การลดความเสี่ยงจากการสัมผัสสารพาราควอทของเกษตรกรชาวไร่ข้าวโพด โดยใช้รูปแบบการสื่อสารความเสี่ยง ณ ตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน ประเทศไทย

นายเด่นพงษ์ วงศ์วิจิตร

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรดุษฎีบัณฑิต
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RISK REDUCTION OF PARAQUAT EXPOSURE THROUGH RISK COMMUNICATION MODEL IN MAIZE FARMERS AT NAMTOK SUB-DISTRICT, NANOI DISTRICT, NAN PROVINCE, THAILAND

Mr.Denpong Wongwichit

A Dissertation Submitted in Partial Fulfillment of the Requirements
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Thesis Title	RISK REDUCTION OF PARAQUAT EXPOSURE THROUGH RISK COMMUNICATION MODEL IN MAIZE FARMERS AT NAMTOK SUB-DISTRICT, NANOI DISTRICT, NAN PROVINCE, THAILAND
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เด่นพงษ์ วงศ์วิจิตร : การลดความเสี่ยงจากการสัมผัสสารพาราควอทของเกษตรกรชาวไร่ข้าวโพดโดยใช้รูปแบบการสื่อสารความเสี่ยง ณ ตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน ประเทศไทย.(Risk Reduction of Paraquat Exposure through Risk Communication Model in Maize Farmers at Namtok Sub-district, Nanoi District, Nan Province, Thailand) อ. ที่ปรึกษาวิทยานิพนธ์หลัก : อาจารย์ ดร.วัฒน์สิทธิ์ ศิริวงศ์, อ. ที่ปรึกษาวิทยานิพนธ์ร่วม: ศาสตราจารย์ ดร.มาร์ค เกเกอรี่ รีอบสัน, 202 หน้า

วัตถุประสงค์: 1) เพื่อศึกษาข้อมูลพื้นฐานและทดสอบหาความสัมพันธ์ระหว่าง ความรู้ ทัศนคติ และการปฏิบัติตัว ต่อการใช้และสัมผัสสารกำจัดศัตรูพืชในเกษตรกรชาวไร่ข้าวโพดตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน; 2) เพื่อพัฒนารูปแบบการสื่อสารความเสี่ยงเพื่อลดความเสี่ยงจากการสัมผัสสารพาราควอทของเกษตรกรชาวไร่ข้าวโพดตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน; 3)เพื่อประเมินประสิทธิผลของรูปแบบการสื่อสารความเสี่ยงในเกษตรกรชาวไร่ข้าวโพด ตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน

รูปแบบและวิธีการศึกษา: ระยะแรกของการศึกษาใช้รูปแบบการศึกษาแบบภาคตัดขวาง ทำการเก็บข้อมูลด้วยวิธีการสัมภาษณ์แบบตัวต่อตัวด้วยแบบสัมภาษณ์ การสังเกตแบบมีส่วน และการสัมภาษณ์เชิงลึก ระยะที่สองของการศึกษาใช้รูปแบบการศึกษาแบบกึ่งทดลอง โดยมีการพัฒนารูปแบบการสื่อสารความเสี่ยงโดยใช้หลักการของการสื่อสารความเสี่ยงที่มีประสิทธิภาพ รูปแบบการสื่อสารความเสี่ยงประกอบด้วย 4 องค์ประกอบสำคัญ คือ การประชุมเชิงปฏิบัติการ การผลิตและการกระจายสื่อ การติดตามเยี่ยมบ้าน และการสนับสนุนอุปกรณ์ในการป้องกันส่วนบุคคล การประชุมเชิงปฏิบัติการแบ่งเป็น 6 ประเด็นคือ การสนทนากลุ่ม การบรรยายผลกระทบของพาราควอทต่อมนุษย์และสิ่งแวดล้อม การประเมินและวิเคราะห์การสัมผัสสารพาราควอท การส่งเสริมและสนับสนุนการจัดการกับความเสี่ยง การฝึกทักษะในการใช้สารพาราควอท รูปแบบการสื่อสารความเสี่ยงนี้นำไปใช้ในพื้นที่เป้าหมายเป็นระยะเวลา 6 เดือน หลังจากนั้นทำการประเมินประสิทธิผลของรูปแบบการสื่อสารความเสี่ยง ทั้งสองกลุ่ม ทั้งก่อนและหลังการใช้รูปแบบการสื่อสารความเสี่ยง

ผลการศึกษา: ระยะแรกของการศึกษาพบว่า เกษตรกรชาวไร่ข้าวโพดในตำบลน้ำตกส่วนมากมีความรู้อยู่ในระดับสูง มีทัศนคติที่ถูกต้องและมีการปฏิบัติตัวที่ถูกต้องในการใช้และสัมผัสสารกำจัดศัตรูพืช แต่ยังพบว่าเกษตรกรชาวไร่ข้าวโพดยังมีอาการที่เกิดจากพิษของสารกำจัดศัตรูพืช เพราะมีเกษตรกรบางส่วนไม่ใช้อุปกรณ์ป้องกันตัวเอง นอกจากนี้ยังพบว่าเกษตรกรบางส่วนใช้อุปกรณ์ป้องกันตัวเองที่ไม่เหมาะสม ในระยะที่สองของการศึกษา พบว่า การตกค้างของสารพาราควอทในซีรั่ม ก่อนการใช้รูปแบบการสื่อสารความเสี่ยง ไม่สามารถตรวจพบในปริมาณที่มากกว่า 0.21 มิลลิกรัมต่อลิตรในทั้งสองกลุ่ม และหลังการใช้รูปแบบการสื่อสารความเสี่ยง พบว่า สามารถตรวจพบการตกค้างของสารพาราควอทในซีรั่มในปริมาณที่มากกว่า 0.21 มิลลิกรัมต่อลิตร โดยพบในกลุ่มทดลอง 4 คน ร้อยละ 7.8 ในกลุ่มควบคุมพบ 11 คน ร้อยละ 19 และเมื่อทำการทดสอบความแตกต่างของสัดส่วนที่ตรวจพบ พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p>0.05$) ในส่วนของความรู้ ทัศนคติ และการปฏิบัติของการใช้และสัมผัสสารพาราควอท พบว่า มีการเพิ่มขึ้นของความรู้ ทัศนคติ และการปฏิบัติ อย่างมีนัยสำคัญทางสถิติในกลุ่มทดลอง($p<0.05$) ในขณะที่ภายในกลุ่มควบคุมไม่พบว่ามีการเพิ่มขึ้น และยังพบว่ามีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติระหว่างกลุ่มทดลองและกลุ่มควบคุม หลังจากการใช้รูปแบบการสื่อสารความเสี่ยง($p<0.05$) นอกจากนี้ยังพบว่าความแตกต่างของค่าเฉลี่ยที่เพิ่มขึ้นหลังการใช้รูปแบบการสื่อสารความเสี่ยงระหว่างทั้งสองกลุ่มมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ($p<0.05$) สำหรับการใช้อุปกรณ์ป้องกันตัวเองพบว่า มีความแตกต่างกันของสัดส่วนอย่างมีนัยสำคัญทางสถิติระหว่างกลุ่มภายหลังมีการใช้รูปแบบการสื่อสารความเสี่ยงในอุปกรณ์ หมวก ผ้าพันคอ แว่นตา ถุงมือ และผ้าปิดจมูก($p<0.05$) และในส่วนของการยินยอมใช้อุปกรณ์ป้องกันตัวเองอย่างเต็มรูปแบบพบว่า มีความแตกต่างกันของสัดส่วนอย่างมีนัยสำคัญทางสถิติระหว่างกลุ่มทั้งก่อนและหลังมีการใช้รูปแบบการสื่อสารความเสี่ยง($p<0.05$) และอาการที่เกิดจากพิษของสารพาราควอทภายหลังการใช้ภายในระยะเวลา 24 ชั่วโมง พบว่าภายหลังการใช้รูปแบบการสื่อสารความเสี่ยง สัดส่วนของการเกิดอาการมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ในอาการแสบร้อนจมูก ระคายเคืองตา น้ำตาไหล และน้ำมูกไหล ($p<0.05$)

สรุปและอภิปรายผล: สรุปได้ว่า การสัมผัสสารพาราควอทในการฉีดพ่นในไร่ข้าวโพดจะไม่ถือว่าเป็นความเสี่ยงต่อภาวะสุขภาพเลย หากมีการใช้เครื่องมือป้องกันตัวที่ถูกต้องและเหมาะสม และปฏิบัติตามคำแนะนำของการใช้สารพาราควอทอย่างเคร่งครัด ในการศึกษาครั้งต่อไปควรทำการศึกษารูปแบบการสื่อสารความเสี่ยงนี้อีกครั้งในพื้นที่ที่ประสบปัญหาเหมือนกันและมีรูปแบบการดำรงชีวิตของประชากรที่ใกล้เคียงกัน เพื่อเพิ่มความน่าเชื่อถือของรูปแบบการสื่อสารความเสี่ยงนี้ และควรศึกษาหารูปแบบและวิธีการอื่นๆที่จะใช้ในการตรวจหาการตกค้างของสารพาราควอทในซีรั่ม ที่สามารถตรวจพบในปริมาณที่น้อยกว่า 0.21 มิลลิกรัมต่อลิตร

สาขาวิชา.........สาธารณสุขศาสตร์.......................ลายมือชื่อนิสิต...

ปีการศึกษา........2553...................................ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก...

ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม ....

PH 5179201453 : MAJOR PUBLIC HEALTH
KEYWORDS : RISK REDUCTION/PARAQUAT EXPOSURE / RISK COMMUNICATION

DENPONG WONGWICHIT : RISK REDUCTION OF PARAQUAT EXPOSURE THROUGH RISK COMMUNICATION MODEL IN MAIZE FARMERS AT NAMTOK SUB-DISTRICT, NANOI DISTRICT, NAN PROVINCE, THAILAND. ADVISOR: WATTASIT SIRIWONG, M.Sc., Ph.D., CO-ADVISOR : PROFESSOR MARK GREGORY ROBSON, Ph.D., 214 pp.

Objectives: 1) To provide background and assess an association among the knowledge, attitudes, and practices of pesticide use and exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan province; 2) To modify risk communication model for reducing risk of paraquat exposure in the maize farmers at Nantok sub-distric, Nanoi district, Nan province t; 3) To evaluate the effectiveness of risk communication model in the maize farmers at Namtok sub-district, Nanoi district, Nan province.

Methods: Cross-sectional was conducted by face to face interviewed with questionnaires, in-depth interviewed and participatory observed in the first phase. Quasi-experimental was conducted in the second phase. Risk communication model was developed base on risk communication principle and was implemented into experimental group. Risk communication model comprised 4 components including public meeting workshop, production and distribution media, home visit and Personal Protective Equipment (PPE.) supporting. Public meeting workshop comprised 6 sessions within 2 days including focus group discussions, toxicity and health effect of paraquat, environmental effect of paraquat, susceptibility to paraquat exposure, peer norms for safe paraquat handling, skill training to increase self-efficacy beliefs. Risk communication model was performed in the target area within 6 months. Finally, the last phase was evaluated effectiveness of risk communication model.

Results: Phase 1: The majority of maize farmers have high knowledge, positive attitude, good practices, but maize farmers still have poisoning toxic symptoms due to pesticide exposure because some farmers did not use PPE and some farmers used improperly PPE. Phase 2: Primary outcome, paraquat residues in human serum were less than 0.21 mg/l (Limit of Detection, LOD) in both groups. After intervention, paraquat residues more than 0.21 mg/l were detected in 4 cases (7.8%) of experimental group and 11 cases (19.0%) of control group. Proportion test by non parametric statistic was almost significant ($p>0.05$). Secondary outcome, knowledge attitude, and practice within group in experimental group were significantly increase ($p<0.05$) whereas the control group were not. Knowledge, attitude, and practice between group after intervention were significantly difference ($p<0.05$). Moreover, the difference of mean of knowledge, attitude, and practice of paraquat and exposure between groups was strongly difference. The proportion of personal protective equipments (PPEs) use between group after intervention was significantly difference in use of hat, scarf, goggle, glove, and mask ($p<0.05$). Full compliance of PPE use was significant difference between group both before and after intervention ($p<0.05$). Finally, the proportion of paraquat poisoning toxic symptoms between group after intervention were significantly difference in burn nose, eye irritation, tear drop, and mucus symptoms ($p<0.05$)

Conclusion and discussion: Risk communication model may not affected to significantly decrease paraquat residue and paraqaut poisoning toxic symptoms after intervention in the experimental group when compared with the control group. On the other hand, risk communication model was affected to significantly increase the knowledge, attitude, and practice of paraquat use and exposure and significantly increase full compliance of PPE use after intervention in the experimental group when compared with the control group. In conclusion, the occupational exposure of paraquat that the maize farmers may not pose a health risk, if they follow the recommendations for use and adherence to safe working practices. The future research should be repeated done risk communication model in this area and other similar areas..

Field of Study : Public Health	Student's Signature Denpong Wongwichit
Academic Year : 2010	Advisor's Signature [signature]
	Co-advisor's Signature Mark Robson

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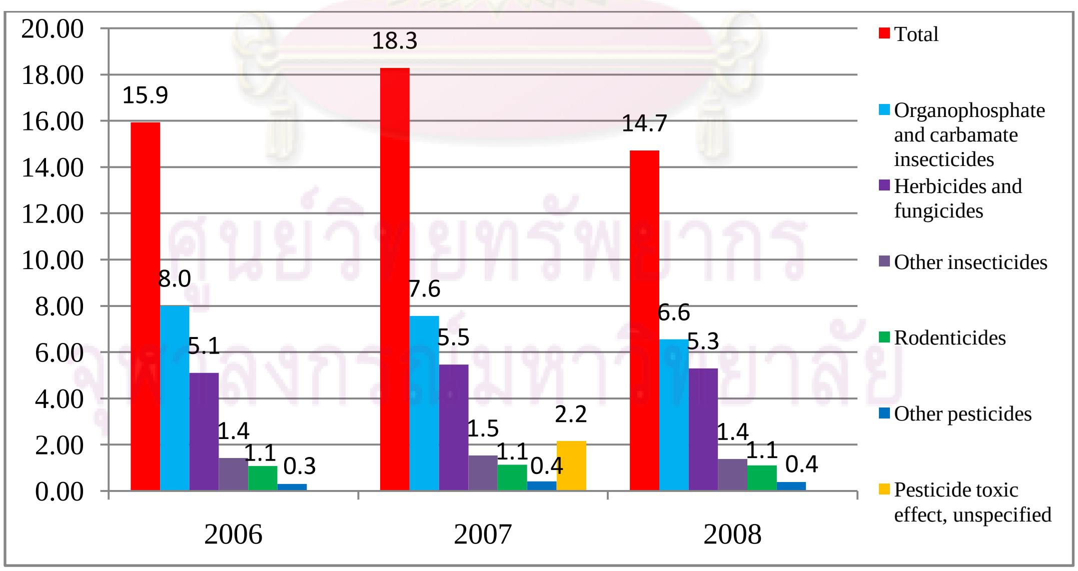
CHAPTER I
INTRODUCTION

1.1 Background and Rationale

The kingdom of Thailand lies in the heart of Southeast Asia. The country comprises 76 provinces that are further divided into districts, sub-district and villages. The Gross Domestic Product for 2009 shows that the industry sector contributed 34.93% while the wholesale and retail sector 14.14%, the agricultural sector 11.64%, the transportation sector 7.09%, the hotel and restaurant sector 4.82%, the government administrative and protective sector 4.41%, the education sector 4.16% and lastly, other sectors 18% (Office of Agricultural Economics, 2009a : online). It can be seen that the agricultural sector is an important sector because that contributes to the country's wealth as well as addresses the basic needs of its residents. Thailand produces three majors of agricultural products including farm plant (i.e. rice, maize, millet, cassava, sugar cane, soybean, green bean, peanut), fruit and perennial plant (i.e. rubber tree, oil palm, coffee, tea, lungan, durian, mangosteen, rambutan), and vegetable (i.e. garlic, onion, potato)(Office of Agricultural Economics, 2009b : online).

Thailand has been importing pesticides including herbicide, insecticide, and fungicide since the 1950s coinceiding with the expansion of the country's agricultural system from domestic to industrial production and mono-cropping agriculture (Wattasit Siriwong et al., 2009). The amount of chemicals imported into the country has increased dramatically from 1994 to 2007, 20,790 tons to 116,322 tons respectively (Office of Agricultural Economics, 2009c : online). Agrochemicals, such as fertilizers and pesticides have become a major part of farming in Thailand allowing for increased crop production and income. Although pesticides are available in the market, easy to use, require a small labor force, and allow for quick yield, many adverse health effects and environmental impacts have resulted from pesticide use. Pesticides not only destroys targeted weeds and pests, but it also contaminates soil, water, and air as well as damages the surrounding ecosystem and other living organisms necessary for maintaining ecological balance, for example, insects, birds, worms, fish, etc (Wattasit Siriwong, 2007, 2008, 2009) Pesticide residues can remain in the environment and cause long-lasting effects to humans and the environment long after discontinuation of it use (IPM Thailand, 2002 : online ; Sarun Keithmaleesatti, 2010). In humans and animals, pesticides target the endocrine system and can also cause cancer, infertility, and mutations. .

Figure 1 shows the latest morbidity rates among farmers in the use of different kinds of pesticides. According to the reports of Bureau of Occupational and Environmental Disease, the recent total morbidity rate of pesticide poisoning from 2006-2008 were 15.9, 18.3, 14.7 per 100,000 populations respectively. This shows that the pesticide poisoning still being problem in Thailand (Bureau of Occupational and Environmental Disease, 2008 : online). Organophosphate and carbamate insecticides morbidity, which has the highest morbidity rate of poisioning among farmers, were pegged at 8.0, 7.6, and 6.6 per 100,000 populations. Herbicides and fungicides poisoning morbidity which the second morbidity rate of poisioning in farmers were 5.1, 5.5, and 5.3 per 100,000 populations.



Source: *Bureau of Occupational and Environmental Disease*

Figure 1: Morbidity rate of pesticide poisoning in Thailand (2006-2008)

Occupational poisoning with pesticide is common in Thailand. This has largely been driven by the fact that farmers are often under trained and illiterate. Many of them consider it impractical and expensive to use safety equipment, especially in tropical climates where it gets very hot when using these types of equipment.

Maize is the third agricultural crop in Thailand. In 2009, the total growing area and harvesting area were 6,691,807 and 6,517,662 rais respectively. The northern region has the highest production of maize in Thailand where 4,181,975 rais is devoted to growing areas and 4,081,909 rais for harvesting areas (Office of Agricultural Economics, 2009d : online). Maize crop production involves the extensive use of herbicides. Maize farmers, on the other hand, lack knowledge on how to protect themselves from herbicide poisoning. Most of them frequently used herbicide without Personal Protective Equipment (PPE) use (Bureau of Epidemiology, 2004 : online). Also, due to pricing of herbicides, short reentry intervals, and inefficient sprayer maintenance, not only farmers but also their families are exposed to herbicides therefore increasing their risk.

Topographically, Nan province comprises 15 districts, 98 sub-district and 129,988 households. Close to 80% of the 103,299 households are farmers' households. In 2009, the top five agriculture products produced in Nan were maize 421,766.7 tons, rice 104,345.9 tons, longan 14,226.40 tons, lychee 10,432.41 tons respectively (Office of Commercial Affairs Nan, 2010 : online). In 2003, Roumsak Yamaiwong and Pichad Nongchang studied the situation of agrochemical in Nan province (Roumsak Yamaiwong and Pichad Nongchang, 2003). They found that farmers in all districts in the province have been using agrochemics dating as far back as 20 years ago. The top 3 districts that reported the highest use of herbicides in maize production, particularly paraquat (78.68%) are Tawangpha, Nanoi, and Meijarim districts. They also found risks of pesticide exposure in Nan province.

In Nanoi district, maize farms are located in the Namtok sub-district. Farmers have been using paraquat over 25 years for killing unwanted weed, protecting crops from pest, increasing crop yield, and hence increasing income (Namtok Sub-district Health Center, 2009). Due to othis situation, Namtok sub-district health workers were concerned about risk of paraquat exposure and its adverse impact on health. This has led to the establishment of asurveillance system using cholinesterase testing in all maize farmers in 2009. The initial surveillance results indicated that 39.5% of the total population had normal and safe level while 60.7% had risk and no safety of chorinesterase test. This demonstrates that a significant proportion of farmers are experiencing adverse health effects due to paraquat exposure. Unfortunately, there has been no study that has been carried out on the impact of paraquat use and exposure both human and the environment health.Maize farmers in Namtok sub-district are still at risk of paraquat exposure, while they have not known about exact risk of paraquat and how to get lid of or reduce risk.

Paraquat is one of the most widely used herbicides, and held the largest share of the global herbicide market. This herbicide was first synthesized in 1882. Its herbicidal properties were discovered only in 1955 in the ICI laboratories, which produced it commercially in 1961. Paraquat is sold in about 130 countries for use on large and small farms, plantations and estates and in non-agricultural weed control. It is a quick acting, non-selective herbicide, which destroys green plant tissue on contact and by translocation within the plant. Paraquat is increasingly used to destroy weeds in preparing land for planting in combination with no-till agricultural practices which minimise ploughing and help prevent soil erosion.

With regards to the key health issues its use, the greatest risk to workers for fatal and serious accidents is during mixing and loading. Several studies have shown high incidence of paraquat-related ill-health. A study in Guapiles, one of the main plantation regions of Costa Rica, identified 284 accident cases caused by paraquat between 1988 and 1990, including 123 cases of systemic poisonings, burns, eye injuries and fingernail damage. Conditions of use in many developing countries mean it is difficult to follow label instructions and recommendations for use. Sprayers generally have no or inadequate protective clothing, lack training, and have little knowledge of the specific effects of products they use. Workers on estates are frequently employed as sprayers for 10 months of the year, six days a week (Vergara, 1991).

In occupational use, the main route of exposure is through the skin where the worst cases of exposure occur during knapsack spraying. Continued exposure, as encountered by spray operators on plantations, is reported to affect the skin, eyes, nose and finger nails. Skin problems include mild irritation, blistering and ulceration, desquamation (peeling of the outer layer of the skin), necrosis (cell-death in skin tissue), dermatitis of the hands and in some cases scrotal areas (from leaking spray machines soaking trousers) (Ongom et al, 1994 cited in Internation Programme on Chemical Safety, Environmental Health Criteria 39, Paquat and Diquat**,** EHC 39. 1984). Severe exposure on hands has resulted in nail damage, ranging from localised discoloration to temporary nail loss (Samman and Johnston, 1969; Howard, 1979). Eye splashes can result in irritation and inflamed eyelids (blepharitis) and visual acuity can decrease. A study in Thailand found clear indications of caustic burns on the feet after working with spinning disk applicators (Howard, 1996).

While small farmers face some of the same problems as estate workers (lacking training, distant washing medical facilities), they are exposed to paraquat less regularly. A study of small farmers in Kenya found no protective clothing was worn (the cost of a pair of rubber gloves was equivalent to a day's wage) (Craig and Chris, 1993).

