



## CHAPTER 3

### MATERIAL AND METHODOLOGY

#### 3.1 Population and Samples in Tambon Bang Rieng

##### 3.1.1 Tambon Bang Rieng

Department of Provincial Administration, 2001, and the Office of Agricultural Research and Development (Zone 8), 1996, report that area of Tambon Bang Rieng was 22,665 rais (9,066 acres) with the population of 8,474 persons from 1,840 families. Approximately 520 families are farmers, which are the main occupation in this area. Map of Tambon Bang Rieng was shown in the Figure 3.1

##### 3.1.2 Interview questionnaire study

From 520 families of Traditional and IPM farmers, the amount of samples were 33 Traditional and 40 IPM farmers who were selected by simple random sampling method. The samples in the interview questionnaire study may be the same person as the pesticide concentration in the working air study.

##### 3.1.3 Pesticide concentration in the working air condition study

McCommon (1998) recommended for the sampling size in the industrial hygiene study. For the accuracy of the sampling and measurement method to be used and the confidence one wishes to have in predicting the exposure of the workforce, the minimum sample size including 90% confidence interval at least one high risk employee was 22 samples, which calculated from the infinite population. This study will apply Judgment or Purposive Sampling method to specify the sample by assigning farmers who spray pesticide. 18 Traditional and 15 IPM farmers were selected as the sample of pesticide concentration in

the air. Organophosphate pesticides in this study were chlorpyrifos and methyl parathion.

