, THAILAND: A CROSS-SECTIONAL SURVEY) **ของ MISS QIN CAI** นิสิตระดับมหาบัณฑิต วิทยาลัยวิทยาศาสตร์สาธารณสุข

จึงเรียนมาเพื่อโปรดทราบ

(ผู้ช่วยศาสตราจารย์ ดร.นันทรี ชัยชนะวงศ์โรจน์)
กรรมการและเลขานุการ
คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน
กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย

# Appendix F

AF 05-07

**หนังสือยินยอมเข้าร่วมในการวิจัย**

สถานที่ สองพี่น้อง

วันที่ 1 เดือน ก.ค. พ.ศ. 2562

เลขที่ ตัวอย่าง/ผู้มีส่วนร่วมในการวิจัย .....

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย

ชื่อโครงการวิจัย อาการเฉียบพลันที่เกิดจากการใช้สารเคมีกำจัดวัชพืชในกลุ่มของชาวนา ตำบลสองพี่น้อง อำเภอสุพรรณบุรี จังหวัดสุพรรณบุรี ประเทศไทย (การศึกษาภาคตัดขวาง)

ชื่อผู้วิจัยหลัก .....นายสวาจิน ไข่ .....

ที่อยู่ที่ติดต่อ ..... 223 ซอย เพชรบุรี 5 ซอย เพชรบุรี 7 แขวง ทุ่งพญาไท เขต ราชเทวี กรุงเทพมหานคร โทรศัพท์ 0652641704

ข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่าง ๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมในโครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย โดยข้าพเจ้ายินยอมเข้ารับการสัมภาษณ์ด้วยแบบสอบถามอาการเฉียบพลันที่เกิดจากการใช้สารเคมีกำจัดวัชพืชในกลุ่มของชาวนา ตำบลสองพี่น้อง อำเภอสองพี่น้อง จังหวัดสุพรรณบุรี ประเทศไทย โดยมีข้อคำถาม 72 ข้อ ใช้เวลาประมาณ 30 นาที เอกสารบันทึกข้อมูลจะถูกทำลายเมื่อการวิจัยเสร็จสิ้นสมบูรณ์กระบวนการ

ข้าพเจ้ามีสิทธิถอนตัวออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้นจะไม่มีผลกระทบในทางใด ๆ ต่อการดำเนินชีวิตและการประกอบอาชีพของข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใด ๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถร้องเรียนได้ที่ คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 *จุฬาลงกรณ์มหาวิทยาลัย อาคารจามจุรี 1 ชั้น 2 254 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์ 0-2218-3202 อีเมล* eccu@chula.ac.th

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน นอกจากนี้ข้าพเจ้าได้รับสำเนาเอกสารข้อมูลซึ่งเป็นคำชี้แจงผู้มีส่วนร่วมในการวิจัย และสำเนาหนังสือยินยอมไว้แล้ว

ลงชื่อ ..... ลงชื่อ .....

( QIN CAI ) ( )

ผู้วิจัยหลัก ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ .....

( )

พยาน

เลขที่โครงการวิจัย 093.1/62

วันที่รับรอง 20 มิ.ย. 2562

วันหมดอายุ 19 มิ.ย. 2563

# VITA

| | |
|---|---|
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| **PLACE OF BIRTH** | china |
| **INSTITUTIONS ATTENDED** | college of public health |
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