Intact human skin is relatively impermeable to paraquat, although a number of fatalities resulting from dermal exposure to intact skin have been documented (Smith, 1988). The presence of scratches, cuts, sores or severe dermatitis on the skin substantially increases the risks. Dermal exposure to paraquat can lead to skin injury including severe dermatitis, second degree burns and itching rash on the face, neck, hands or all over the body. A study of Malaysian plantation sprayers cited health problems after exposure to paraquat (Arumugam, 1992). An education worker with banana plantation workers in Honduras sent reports of common nose bleeds, diminishing eye sight, burning of skin, thinning of hair, nausea, loss of toe and finger nails (Brady, 1992). Similar incidents have also been reported in developed countries as well. In 1992, a UK agricultural worker died after being splashed in the face with paraquat when he dropped an open container (Thomson, Casey, and Vale, 2008-09). In 1994, a farmworker in the UK suffered a severe rash and infection to his groin after applying paraquat with a knapsack sprayer (Thomson et al., 2008-09).

Several methods have been suggested to minimize pesticide exposure and effect. The implementation methods depend on the resources available in the area under question. In 1985, the UN Food and Agricultural Organization (FAO) initiated a voluntary code of conduct, but due to lack of adequate government resources in the developing world makes this code ineffective and thousands of deaths continue even today. WHO has recommended that access to highly toxic pesticides should be restricted in areas where these are used, and lower poisonings effect are seen (Konradsen et al., 2003). In the US, paraquat is a restricted use pesticide where certified applicators can use and purchase it. In the UK, there are no such restrictions and Pathclear and Weedol are allowed for amateur use in household gardens. Professional users should wear a protective face shield, wash splashes immediately, avoid spray drift and remove contaminated clothes immediately. The WHO Health and Safety Guide adds that normal personal protection and hygienic measures should be rigorously observed; paraquat should not be sprayed with inadequate dilution, nor used by people suffering dermatitis or with wounds.

Another way to deal with this problem is to educate the people could be considered as one of the best methods to curb the indiscriminate and harmful use of pesticides. According to paraquat poisoning and effect that caused paraquat exposure in maize farmer in Namtok sub-district, risk analysis should apply to reduce risk of paraquat exposure in this communication. Generally, exposure assessment has the potential to be an effective way to address community environmental health concern, because communities can use exposure assessments to a) inform residents about their environmental exposure level and the sources of those exposures, b) suggest strategies for exposure reduction, and c) enhance the level of substantive dialogue with government policy officials.

Although exposure scientists and researcher are well trained at reporting human exposure results in peer-reviewed journals, this mode of communicating and interpreting result may not address the adverse health effect concern and information need of the community. Community-based studies generate an obligation on the part of the researcher to ensure that participants and the community obtain the information necessary to address their concern (Israel, Schulz, Parker, and Becker, 1998)

Knowledge attitude and practice questionnaires have been found to provide insights about the pesticide handling practices and pesticide exposure and have been used to identify the lack of appropriate knowledge and shortage of inputs when dealing with pest problems (Conant, 2005 ; Ellenhorn, 1997). A greater impact can be achieved if the awareness programs are initiated among agricultural population and in areas with higher occurrence of poisoning. Therefore, this study was carried out to identify the occurrence of paraquat poisoning among maize farmers. The effectiveness of the risk communication model developed to reduce risk of paraquat exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan Province, Thailand was then assessed.

1.2 Research Objectives

1. To provide the general and background and to assess an association among the knowledge, attitudes, and practices of pesticide used and exposure in the maize farmers in Namtok sub-district, Nanoi district, Nan Province, Thailand.

2. To modify risk communication model for communicating risk of paraquat exposure in the maize farmers in Namtok sub-district, Nanoi district, Nan Province, Thailand.

3. To evaluate the effectiveness of risk communication model in the maize farmers at Namtok sub-district, Nanoi district, Nan Province, Thailand.

1.3 Research Question

Does the risk communication model effectively decrease paraquat exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan province, Thailand?

1.4 Research Hypothesis

H0: Risk communication model dose not decrease exposure of paraquat in the maize farmers at Namtok sub-district, Nanoi district, Nan province, Thailand.

H1: Risk communication model decrease exposure of paraquat in the maize farmers at Namtok sub-district, Nanoi district, Nan province, Thailand.

1.5 Scope of Study

The study was conducted in Nanoi district, Nan Province, Thailand. This study was applied the PRECEDE-PROCEED planning framework to demonstrate community-based environmental health research. The risk communication model was then modified in accordance to the risk communication principle.

The study was divided into three phases. The first phase was the cross-sectional study for conducing social assessment, epidemiological behavioral, and environmental assessment, and educational and ecological assessment. The second phase was the quasi-experimental study for conducing administrative and policy assessment and intervention alignment and implementation. Lastly, a series of evaluation studies were done to assess the process, outcomes and impact of the intervention. .

The participants in the first phase were the maize farmers in Namtok sub-district and the participants in the second phase were both Namtok sub-district (Intervention group) and Bouyai sub-district (Control group).The study focused on evaluating the effective of the risk communication model after the intervention in both groups. The data were collected from June 2010 to February 2011.

1.7 Definition of Terms

PRECEDE-PROCEED model refer to health promotion planning model which was applied to demonstrate how environmental health research in communities lead to effective risk communication model.

Risk communication model refer to the model which was applied base on principle of the effectiveness of risk communication in order to communicate risk of paraquat exposure and encourage the maize farmers to protect themselves by using the personal protective equipments (PPE) for reducing risk of paraquat exposure.

Risk reduction is the effectiveness of risk communication model to reduce paraquat exposure and poisoning in maize farmers.

Full compliance with the required Personal Protective Equipments (PPE) refer to using all of personal protective equipments including hat, goggle, mask, gloves, long-sleeved shirt, trousers, socks and boots in maize farmers while they apply paraquat including mixing, loading, spraying, otherwise it is not full compliance.

Pesticide is defined as the chemicals which include herbicide, insecticide, and fungicide**.**

1.8 Overview of the Dissertation

In chapter 1, the study was introduced background and rationale, research objectives, research question, research hypothesis, scope of study, definition of term, and overview of the dissertation. The relevant literature related to summary of paraquat, risk communication principle, PRECEDE-PROCEED model, and High Performance Liquid Chromatoghrapy (HPLC) method is described in chapter 2. This chapter was divided into 7 sections. The first section presented a summary of paraquat. This was followed by a description of the risk communication principle and its components. Thirdly, the PRECEDE-PROCEED model was explained particularly how it relates to environmental research in the communities. The fourth section described the measures for paraquat residues concentration, particularly the use of High Performance Liquid Chromatoghrapy. The second to the last section presented the relevant research on risk reduction of paraquat exposure through risk communication. Lastly, the conceptual framework of this study was presented.

Chapter 3 was provided the methodology of the study including research design, sample and sampling method, sample size, study area, study period, study procedure, structure of intervertion program, measurement tool, data collection, data analysis.

Chapter 4 was presented the result of the study. Chapter 5 contains the discussions of the findings, including the limitations of the study. Finally, the conclusions and future research were presented.

CHAPTER II
LITERATURE REVIEW

To understand the concepts related to this dissertation, this chapter reviews the content related to risk reduction of paraquat exposure through risk communication model including as follow;

2. 1 Definition of Paraquat

2.1.1. Summary

Paraquat (1, 1'dimethyl, 4, 4' bipyridyl) is a non selective contact herbicide. It is produced in several countries including China, Province of Taiwan, Italy, Japan, the United Kingdom, and the USA. It is used world-wide in approximately 130 countries. If not manufactured under strictly controlled conditions, it can contain impurities that are more toxic than the parent compound. It is almost exclusively used as a dichloride salt and is usually formulated to contain surfactant wetters (World Health Organization, 1984).

Both its herbicidal and toxicological properties are dependent on the ability of the parent cation to undergo a single electron addition to form a free radical which reacts with molecular oxygen to reform the cation and concomitantly produce a superoxide anion. This oxygen radical may directly or indirectly cause cell death. Paraquat can be detected because of its ability to form a radical. Numerous analytical procedures are available (WHO, 1984).

2.1.2 Environmental distribution and transformation environmental effects

Paraquat deposits on plant surfaces undergo photochemical degradation to compounds that have a lower order of toxicity than the parent compound. On reaching the soil, paraquat becomes rapidly and strongly adsorbed to the clay minerals present. This process inactivates the herbicidal activity of the compound. While free paraquat is degraded by a range of soil microorganisms, degradation of strongly-adsorbed paraquat is relatively slow. In long-term field studies, degradation rates were 5 - 10% per year.

Strongly-bound paraquat has no adverse effects on soil microfauna or soil microbial processes (WHO, 1984).

Paraquat residues disappear rapidly from water by absorption on aquatic weeds and by strong absorption to the bottom mud. Normal applications of paraquat for aquatic weed control are not harmful to aquatic organisms. The toxicity of paraquat for fish is low, and the compound is not cummulative. However, care should be taken when applying paraquat to water containing heavy weed growth to treat only a part of the growth, since oxygen consumed by subsequent weed decay may decrease dissolved oxygen levels to an extent that may be dangerous for fish. Treated water should not be used for overhead irrigation for 10 days following treatment (WHO, 1984).

Paraquat is not volatile and following spraying the concentrations of airborne paraquat have been shown to be very low. Under normal working conditions, the exposure of workers in spraying and harvesting operations remains far below present Threshold Limit Value (TLVs) and the exposure of passers-by or of persons living downwind of such operations is even lower. Normal paraquat usage has been shown not to have any harmful effects on birds. Finite paraquat residues are to be expected only when a crop is sprayed directly. Cattle allowed to graze on pasture 4 hours after spraying at normal application rates did not suffer any toxic effects. Consequent residues in products of animal origin are very low (WHO, 1984).

2.1.3 Paraquat kinetics and metabolism

Although toxic amounts of paraquat may be absorbed after oral ingestion, the greater part of the ingested paraquat is eliminated unchanged in the faeces. Paraquat can also be absorbed through the skin, particularly if it is damaged. The mechanisms of the toxic effects of paraquat are largely the result of a metabolically catalyzed single-electron reduction-oxidation reaction, resulting in depletion of cellular NADPH and the generation of potentially toxic forms of oxygen such as the superoxide radical (WHO, 1984).

Absorbed paraquat is distributed via the bloodstream to practically all organs and tissues of the body, but no prolonged storage takes place in any tissue. The lung selectively accumulates paraquat from the plasma by an energy-dependent process.

Consequently, this organ contains higher concentrations than other tissues. Since the removal of absorbed paraquat occurs mainly via the kidneys, an early onset of renal failure following uptake of toxic doses will have a marked effect on paraquat elimination and distribution and on its accumulation in the lung (WHO, 1984).

2.1.4 Biochemical mechanisms

The mechanism of the toxic action of paraquat has been extensively investigated. Several reviews or monographs have summarized the biochemical mechanism of paraquat toxicity in plants (Calderbank, 1968; Fridovich and Hassan, 1979) bacteria (Fridovich and Hassan, 1979) and animals.

Paraquat has long been known to participate in cyclic reduction-oxidation reactions in biological systems. The compound readily undergoes a single electron reduction in tissues, forming a free radical. In an aerobic environment, however, a free radical is immediately oxidized by molecular oxygen, generating the superoxide radical (O_2). The deoxidized paraquat is capable of accepting another electron and continuing the electron transfer reactions in a catalytic manner (Figure 2.1). Research into the mechanism of paraquat toxicity has identified at least 2 partially toxic consequences of the redox cycling reaction: a) generation of O_2, and b) oxidation of cellular NADPH, which is the major source of reducing equivalence for the intracellular reduction of paraquat. Generation of O_2 can lead to the formation of more toxic forms of reduced oxygen, hydrogen peroxide (H_2O_2) and hydroxyl radicals (OH). Hydroxyl radicals have been implicated in the initiation of the membrane-damaging by lipid peroxidation, depolymerization of hyaluronic acid, inactivation of proteins and damage to DNA (Hassan and Fridovich, 1980). Depletion of NADPH, on the other hand, may disrupt important NADPH-requiring biochemical processes such as fatty acid synthesis (Smith, Rose, and Wyatt, 1979).

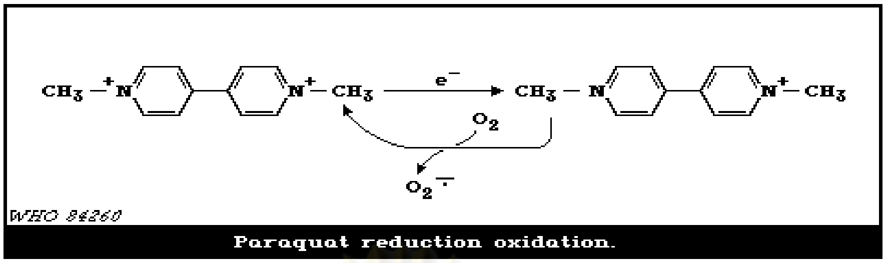


Figure 2.1: Paraquat reduction oxidation **(Who, 1984)**

The importance of molecular oxygen and the potential role of O_2 generation in mediating have been implicated in studies on plants, bacteria, and in in-vitro and in-vivo mammalian systems. In cultures of Escherichia coli, (Hassan and Fridovich, 1977; Hassan and Fridovich, 1979) demonstrated that paraquat stimulated cyanide-resistant respiration, which could be almost entirely accounted for by an NADPH-dependent formation of O_2. The possibility that formation of O_2 might be responsible for the toxicity of paraquat in bacteria was supported by observations that bacteria containing elevated activities of superoxide dismutase, an enzyme that detoxifies O_2, were resistant to paraquat toxicity (Hassan and Fridovich, 1977; Hassan and Fridovich, 1978; Moody and Hassan, 1982).

In vitro studies on preparations of lung and liver from various animal species have supported the hypothesis that paraquat redox cycling and associated O_2 and H_2O_2 generation also occur in mammalian systems (Gage, 1968; Ilett, Stripp, Menard, Reid, and Glllette, 1974; Montgomery, 1976; Steffen and Netter, 1979; Talcott, Shu, and Wei, 1979). Bus et al. (1974) reported that the single electron reduction of paraquat in mammalian systems was catalysed by microsomal cytochrome P-450 reductase and NADPH. The observation that the in vivo toxicity of paraquat in animals is markedly potentiated by exposure to elevated oxygen tensions further supported the potential role for molecular oxygen in mediating toxicity (Autor, 1974; Bus et al., 1975; Fisher, Clements, and Wright, 1973).

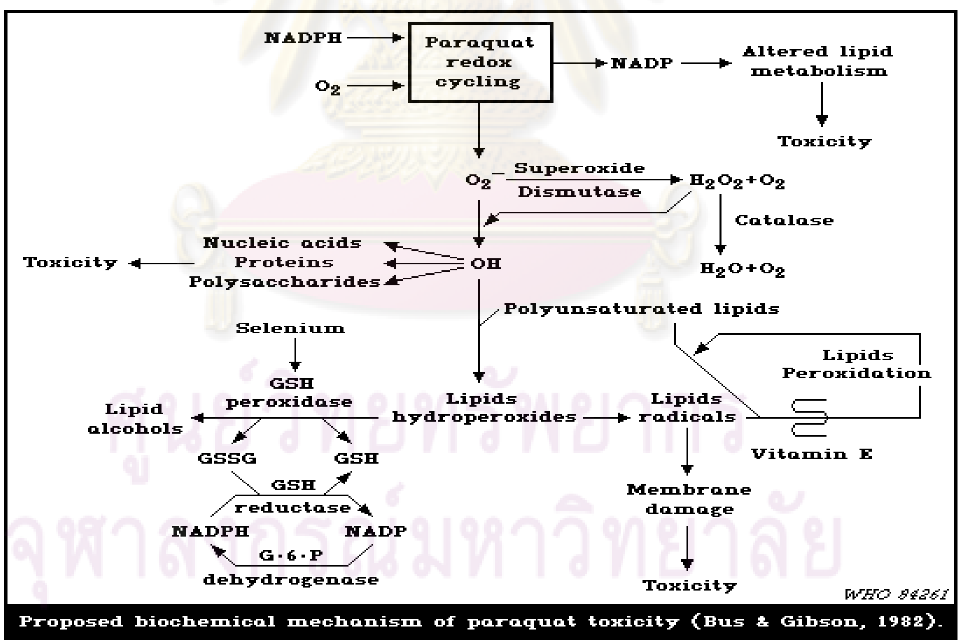
The results of in vivo studies conducted by Bus et al. (1974) suggested that stimulation of lipid peroxidation, which was dependent on paraquat redox cycling and associated O_2 generation, might be an important toxic mechanism in mammalian systems.

Consistent with this hypothesis, animals fed diets deficient in selenium or vitamin E, in order to diminish cellular antioxidant defences, were significantly more sensitive to paraquat toxicity than control animals (Bus, et al., 1975; Omaye, Reddy, and Cross, 1978). In contrast to these studies, a number of studies have shown that paraquat inhibited in vitro microsomal lipid peroxidation (Ilett, et al., 1974; Kornbrust and Mavis, 1980; Montgomery and Niewoehner, 1979; Steffen and Netter, 1979). Subsequent studies have indicated, however, that paraquat would stimulate microsomal lipid peroxidation when an adequate supply of electrons (NADPH) and in vitro oxygen tensions were maintained (Trush, Mimnaugh, Ginsburg, and Gram, 1981 ; Trush, Mimnaugh, Ginsburg, and Gram, 1982).

Despite the evidence described above, the hypothesis that lipid peroxidation is the underlying toxic mechanism functioning in vivo has not been conclusively demonstrated. Direct quantification of paraquat-induced lipid peroxidation damage in vivo by analysis of tissue malondialdehyde levels or ethane exhalation, both markers of peroxidation injury, has been largely unsuccessful (Reddy, Litov, and Omaye, 1977; Shu, Talcott, Rice, and Wei, 1979; Steffen, Muliawan, and Kappus, 1980). Furthermore, attempts to counteract paraquat toxicity by administration of various antioxidants have also been unsuccessful(Fairshter and 1981).

Superoxide radicals generated in paraquat redox cycling may induce biochemical changes other than the initiation of peroxidation reactions. Ross et al. (Ross, Block, and Chang, 1979) demonstrated that paraquat increased DNA strand breaks in cultured mouse lymphoblasts. Paraquat was also reported to induce a superoxide-dependent stimulation of guanylate cyclase activity in rat liver (Veseley, Watson, and Levey, 1979) and guinea-pig lung (Giri and Krishna, 1980). These investigators postulated that increased cyclic GMP might stimulate the pulmonary fibroproliferative changes characteristic of paraquat toxicity. In other studies, paraquat has also been found to increase collagen synthesis in rat lung (Greenberg, Lyons, and Last, 1978; Hollinger and Chvapel, 1977;Thomoson and Patrick, 1978).

Redox cycling of paraquat has also been proposed to lead to increased oxidation of cellular NADPH (Brigelius and Anwer, 1981; Keeling, Smith, and Aldridge, 1982). The activity of pentose shunt enzymes in the lung rapidly increased in rats administered paraquat, which suggested an increased demand for NADPH (Fisher, Clements, Tierney, and Wright, 1975; Rose, Smith, and Wyatt, 1976). The observation that paraquat decreased fatty-acid synthesis in lung slices (Smith et al., 1979) further supported this hypothesis, since fatty acid synthesis requires NADPH. Direct analysis of NADPH in the lung has confirmed that paraquat treatment decreased the NADPH content in rat lung (Smith, et al., 1979; Witschi et al, 1977). These observations led Smith et al. (1979) to propose that xidation of NADPH might not only interrupt vital physiological processes, such as fatty-acid synthesis, but also render tissues more susceptible to lipid peroxidation by decreasing the equivalents (NADPH) necessary for the function of the antioxidant enzyme glutathione peroxidase.



Proposed biochemical mechanism of paraquat toxicity (Bus & Gibson, 1982).

Figure2.2: proposed biochemical mechanism of paraquat toxicity

2.1.5 Effects on humans

Occupational exposure to paraquat does not pose a health risk if the recommendations for use are followed and there is adherence to safe working practices. This has been shown in several studies evaluating the potential risk either short or long term. However, nail damage, epistaxis, and delayed skin damage have been described and may generally be taken as an indication that work practices should be reviewed.

In the small number of reported cases of paraquat poisoning allegedly resulting from occupational exposure, the cause can be identified as one or a combination of a number of factors, via contamination of the skin with concentrated products, use of inadequately diluted solutions, use of faulty equipment, misuse of equipment (e.g., blowing blocked spray jets) or failure to take action in the event of contamination of skin or clothing. Eye and skin damage can follow splashes with the concentrate.

A large number of cases of suicidal or accidental poisoning from paraquat have been reported. With the exception of a few unusual cases in which the liquid concentrate was improperly used to treat body lice, poisoning has followed its ingestion or, in a few cases, ingestion of the granular formulation. Two types of fatal poisoning can be distinguished: acute fulminant poisoning leading to death within a few days, and a more protracted form that may last for several weeks, resulting in fatal pulmonary fibrosis. Depending on the severity of the poisoning, there may be involvement of kidneys, liver, and other organs. Extensive damage to the oropharynx and the oesophagus are usually seen in cases of ingestion of liquid concentrate.

After ingestion, speed is imperative in commencing emergency treatment and it should be noted that this can take place before arrival of the patient at hospital. The response to treatment of paraquat poisoning is very disappointing and the mortality rate remains high. In less severe cases, without lung damage, recovery has always been complete. The possibility of recovery clearly depends on the dose of paraquat taken and the time interval between ingestion and the commencement of emergency treatment.

2.1.6 Occupational exposure

1) Epidemiological studies and case reports

1.1 Spraying personnel

Paraquat has been in agricultural use since the early 1960s and several surveys have been conducted on spray operators (Swan, 1969; Hearn and Kier, 1971; Staiff et al., 1975; Chester and Woollen, 1982; Wojeck et al., 1983). Some of these studies were aimed at clinically evaluating possible adverse effects, others at estimating inhalatory and dermal exposure. Some of the latter studies have been summarised from which it can be seen that the main route of exposure of agricultural workers to paraquat is via the skin; respiratory exposure is negligible and the worst case of exposure (of those examined) was via knapsack spraying.

In Malaysian rubber plantations, exposure is likely to be greater than in most other situations (Swan, 1969). Weed control is required continuously for 10 months of the year, and the herbicide is applied by knapsack sprayers during the entire working day, 6 days a week. The high temperature and humidity together with the light clothing of the sprayers increase the potential risk of dermal exposure. In 1965, a study was carried out on a team of 6 sprayers, and in 1967 on 4 teams, to estimate the efficacy of protective measures. The operators used spray dilutions containing paraquat at 0.5 g/litre, for 12 weeks. Attention was paid to personal hygiene. Each man was given a thorough physical examination and urine samples were taken before spraying began and at weekly intervals throughout the study. Paraquat analyses were carried out using the method of Calderbank and Yuen (1965). Chest X-rays were taken before the study started and at the end of the 6th and 12th weeks.

In the course of the 2 studies, a total of 528 urine samples were examined. Paraquat was found on 131 occasions, the maximum concentration detected being 0.32 mg/litre in the first study and 0.15 mg/litre in the second. Average urine levels of paraquat of 0.04 mg/litre were found in the 1965 study, and of 0.006 mg/litre in the 1967 study. After spraying ceased, these levels declined steadily to become undetectable within a week - with one exception. It was concluded that the workers were not subjected to hazardous levels of paraquat.