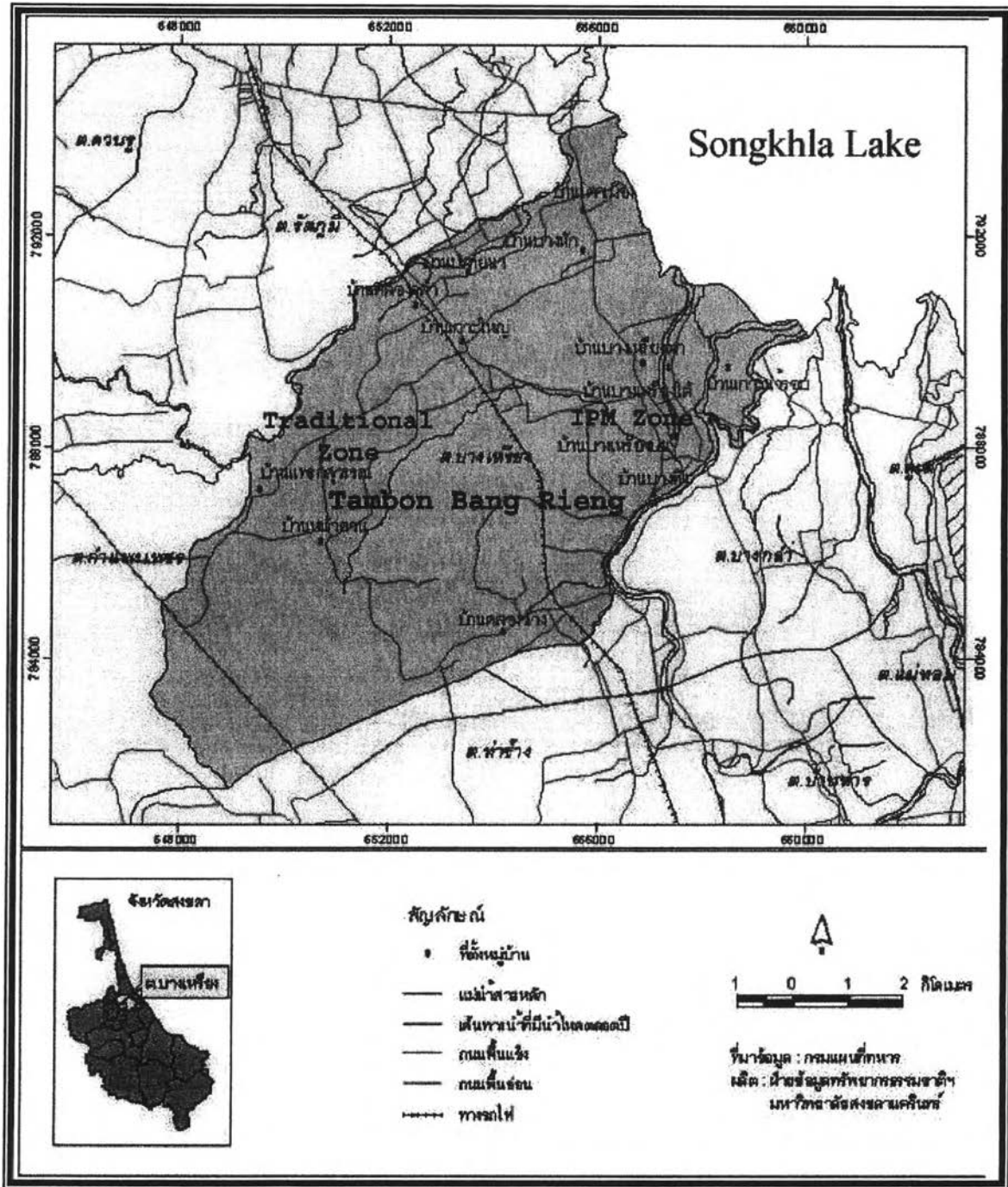
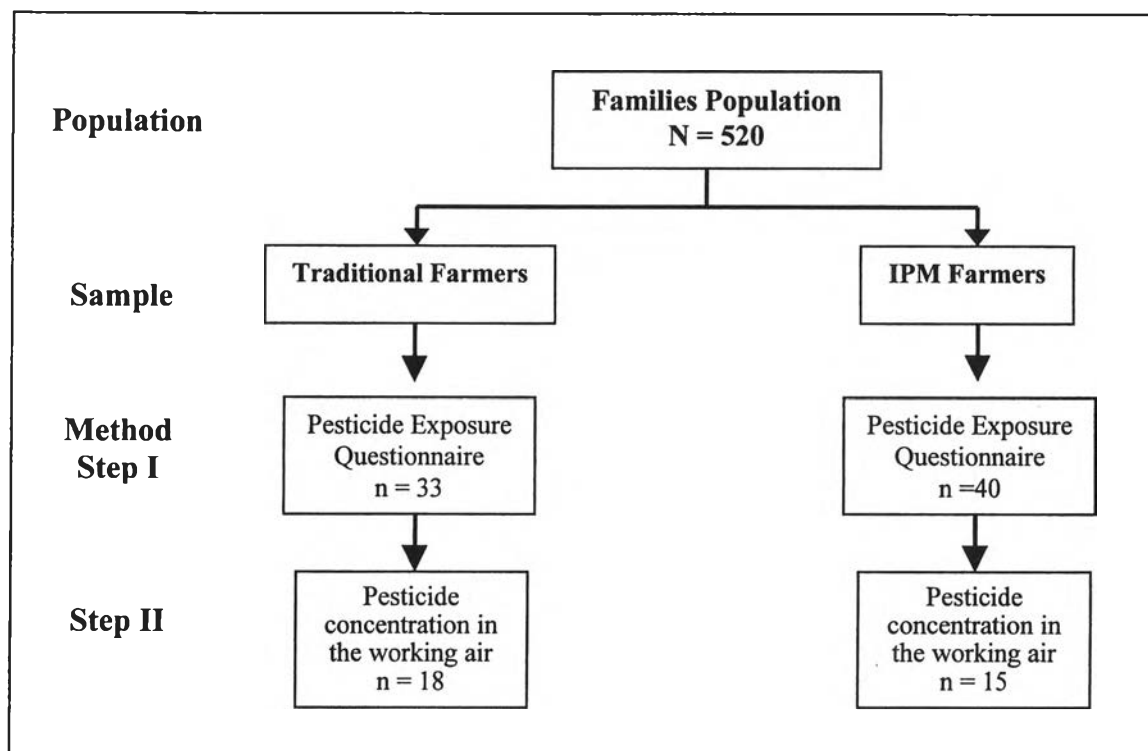


Figure 3.1 Map of Tambon Bang Rieng

For the appropriateness of sample, it needed to interview and collect some information from the farmers before sampling the pesticide concentration in working conditions. The required data were the name and duration of pesticide applied, and the observation of personal protective device, whether the farmer wear mask or not, etc.

Details of the population, samples and sampling method in this study are show in Figure 3.2.



