CHAPTER I

INTRODUCTION

Thailand is one of the largest worldwide agricultural producers and exporters of products such as rice, fruits, cassava, sugar, para-rubber, etc. To keep up with an increasing worldwide demand, Thai farmers use a large amount of agricultural chemicals (pesticides, chemical fertilizers, or synthetic hormones) to help increase productivity by speeding up and controlling crop productions as well as reducing pests and epidemic plants. Use of pesticides has increased enormously in the past twenty years. By year 2002, approximately 39,000 tons of active ingredients were being imported into Thailand (IMP Thailand, 2003).

Bang Rieng agricultural community is one of the largest vegetable farming region located within the Bang Rieng subdistrict, Khuan Nieng district, Songkhla province, Southern Thailand (Figure 1.1). The community is divided into two regions based on the patterns of agricultural practices: intensive and integrated pest management (IPM) areas. In this study, intensive agriculture refers to a commercial agricultural system that relies on a large market. As part of traditional practices, farmers mainly use pesticides for pest control. IPM agriculture, on the other hand, refers to an agricultural practice that promotes farmers to grow their crops using less pesticide, by combining pesticide use with an alternate technique such as, biological control, crop rotation or netted crop growing. The intensive agriculture region within the Bang Rieng community covered approximately 891 rais of vegetable farm area, including 92 households. The IPM region within the Bang Rieng community covered approximately 276 rai of vegetable farm area (Information from a GIS surveying by Faculty of Natural Resource, Prince of Songkla University between September to October, 2004).

This study focused on the intensive agricultural area because of its high pesticide use. According to the previous studies in the Bang Rieng agricultural

community, organophosphate (OP) pesticides have been used as common pesticides in this area and were measured in soil and water pond around the agricultural region (Danai Tipmanee, 2000; Nongrat Klabrod, 2000). A previous study also found that intensive farmers are exposed to higher levels of OP pesticides compared to IPM farmers (Jirachaiyabhas *et al.*, 2004). Most studies thus far have examined occupational exposure of farm workers who have been exposed to pesticides directly. However, little is known about non-occupational pesticide exposure in this area, especially for sensitive population such as young children.

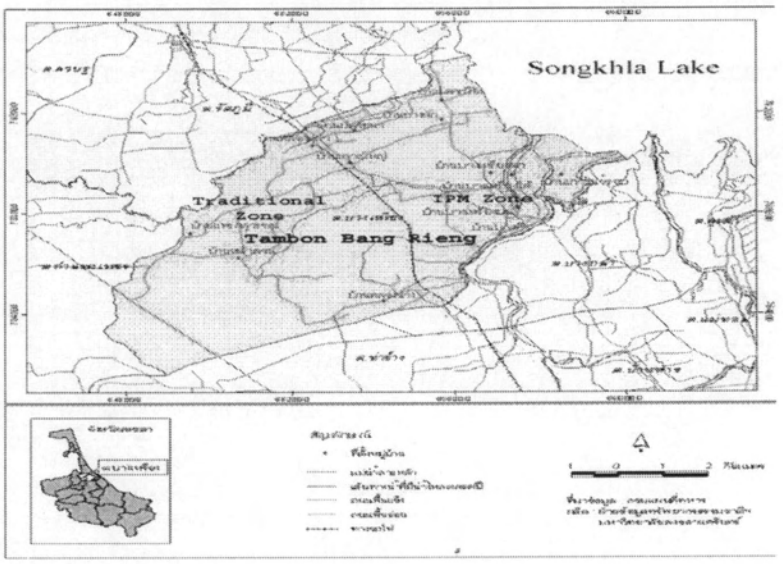

Figure 1.1 Map of Bang Rieng Agricultural Community

Agricultural pesticide use may be an important source of non-occupational pesticide exposure, particularly for children (Azaroff, 1999). Children are more sensitive to exposure of toxic compounds than adults because of their higher metabolism and lower body weights. They are also undergoing physical development and enhance hand-to-mouth or object-to-mouth behaviors (Bearer, 1995). The exposure potential for children of agricultural families may be higher than for other child population because the pesticides are used in high volume near their home. The children can be exposed to pesticides indirectly through dust in the home or by entering recently sprayed fields (Simcox *et al.*,1995; Loewenherz *et al.*,1997).

Several studies have also shown that children can be exposed to pesticides via take-home pathway which their parents bring to the home such as clothing, shoes, or vehicle dust (Lu *et al.*, 2000; Curl *et al.*, 2002).

However, non-occupational exposure studies to date have been mostly conducted in developed countries. Few studies have investigated pesticide exposures in developing countries which most people are rely on agricultural products. It was reported that in some countries, farmers and their families lived close to their fields, and the risk of indirect exposure was higher than in those countries where farmers lived in villages and walked daily to their fields (Copplestone, 1985). Moreover, the mortality rate of the occupational cases tended to be lower than the non-occupational cases, and the incidence of cases is considerably higher in developing countries. The main victims among the non-occupational cases are children under five years old (Copplestone, 1985).

The potential health effects associated with children's non-occupational exposure to pesticides have been a subject of increasing concern particularly in developing countries. The purpose of this study, therefore, was to investigate non-occupational pesticide exposure among preschool children living in an agricultural community in order to provide some initial baseline information for studying children's pesticide exposure in Thailand.

1.1 Objectives

The main objective of this study was to investigate non-occupational pesticide exposure among preschool children (2-5 years of age) living in Bang Rieng agricultural community. The specific objectives include:

1) To determine the exposure pathways by environmental monitoring and personal measurement for selected organophosphate (OP) pesticide, and biological monitoring for urinary OP metabolites.

2) To identify possible exposure factors of non-occupational exposure to OP pesticides for children

3) To determine the relationship among OP pesticide in environmental and personal media including children's activities with OP metabolites in children's urine

4) To calculate the average daily dose (ADD) for each exposure pathway of concern and estimate biologically based pesticide dose from urinary metabolite concentration data, and compare to the toxicological reference dose

5) To estimate the potential risk associated with the children's exposure to OP pesticides and compare the risk between children inside farming area and children outside the farmland, and compare across spraying season.

1.2 Hypothesis

- Preschool children living inside or nearby treated farmland have higher potential risk from non-occupational OP pesticide exposure than children in non-farming areas.
- Children activities can contribute to the OP exposure.
- Difference in seasonal pesticide spraying can cause the difference of the pesticide exposure for the children.

1.3 Scope of the study

This study employed a cross-sectional design took place in Bang Rieng agricultural community, Songkhla province, Southern Thailand. The study was designed to determine OP pesticide exposure of preschool children (2 to 5 years of age) living in the community. Sample collection was carried out over two rounds of sampling; dry season (April-May 2004) and wet season (September-October 2004). Samples were repeatedly collected for each season. Chlorpyrifos, dicrotophos,

methyl-parathion, and profenofos were measured from surface soil, floordust, dermal wipes (children's hands and feet), and five common urinary OP metabolites were analyzed from children's urine. Parental interview was also conducted using questionnaire and child's activity diary for identifying possible exposure factors. Hazard index calculation was performed to assess the potential non-carcinogenic hazard associated with the children's exposure to OP pesticides.

Conceptual Framework