Both trials showed that about half of the men had suffered mild irritation of the skin and eyes, but had recovered rapidly with treatment. Two cases of scrotal dermatitis occurred in workers wearing trousers that were continuously soaked by the spray solution. There were also 2 cases of epistaxis. All chest radiographs were normal.

Studies over a period of several years on 296 workers were performed by Hearn and Keir (1971) on a Trinidad sugar estate. This survey drew attention to nail damage following gross contamination with paraquat at 1 - 2 g/litre that ranged in severity from localized discoloration to nail loss. The typical distribution of the lesions - affecting the index, middle, and ring fingers of the working hand - suggested that they had occurred through leakage from the knapsack sprayer, and inadequate personal hygiene. Apart from 2 cases of contact dermatitis of the hands, no skin, eye, or nose irritation was reported, nor were there any systemic effects.

Similar data were obtained by Makovskii (1972), who examined several groups of workers spraying paraquat as a herbicide and dessicant in cotton fields during the hot season. These workers were exposed to paraquat aerosol concentrations of 0.13 - 0.55 mg/m^3 air. Dermal exposure was low, not more than 0.05 - 0.08 mg paraquat on the hands and face. There were no complaints, nor did the clinical and laboratory examinations of the workers demonstrate any significant deviations from the matched control groups.

In the USA (Staiff et al., 1975), the exposure of field workers operating tractor-mounted spray equipment in orchards was determined. About 4.6 litre paraquat liquid concentrate (291 g/litre) was used in 935 litre water per h. In addition, exposures from yard and garden applications were studied in volunteers using pressurized hand dispensers containing paraquat solution (4.4 g/litre). Dermal contamination was measured by adsorbent cellulose pads attached to the worker's body or clothing, and by hand-rinsing in water in a polyethylene bag. Special filter pads were used in the filter cartridges of the respirators worn by the subjects under study.

In all, 230 dermal and respiratory exposure pads, 95 samples of hand-rinse water, and 130 urine samples, collected during and following the spray, were analysed. This involved 35 different paraquat application situations. The exposure of field workers was found to range from about 0.40 mg/h (dermal) to less than 0.001 mg/h (inhalation). As for individuals spraying the yard or garden, exposure ranged from 0.29 mg/h (dermal) to less than 0.001 mg/h (inhalation).

In almost all cases, dermal exposure affected the hands. The respiratory paraquat values were generally below the sensitivity level of the analytical method. No detectable paraquat concentrations were found in the urine samples (lower limit 0.02 mg/litre). This study confirmed the general safety of paraquat under correct conditions of use.

The potential long-term hazard associated with the use of paraquat has also been studied. Howard et al. (1981) studied the health of 27 spraymen who had been exposed to paraquat for many months per year for an average of 5.3 years, and compared them with two unexposed control groups consisting of 24 general workers and 23 factory workers. There were a few skin lesions resulting from poor spraying techniques and 1 case of eye injury. The workers were given full clinical examinations and lung, liver, and kidney function tests were carried out. There were no significant differences in all health parameters measured between the groups, which led the authors to suggest that the long-term use of paraquat was not associated with harmful effects on health.

A paraquat formulation (240 g/litre) diluted 300 times by volume with water was sprayed for 2 h on weedy ground (Kawai and Yoshida, 1981). No irritation of the eyes and the skin was reported. The urine of the workers who wore gauze masks contained 1.4 - 2.7 µg paraquat, 24 h after the spraying. The urine of workers who had worn a high-performance mask did not contain detectable levels of paraquat. During the spraying operations, the concentration of paraquat aerosol was 11 - 33 µg/m^3 air. The total dermal exposure was about 0.22 mg. The authors discussed the need for protective equipment to decrease skin contact with paraquat and to avoid aerosol inhalation.

Quantitative estimates of dermal and respiratory exposure of 26 plantation workers in Malaysia (Chester and Woollen, 1982) have shown a mean dermal dose of 1.1

mg/kg body weight per h. The highest individual total exposure was equivalent to 2.8 mg/kg body weight per h; the mean respiratory exposure was 0.24 - 0.97 µg paraquat/m^3 air. Spray operators and carriers were exposed to an order of 1% or less of a TLV of 0.1 mg/m^3 for respirable paraquat. Urine levels of paraquat were generally below 0.05 mg/litre.

A study was carried out on a group of 14 spray men in Thailand using conventional high-volume knapsack sprayers and low-volume spinning disc applicators with paraquat ion concentrations of 1.5 g/litre and 20 g/litre, respectively (Howard, 1982). Irritation of unprotected skin was found, and this was severe in workers using high spray concentrations (caustic burns on the feet after work with spinning disc applicators and paraquat solution (20 g/litre)). Urinary paraquat levels after 14 days spraying were significantly higher (10.21 - 0.73 mg/litre) in unprotected men using both concentrations, and there was evidence that urinary levels of paraquat increased as the trial progressed. No evidence of systemic toxicity was discovered among the spray men undergoing clinical and radiographic examination 1 week after spraying ended. The author concluded that spray concentrations in hand-held equipment should not exceed 5 g paraquat ion/litre. After tomato spraying in the USA, the total body exposure to paraquat was determined to be 168.59 mg/h (Wojeck et al., 1983).

The use of enclosed tractor cabs or a high clearance tractor reduced total body exposures to paraquat to 26.91 mg/h or 18.38 mg/h, respectively. The authors reported that the total body exposure of tractor spray men working in two citrus locations was proportional to the tank concentrations (paraquat dilutions of 1.1 g/litre and 0.7 g/litre were applied); exposure levels of 28.50 mg/h and 12.16 mg/h were found for workers using the higher and the lower concentrations, respectively. In all situations studied, the respiratory exposure was consistently a small fraction (<0.1%) of the total body exposure. Exposure was mainly through the skin.

1.2 Formulation workers

Groups of workers exposed to formulations were examined by Howard (l979). The first group of 18 workers in England comprised subjects exposed to dust and liquid paraquat formulations during a 37.5 h working week, the mean length of exposure being 5 years. The second group also comprised 18 males, from Malaysia, exposed to liquid concentrate formulations during a 42-h working week, the mean length of exposure being 2.3 years. Partly protective clothing was worn. However, in Malaysia, no gloves, rubber aprons, or goggles were used. The medical records and the dermatological examinations revealed acute skin rashes, nail damage, epistaxis, blepharitis, and delayed wound healing in 12 - 66% of these workers. Delayed caustic effects were often found among the Malaysian formulation workers where a lower level of safety and hygiene was apparent. Clinical examination did not reveal any evidence of chronic contact dermatitis, hyperkeratosis, or eczematous lesions.

2. Cases of occupational poisoning and local caustic effects

Hayes and Vaughan (1977) reviewed deaths from pesticides in the USA. From 1956 - 1973, no deaths attributable to paraquat were registered among agricultural workers, but in 1974, 4 fatal cases were associated with this herbicide, although it was not clear whether they were accidental, suicidal, or occupational. Conso (1979) reported 17 cases of skin and eye irritation, not accompanied by epistaxis or other signs of systemic effects, in paraquat-exposed workers in France. Bismuth et al. (1983) discussed a few cases of paraquat poisoning due to skin contamination and eye irritation.

The available evidence indicates that, at the recommended dilution rates and correctly used, systemic oral, inhalation, or dermal effects should not be expected. Skin and eye irritation have occurred only when protective measures were disregarded.

However, it should be emphasized that carelessness in handling paraquat may have serious consequences. Fitzgerald et al. (1978a) summarized the clinical findings and pathological details concerning 13 accidents involving paraquat among agricultural workers, 6 of which were fatal. In 5 of these cases, swallowing was involved.

2.1 Oral ingestion

The ingestion of paraquat may occur accidentally, if liquid concentrates are decanted into unlabelled containers near the working areas (Kawatomi et al., 1979), and dangerous ingestion can occur if operators suck or blow out the blocked pipes or nozzles of spray apparatus.Of the 6 fatalities studied by Fitzgerald et al. (1978a), 3 swallowed Gramoxone(R) after sucking the outlet of a sprayer. In one non-fatal case, the man had sucked out a nozzle containing diluted paraquat, while in another case, the man who had blown into the jet, to clear it, escaped with only minor signs of poisoning. Dilute solution blown into the face by the wind and splashes of concentrate that get into the mouth probably explain the resultant signs in the mouth, on the tongue, and in the throat. Smoking with paraquat-contaminated hands has been reported to result in a farmer's developing oropharyngeal irritation, nausea, and muscular weakness (Mourin, 1967).

2) Dermal absorption

Acute dermal paraquat poisoning has been described by Fitzgerald et al. (1978a). The use of a leaking sprayer by a worker with severe extensive dermatitis probably resulted in fatal absorption of paraquat through the damaged skin. Jaros (1978) has described how the use of concentrated solutions of paraquat (50 g/litre instead of 5 g/litre), with an old leaking knapsack sprayer, resulted in paraquat contamination of the neck, back, and legs of a worker. After 4 h of work, he complained of a burning sensation on the neck and scrotum. On admission to hospital 6 days later, cough and respiratory difficulties were recorded. Three days later the patient died of renal and respiratory failure. This author has stressed the need for careful handling of paraquat. Jaros et al. (1978) have discussed several other cases of paraquat poisoning in the CSSR related to paraquat application.

Severe skin damage, followed by death due to respiratory insufficiency, occurred in a woman (Newhouse et al., 1978), 8 weeks after initial contact with paraquat. The toxic dermatitis started with scratches on the arms and legs from the branches of fruit trees. The patient had often failed to wear protective clothing or to shower after spraying. During the 4 weeks preceding her first admission to hospital, she developed ulcers and respiratory complaints combined with anorexia. Damaged and broken skin was thus exposed to paraquat.

A chest X-ray and needle biopsy of the lung revealed pulmonary lesions. Seventeen days after discharge from hospital, without a specific diagnosis, she was readmitted, and died 2 weeks later with progressive lung, hepatic, and renal dysfunction. More recently, Levin et al. (1979) described the clinical and pathomorphological investigation of a patient who died of hypoxia after repeated dermal exposure to paraquat (28 g/litre) and diquat (29 g/litre) in a water-oil dilution - contrary to accepted practice. The worker had used a leaking sprayer.

A characteristic ulcer developed at the site of paraquat contact. There was also lung damage. Waight and Weather (1979) reported a fatal case of dermal poisoning with paraquat after prolonged contact with a concentrated formulation following spillage from a bottle in the back trouser pocket. Wohlfahrt (1982) discussed the factors related to severe paraquat poisoning due to dermal absorption in tropical agriculture. Three fatal incidents followed skin contamination; one victim used paraquat to treat scabies infestation, and one to treat lice. In all cases, the skin was blistered and ulcerated. The patients died of progressive respiratory failure, 4 - 7 days after the accidents. However it has been pointed out that each of these three spraymen showed skin lesions much more severe than would be expected had recommended and customary dilutions been used and that, in one of these cases, the presence of mouth and throat ulceration strongly suggested that ingestion might also have occurred (Davies, 1982).

2.3 Local skin and nail effects

Paraquat has a delayed effect on the skin. Brief contact with liquid formulations, as well as repeated exposure to dilute solutions, produced skin irritation, desquamation, and, finally, necrosis at the site of contact (Binns, 1976; Newhouse et al., 1978; Waight and Wheather, 1979; Levin et al., 1979). Harmful dermal effects have been reported (Howard, 1982) among spray men who worked without protective clothes and with naked feet. The blistering and ulceration of the skin were due to excessive contact and inadequate personal hygiene. Horiuchi and Ando (1980) carried out patch testing on 60 patients with contact dermatitis due to Gramoxone(R). In 8 patients (13.3%) positive allergic reactions were established. In another survey with 52 persons, a positive photo-patch response was reported in 11 patients.

Nail damage has also been reported after frequent exposure to paraquat concentrates during the formulation of the herbicide or the preparation of working dilutions (Samman and Johnston, 1969; Howard, l979). Leakage from sprayers may cause nail damage only if there is gross contamination (Hearn and Keir, 1971). Asymmetric discoloration and softening of the nail base appears together with an infection, that usually persists after the loss of the nail, but a few months after cessation of paraquat exposure, the nails re-grow satisfactorily.

2.4 Ocular damage

A number of studies have demonstrated the hazard from splashes of concentrated paraquat that come into contact with the eye (Swan, 1969; Howard, l979). Apart from irritation of the eye and blepharitis, a week later more serious ocular damage may occur such as destruction of the bulbar and tarsal conjunctiva and of the corneal epithelium. Anterior uveitis was also noted. Joyce (1969) reported a case of conjunctival necrosis after paraquat had been splashed into the eyes during spraying in windy weather. In a second case, there was progressive keratitis with gross corneal opacity. Severe conjunctival injuries with keratitis and decreased visual acuity were reported in 3 workers by Watanabe et al. (1979) and in another by Okawada et al. (1980). The eyes were washed with water immediately, but the damage progressed and required treatment for more than 3 weeks.

2.5 Inhalation

The inhalation of droplets in normal paraquat spraying does not appear to represent a significant health hazard (Howard, 1980), and the effects of occupational inhalation have been limited to nose bleeds, and nasal and throat irritation (Swan, 1969; Howard, 1979b). Standard spraying equipment failed to produce significant levels of droplets in the respirable range of < 5-7 μm diameter, and chemical analyses of paraquat aerosols or particulate matter, sampled from working areas, have usually shown them to be well below the TLV. However, there have been some reports of adverse effects as a result of inhalation exposure.

2.2 Risk communication principle

2.2.1 Definition of Risk communication

1) Risk communication is the process of informing people about hazards to their environment or their health. Communicating risk is two-way exchange in which organizations in form target audiences of possible risks, and gather information from those affected by the risk (United States Environmental Protection Agency, 2003).

2) Risk communication is a critical step in effectively defining and managing any crisis situation. Communicating a message with specific instructions and alternatives regarding a health or environment risk to a community can lead to successful risk management of a crisis (US EPA, 2003).

3) The National Academy of Sciences defines risk communication as an interactive process of exchange of information and opinion among individuals, groups, and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management (National Research Council, 1989).

4) The scientific literature on risk communication addresses the problems raised in the exchange of information about the nature, magnitude, significance, control, and management of risks (National Research Council, 1989; Covello, 2001). It also addresses the strengths and weaknesses of the various channels through which risk information is communicated: press releases, public meetings, hot lines, web sites, small group discussions, information exchanges, public exhibits and availability sessions, public service announcements, and other print and electronic materials (Arkin, 1989).

5) Risk communication is a process rather than a set of specific gimmicks or techniques. It requires awereness of the the factors that affect the communication process and how individuals perceive risk and risk information. Focusing on the communication process rather than just the risk may be one of the most important considerations for successful risk communication. REFERENCE PLEASE

2.2.2 Effective Risk Communication Principle

Effective risk communication recognizes that the public has right to receive information and to be actively involved in both the dialogue regarding the nature of the risk and the decisions about way to minimize or control identified risks. This dialogue often blurs the distinction between risk assessments (“Is there a risk?” “What is it?” “How bad is it?”) and risk management (“What should we do about the risk?”).

Another important principle of risk communication is that communicating risk information be perceived as credible. If not, the message will not be believed, especially if it involves risk information. Peters, Covello, and Mccallum (1997) suggested that several factors influence source credibility including the degree of empathy and caring conveyed, the degree of openness and honesty, the extent to which the source is considered competent, andthe extent to which a communicator shows commitment and dedication to health and safety and resolving the risk. No one approach or method to communicating risk or risk assessment information can be universally applied to all purposes or audiences, but certain steps can be followed to foster more effective communication. Developing an effective risk-communication program involves the following considerations,

1) Determining communication goals and objectives

Risk communication can have several goals and objective. Sometimes the goal is to alert people to particular risk and move them to action. At other times, the goal is to tell them not to worry or to calm down. In the latter instances, the communicator wants to inform individuals that a particular situation does not pose health risk. Because people’s concern and information needs are different when they are being alerted and when they are being calmed down, strategies for communicating also need to vary. As discussed earlier in this chapter, purposes of risk communication including education and information, improving public understanding, behavior change and protective action, organizationally mandate goal, legally mandated or process goals, joint problem solving and conflict resolution.

2) Identifying the audience and it concerns

Identifying stakeholder goes beyond just determining who need to be informed. It includes the concerns and information need of the various interested parties. Characterizing target audiences is similar to a data collection effort for conducting a risk assessment. Without knowing what chemicals are present at what quantities and in what forms, it is impossible to characterize risk.

Characterizing target audiences involves looking at such area as demographics, psychographics, and information and source-utilization characteristics. For effective communication to occur public concerns public concern must be known prior to conducting the risk assessment or relaying of risk information. Only then can the message be presented and disseminated in a manner that acknowledges and addresses the apprehensions and needs of receivers.

Although audience concerns vary from situation, it is possible to categorize them. Hance, Chess, and Sandman (1987) developed four general categories of concerns: (1) health and lifestyle concern, (2) data and information concern, (3) process concerns, (4) risk management concern. Health and lifestyle concern are often the most important because in any risk situation, people inevitably want to know what the implications are for themselves and their families. These what-does-it-mean-to-me series of questions are often the most difficult for risk assessors to respond to. Instead they often rely on default assumption used to characterize risk. However such questions can also be thought of as a sensitivity analysis to better bound the risk estimates provided. Data and information concern are usually associated with the technical basis for any estimation of risk. Process concerns relate to how decisions are made by the entity responding to a risk and to how communication occurs. Obviously, trust and credibility are important in these issues, as is the control the public feels it has in the decision-making process. Finally, risk management concern relate to how and the risk will be handled: Will it be effectively mitigated, avoided, or reduced?

A variety of the techniques are available for documenting audiences information needs and concerns, including interview, written or telephone surveys, the use of existing public poll information, review of new coverage and letter to the editor, small informal community group meeting and focus groups that are structure group interviews with participants from specific target groups or from the general population.

3) Understanding issues of risk perception that will influence the audience

1) Voluntary or involuntary: Risk that are voluntary are usually perceived by the public as less serious or dangerous than those that seem to be involuntary, regardless of actual hazard. A voluntary risk (such as smoking or sun bathing) should never be compared with a perceived involuntary risk (such as exposure to contaminated air or water).

2) Controlled by the system or by the individual: People tend to view risk that they can not control as more threatening than that those they can control, regardless of actual hazard. Pesticide residues on food products (whether regulations deem them allowable or not) or emission from a facility that are permitted are perceived to be beyond the control of the individual.

3) Trustworthy or untrustworthy sources: How individuals view a risk is often a function of how much they trust the organization that seems to be imposing or allowing the risk and of how credible they believe the source of risk in formation to be. Trustworthiness and credibility can be increased by the source's collaboration with credible soureces outside the organization who can help to communicate the message to the public.

4) Exotic or familiar: Exotic risk appears more risky than familiar risks. Toxic pollutants, with their long names, can certainly seem exotic. Further, the use of unit of measurements that is also unfamiliar such as parts per billion or ug/l add to the exotic nature of the risk.

5) Dreaded or not dread: Risks that are dreaded seem more serious than those that carry less dread. For example, nuclear radiation or chemical that are carcinogens may seem more risky and less acceptable than common household cleaner or a common illness such as influenza. It is important that communication efforts recognize and acknowledge this dread.

6) Certainty or uncertainty: Risks that are thought to be more certain or know are often perceived by the public to be less serious (and more acceptable) than those that are not. Conversely, risks that scientists are uncertain about are considered far more serious. In these cases, the public tends to want to err on the side of caution. Risk communication efforts must acknowledge points of uncertainty.But it is important to be careful not to overwhelm people by pointing out all the uncertainty associated with risk estimates.

In summary, risk-perception considerations cannot be ignored or minimized as emotion, unfactual, or irrelevant. Emotion, feeling, values, and attitude carry as much weight if not more - to the public than the technical magnitude of the risk situation.

4) Design risk-communication messages and testing those messages

The potential for distorted communication is not solely based on the public's lack of a technical background or the relevance of the information provided. Those assessing risk need to aware that the varying and often conflicting interpretation of risk results that get communicated are a function of several factors. In part, the problem may stem from the lack of a clear message as to what the results are or the limitations of scientists and risk assessors to place results in context for various stakeholders. Message about risk are further obscured by technical jargon. In addition, results are interpreted not only by the scientists themselves but by other parties and institutions, including government agencies, activist or interest group, and the media.

The two way nature of risk communication requires that messages contain the information the audience wants, as well as the information the communicator wishes to convey. Effective message should also clarify point that might be difficult to understand. The goal of risk communication should be to make the differences in language between experts and others more transparent. Strong differences between the two languages serve as barriers to dialogue and deliberation, and impede the possibility of developing a shared understanding. In general, the public receivers of this information have limited access to the information used in decision making. Even when the information is available, it may not be fully understood or accepted due to a lack of trust.

Written messages and oral presentations must transmit the information to the public in an understandable form. Many risk analysts tend to use overly technical or bureaucratic language which may be appropriate for the risk assessment document and for discussions with other experts but not for communicating with the general public. Similarly, experts in seeking to simplify risk messages may leave out important content that provides context. The challenge is to provide sufficient detail and content. Take care in using words such as insignificant or significant risk. Risk messages need to place health effect information into proper perspective so that people can comprehend the difference between significant and less significant risks. Messages should explain, as simply and directly as possible, such things as risk estimates, exposure considerations, and what uncertainties drive the risk estimate.

Because different audiences have different concerns and levels of understanding, one risk message may not be appropriate for all interested parties. It may be necessary to develop a series of message on the same topic. Finally, a critical part of successful message design is testing or trying out the message. This can be done formally, for example, by the use of focus groups or citizen advisory committees, or informally, for example, by testing the material on uniformed third parties.

Scientists are by nature precise and, as such, tend to describe all the uncertainties and limitations associated with a risk assessment. This may be overwhelming for the public, who is trying to figure out what the risk means and wants certainty, not caveats. It is important to discuss the major sources of uncertainty. When interpreting the result of health risk assessment for the public, explaining how health standard were developed and their applicability to the population at risk may be very important. In other instance, limited sampling data may be the most important uncertainty to explain. While the public may press for assurance of whether it is safe or unsafe, experts need to take care to be neither overly reassuring nor overwhelming with uncertainties. Explaining what you will do to reduce uncertainty may be especially important to communicate.

The complex nature of risk communication calls into question the value of requiring simple comparisons of risk end point with either common risk of daily life or other risks posed by chemical or physical agents or bright line risk values. Without a context, this information might provide inaccurate or confusing messages for the public. For most individuals these types of comparisons ask the primary question: What does the information mean to me? And, more specifically What does the risk mean to me? To address such broad issues, risk communication effort should seek to inform and enhance a recipient's understanding by providing information within a context. To be complete, risk messages should also provide information that can help facilitate individual decision making. Experience in risk communication suggests that risk comparison should be presented in way that provide cues to action and respect the values of participants in the process. Failure to consider social and political issues and values will increase the likelihood that a comparison will not be meaningful (Santos and McCallum, 1997)

2.3 PRECEDE-PROCEED (P-P) model

It is a model developed by Green and Kreuter (1991) known as Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation-Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development PRECEDE-PROCEED (P-P), is a health promotion planning model. This model involves a detailed series of 8 steps or phases for planning including: (1) Phase 1 Social Assessment, (2) Phase 2 Epidemiological, Behavioral, and Environmental Assessment, (3) Phase 3 Educational and Ecological Assessment, (4) Phase 4 Administrative and Policy Assessment and Intervention Alignment, (5) Phase 5 Implementation, (6) Phase 6 Process Evaluation, (7) Phase 7 Impact Evaluation, and (8) Phase 8 Outcome Evaluation.