**Figure 3.2: Population, Samples and Sampling Method in each Study**

## 3.2 Procedure

### 3.2.1 Pesticide Exposure Questionnaire

The methods of questionnaire development for pesticide exposure assessment are the following:

- 1.1 Questionnaires will be adapted from Agricultural Health Study Questionnaire from USA, The Institute of Environmental Medicine; WHO, and etc, and translated into Thai language.

However, each item would be assigned its score. Questionnaires would be an open-ended question which consisted of 4 parts as follow:-

- Part 1: General Information; This is to get the necessary data from the farmers such as name and addresses, ages, gender, educational backgrounds, house locations, number of children, applying pesticide information, and etc.
- Part 2: Health Information; This is to assess farmers' health problems which may arise from the exposure with organophosphate pesticide including some related signs and symptoms.
- Part 3: Pesticide Exposure Assessment; It contains 26 questions to assess farmer's behaviors and their activities related with pesticide exposure such as mixing and spraying method, storage and disposal, wearing personal protective devices, drinking, consuming and smoking behaviors, and etc. Each item will consist of ranking score to evaluate each behavior's content and total score in this part is 92 points.
- Part 4: IPM Information; This is to evaluate the alternative method that IPM farmers for pest control. This part will be answered by IPM farmers only.

Details of the questionnaire are shown in Appendix A

- 1.2 Language used in the questionnaire and its content would be reviewed by the Psychological specialist from the faculty of Liberal Arts; Thammasat University, Occupational Health and Safety specialist from the faculty of Public Health, Mahidol University, and Pesticide specialist from the faculty of Environmental Resource, Prince of Songkla University.

- 1.3 Five samples of Traditional and IPM farmers would be requested to answer the questionnaires to test whether it would be in line with population behavior, social and culture or not.
- 1.4 Data would be collected by interviewing with 33 Traditional and 40 IPM farmers in Tambon Bang Rieng.
- 1.5 Data would be input and analyzed by SPSS program.

### **3.2.2 Pesticide Concentration in the Air Sampling**

#### **3.2.2.1 Equipment for air sampling are as follows:-**

1. Personal Sampling Pump: SKC 224-PCXR4 with flow rate 1 l/min with OVS tube holder.
2. OVS-2 tubes: 11-mm ID x 13 mm OD x 50 mm long, with outlet end drawn to a 6-mm o.d. x 25-mm. long tube. The enlarged part of the tube contains a 270mg front section of 20/60 mesh XAD-2 sorbent or equivalent held in place by a 9 -10 mm o.d. quartz fiber filter and polytetrafluoroethylene (PTFE) retaining ring.
3. Field Rota Meter : measure range 0.4-5 l/min
4. Teflon tubing
5. Polystyrene foam box

#### **3.2.2.2 Equipment for sampling preparation and analysis are the following:-**

1. Vial 5-mL with cap
2. Beaker 250 ml
3. Pipette 5-, 3-, 2- and 1-ml
4. Aluminum foil
5. Tweezers
6. Ultrasonic Cleaning Bath
7. Gas Chromatograph: Hewlett Packard 6890plus series, the specification are the following:  
Column: HP fused-silica capillary Column; HP-5 Cross-Linked 5% Phenyl Methyl Siloxane,

Film Thickness 0.25  $\mu\text{m}$ ., ID 0.32 mm.,  
Length 30.0 m., phase ration 320  
Temperature - Injection: 250  $^{\circ}\text{C}$   
- Detector: 320  $^{\circ}\text{C}$   
Detected: NPD Detector  
Carrier gas: He  
Fuel gas:  $\text{H}_2$

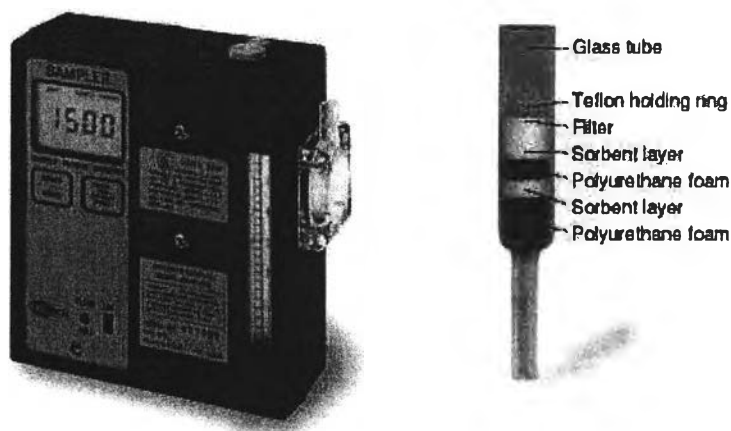
### 3.2.2.3 Analytical Reagent

1. Standard Solution of organophosphste pesticide: chlorpyrifos and methyl parathion, in 10 ng/ $\mu\text{l}$
2. Toluene; pesticide analytical grade
3. Acetone; ACS reagent grade
4. Cyclohexane; ACS reagent grade