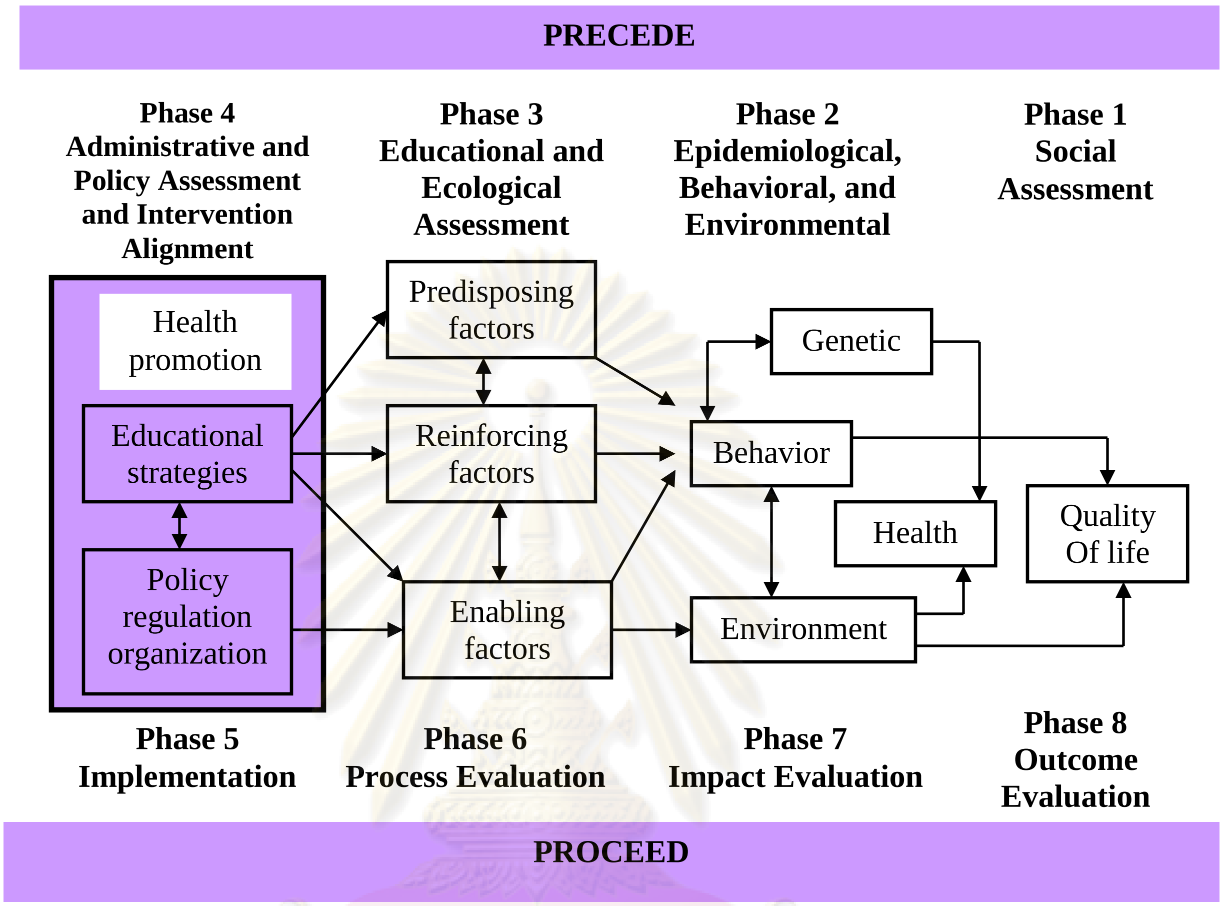


Figure2.3 PRECEDE-PROCEED Planning Model

2.3.1 Phase 1 Social Assessment, participatory planning, situation Analysis

A social assessment is the "application, through broad participation, of multiple sources of information, both objective and subjective, designed to expand the mutual understanding of people regarding their aspirations for the common good" (Green and Kreuter, 2005). At this stage, the planners expand their understanding of the community in which they are working by conducting multiple data collection activities, such as interviews with key opinion leaders, focus group with members of the community, observations, and surveys.

The social assessment articulates the community's needs and desires and considers the community members' problem-solving capacity, their strengths and resources, and their readiness to change. Focusing on community strengths in addition to problems allows the planners and community to form more effective and meaningful partnerships that will help to support both initial and sustained commitment to the program. Although programs are often predetermined with regard to audience to audience, health problem, or health behavior problem, the planner should still engage the community in partnership to build the program and link the community's concerns about quality of life issue to the program objectives. Developing a planning committee, holding community forums, and conducting focus group or surveys are all examples of helpful activities to engage the audience in planning and are necessary, regardless of where a planner be gins in the PRECEDE-PROCEED process.

An innovative method that may be particularly appropriate for this phase in the planning process is concept mapping. Concept mapping is a participatory method that allows the planner to obtain a conceptual model of how people understand or feel about a particular topic or issue. It is a structured group activity that allows participants to generate a large number of ideas that are then subject to quantitative analysis in real time. This analysis result in cluster maps that show participants' ideas in relation to one another, and, with input from the participants final agreement is reached on the concept map that best reflect the participants' views.

2.3.2 Phase 2: Epidemiological, Behavioral, and Environmental Assessments

This phase of the needs assessment identifies the health priorities and their behavioral and environmental determinants. The epidemiological assessment involves the (1) identification of the health problems, issues or aspirations on which the program will focus, (2) uncovering the behavioral and environmental factors most likely to influence the identified priority health issues, and (3) translating those priorities into measurable objectives for the program being developed. On the other hand, the behavior determinants of health problem can be understood on three levels. Most proximal are those behaviors or lifestyles that contribute to the occurrence and severity of a health problem. The second more distal determinant is the behavior of others who can directly affect the behavior of the individuals at risk. The third and most distal behavioral determinant is the action of decision makers whose decision affects the social or physical environment that influences the individual at risk. By thinking about these three levels of behavioral determinants of the health problem, the program planner increases the likelihood that comprehensive and effective interventions will be created.

The environmental factors are those social and physical factors external to the individual, often beyond his or her personal control, that can be modified to support the behavior or influence the health outcome. Modifying environmental factors usually requires strategies other than education.

2.3.4 Phase 3: Educational and Ecological Assessment

After selecting the relevant behavioral and environmental factors for intervention, the framework directs planners to identify the antecedent and reinforcing factors that should be in place to initiate and sustain the change process. These factors are classified as predisposing, reinforcing, and enabling, and they collectively influence the likelihood that behavioral and environmental change will occur. Predisposing factors are antecedents to behavior that provode the rationale or motivation for the behavior. They include individuals knowledge, attitudes, belifes, personal preferences, existing skills, and self-efficacy beliefs. “Reinforcing factors are those factors following abehavior that provide continuing reward or incentive for the persistence or repetition of the behavior”. Enabling factors can affect behavior directly or indirectly through an environment factor. They include program, services, and resources necessary for behavioral and environmental outcome to be realized and, in some cases, the new skills needed to enable behavior change.

2.3.5. Phase 4 Administrative and Policy Assessment and Intervention Alignment.

In this phase, the planners select and align the program’s component with the priority determinants of change previously identified. Its purpose is to identify resources, organizational barriers and facilitators, and policies that are need for program implementation and sustainability. When creating the program plan, it is important to look at two levels of alignment between the assessment of determinants and the selection of intervention. At the the macro level, the organizational and environmental system that can affect the desired outcome should be considered. These are intervention that affects enabling factors for environmental change, which in turn support the desired health behavior or health outcome.At the micro level, the focus is on individual, peer, family, and others who can influence the intended audience's health behaviors more directly. Interventions at the micro level are specifically directed at changing the predisposing, reinforcing, and enabling factors. There are many available strategies, such as mass and small media, counseling, and advocacy, and the "best" strategy is the one that matches the context of the program, the audience's need, and the theory of the problem that the PRECEDE-PROCEED diagnosis has uncovered. Typically, successful program use multiple strategies to have an effective impact on complex health issues.

Green and Kreuter have draw on a body of literature about program development to offer recommendations for "intervention matching, mapping, pooling and patching" at this stage of planning. Specifically, building a comprehensive program requires (1) matching the ecological level to broad program component; (2) mapping specific intervention base on theory and prior research and practice to specific predisposing, enabling, and reinforcing factors, and (3) pooling prior intervention and community preferred interventions that might have less evidence to support them, and if necessary, (4) patching those interventions to fill gap in the evidence-based best practices.

2.3.6 Phase 5-8 Implementation, Evaluation

At this point, the health promotion program is ready for implementation (Phase 5). Data collection plans should be in place for evaluating the process, impact, and outcome of the program, which are the final three phase in the PRECEDE-PROCEED planning model (Phase 6-8). Typically, process evaluation determines the extent to which the program was implemented according to protocol. Impact evaluation assesses change in predisposing, reinforcing, and enabling factors, as well as in the behavioral and environmental factors. Finally, outcome evaluation determines the effect of the program on health and quality of life indicators. Generally, the measurable observe as milestones against which accomplishment are evaluated. Because the emphasis in this chapter is on the application of behavior change theory to program planning, the detail of these phases will not be reviewed. Rather, their application will be described in two case studies that follow.

2.4 Theory of Knowledge Attitude Practice (KAP)

KAP survey

A KAP survey is a representative study of a specific population to collect information on what is known, believed and done in relation to a particular topic (WHO, 2008). In most KAP surveys, data are collected orally by an interviewer using a structured, standardized questionnaire. These data then can be analyzed quantitatively or qualitatively depending on the objectives and design of the study. Besides, KAP survey data are essential to help plan, implement and evaluate the particular topic. It gathers information about what respondents know, what they think, and what they actually do with the particular topic. Moreover, KAP surveys can identify knowledge gaps, cultural beliefs, or behavioral patterns that may facilitate understanding and action, as well as pose problems. They can identify information that is commonly known and attitudes that are commonly held. To some extent, they can identify factors influencing behavior that are not known to most people, reasons for their attitudes, and how and why people practice certain health behaviors. KAP surveys may be used to identify needs, problems and barriers in program delivery, as well as solutions for improving quality and accessibility of services.

KAP survey even can be used to orient resource allocation and project design, and to establish a baseline for comparison with subsequent, post-intervention KAP surveys.

A KAP survey will probably require internal human resources as well as external experts with specialized skills. It may be necessary to hire individuals or agencies to lead tasks such as determining the number of people to be surveyed (sample size), designing the survey questionnaires, conducting the survey interviews in the local languages, entering data from the survey into a computer, or analyzing data. If a consultant's scope of work is expected to be most beneficial at a later phase, such as data analysis, it is important to involve the consultant from the initial design phase. This ensures that consultants are aware of the survey's purpose, design and implementation plan, and can contribute in valuable ways when their skills are needed.

There are 6 steps to have a KAP survey (WHO, 2008) as follow:

Step 1: Define the survey objectives contains information about how to access existing information, determine the purpose of the survey and main areas of enquiry, and identify the survey population and sampling plan.

Step 2: Develop the survey protocol outlines elements to include in the survey protocol and suggestions to help identify the key research questions. Determining whether the survey needs ethical review is critical to this step, as well as creating a work-plan and budget.

Step 3: Design the survey questionnaire proposes important steps for developing, pre-testing and finalizing the questionnaire, and for making a data analysis plan.

Step 4: Implement the KAP survey includes considerations for choosing survey dates, recruiting and training survey supervisors and interviewers, and managing survey implementation.

Step 5: Analyze the data consists of entering and checking the quality of the survey data, and implementing the data analysis plan created in Step 3.

Step 6: Use the data highlights ideas on how to translate the survey findings into action, elements to include in the study report, and how to disseminate the survey findings.

2.5 High-performance liquid chromatography

2.5.1 Definition of High-performance liquid chromatography (HPLC)

High-performance liquid chromatography HPLC) is a chromatographic technique that can separate a mixture of compounds, and is used in biochemistry and analytical chemistry to identify, quantify and purify the individual components of the mixture. HPLC utilizes different types of stationary phase (typically, hydrophobic saturated carbon chains), a pump that moves the mobile phase(s) and analyze through the column, and a detector that provides a characteristic retention time for the analysis. The detector may also provide other characteristic information (i.e. UV/Vis spectroscopic data for analyze if so equipped). Analyze retention time varies depending on the strength of its interactions with the stationary phase, the ratio/composition of solvent(s) used, and the flow rate of the mobile phase. With HPLC, a pump (rather than gravity) provides the higher pressure required to propel the mobile phase and analyze through the densely packed column. The increased density arises from smaller particle sizes. This allows for a better separation on columns of shorter length when compared to ordinary column chromatography.Several methods are available to measure paraquat in plasma, including thin-layer chromatography colorimetric methods, immunoassay gas chromatography and high-performance liquid chromatography.

2.5.2 Case study relevant of HPLC stusy

Nakagiri presented an HPLC method with automated sample pre-treatment that quantified plasma paraquat and diquat in 8 min using special apparatus. Their limit of quantification was 0.1 mg/ ml (Nakagiri et al., 1989).

Brunetto describes the determination of paraquat (PQ) in human blood plasma samples by a direct-injection reversed-phase ion-pair chromatographic method. Blood plasma filtrate was injected directly into the LiChrospher RP-18 alkyl-diol silica (ADS) precolumn integrated in a column switching system using a mixture of 3% 2-propanol and 10 mM sodium octane sulfonate (SOS) in a 0.05 M phosphate buffer (pH 2.8). After washing with this phase, the ADS precolumn was back-flushed with the analytical mobile phase consisting of 40% of methanol and 10 mM SOS in a 0.05 M phosphate buffer (pH 2.8) at a flow rate of 1.0 ml/min, in order to carry the analyte to a conventional reversedphase analytical column, where the separation of PQ was achieved and finally detected by UV at 258 nm. The recoveries of PQ from human blood plasma samples ranged between 95.0 and 99.5% at nine different concentrations (from 0.05 to 3.00 mg/ml of PQ) with coefficients of variation B 2.5%. The precision expressed as relative standard deviation was below 3.5% for between-day and below 4.3% for within-day measurements. The detection limit was 0.005 mg ml_1 with an injection volume of 200 ml. The proposed method is promising for the identification and quantification of PQ at low concentration levels and is suitable for its analysis in human blood plasma samples from intentional or accidental poisonings cases with a sample throughput of 5 samples per hour.(Brunetto, Morales, Gallignani, Burguera, and Burguera, 2003)

Paixa conducted a simple and fast HPLC system that is presented for quantifying paraquat in human plasma and serum using 1, 19-diethyl-4,49- bipyridyldiylium (diethyl paraquat) as an internal standard. An octadecyl–silica column is used with an eluent of 10% acetonitrile (v/v) containing sodium 1-octanesulphonic acid (3.0 mM) and a diethylamine–orthophosphoric acid buffer (pH 3). Unlike with other techniques, sample treatment requires only the precipitation of protein contents by 6% perchloric acid (v/v) in methanol. The method has a limit of detection of 0.1 mg/ml and is linear up to 10 mg/ ml. The serum of four patients and the plasma of one patient with paraquat intoxication's were analysed and positive identification and quantification was readily achieved. One of those patients survived, partially given the rapid disclosure of his levels of paraquat. Therefore, this method is suitable for quantification of paraquat in toxicological samples. It may be used as a prognostic tool in critical case detoxification and to quickly identify potentially salvageable patients for enrolment in new hemofiltration studies (Paixao, Costa, Bugalho, Fidalgo, and Pereira, 2002).

Mika ITO conducted the study, by using IPCC-MS3 as the counter-ion in the mobile phase, we established a simple, quick method of analysis that separated and quantified paraquat and diquat on an ODS column by introducing the deproteinized serum sample directly into HPLC. The calibration curve of paraquat and diquat detected at UV 290 nm showed good linearity when the concentration of the injected sample was in the range 0.1-10.0m g/ml. The detection limit was 0.05m g/ml, and the mean recoveries (n=5) added 1.0m g/ml each of paraquat and diquat to standard serum were 87.5% and 89.1%, respectively, while the RSD were 4.52% and 3.85%. All of these were good results, and the time taken for one analysis was less than 30 min. As a result of employing this analytical method for the analyses in four cases of acute poisoning, it was possible to decide promptly on treatment approaches for all of the present cases (Ito et al., 2005).

Shuuji conducted a rapid and sensitive HPLC method which is the simultaneous determination of paraquat and diquat in human serum. After deproteinization of the serum with 10% trichloroacetic acid, the samples were separated on a reversedphase column, and subsequently reduced to their radicals with alkaline sodium hydrosulfite solution. These radicals were monitored with a UV detector at 391 nm. This method permitted the reliable quantification of paraquat over linear ranges of 50 ng–10 μg/ml and 100 ng–10 μg/ml for diquat in human serum. The within- and between-day variations are lower than 2.3 and 2.2%, respectively. This technique was also utilized to determine the paraquat and diquat serum levels in a patient who had ingested herbicide containing paraquat and diquat (Hara et al., 2007).

Hye Suk Lee conducted a new ion-pair high-performance liquid chromatographic method with column-switching which is the determination of paraquat in human serum samples. The diluted serum sample was injected onto a precolumn packed with LiChroprep RP-8 (25-40 mm) and polar serum components were washed out by 3% acetonitrile in 0.05 M phosphate buffer (pH 2.0) containing 5 mM sodium octanesulfonate. After valve switching to inject position, concentrated compounds were eluted in the back-flush mode and separated on an Inertsil ODS-2 column with 17% acetonitrile in 0.05 M phosphate buffer (pH 2.0) containing 10 mM sodium octanesulfonate. The total analysis time per sample was about 30 min and mean recovery was 98.562.8% with a linear range of 0.1–100 mg/ ml. This method has been successfully applied to serum samples from incidents by paraquat poisoning (Lee, Kim, Kim, Do, and Lee, 1998).

Conceptual Framework

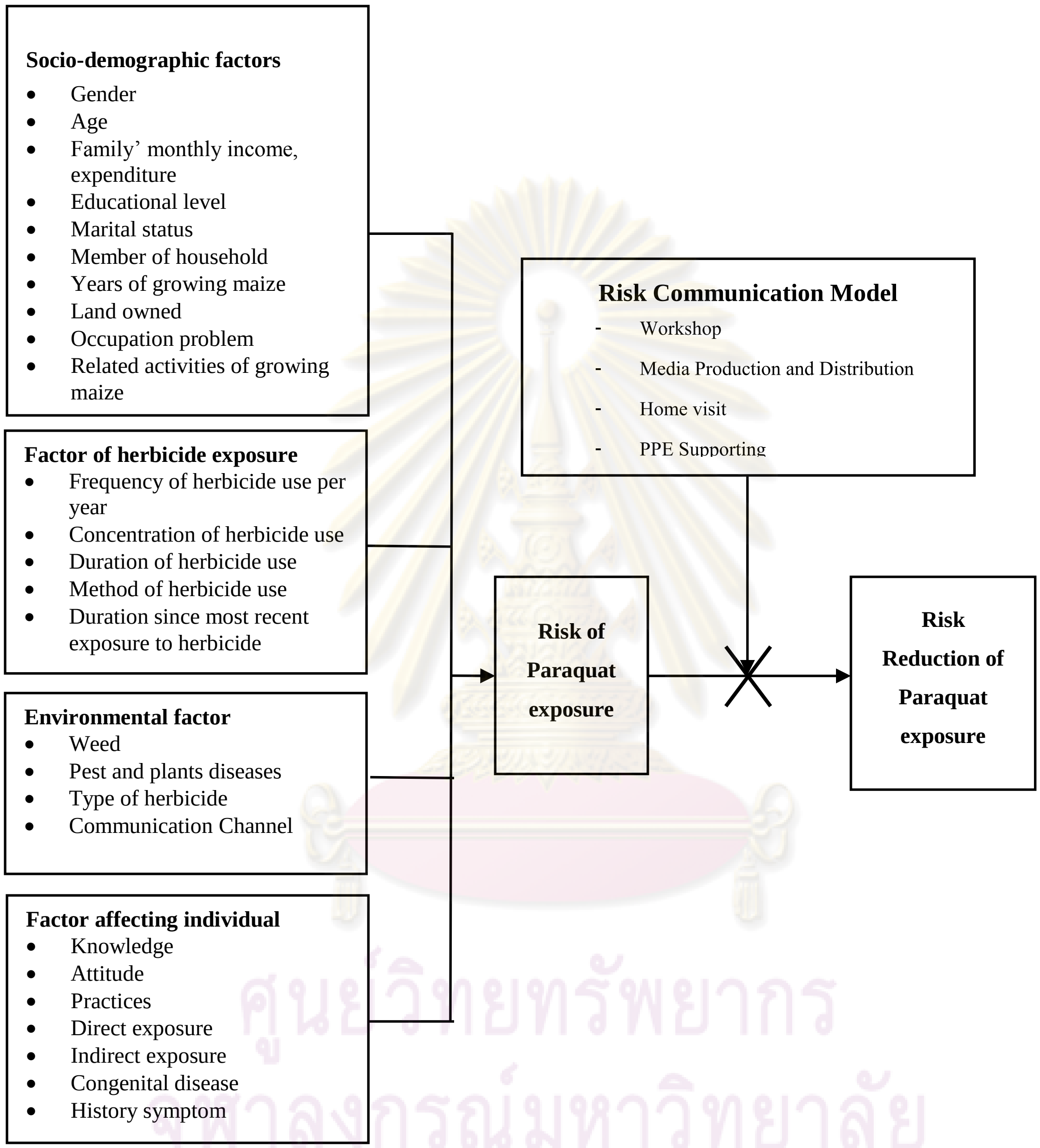


Figure 2.4 Conceptual Framework

CHARPTER III
METHODOLOGY

This study was classified into 3 phases; phase 1 was conducted a cross-sectional study, phase 2 was conducted a quasi experimental study, and phase 3 was conducted a process of evaluation. All phases employed both quantitative and qualitative methods. Phase 1 provided to study the background, general information and to assess the association among knowledge, attitudes, and practices of paraquat use and exposure. Phase 2 was developed and implemented the risk communication model for implementing in the maize farmers. Phase 3 was evaluated the effective of the risk communication model.

3.1 Research Design

The research designs of this study were used a cross-sectional study in the first phase, a quasi-experimental study in the second phase, and the evaluation process in the third phase. The first phase was surveyed by face to face interviewed with questionnaires, in-depth interviewed and participatory observed. The second- phase were developed and implemented the risk communication model. The third phase was evaluated effective of risk communication model.

3.2 Sample and Sampling Method

3.2.1 Sample and Sampling Method in Phase 1

Namtok sub-district, Nanoi district, Nan province was purposively selected as the study site of this study, because this area has the participants and activities involed with the objective of this study. The target population was selected only one maize farmer from all households which are the maize farmer households. The target population was the maize farmers who have direct exposed to paraquat through mixing, loading, and spraying for more than 1 year and hasve not communicated problems, have road and written Thai language, and have been willingness to participate in this study. The total households of Namtok sub-district were 603 households and 92% of total household was maize farmer households. Then, the target population in first phase was 555 maize farmers who were the household representation.

3.2.2 Sample and Sampling Method in Phase 2

A quasi-experimental study was conducted by the pre-test and post-test design with non-equivalent group. The target population was divided into 2 groups including the experimental group and the control group. The sample size of the target population in this phase was calculated by the Power and Sample Size Calculations Version 3.0 (Dupont & Plummer, 1990). According to the primary outcome of this study is paraquat residues concentration which is the continuous variable, therefore the formular for calculating the sample size is follow criteria in the independent t-test with the equation and criteria as follows (Daniel, 1999; Gulford and Fruchter, 1978; Lemeshow, Hosmer, klar, and Lwanga, 1990)

$$n/group = \frac{\boldsymbol{\sigma}^2 (Z\alpha + Z\beta)^2}{d^2}$$

For independent t-tests this is the number of experimental group that must be studied to detect a true difference in population means (**δ** =5) with Type I error probability **(α** =0.05) given a standard deviation (σ=9) and (*m*=1) controls per experimental patient. Follow these criteria the sample size of this phase was 51 persons in both group.

$$n/group = \frac{\boldsymbol{\sigma}^2 (Z_\alpha + Z_\beta)^2}{d^2}$$

$$= \frac{9^2 (1.960+0.842)^2}{5^2}$$

$$= 25.22 \times 2 = 50.88 \sim 51 \text{ cases/group}$$

Generally, the approximately sample size should add 10 % of dropout rate in to the total sample size.

Calculate n*

$$n^* = \frac{n}{(1-R)} = \frac{51}{(1-0.1)} = 58 \text{ cases/group}$$

* R = dropout rate

Next, the stratified random sampling was applied to random the 58 participants from the 555 persons by proportion of gender, age and duration year of paraquat use in Namtok sub-district.

The control group, the stratified random sampling was applied to random the 58 participant from 733 participants who are the maize farmers in registered list and direct exposed to pesticides through loading, mixing, and spraying in Bouyai sub-district, Nanoi district where is similar careers and similar living conditions by matching gender, age and duration year of paraquat use with intervention group.

Eligibility Criteria in both groups

Inclusion criteria

1. No communication problems, able to read and write Thai.
2. Informed consent for the farmers who are willing to participate in this study.

Exclusion criteria

1. The maize farmer who has acute and chronic renal and liver system diseases.
2. The maize farmer who has historical suicide by drinking or swallowing paraquat.

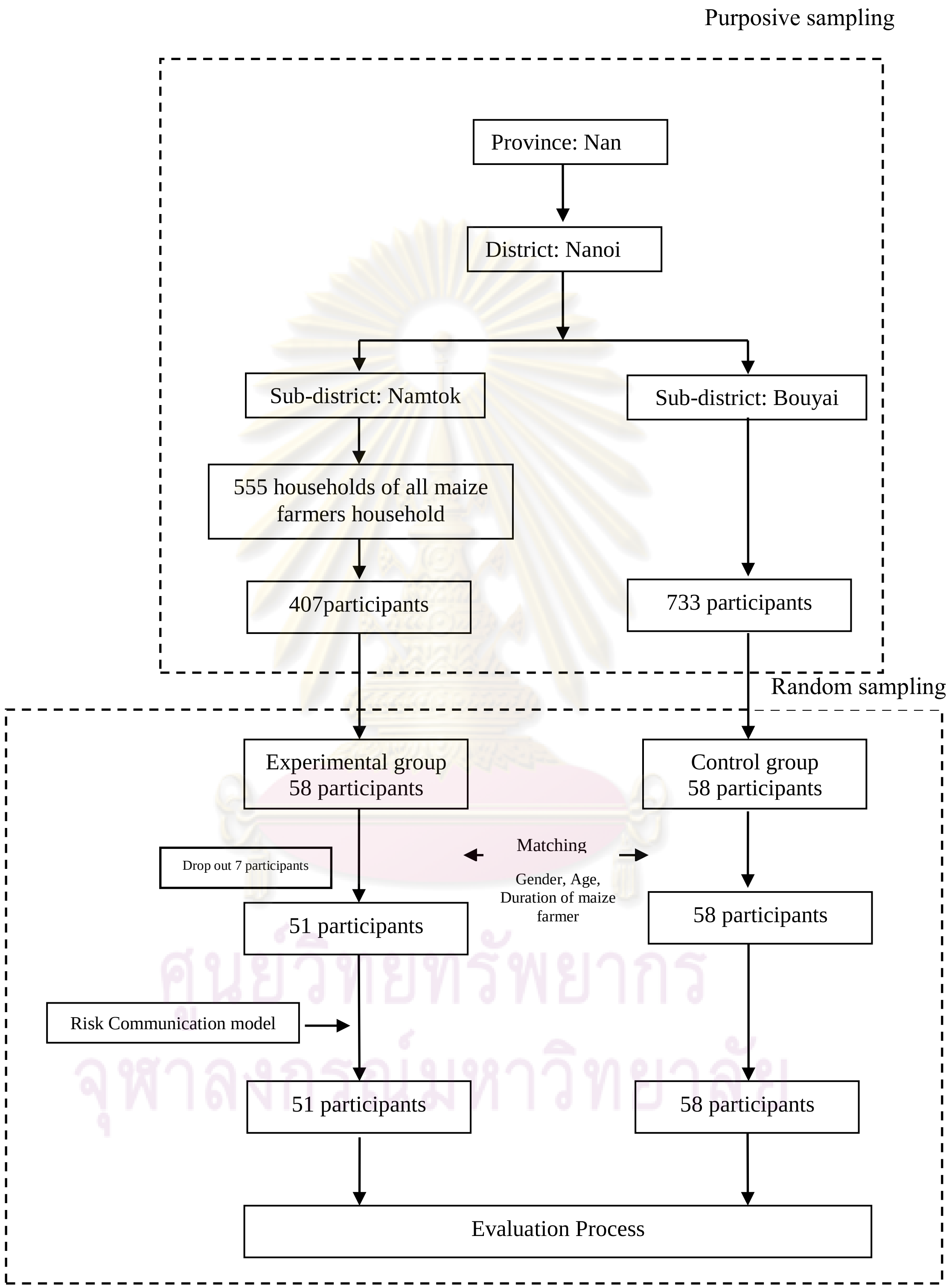


Figure 2.5 Sampling technique of this study

3.3 Study Area

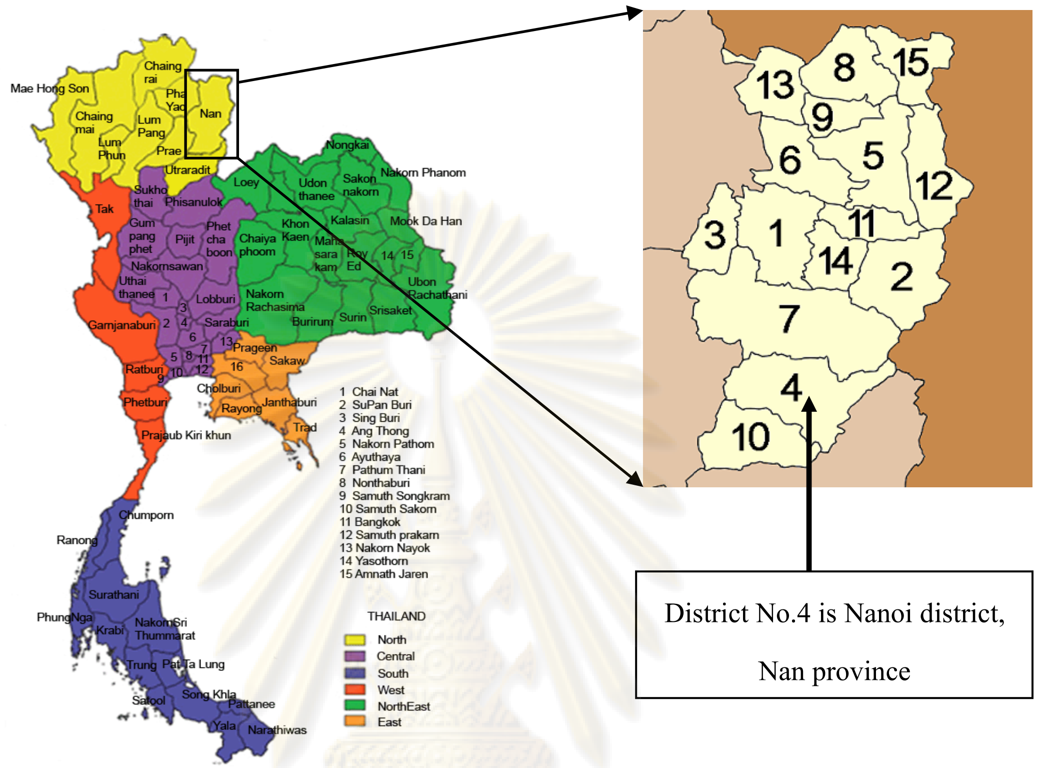


Figure 2.6: Map of study area

Phase 1: Namtok sub-district was purposively selected for surveying by face to face interview with questionnaires. This sub-district is one part of Nanoi distict in Nan Province where is located in a northern part of Thailand. This sub-district comprises 7 villages, 606 households, and 2,549 residents.

Second phase a quasi-experimental: Namtok sub-district was purposively selected for the intervention group. Bouyai sub-district was purposively selected for the control group. Bouyai sub-district comprises 8 villages, 902 households, and 4,001 residents. The distance from Namtok sub-district to Bouyai sub-district is around 30 kms. The border line that separates between both areas is the mountains.

3.4 Study procedure

This study was used the PRECEDE-PROCEED model to demonstrate how environmental health research in communities can lead to effective risk communication model (interventions) to alert people to particular risk and move them to action, to improve public understanding, to change behavior and to protect action.

Preparing period

Before carried out the study, building teamwork was established for supporting to collect data in each phase, to be moderators in the public meeting workshop, to be the observer, to cross check the self reports. Many teams were established in each phase as follow:

Building teamwork in phase 1:

Face to face interviewer's team, 14 students who have studied in Nanoi district school(secondary school) at the fourth to sixth level and have lived in Namtok sub-district were selected to be the interviewers. Before conducted face to face interview, the researcher already trained all of the interviewers to understand the objective and the details of how to survey and how to use correctly questionnaires.

In-depth interview's team, this team was comprised a researcher, a registered nurse and a public health technical officer who have worked in Namtok sub-district health center, and a agricultural technical officer who has worked in Namtok sub-district agricultural office. They were trained and informed to understand the purposive of this study and this technique. Morover, they also discussed about the guidline of in-depth interview and participated to prove guidline before conducted.

The participatory observation's team, this team was comprised a researcher, 3 representaion of village health volunteers. The team objective was to observe the maize farmers behaviors of PPE use when they applied paraquat in real situation for double checking back the self reports.

Building teamwork in Phase 2

Intregated team, this team was comprised 13 persons including a rearcher**,** a Registered Nurse of Namtok Sub-District Health center, a Public Health Technical erOfficer of Namtok Sub-District Health Center, a Agricultural Technical of Namtok Sub-District Agricultural office, a Environmental Technical Officer of Nan Provincial Environmental Office, a Pharmacist of Nan Provincial Health Office, and a Physician, a Medical Sciencetist, 3 Registered Nurses of Nanoi District Hospital, 2 ICT Technical officers. This team helped to collect blood and prepair serum samples in both group before and after the intervention, to conducte pre- and post- test questionnairs, to be the lecturers and the moderators in public meeting workshop, to train the participants for understanding, using and checking the quastionnaires and self reports which were the outcome measurement. Also, they took photography in the maize field when the farmer worked and applied paraquat.

Step by step of Study precedure

Phase 1: Social Assessment, participatory planning, situation Analysis; The social assessment articulates the community's needs and desires and considers the community members' problem-solving capacity, their strengths and resources, and their readiness to change (Figure 2.7). This study was focus on the environmental health problem. Face to face interview with questionnaires, indepth interview, participatory observation were conducted to find out environmental health concern. We found the important environmental health concern which was the extensive paraquat exposure in the maize farmers, because the maize farmers use extensive paraquat in their fields and they did not deny using paraquat in the real world. Therefore, the risk of paraquat exposure still existed in the maize farmers until they stoped to use and reduced the exposure.

Phase 2: Epidemiological, Behavioral, and Environmental Assessments; this phase of the needs assessment identifies the health priorities and their behavioral and environmental determinants (Figure 2.8**)**. The existing data, the secondary data, the data from survey and the focus group discussion were analyzed to identify the health problem, behavioral determinants and environmental determinants. According to the finding in phase 1, the health problem which related to extensive paraquat exposure in this area was the adverse health effect in term of both long term consequence and immediate consequences.

Phase 3: Educational and Ecological Assessment; after selecting the relevant behavioral and environmental factors for intervention, we identified the antecedent and reinforcing factors. Predisposing factors were knowledge, attitude, and belief especially the individual knowledge of paraquat use and exposure, knowledge of right and regulation and perceive as susceptible. Reinforcing factors were the social support to change behavior such as friend, family, community, health officer, agriculture officer. Enabling factor was the practices which reduced and control exposure at work including problem solving, diagnosing problem (Figure 2.9).

Phase 4: Administrative and Policy Assessment and Intervention Alignment; we selected and aligned the program's component with the priority determinants of change previously identified. Its purpose is to identify resources, organizational barriers and facilitators, and policies. This study was looked at the micro level. The focus was on individual, peer, family, and others who can influence the intended audience's health behaviors more directly. Risk communication model (intervention) at the micro level was drawn on a body of literature about program development to offer recommendations for "intervention matching, mapping, pooling and patching". Specifically, building a comprehensive program requires (1) matching the ecological level to broad program component; (2) mapping specific intervention base on theory and prior research and practice to specific predisposing, enabling, and reinforcing factors, and (3) pooling prior intervention and community preferred interventions that might have less evidence to support them, and if necessary, (4) patching those interventions to fill gap in the evidence-based best practices.

Phase 1-Phase 4 of Precede-Proceed were applied to use in the phase 1 of research study design as a cross-sectional study. Survey by interview with questionnairs, indepth interview, and participatory observation were conducted to find out the answer that related to the objective of Phase 1-Phase 4 of Precede-Proceed. Next, the quasi experimental study design was conducted. The target population was divided into 2 groups including experimental group and control group. 58 participants of experimental group were randomed from 407 maize farmers in Namtok sub-district. 58 participants of control group were randomed from 733 maize farmers in Bouyai sub-district. Before going on the intervention as risk communication model, blood collection and pretest were conducted in both groups. Blood collection was conducted for measuring the primary outcome of this study as the paraquat residues concentration in human serum. This is the first time or baseline of blood collection in both groups. They were collected blood 10 ml per person for 5 ml serum centrifugation. Before the workshop started, pretest questionnairs were conducted in both groups at the same time. Then, the workshop started in the experimental group for using risk communication model.

Risk communication model was drawn on 10 questions environmental managers should ask of the planning of risk communication including 1) why are we communication, 2) Who is our audience, 3) What do our audiences want to know, 4) What do we want to get across, 5) How will we communicate, 6) How will we listen, 7) How will we respond, 8) How will carry out the plan When, 9) What problems or barriers have we planned for, 10) Have we succeeded.

The first question "why are we communication" which was purposed to ask the reason from the planners before communicating risk to the public for clearing the goal of communication. The answers of this question in this study were to gain insights of paraquat exposure risk, to build credibility of the message and senders of risk communication, to meet regulator requirements for reducing and controlling risk, to provide opportunity for input risk communication, and to encourage behavior of risk communication in public.

The second question "who are our audiences" which was to know who were the groups likely to be affected and likely to perceive themselves as affected of paraquat exposure. The answer in this question was the maize farmers who have directly exposed paraquat when they apply in the maize field.

The third question "What do our audiences want to know" which was mean what do we want to say, what your audiences is likely to misunderstand and also what you think is important. The appropriate answers of this study were what the adverse health effect that caused of paraquat exposure is, what the causes of paraquat exposure are, what risks of paraquat exposure are, how to get risk of parequat exposure, and how to get rid of risk of paraquat exposure.

The fourth question "what do we want to get accross" which was consider what the audience want to know, what your audience is likely to misunderstand if you don't spell it out and what your agency thinks is important. Risk reduction of paraquat exposure was the answer of this question in this study.

The fifth question "how will we communicate" which was considered the audience preferences and existing communication channels and the amount of interaction needed. This study focus on the group of maize farmers in the experimental group in Namtok sub-district around 58 persons, then the appropriate channel to communicate was the public meeting or workshop. The reasons of why set the workshop for communicating were those are the direct communication to the target group, fast time, save money and high efficacy. Not only production new media was made including VCD of risk communication, the article which was advertised through public service announcements, household poster, fact sheets, but also the existing media was used including sygenta handbook of chemical use. Moreover, home visit was used to follow up for face to face communication again.

The sixth question "how will we listen" which was the way to listen feedback of the risk communication from the audiences including message, medium, and channels. This study was use the feedbach through interactive workshops and informal meeting.

The seventh to tenth question which responsibility and evaluation process of the risk communication were answer with the priamary and secondary outcome of the study including the paraquat residues concentration in serum, the level of knowledge, attitude, practice, and behavior change of full compliance of PPE use.

The risk communication model comprised 4 activities including public meeting workshop, production and distribution media, home visit, and PPE support. After, blood collection and pretest done, whorkshop was conduct 2 days or 16 hours that was consisted 6 sessions. Then, production and distribution media, home visit, and PPE support were conducted follow the workshop. Prodution and distribution media was conducted to communicate into the experimental group around 6 months. PPE supported was conducted after the workshop was finished.

The second round of blood collection was conducted in both groups after they exposed paraquat in recent season when they completed exposure 10 cumulative days. After completed the intervention, pretest was conducted in both group at the same time.

Phase 5-8 Implementation, Evaluation; At this point, the risk communication model is ready for implementation. Data collection plans should be in place for evaluating the process, impact, and outcome of the program, which are the final three phase in the PRECEDE-PROCEED planning model. Typically, process evaluation determines the extent to which the program was implemented according to protocol. Impact evaluation assesses change in predisposing, reinforcing, and enabling factors, as well as in the behavioral and environmental factors. Finally, outcome evaluations determine the effect of the program on health and quality of life indicators.

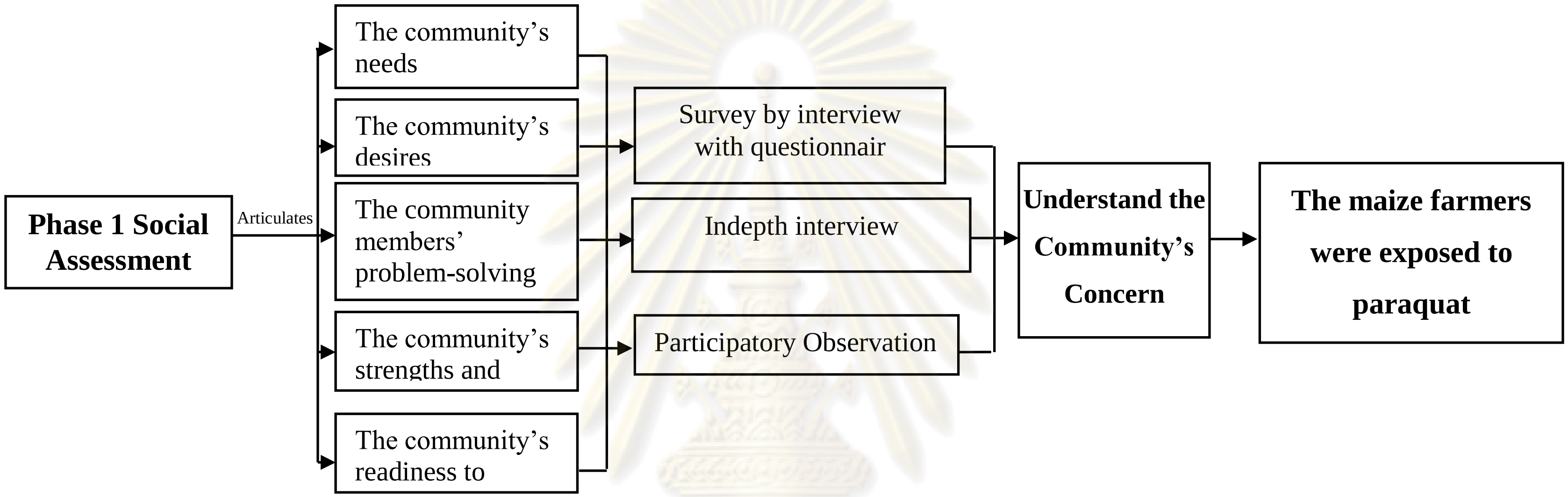


Figure 2.7: Phase 1 Social assessment of PRECEDE-PROCEED model

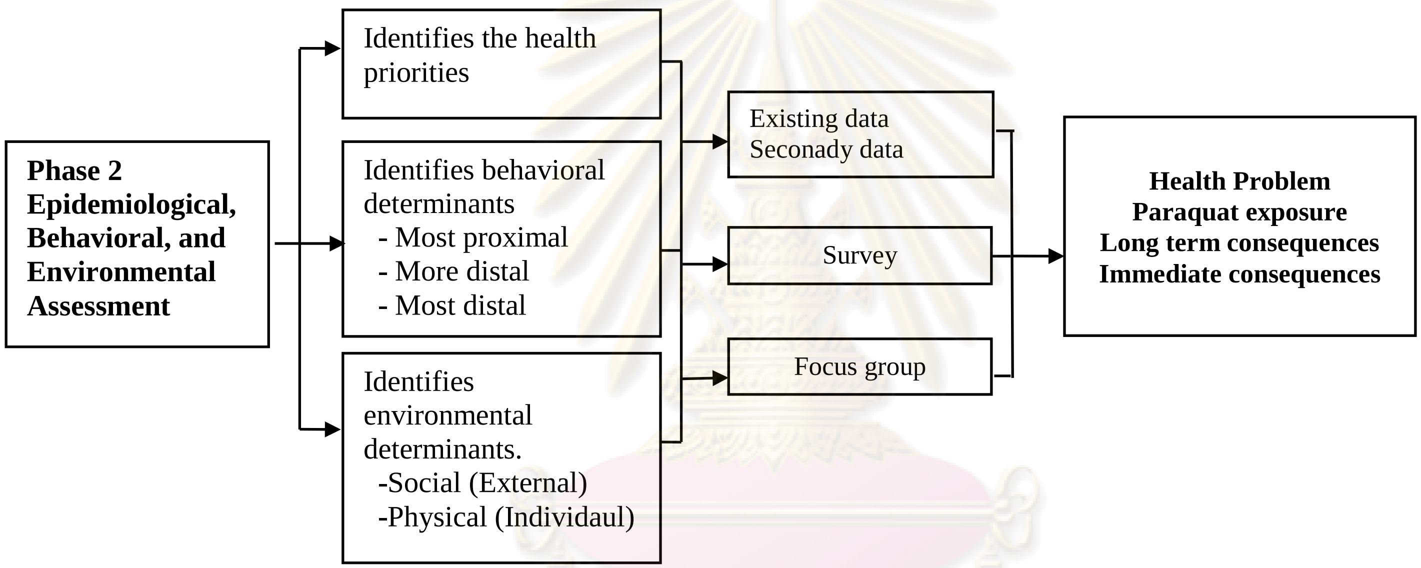


Figure 2.8: Phase 2 Epidemiological, Behavioral, and Environmental Assessment of PRECEDE-PROCEED model