## 3.3 Sampling Procedure

Sampling method to study the pesticide concentration in the air followed NIOSH Manual of Analytical Methods Number 5600: Organophosphorus Pesticides, Issue 1: 15 August 1994. Fourth Edition The summary method was the followings:-

- 3.3.1 Calibrating the personal pump for setting the suitable flow rate at 1 l/min.
- 3.3.2 Using the personal pump to evacuate air through solid sorbent tube (OVS-2 tube: 13 m.m. quartz filter; XAD-2, 140/270 mg). The requirement air sampling volume between 60-120 liters or use sampling time 60-120 min. Figure 3.1 showed pesticide sampling both personal pump and OVS-tube.



**Figure 3.3: Personal Pump Sampling and OVS-tube**

- 3.3.3 Removing filter and front XAD-2 section to vial and transferred the short polyurethane foam plug along with back up XAD-2 section to a second vial.
- 3.3.4 Extracting with desorbing solvent (2 ml of Acetone/Toluene solution: 1/9) and stand 30 min. then put in the ultrasonic bath 30 min.
- 3.3.5 Transferring 1-1.5 ml from each vial to a clean 2-ml vial, cap and labeled before inject in GC.
- 3.3.6 Analyzing the concentration of organophosphate pesticide by GC-NPD and HP ChemStation Software.
- 3.3.7 Calculating the total organophosphate pesticide concentration in working air when the farmers sprayed the pesticide. By determining the mass in mg of respective analyte found in the sample front ( $W_f$ ) and back ( $W_b$ ) sorbent section, and in the media blank front ( $B_f$ ) and back ( $B_b$ ) sorbent section then calculating concentration,  $C$ , of analyte in the air volume sample,  $V(L)$ :

$$C = (W_f + W_b - B_f - B_b)/V \text{ (mg/m}^3\text{)}$$

If  $W_b > W_f/10$  report breakthrough and possible samples loss.

### 3.3.8 Calibration and Quality Control

3.3.8.1 Calibrating by adding known amounts of calibration spiking solution to desorbing solution in 2-mL volumetric flasks and diluting to the mark. Include a calibration blank of unspiked desorbing solution and analyzed together with field blanks, and laboratory control samples Prepared calibration graph.