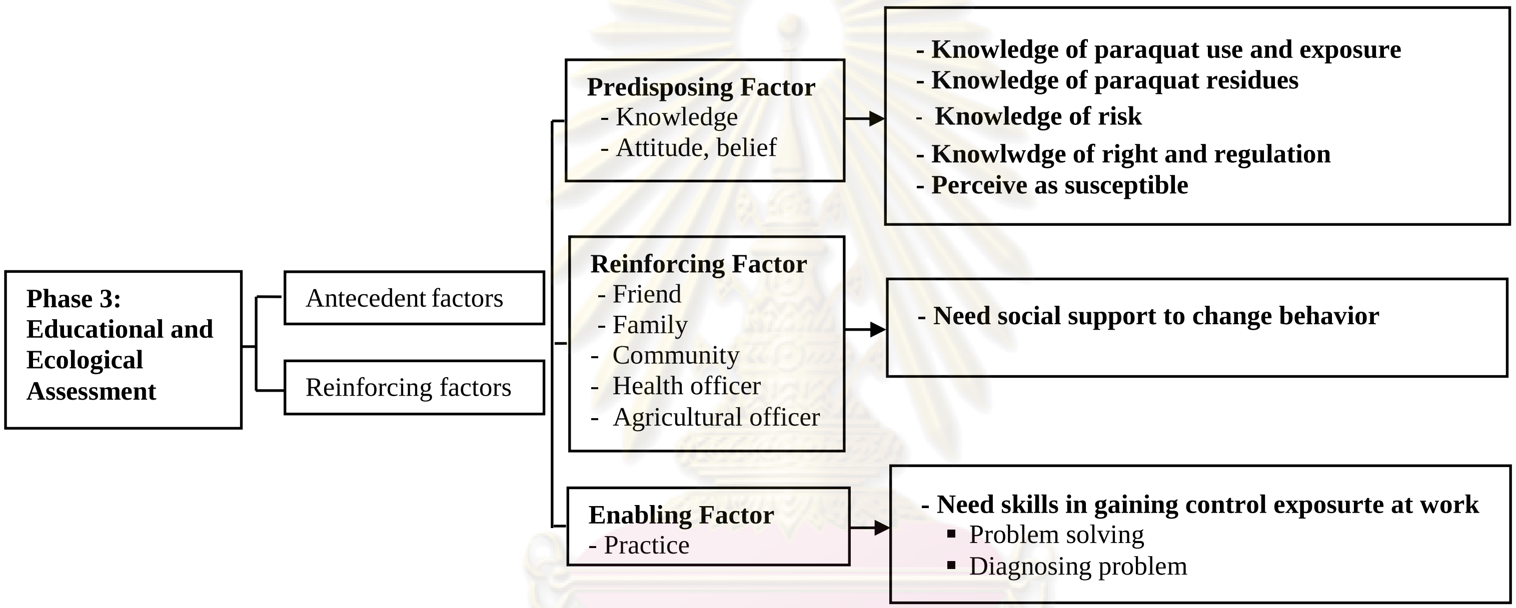


Figure 2.9: Phase 3 Educational and Ecological Assessment of PRECEDE-PROCEED model

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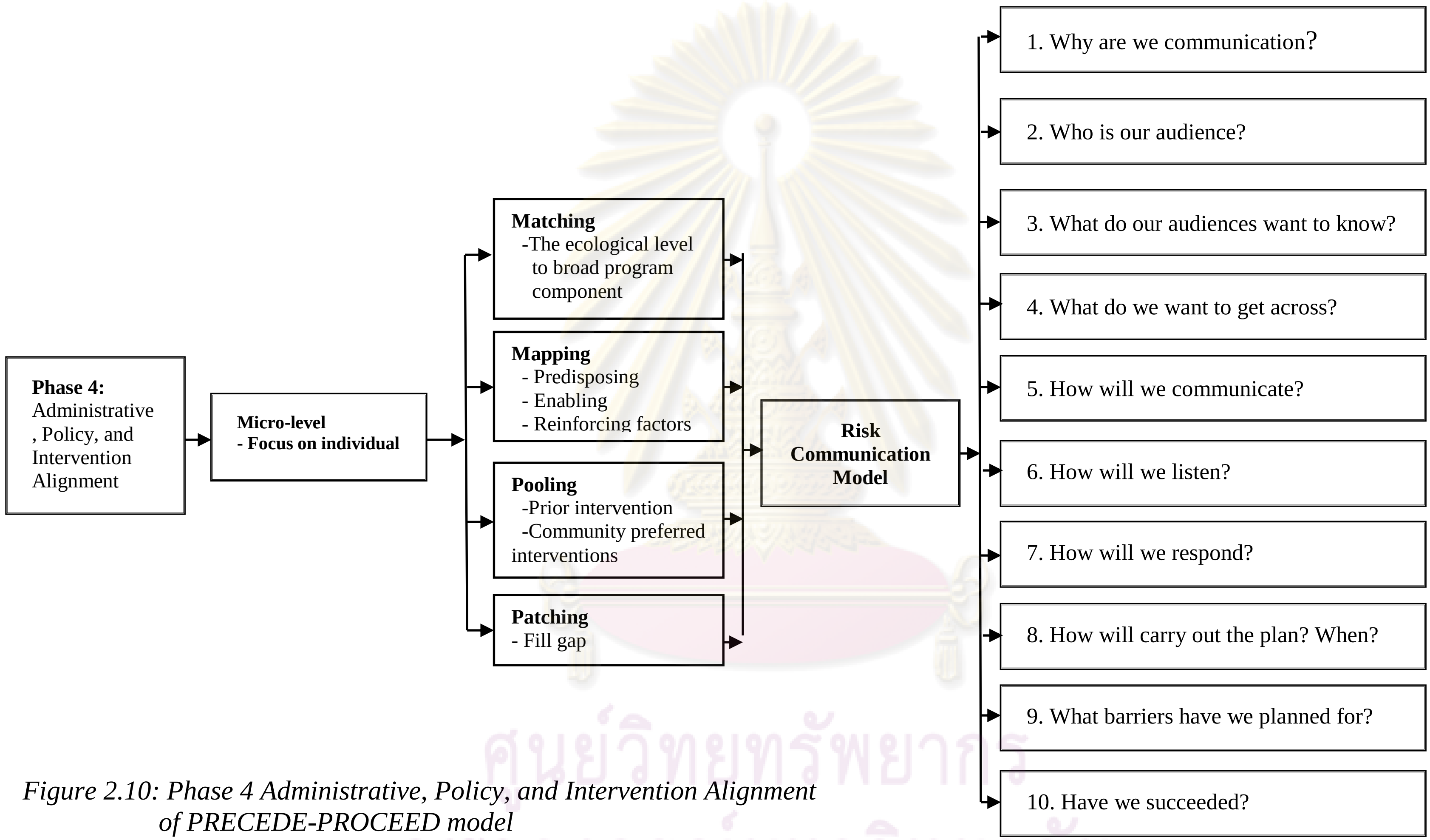


Figure 2.10: Phase 4 Administrative, Policy, and Intervention Alignment of PRECEDE-PROCEED model

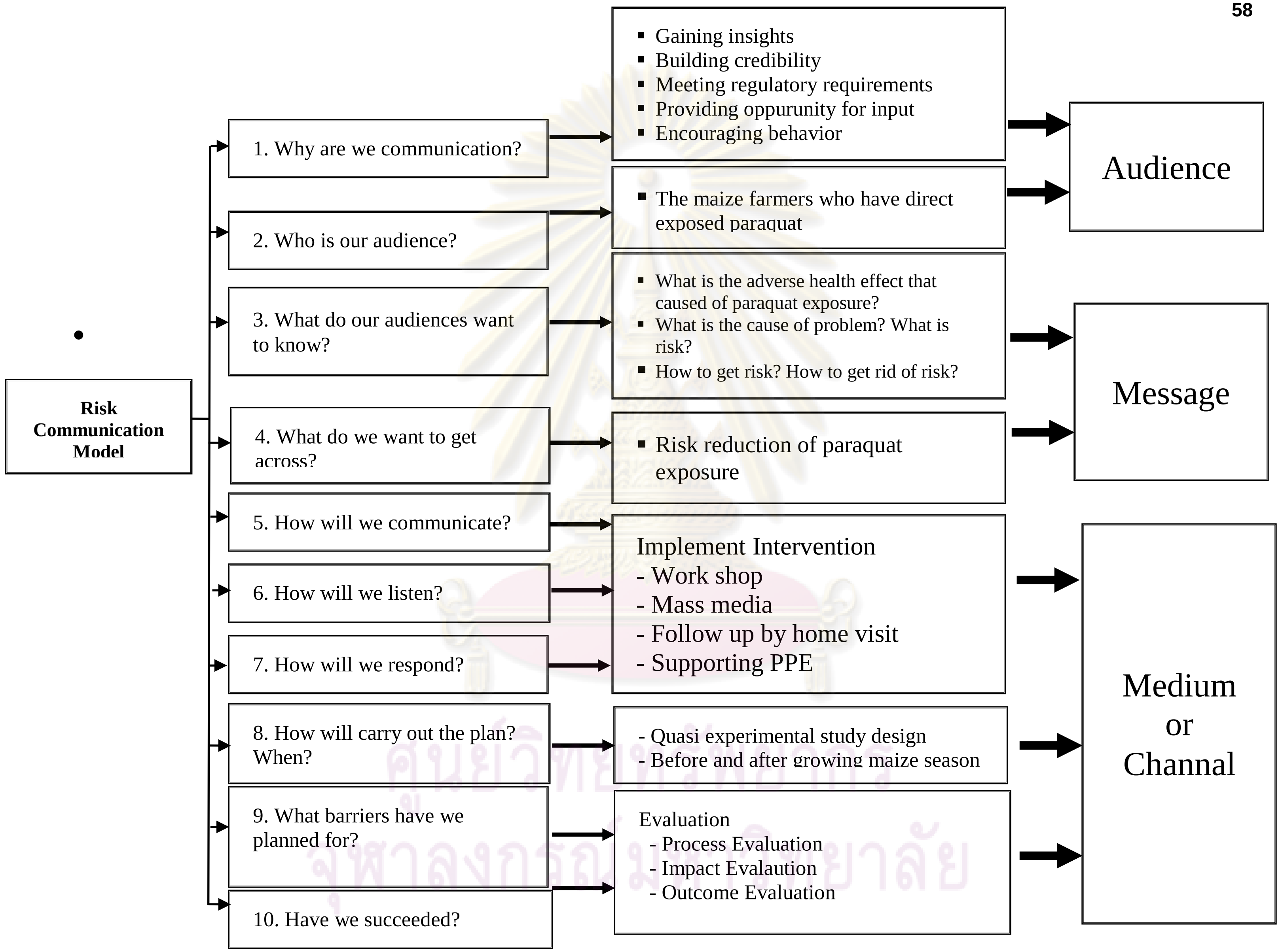


Figure 2.11: How to modify risk communication model base on 10 questions of risk communication

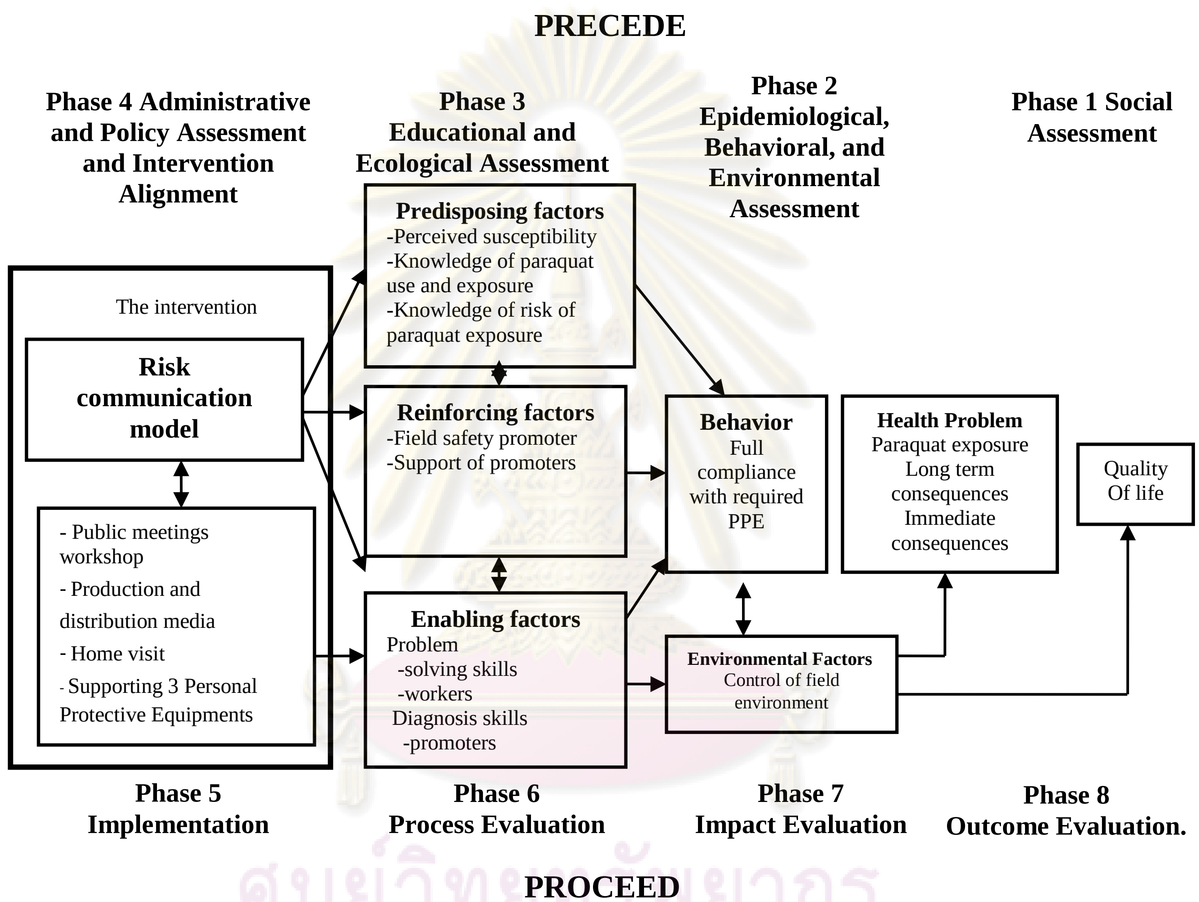


Figure 2.12 Summary of modifying model

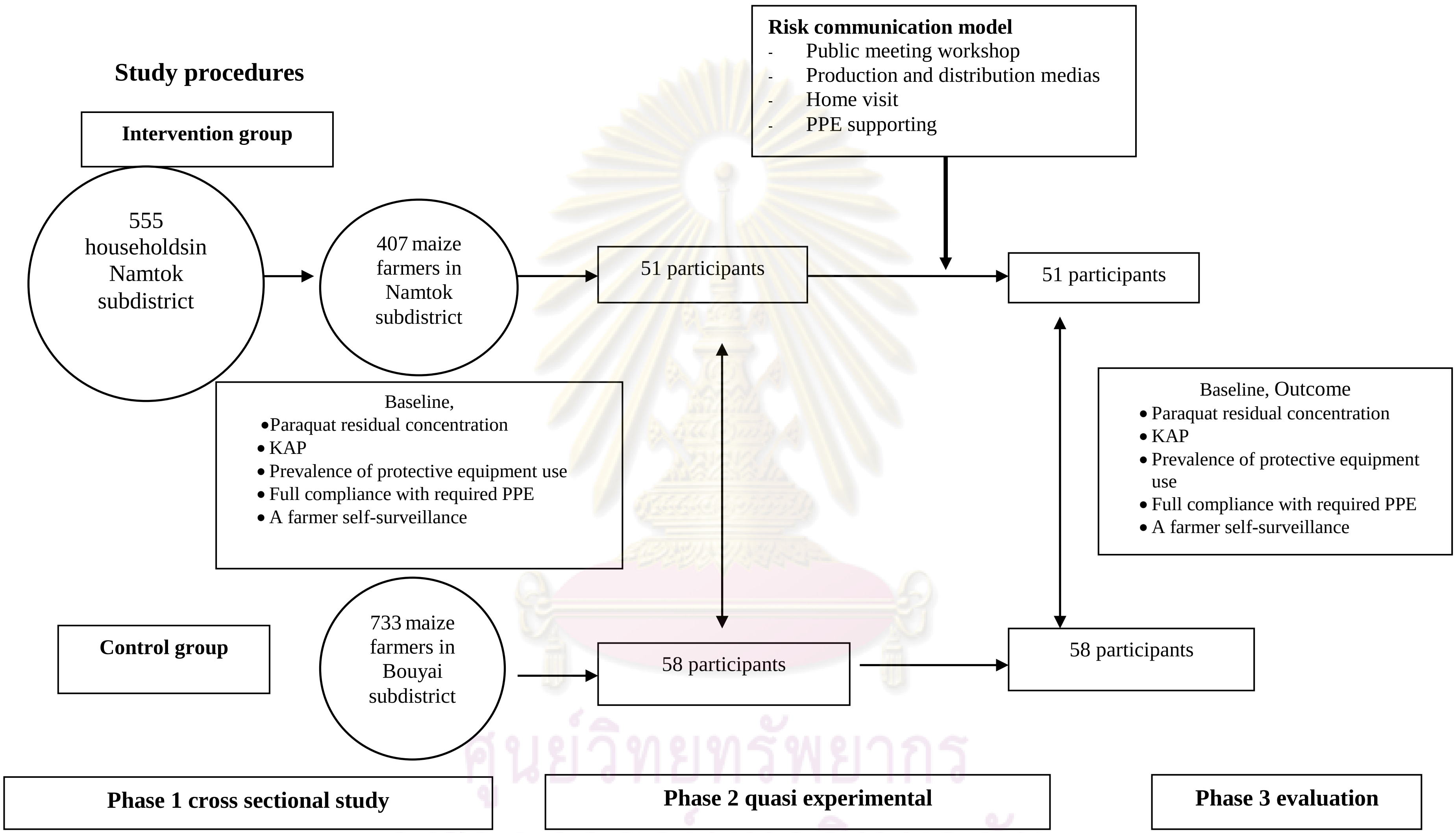


Figure 2.13 Study Procedure mapping

3.5 Structure of risk communication model

Risk communication model was compried into 4 important parts including public meeting workshop, production and distribution media, home visit, and supporting Personal Protective Equipments (PPE) into the experimental group

1. Public meetings workshop

This process was carried out by holistic team which incorporate among health care officer, agricultural officer, local administrative officer within 2 days (16 hours). The interventions session content was comprised 7 sesssion as follow;

Session 1: Focus group discussions (FGD)

This session was applied the focus group discussion principle to find the thinking and experience from the participants. The participant was divided into 4 groups; in each group has the moderator who acts as the leader to encourage the participants to exchange the experience of paraquat application in maize filed with the guideline (Annex E).

Guideline of focus group discussion

Introduction

- Introducing facilitator and describing the reason and objective for the discussion group
- Letting them introduce themselves and breaking the ice before the discussion

1. The reason why use paraquat in maize fields.

- Asking their individual why use paraquat in maize growing fields within group
- Asking their alternative way if not use paraquat within group
- Discussion about the problem of paraquat use in maize fields within group

2. Awareness of adverse health effect of paraquat exposure

- Asking their individual adverse health effect of paraquat exposure and sharing within group
- Asking their health problem solving and discussing within the group
- Discussion about the health consequence of paraquat exposure in their opinion

3. Paraquat application in real situation (How, why)

- Asking how their applied paraquat in real situation and sharing within group
- Asking why choose and discussing within the group
- Discussion about the problem when applied paraquat in their experience

4. Experience of Personal Protective Equipment (PPE) (How, why)

- Asking their Experience of Personal Protective Equipment (PPE) and sharing within group
- Discussion about the problem when applied paraquat in their experience

Session 2: Toxicity and health effect of paraquat

This presentation focused on the history and background of paraquat, poisonings, acute toxicity, long term toxicity, chemical profile, health toxicological assessment (acute toxicity, skin and eye irritation, chronic toxicity, immune system, endocrine disruption, nervous system, birth defects, cancer, mutagenicity)

Session 3: Environmental effect of paraquat

This session was summarized in a presenting format for a lay audience. This presentation was focused on environmental effects (aquatic toxicity, terrestrial ecotoxicity, micro organism, herbicide resistance, environmental fate).

Session 4: Susceptibility to paraquat exposure.

Slides depicting paraquat exposure were used to illustrate how paraquat contacts the body during the use of different level of protective equipment. The important of preventing paraquat from entering the body through inhalation, absorption, and ingestion was emphasized using information from prior biomonitoring studies.

Session 5: Peer norms for safe paraquat handling.

A respected participant maize farmer, identified through nomination on the baseline assessment, was asked to speak to the group on how they had incorporated safe handling into their pesticide application routines. This component of the intervention proposed that using a well-regarded member of a peer group (i.e., farmers in a shared community) to endorse the desired behavior change (i.e., use of personal protective equipment during application) would exercise peer influence directly to encourage behavior change among the peer group.

Session 6: Skill training to increase self-efficacy beliefs.

The personal protective equipment (PPE) was encouraged to properly use protective equipment and safe handling practices. The demonstration paid particular attention to how applicators can make minor adjustments in their application routines to easily incorporate these practices. For example, the presenter suggested placing an extra set of disposable cover alls and rubber gloves in several places for easy access (e.g., in the barn, on the tractor, and in a storage box in the field). In addition to the demonstration by a presenter, each of the applicators was given the opportunity to experiment with the protective equipment. This included trying on respirators, practicing a brief check to make sure that all parts of the body were covered, and timing each other to illustrate how one can equipment up properly in only a few minutes. The objective of this component of the session was to give applicators time to acquire the skills necessary to practice safe handling procedures.

Table   : Schedule of Public meetings workshop

Day 1	**Activities**
07.30-08.00	Registration
08.00-08.30	Open ceremony by head of district health office
08.45-09.00	Mayor of local government meet the participants
09.00-09.15	Group activities
09.15-09.45	Pre-test
09.45-10.15	Inform the objective and the detail of the dissertation
	By Mr.Denpong Wongwichit, Technicial Health officer, Nanoi district health office
10.15-10.25	Break
10.25-11.30	**Session 1: Focus group discussion**
11.30-12.00	Watch VCD “Silence risk in Agrochemical”
12.00-13.00	Lunch Time
13.00-14.00	**Session 2: Toxicity and health effect of paraquat**
	By Mr. Samrarn Deearesa, Pharmacologist, Nan provincial health office

Day 1	Activities
14.00-14.20	Group activities
14.20-15.30	**Session 3: Environmental effect of paraquat** By Mr.Manit Thanawong, Technicial Environmental officer, Nan provincial environmental office
15.30-15.40	Break
15.40-16.30	**Session 4: Susceptibility to paraquat exposure (occupation health in the maize farmers)** By Miss Wanpen Songkam, Lecturer of nursing faculty, Chiangmai university
16.30-17.00	Question and Answer

Day 2	Activities
08.00-08.30	Registration
08.45-09.00	Group activities
09.00-10.30	**Session 4: Susceptibility to paraquat exposure (Principle of risk assessment of paraquat exposure)** By Dr.Wattasit Siriwong, Lecturer of the Coledge of Public Health Sciences, Chulalongkorn university
10.30-10.45	Break
10.45-12.00	**Session 2: Toxicity and health effect of paraquat** Paraquar poisoning; A practical guide to diagnosis, first aid and hospital treatment By Miss Phanida Yongskunroath, Physicial of Nanoi district hospital
12.00-13.00	Lunch Time
13.00-13.15	Group Activities
13.15-14.30	**Session 5: Peer norms for safe paraquat handling.** Training of Right and safety practice when applied paraqut
14.30-14.45	By Mr.Denpong Wongwichit, Technicial Health officer, Nanoi district health office
15.30-15.40	Break
15.40-16.30	**Session 6: Skill training to increase self-efficacy beliefs.** Trainning of how to use Personal Protective Equiptment (PPE) toc reduce paraquat exposure, trainning of how to check list in self reports and to answer the questionnaires
16.30-17.00	Question and answer and close the public meeting workshop

2. Producted new media and used existing media.

The purpose of this part was to communicate the participants in experimental group about risk of paraquat exposure, how to reduce risk, and how to practices. Many media including VCD, household poster, fact sheet, document of public service announcements were produced newly for direct communicating to the participants in their household. The content of the newly produced media was base on risk of paraquat exposure (human health effect, environmental effect, how to reduce risk, and how to practice behaviors for reducing risk).

Risk communication CVD was the multi media which consisted movement picture, sound, visual piture and gharphic which presented risk analysis of paraquat exposure around 20 minutes. It was distributed coverall households which were the participants's household in the experimental group.

Household poster, fact sheet were produced with the content of how to reduce risk and how to practice to get rid of risk and also distributed coverall households which were the participants's household in the experimental group.

Public service announcements Document was designed for announcing in the village at the morning or evening of 3 days per week by primary students who were the volunteers. All media were distributed and announced after finished public meeting workshop for 6 months from June to December 2010.

3. Home visit

This process was applied to follow up and encourage all participants to pay attention to learn the paraquat knowledge through medias which produce and distribute. The activities of this process comprise ask and answer the question, face to face communication, and cross check the understanding of self report. This process was done 2 times per each a participant within 6 months.

4. Supporting Personal Protective Equipments

This process was provided 3 Personal Protective Equipments into intervention group including goggle, gloves, and mask for purposing to reduce the paraquat exposure when the participants applied paraquat in all activities including mixing, loading, especially when they was spraying cover the maize field.

3.6 Measurement tool

The measurement tool was included as follow;

Measurement tool in Phase 1:

1. Phase 1 cross-sectional questionnaires (Annex A): A questionnaire was adopted base on the objective of the study and also applied from previous studies which related to this study. The validity was proved and tested the content by expert of public health. Also, the reliability of the questionnaire was tested the questionnaires in thirty maize farmers who have similar characteristics and similar living conditions in the Santa sub-district a month before the study began and modified according to their feedback. The reliability of questionnaires was 0.79. The questionnaire was categorized into five sections as follow;

Section one was general and background data such as age, gender, education, marital status, etc.

Section two was collected information on weeds, pests, and pesticides, such as type of pests, pesticide characteristics, and method of pesticide application.

Section three was evaluated the farmer's knowledge of pesticide use and exposure, health effects of pesticide use, and Personal Protective Equipment (PPE) use. The total number of question in this section was 16 questions. The question had 4 muliple-choice answers. The answers were score as follow;

Correct answer obtaining	1	score
Incorrect answer obtaining	0	score
Missing answer obtaining	0	score

Possible scores were ranged between 0-16 score. A mean score and standard deviation of the total score were classified into three categories as follow (Srisaard, 1992, Suchat, 1997)

High level	: score > Mean+S.D.
Moderate level	: score = Mean+S.D.
Low level	: score < Mean-S.D.

Section four was evaluated the maize farmers's attitude of pesticide use and exposer. The total number of question in this section was 14 questions which included both positive and negative attitude. Likert's scale was used to assess the attitude of the subjects towards pesticide use and exposure (Likert R, 1932). Each question was score in five-score Likert scale strongly agree, agree obtaining, neutral obtaining, disagree, and strongly disagree. All of them had the meaning as follow:

Strongly agree meant the maize farmers thought that the message was coincide with his feeling, opinion or belief following his perception most.

Agree meant the maize farmers thought that the message was coincide with his feeling, opinion or belief following his perception.

Neutral meant the maize farmers were uncertain with the message in that sentence which was coinside or against his feeling, opinion or belief with perception.

Disagree meant the maize farmers thought the message opposes his feeling, opinion or belief with perception.

Strongly disagree meant the maize farmers thought the message opposes all of his feeling, opinion or belief with perception.

Rating scale of attitude

The target group could choose one choice and the criterion of the measurement was as follow:

	Positive statements	Negative statements
Strongly agree	5 scores	1 score
Agree obtaining	4 scores	2 scores
Neutral obtaining	3 scores	3 scores

	Positive statements	Negative statements
Disagree obtaining	2 scores	4 scores
Strongly disagree	1 score	5 scores

All individual score were summed up for a total score and the means and standard deviations were calculated. Possible scores were ranged between 14-70 score. The total scores were classified into three levels as follow; (Srisaard, 1992, Suchat, 1997)

Positive attitude	: Score > Mean+S.D.
Neutral attitude	: Score = Mean±S.D.
Negative attitude	: Score < Mean-S.D.

Section five was addressed practice of pesticide use which included 21 questions. This section was divided into positive and negative statements, and separated into 3 levels Likert scale including always done, sometime done and never done. All of them had the meaning as follow:

Always done meant the maize farmers perform the dangerous protection activities from pesticide every time when they applied pesticide.

Sometime done meant the maize farmers sometime perform the dangerous protection activities or do not perform dangerous protection activities over 5 of 10 times.

Never done meant the maize farmers never perform the dangerous protection activities every time when they applied pesticide.

Rating scale of Practices

The target group could choose one choice and the criterion of the measurement was as follow:

	Positive statements	Negative statements
Always done btaining	3 scores	1 scores
Sometime obtaining	2 scores	2 scores
Never done obtaining	1 score	3 scores

All individual points were summed up for a total score, means and standard deviations were calculated. Possible scores were ranged between 21-63 score. The total scores were classified into three levels as follow

Good practice	: Score > Mean+S.D.
Moderate practice	: Score = Mean±S.D
Poor practice	: Score < Mean-S.D.

2. Participatory observation

This method was applied to confirm and explain some phenomianas which can not explain by the information from the quatiative method. This method plan to observe behavior of the maize farmers when they applied pesticide in routine working. Participatory observation method was performed by the researcher and team. The scope of this method was focus on the maize farmer's behavior of Personal Protective Equipment (PPE) when they applied pesticide or when they direct exposure of pesticide. Log note was used to note dayly activities of the maize farmers in the field. Scratch notes was applied to short note when was observation, conversation, and interview. Scretch note focused on keyword of phenomina in the real situation. Fieldnotes was applied to edit and extend the data from log note for analysis the information. Descriptive notes was used to explain what the findind of the maize farmers are, where, when, how they exposed to pesticide.

3. In-depth interview

This method was purposed to ask the questions which were structured before to the leader of the village, some of the participants whose was randomed to be a representation of all participants. This method focus on pesticide exposure situation, their concern and awareness of consequence of pesticide exposure, their practice when they applied pesticide, their opinion about our project and also ask for some comments or advise to improve the suitable intervention program in their area, and their need or what they want to achieve after finished the project. Tape recorder and interview note was used to conclude summary, analysis and explain all the phenomena in the maize farmer's community.

The target group of this method was purposively selected 2 key persons in each village of Namtok sub-district including village head and a maize farmer represention. Both persons were able to communicate and willingness to participate in in-depth interview process. The appropriate time for in-depth interview per case is around 30 minutes. The outliner of questionnaires will be set before the interview started.

Measurement tool in Phase 2

5. Photography evaluation

This method was purposed to evaluate the distinct bevavior change through take a picture of Personal Protective Equipment use when they applied paraquat after the intervention (public meeting workshop 16 hours) in some participants of experimental group.

6. High Performance Liquid Chromatoghaphy (HPLC)

High Performance Liquid Chromatoghaphy (HPLC) is the method that was conducted to measure the primary outcome which as paraquat residues concentration in human serum and urine in both experimental and control group. The experimental has the detail as follow:

6.1 Materials and reagents

Paraquat dichloride was obtained from Labor Dr.Enrenstofer-Schafers, Bgm-Schlosser-Sir, 6A-86199 Augsburg- Germany. All other reagents were of HPLC grade. Solid phase extraction as VertiPak™ CN Tubes 100 mg/1 ml, P/N: 0113-0336 was obtain from Vertical Chromatography Co., Ltd., Thailand.

6.2. Chromatographic system

The HPLC system was Hewlett Packard series 1100 software program. The column was Vertisep™ UPS C18 HPLC Colum (4.6×250 mm, 5 um P/N: 03CA-E521, S/N: 938, QC: 51637). The HPLC detector was Ultraviolet absorption detector.

The washing solvent and mobile phase were 8 % acetonitrile and 92% of 0.5 % H_3PO_4 in DI water. The flow-rates were 1.0 ml/min and the detection wavelength was 254 nm. The injection volume was 50 µl and temperature was 40 ºC

6.3 Target population and samples

Target population was the maize farmers who were included in both the experimental group 58 persons and the control group 58 person. Blood and urine samples were collected 10 ml and 30 ml for 2 times. For control the quality of time when the researcher and team arrange meeting the participants in both group for collecting the blood and urine, the schedule was set including the meeting, the remind letter and direct inform again through village health volunteer. The meeting was informed the participants the objective and the details of activities including the reason why collecting blood and how to do it. Next, the researcher and team sent remind letter directly to the participants in both group and remind informed the village health volunteers for confirming the participations group again. The first time of collecting specimens was conducted on Saturday and Sunday of the last week of July 2010, because at that time, the maize growing season was stared and the maize farmers have not exposed paraquat since October 2009 (around 10 months).

The intervention group, the first time of collecting blood and urine was set on Saturday morning of the last week of July 2010 at 7.00 am at Namtok sub-district health center. The control group, the first time of collecting blood and urine was set on Sunday morning of the last week of July 2010 at 7.00 am in Bouyai sub-district. Blood and urine were collected by the professional nurse team who come from Nannoi district hospital and Namtok sub-district health center. Blood was collected 10 ml or 2 teaspoons from all the participants. The urine was also collected 30 ml or 6 teaspoons from a half of all the participants. The reason of collecting urine a half of all the participants in both groups was to confirm with the paraquat residues concentration in serum. The hypothesis of test at this time, the paraquat residues concentration in serum and urine were similar.

The second time of collecting blood and urine, the meeting was set at the end of October 2010, because at that time the maize farmers just sprayed paraquat in the maize field. According to the pilot survey and interview by face to face with some maize farmers in the both areas, we found the maize farmer started to spray paraquat at the different time depend on the time when they started to grow the maize and we also found the average of total days which the maize farmers use to spray paraquat are 10 days. Therefore, the appropriate time to collect the specimens in the second is the day after 10 culmulatives day.

For control the quality of time, the researcher and team made understanding with the participants to know the detail of procedure through self check list, established head of participants of each village for helping to manage the time and used village health volunteer for helping to remind and confirm the participation again.

After Blood collected, they were centrifuged for getting serum, then it was freezed it at – 30 °C, serum samples were tested in HPLC method.

6.3 Solid Phase Extraction (SPE) procedure

Vertipak CN SPE tube can be used to extract Paraquat in serum prior to HPLC analysis.

Preparation

Serum samples were first filtered through 0.45 um PVDF filters with glass micro fiber (VertiPure PVDF_HL, part# 0201-03401) to prevent SPE tube blockage.

Condition

VertiPak™ CN Tubes were conditioned with 0.1 M Methanol 5 mL and 0.1 M Ammonia 5 mL.

Loading

5 ml of Filtered serum was applied to the tube and draw throught by vacuum manifold until the tubes are dry.

Washing

The tubes were rinsed with 1 mL 0.1 M ammonia until they were dry.

Elute

Paraquat is eluted with 0.8 mL 0.1 M HCl into vial. Neutralized samples were done with 0.5 mL ammonia hydroxide. Then adjusted the volume to 3 mL for analysis with HPLC grade water.

6.4 Analytical procedure

Step 1 (10 min): The column was washed with DI water to clean and clear solid silica support particles until the chromatogram smonth. Then switch to inject with the mobile phase until the chromatogram smonth as well.

Step 2 (5 min): The sample was injected into the column with inject volume 50 ul, flow rate 1 ml/min, temp 40 ºC, wave length = 254. The retention time of paraquat dection was around 2.2 minute. Therefore, total time running a case were 5 minute.

6.5 Quality parameters

The limit of Detection (LOD) of paraquat was determined by mean and standard deviation of paraquat concentration 0.1 mg/l result which repeated 4 times by standard formular (REF) as follow:

LOD = Mean + 3 SD.

= 0.172+ 0.037

= 0.21 mg/l (0.21 µg/ml)

The percentage of recovery of paraquat was calculated by mean of concentration of extraction sample divide by mean of concentration of reference sample. The mean of SPE recovery rate of this method was 97.68%. The correlation of peak areas with the concentrations of paraquat in serum was linear in the range of 0.1–5.0 mg/ml with a correlation coefficient of 0.998. The detection limit of paraquat was 0.21 mg/ ml with 5 ml of serum.

6. Advance questionnaires; knowledge, attitude, practice of paraquat use and exposure (Annex C)

This questionnaires was designed for evaluating knowledge, attitude, and practices in the participants both experimental and control groups pre and post test. The questionnaires, which was adopted base on paraquat knowledge and its application. To evaluate the clarity of the questionnaire, the questionnaire was pre-tested on thirty maize farmers with similar occupations and similar living conditions in the Santa sub-district one month before the study began and modified according to their feedback. The questionnaire was categorized into three sections as follow:

Section one; Maize farmer's knowledge of paraquat use and exposure

This section was purposed to evaluate the farmer's knowledge of paraquat use and exposure, health effects of paraquat exposure, and Personal Protective Equipment (PPE) use. The total number of question in this section was 15 questions. The question had 4 muliple-choice answers. The answers were score as follow;

Correct answer obtaining	1	score
Incorrect answer obtaining	0	score
Missing answer obtaining	0	score

Possible scores were ranged between 0-15 score. A mean score and standard deviation of the total score were classified into three categories as follow (Srisaard, 1992, Suchat, 1997)

High level	: score > Mean+S.D.
Moderate level	: score = Mean+S.D.
Low level	: score < Mean-S.D.

Section two; Maize farmer's attitude of paraquat use and exposure

This section was purposed to evaluate farmer's attitude of paraquat use and exposure. The total number of question in this section was 15 questions which included both positive and negative attitude. Likert's scale was used to assess the attitude of the subjects towards pesticide use and exposure (Likert R, 1932). Each question was score in five-score Likert scale strongly agree, agree obtaining, neutral obtaining, disagree, and strongly disagree. All of them had the meaning as follow:

Strongly agree meant the maize farmers thought that the message was coincide with his feeling, opinion or belief following his perception most.

Agree meant the maize farmers thought that the message was coincide with his feeling, opinion or belief following his perception.

Neutral meant the maize farmers were uncertain with the message in that sentence which was coinside or against his feeling, opinion or belief with perception.

Disagree meant the maize farmers thought the message opposes his feeling, opinion or belief with perception.

Strongly disagree meant the maize farmers thought the message opposes all of his feeling, opinion or belief with perception.

Rating scale of attitude

The target group could choose one choice and the criterion of the measurement was as follow:

	Positive statements	**Negative statements**
Strongly agree	5 scores	1 score
Agree obtaining	4 scores	2 scores
Neutral obtaining	3 scores	3 scores
Disagree obtaining	2 scores	4 scores
Strongly disagree	1 score	5 scores

All individual score were summed up for a total score and the means and standard deviations were calculated. Possible scores were ranged between 15-75 score. The total scores were classified into three levels as follow; (Srisaard, 1992, Suchat, 1997)

Positive attitude	: Score > Mean+S.D.
Neutral attitude	: Score = Mean±S.D.
Negative attitude	: Score < Mean-S.D.

Section three; Maize farmer's practice of paraquat use and exposure

This section was purposed to evaluate practice of paraquat use and exposure. This section was divided into positive and negative statements, and separated into 3 levels Likert scale including always done, sometime done and never done. All of them had the meaning as follow:

Always done means the maize farmers perform the dangerous protection activities from pesticide every time when they applied pesticide.

Sometime done means the maize farmers sometime perform the dangerous protection activities or do not perform dangerous protection activities over 5 of 10 times.

Never done means the maize farmers never perform the dangerous protection activities every time when they applied pesticide.

Rating scale of Practices

The target group could choose one choice and the criterion of the measurement was as follow:

	Positive statements	Negative statements
Always done btaining	3 scores	1 scores
Sometime obtaining	2 scores	2 scores
Never done obtaining	1 score	3 scores

All individual points were summed up for a total score, means and standard deviations were calculated. Possible scores were ranged between 20-60 score. The total scores were classified into three levels as follow

Good practice	: Score > Mean+S.D.
Moderate practice	: Score = Mean±S.D
Poor practice	: Score < Mean-S.D.

7. Self report of Personal Protective Equipments (PPE) use

Self report was checked when the participants in both groups applied paraquat in the maize field. It was designed to check list of 9 equiptments including hat, scarf, goggle, glove, mask, long-sleeve shirt, trousers, socks, boots by themselves while they mixed, loaded, and sprayed paraquat in the real situation. It was checked 2 times before intervention (last applied paraquat in last year) and after intervention (after applied paraquat recent season in this year). It was divided into 2 scales including use and not use. The complete PPE use in all equipments was the full compliance of PPE use. (Annex G (a, b, c))

8. Self report of surveillance system of paraquat poisoning symptoms.

This self report which comprised 34 symptoms was designed to check list about paraquat poisoning symptoms after the participants in both groups while they applied paraquat or within 24 hours after they applied (Annex H).

Rating scale of evaluating symptoms scale

The target group could evaluate symptoms with the criterion of the measurement was as follow:

Level of symptoms	evaluating symbols
Severe symptom	+++
Moderate symptom	++
Mild symptom	+
Never	0

3.7 Data Collection

Data collection of this study was collected by following the outcome as follows;

Phase 1data collection:

1. Quantitative data of background and general data of paraquat use and exposure in the maize farmers in Namtok sub-district was collected by face to face interview with phase 1 cross-sectional questionnaires.

2. Quantitative data of knowledge, attitude, and practice in the maize farmers in Namtok sub-district was also collected by face to face interview with phase 1 cross-sectional questionnaires.

3. Qualitative data in the maize farmers in Namtok sub-district was collected by participatory observation, in-depth interview, and photography evaluation.

Phase 2data collection:

3. The primary outcome as the concentration of paraquat residues in human serum in both groups was collected by High Performance Liquid Chromatoghaphy (HPLC) method.

4. The secondary outcome as knowledge, attitude, and practice of paraquat use and exposure in both groups were collected by advance questionnaires before and after intervention.

5. Prevalence of Personal Protective Equipment (PPE) use in both groups was collected by self report 2 times before and after intervention.

6. Full compliance with required PPE in both groups was collected by self report for evaluating full compliance 2 times before and after intervention.

7. Self surveillance system of paraquat poisoning symptoms in both groups was collected by self report while they applied or after they applied within 24 hours.

3.8 Data Analysis

Data analysis of the study was analyzed following the outcome measurement as follows;

Phase 1; data analysis

1. Quantitative data of background and general data of pesticide use and exposure in the maize farmers in Namtok sub-district was analyzed by descriptive analysis including frequency, percentage.

2. Quantitative data of knowledge, attitude, and practice of pesticide use and exposure in the maize farmers in Namtok sub-district was analyzed by descriptive analysis including frequency, percentage, mean, chi-square test and fisher exact test.

3. Qualitative data was analyzed by narrative description, narrative conclusion, narrative interpretation, and internal-external corrected data.

Phase 2; data analysis

4. The primary outcome as concentration of paraquat residues in human serum was analyzed by descriptive analysis including frequency, percentage and also compaired proportion by Z-test.

5. The mean and mean difference of knowledge, attitude, and practice of paraquat use and exposure was analyzed by paired t-test and unpaired t-test.

6. Prevalence of Personal Protective Equipments (PPE) use was analyzed by descriptive analysis including frequency, percentage and also compared proportion by Z-test.

7. Full compliance with required PPE use was analyzed by descriptive analysis including frequency, percentage and also compared proportion by Z-test.

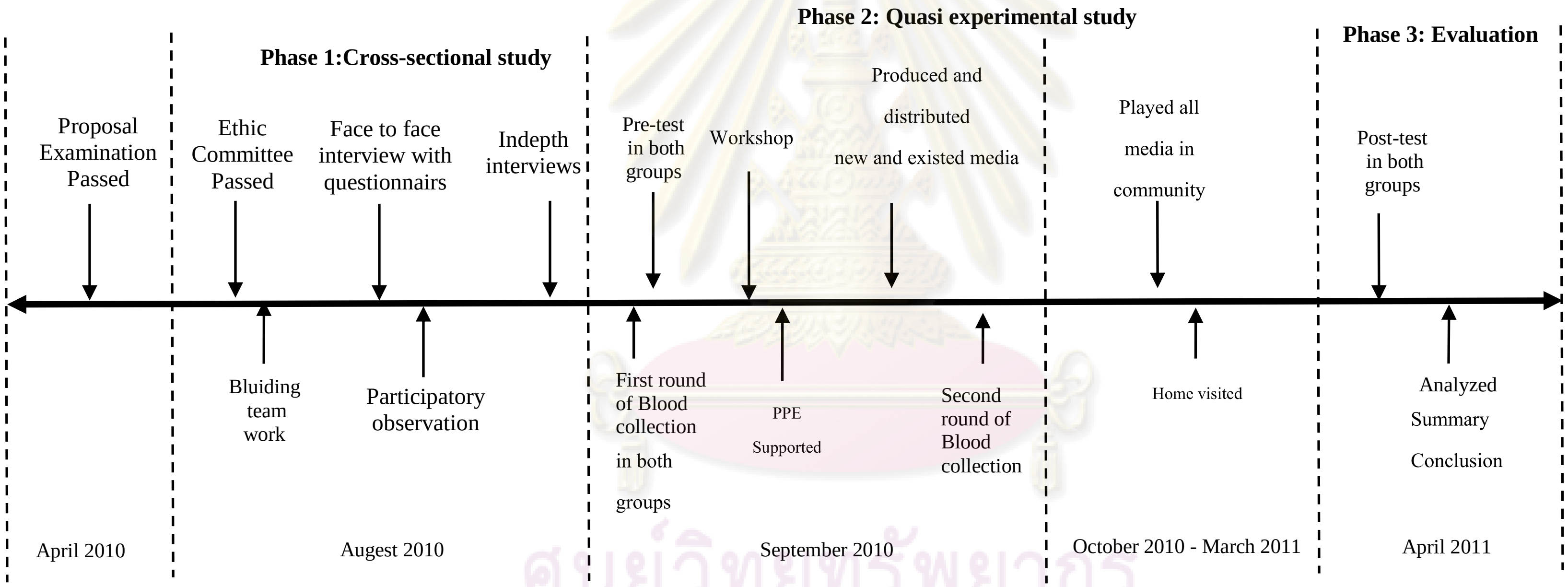
8. Self surveillance system of paraquat poisoning symptoms was analyzed by descriptive analysis including frequency, percentage and also compared proportion by Z-test.