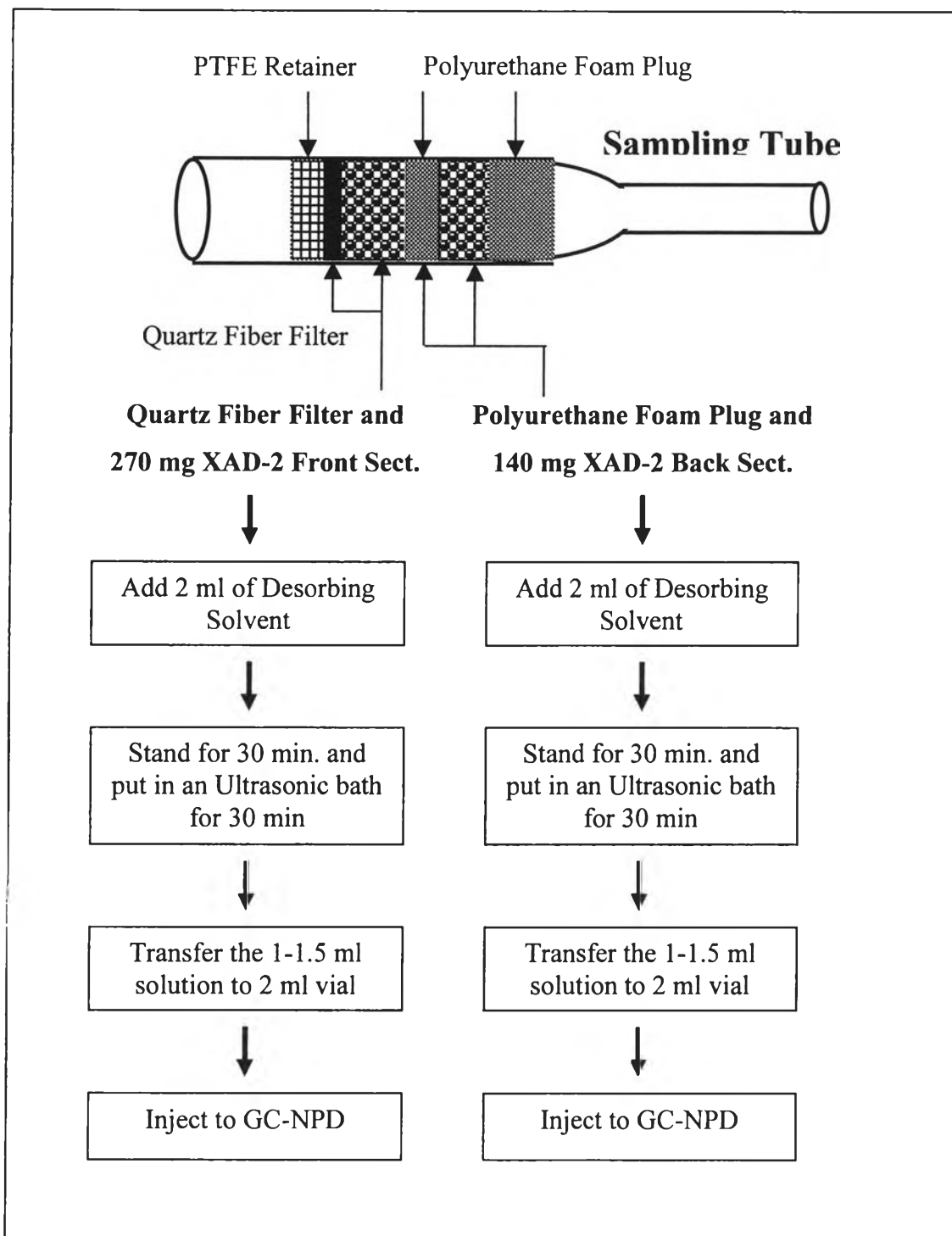
The GC-NPD conditions for chlorpyrifos and methyl parathion analysis and its calibration curve were shown in the Appendix B

3.3.8.2 Prepare Laboratory Control Samples (LCS) by removing cap from large end of sampler tube. Apply 30  $\mu$ l of standard solution to face of quartz fiber filter. Cap and allowed to stand for a minimum of 1 hour. These should be prepared as soon as samples arrive and should be stored with the field samples until analyzed. Include an unspiked sampler as a media blank. Analyze along with field samples and blanks, and liquid calibration standards

Detection limited and Recovery

The detail of sample preparation was showed in the Figure 3.4.





**Figure 3.4: The Sampling Preparation Method**

### 3.4 Statistical Analysis

Data would be analyzed by Statistical Package for the Social Sciences (SPSS for window Version.10.0) program and test hypothesis were following:

#### 3.4.1 Data Description

- Central tendency: mean, mode and percentage to describe the general information of samples such as gender, age, educational background, frequency and duration of usage the pesticide application in the past, etc.
- Data dispersion: Standard deviation

#### 3.4.2 Statistic Testing

- Hypothesis Testing:
  - t-test to compare the pesticide exposure score and pesticide concentration in working condition between Traditional and IPM farmers
  - F-test and ANOVA to compare the pesticide exposure scores and pesticide concentration in differences of house location, usage of spraying equipment, etc. Figure 3.5 showed the pesticide spraying equipment that farmers always used.
- Correlation and association between pesticide exposure score and spraying equipment and pesticide concentration in working air and spraying equipment.



(a) Motor Pump



(b) Hand Pump

**Figure 3.5: Pesticide Spraying Equipment (a) Motor Pump and (b) Hand Pump including their Mist and Plume**

**Note:** The farmers used three different equipment to spray the pesticide, which were Motor pump, Hand Pump and Portable Motor. The highest capacity among these three equipment which Traditional farmers always used was Motor pump (high-pressure pump with the finely mist plume). The second equipment was Portable Motor and the third one with the lowest capacity was Hand pump, which produced the large size of mist and IPM farmers always used.