3.9 Study period

This study was studied for 10 months from June 2010 to March 2011.

Time line of study procedure

Precedure



Time Peroid

CHAPTER IV
RESULTS

The results are presented for 3 phases by the steps of this research study. The first phase was a cross-sectional study. The second phase was a qua-si experimental and the last phase is the phase of evaluation.

4.1 Result of Phase 1: Cross-sectional study

4.1.1 Personal characteristic of the participants in phase 1

Of the 555 households that owned a maize farm, 407 participated in the survey. Therefore, the total response for the questionnaire interview was 73.33%. The average age of the subjects was 44 years. Eighty percent were male; 89% were married; and 70% were the head of the household. Sixty percent of the subjects graduated from primary school and 31% made an income in the range of 200,001-300,000 baht/year/household (US $6,060-9,090). Approximately 61% of maize farmers owned less than 40 rais (15.87 acres) of land. Subjects surveyed performed land reclamation (15%), sowing (15%), fertilizer application (17%), pesticide spraying (16%), harvesting (17%), milling and packing (13%), and distribution and sale (6%).

Table 4.1: Number and percentage of personal characteristic of participants

Characteristics	Number (407)	Percentage (%)
Gender		
Male	325	79.9
Female	82	20.1
Age (years)		
16-34	64	15.7
35-53	288	70.8
54-72	55	13.5
Marital status		
Single	31	7.6
Couple	361	88.7
Dower	12	2.9
Divorce	3	0.7

Characteristics	Number (407)	Percentage (%)
Status in family		
Head of family	285	70.0
Couple of head	71	17.4
Child	32	7.9
Liver	19	4.7
Education		
Never	19	4.7
Primary school	245	60.2
Secondary 1st	74	18.2
Secondary 2nd	59	14.5
Certificate	10	2.5
Income		
0-90,000	45	11.1
90,001-216,000	146	35.9
216,001-288,000	87	21.4
288,001-420,000	90	22.1
420,001-600,000	36	8.8
600,001-1,020,000	3	0.7
Land owner		
<= 40 rais	249	61.2
41-80 rais	150	36.9
>=81 rais	8	2.0
Occupation problem*		
Weed and pest, outbreak	322	18.6
Lack of water	260	15.0
Degenerate soil	323	18.6
Agricultural product price decrease	374	21.6
High price of fertilizer and pesticide	376	21.7
Lack of knowledge of culture	79	4.6
Activities related of maize production*		
Reclaim	338	15.2
Sowing	350	15.8
Apply fertilizer	372	16.8
Spraying pesticide	357	16.1
Harvest	374	16.9
Mill and pack	297	13.4
Distribution and sale	131	5.9

***Multiple choice**

4.1.2 Agricultural characteristics of the participants in phase 1

Table 4.2 illustrates the problems experienced by maize farmers while they were growing their crop were insect (95.0%), weed (90.2%), and blight (80.1%). Popular chemicals used during maize growing were paraquat (60.9%) and glyphosate (39.1%). Herbicide application practices were self-spraying (78.9%) and employing other workers to spray (21.1%).

Sixty-four percent of the subjects never experienced symptoms during or after herbicide application. Those subjects who did experience few symptoms (30%) often had headaches, fatigue, dizziness, loss of appetite with nausea, stomach cramps, tearing, and throat irritation. Moderate symptoms (7%) included nausea, vomiting, blurred vision associated with excessive tearing, shivering, constriction, cramps, hyperventilation, nervousness, contracted pupils, excessive sweating, and salivation. When subjects experienced symptoms from herbicide application the health center was the most used place to seek treatment and the radio was the main source for herbicide information.

Table 4.2 Number and percentage of participants classified by agricultural characteristics

Characteristics	Number (407)	Percentage (%)
Insect problem		
Yes	388	95.3
No	19	4.7
Weed problem		
Yes	367	90.2
No	40	9.8
Plant diseases (Pathology)		
Yes	326	80.1
No	81	19.9
Most used chemical		
Paraquat	248	60.9
Glyphosate	159	39.1
Pesticide Application*		
Spraying by yourself	385	78.9
Rent other person to spray	103	21.1
Chronic disease		
Yes	348	85.5
No	59	14.5
Toxicity symptom		
Never	260	63.9
Few symptom	119	29.2
Moderate symptom	28	6.9
Severe symptom	-	-
How to treat symptoms associated with pesticide		
Nothing	54	21.5
Take medicine and herbal	40	15.9
Alternative medicine	6	2.4
Health center	89	35.5
Private clinic	10	4.0
District hospital	45	17.9
Provincial hospital	7	2.8

Characteristics	Number (407)	Percentage (%)
Source of pesticide information*		
Radio	300	15.1
Television	279	14.0
Document/article	185	9.3
Public announcement	166	8.3
Neighbor	256	12.9
Agricultural officer	255	12.8
Public health office	151	7.6
Salesman	169	8.5
Community leader	133	6.7
Village health volunteer	96	4.8
Ever screened cholinesterase since last year		
Never	291	71.5
Ever but not kwon result	55	13.5
Ever and normal	40	9.8
Ever and not normal	16	3.9
Ever and non safety result	5	1.2

*Multiple choices

4.1.3 Weeds which unexpected and enemies of maize

In the maize field, many weeds which were the unexpected weeds and enemies of maize were found 7 types including Nut grass, Horse purselane, Yaa khachon chop, Thatch Grass, Thatch Grass, Maiyaraap ton, Indian heliotrope, *Paederia linearis Hook.f.* (Picture1-7). Especially, Yaa khachon chop and Thatch Grass were difficult to get rid of, therefore, the maize farmers prefer to use paraquat for killing theirs.

Thai name: หญ้าแห้วหมู ชื่อท้องถิ่น: หญ้าขนหมู
English name: Nut grass, Yellow nutsedge
Scientific name: *1. CYPERUS ROTUNDUS-CYPERUS DESTANS L.*
2. KYLLING MONOCOCEPHALA

Picture 4.1

Thai name: ผักเบี้ยหิน, speผักโขมหิน
English name: Horse purselane, Black pigweed
, giant pigweed
Scientific name: 1.*Trianthema portulacastrum L.*
(Portulaca.portulacastrum L.)

Picture 4.2

Thai name: หญ้าขจรจบดอกเล็ก (หญ้าคอมมิวนิส)
English name: Yaa khachon chop
Scientific name: *Pennisetum polystachyon Schult*

Picture 4.3

Thai name: หญ้าคา, คาหลวง (ทั่วไป)
English name: Thatch Grass.
Scientific name: *Imperata cylindrical Beauv*

Picture 4.4

Thai name: ไมยราบยักษ์
English name: Maiyaraap ton
Scientific name: *Mimosa pigra L.*

Picture 4.5

Thai name: หญ้างวงช้าง
English name: Indian heliotrope, turnsole
, wild clary, scorpion weed
, erysipelas plant, heliotrope
Scientific name: *Heliotropium indicum L*

Picture 4.6

Thai name: **ตำยานตัวผู้, เครือตดหมา, ตดหมูตดหมา, พังโหม**
, ย่านพาโหม, หญ้าตดหมา
Scientific name: ***Paederia linearis Hook.f.***

Picture 4.7

4.1.3 Insects which unexpected and enemies of maize

Many insects which were the enemies also found 5 types in the maize field including Ground Weevil, Corn leaf aphid, Beet Armyworm, Corn Stemborer, Bombay Locust, Corn Earworm. However, insects were not severe problem, because nowadays maize seeds were made by Genetically Modified Organisms (GMO). Bacillus thuringiensis was modified into maize gene for protecting themselves from many insect. The action was when insects ate maize, they will die as soon as.

Thai name: มอดดิน
English name: Ground Weevil
Scientific name: *Calomycterus sp.*

Picture 4.8

Thai name: เพลี้ยอ่อนข้าวโพด
English name: Corn leaf aphid
Scientific name: *Rhopaloaiphum maidis* (fitch)

Picture 4.9

Thai name: หนอนเจาะลำต้นข้าวโพด
English name: Corn Stemborer
Scientific name: *Ostrinia furnacalis* (Guenee)

Picture 4.10

Thai name: หนอนเจาะลำต้นข้าวโพด
English name: Corn Stemborer
Scientific name: *Ostrinia furnacalis* (Guenee)

Picture 4.11

Thai name: หนอนเจาะฝักข้าวโพด
English name: Corn Earworm
Scientific name: ***Helicoverpa armigera***
Heliothis armigear **Hubner**

Picture 4.12

Thai name: ตั๊กแตนปาทังก้า
English name: Bombay Locust
Scientific name: *Patanga succinta (Linn)*

Picture 4.13

4.1.4 Time table of maize culture activities

Annual of maize culture comprised 5 peroids including preparing land field, growing period, paraquat spraying, havard period, and storage and sale period.

At the beginning season, the maize farmers starded with preparing land field including plowing, plough up and over for growing maize on the new season. This period began on Apirl to May. After preparing land field, the maize farmers just began to grow maize on May to Augest. The activities in this period were sowed and fertilize the maize.

Next period was paraquat spraying period. This period was started after the maize was grown for a month.Normally, the maize farmers sprayed paraquat on June to September. Paraquat was use to spray for killing unexpected weed. Paraquat spraying was sprayed 1-2 times in a season, and the average time of spraying was 10 days.

Next, the maize farmers harvest the maize on October to Demcember. Finally, the maize farmered storaged and sold maize on November to March.

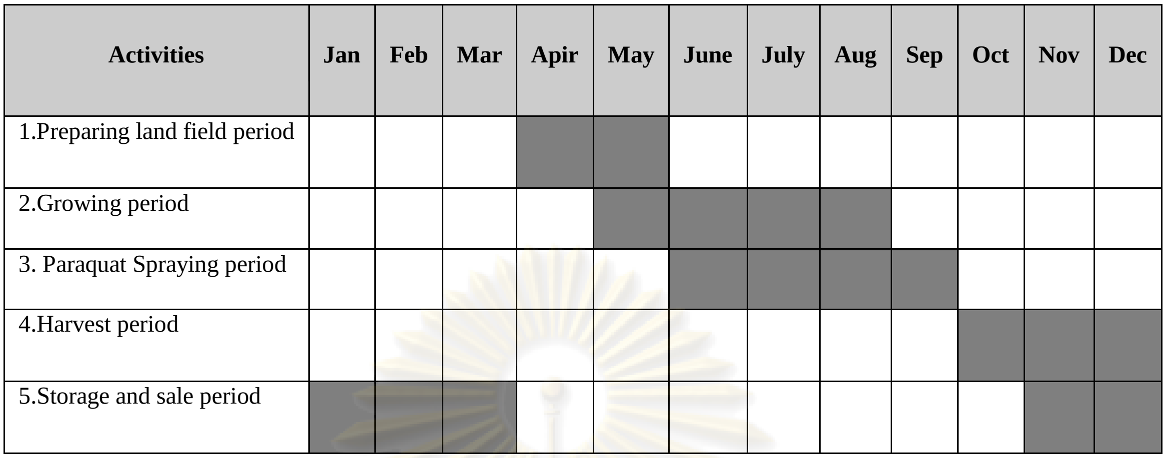


Figure 4.1: Time table of maize culture activities

4.1.5 Knowledge of pesticide used and exposure of maize farmers

Table 4.4 illustrates maize farmer's knowledge of proper herbicide use. Participants were asked to answer a total of 16 questions. Each correct answer was given one point with a total of 16 points. The average knowledge score from the respondents was 12.37 (SD=1.92. The knowledge score ranged from 5 – 16. Seven respondents were able to answer all the questions correctly. Approximately 70% of maize farmers had a score in the range of 11-14, indicating a high level of knowledge.

Table 4.3 Frequency and percentage of pesticide use knowledge of maize farmers

Items	Correct Answer	
	Nuber (407)	Percentage (%)
1. How many pathways pesticides can get inside the body?	384	94.3
2. What are the disadvantages of pesticide use?	296	72.7
3. What is paraquat?	403	99.0
4. How do you select appropriate pesticide?	302	74.2
5. What do you should consider when you purchase pesticides?	238	58.5
6. How do you know about pesticide toxicity?	380	93.4
7. What is right practice of pesticide use? and how you should do?	317	77.9
8. What is the proper way to mix pesticides?	273	67.1

Items	Correct Answer	
	Nuber (407)	Percentage (%)
9. Where are pesticides residuals present in the environment after spraying?	357	87.7
10. What is the correct method for spraying pesticides?	396	97.3
11. What do you do post treatment (wash, change clothes, etc.)	388	95.3
12. How is left over pesticide stored after use?	392	96.3
13. How do you dispose of the pesticide container	327	80.3
14. What are the symptoms of long term pesticide exposure?	329	80.8
15. How do you treat acute pesticide exposure?	373	91.6
16. What do you do if you or someone ingests a pesticide?	214	52.6

The distribution of the knowledge of the respondents showed that 5.4% of subjects had “Low level of knowledge”, 45.9% of them had “Moderate knowledge” while 48.6% of the respondents had “High knowledge” as shown in table 4.

Table 4.4 Level of knowledge of pesticide used and exposure of maize farmers

Knowledge level	Number (407)	Percentage (%)
Low level of knowledge	22	5.4
Moderate level of knowledge	187	45.9
High level of knowledge	198	48.6

4.1.4 Attitudes of pesticide used and exposure of maize farmers

According to table 5, approximately 90% of the respondents’ attitudes disagreed with the idea that pesticide harm to insect only, it is not harmful to human. 83.2% of respondents disagreed that pesticide can enter the body through only ingestion route. 57.0% of respondents ensured that pesticide residue in their body can be excreted by drinking coconut water, while 88.5% of respondents agreed that pesticide can harm to human and environment.

Table 4.5 Percentages of attitudes of pesticide used and exposure of maize farmers

Attitude items	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)
1. Pesticide can enter into body only ingestion route *	1.0	6.6	9.1	34.6	48.6
2. Pesticide harm to only insect, not harm to human*	1.5	3.2	5.2	35.9	54.3
3. Should increase amount of pesticide anytime of use*	4.4	17.2	17.7	34.6	26.0
4.Various pesticide mixture is effectiveness of pesticide use and no disadvantage*	1.7	12.8	21.1	38.6	25.8
5.Using wood-based chemical mixture is safety than using hand	46.7	41.8	3.2	4.2	4.2
6.Over mixture more than label recommendation should increase yield*	3.7	11.1	24.3	39.8	21.1
7. If you stand above the wind when spraying pesticide, don't concern about clothes*	2.7	4.4	9.6	44.2	39.1
8.Pesticide harm to human and environment	46.7	41.8	3.2	4.2	4.2
9.Should drink coconut water after exposed pesticide for excreting pesticide toxicity	2.7	21.4	57.0	10.6	8.4
10. Should more drink water after pesticide exposure for excreting pesticide toxicity	6.6	35.4	39.6	11.3	7.1
11.Excercise can help to excreting pesticide toxicity through sweat	11.5	36.9	37.6	11.3	2.7
12.While you are spraying pesticide, you should not wearing clothes *	2.5	12.0	6.1	26.5	52.8
13.Pesticide can residues in agricultural product and its harm to consumer	37.6	48.6	7.1	3.2	3.4
14.Pest eradication have many methods, not only pesticide use	20.1	50.1	16.7	7.4	5.7

*negative statement

Table 6 illustrates maize farmers answered a total of 14 questions with the total score of 70. The distributions of attitudes of respondents were shown in table 6, there were 69.3% of respondents who had “positive attitude”, 30.5% of them had “neutral attitude”, while 0.3% had “negative attitude”. The average attitude score for all respondents were 53.8 (SD=5.3) out of a possible 70 points.

Table 4.6 Level of attitude of pesticide used and exposure of maize farmers

Level of attitude	Number (407)	Percentage (%)
Positive level (52-70)	316	69.3
Neutral level (33-50)	90	30.5
Negative level (14-32)	1	0.3

4.1.5 Practices of pesticide used and exposure of maize farmers

Table 7 illustrates maize farmer usually wore boot while spraying (96. 3%), usually wash hand and wash face with soup before having meal after using pesticide (90.7%), usually closely wear cloths while spraying (90.4%) and usually check equipment and material before using (90.2%), and never should confirm real or fake pesticide through inhale (90.9%).

Table 4.7 Percentages of practice of pesticide used and exposure of maize farmers

Practice	usually (%)	sometimes (%)	never (%)
1.Should learn about appropriate type of pesticide	68.3	27.0	4.7
2.Should select pesticide follow neighbor advised*	20.9	67.1	12.0
3.Should read label before use and follow recommendation all steps	78.4	20.1	1.5
4.Should check equipment and material before using	90.2	8.8	1.0
5.Should prohibit human and animal at spraying area	82.1	16.5	1.5
6.Should wear gloves when spraying and wear mask when mixing	83.5	15.7	0.7
7.Should confirm real or fake pesticide through inhale*	4.2	4.9	90.9
8.Should mix pesticide by hand*	2.7	16.5	80.8

Practice	usually (%)	sometimes (%)	never (%)
9.Should mix various pesticide for increase effective eradication of weed and pest*	9.8	51.1	39.1
10.Should closely wear cloths while spraying	90.4	8.1	1.5
11.Should wear boot while spraying	96.3	2.5	1.2
12.Should smoke or drank while spraying*	2.7	21.4	75.9
13.Should spray pesticide while windy*	1.7	60.2	38.1
14. Should stand above wind while spraying, unless use protective gears	61.9	28.0	10.1
15. Cleaning pesticide container in the river after used*	2.9	26.0	71.0
16.Left pesticide container in the river after used*	1.5	13.0	85.5
17.Wash pesticide applicators with detergent before storage	51.6	39.1	9.3
18.Should remove cloths which was wearing when spraying immediately	88.0	8.4	3.7
19. Pesticide Should be stored in cabinets	80.8	14.3	4.9
20.Empty pesticide container should be embedded or burned	68.8	20.1	11.1
21.Should wash hand and wash face with soup before having meal	90.7	6.9	2.5

*Negative statement

Table 4.8 illustrates maize farmers answered a total of 21 questions with the total score of 63. The distributions of attitudes of respondents, there were 93.9% of respondents who had “good practice”, 6.1% of them had “fair practice”. The average attitude score for all respondents were 55.2 (SD=3.4) out of a possible 63 points.

Table 4.8 Level of practices of pesticide used and exposure of maize farmers

Practice level	Number (407)	Percentage (%)
Good Practice Level	382	93.9
Fair Practice Level	25	6.1
Poor Practic Level	0	0

4.1.6 The association among knowledge, attitude, and practice of pesticide used and exposure of maize farmers

Cross tab of knowledge and attitude was conducted in Table 4.9 for evaluating the association between two variables. The crosstab result in the low level of knowledge found 12 cases (2.9% of total) in neutral level of attitude and 10 cases (2.5 % of total) in postsitive level of attitude; besides, in the moderate level of knowledge found 47 cases (11.5% of total) in at neutral level of attitude and 140 cases (34.4%) in postsitive level of attitude. Moreover, in the high level of knowledge found 1 case (0.2% of total) in at negative level of attitude, 31 cases (7.6% of total) in neutral level of attitude and 140 cases (34.4%) in postsitive level of attitude. The association between knowledge and attitude by Fisher's ExactTest was significanted ($p \leq 0.05$).

Table 4.9: The association between knowledge and attitude of pesticide used and exposure of maize farmers (n=407)

Knowledge&Attitude			Attitude			Total
			Negative level	**Neutral level**	**Positive level**	
Knowledge	**Low level of knowledge**	Count	0	12	10	22
		% K	0	54.5	45.5	100.0
		% A	0	13.3	3.2	5.4
		% Total	0	2.9	2.5	5.4
	Moderate level of knowledge	Count	0	47	140	187
		% K	0	25.1	74.9	100.0
		% A	0	52.2	44.3	45.9
		% Total	0	11.5	34.4	45.9
	High level of knowledge	Count	1	31	166	198
		% K	0.5	15.7	83.8	100.0
		% A	100.0	34.4	52.5	48.6
		% Total	0.2	7.6	40.8	48.6
	Total	Count	1	90	316	407
		% K	0.2	22.1	77.6	100.0
		% A	100.0	100.0	100.0	100.0
		% Total	0.2	22.1	77.6	100.0

Crosstab Variables	**Statistic test**	**Chi-square**	**p-value**
Knowledge & Attitude	Fisher's Exact Test (a)	19.29	< 0.05

Cross tab of knowledge and practic was conducted in Table 4.10 for evaluating the association between two variables. The crosstab result at the low level of knowledge found 7 cases (1.7% of total) at fair level of prectic and 15 cases (3.7 % of total) at good level of prectic; besides, at the moderate level of knowledge found 12 cases (2.9% of total) at at fair level of attitude and 175 cases (43.0%) at good level of practic. Moreover, at the high level of knowledge found 6 cases (1.5% of total) at at fair level of practic and 192 cases (47.2%) at good level of a practic. The association between knowledge and attitude by Pearson chi-squre test was significanted ($p \leq 0.05$).

Table 4.10 The association between knowledge and attitude of pesticide used and exposure of maize farmers (n=407)

Knowledge&Practic			Practic		Total
			Fair	**Good**	
Knowledge	**Low Levels of knowledge**	Count	7	15	22
		% K	31.8	68.2	100.0
		% P	28.0	3.9	5.4
		% Total	1.7	3.7	5.4
	Moderate Level of knowledge	Count	12	175	187
		% K	6.4	93.6	100.0
		% P	48.0	45.8	45.9
		% Total	2.9	43.0	45.9
	High Level of knowledge	Count	6	192	198
		% K	3.0	97.0	100.0
		% P	24.0	50.3	48.6
		% Total	1.5	47.2	48.6
Total		Count	25	382	407
		% K	6.1	93.9	100.0
		% P	100.0	100.0	100.0
		% Total	6.1	93.9	100.0

Variables	**Statistic test**	**Chi-square**	**p-value**
Knowledge & Practice	Pearson Chi-Square	28.50	< 0.05

Cross tab of attitude and practic was conducted in Table 4.11 for evaluating the association between two variables. The crosstab result at the negative level of attitude found 1 case (0.2% of total) at good level of prectic; besides, at neutral level of f attitude found 12 cases (2.9% of total) at at fair level of attitude and 78 cases (19.2%) at good level of practic. Moreover, at the postsitive level of attitude found 13 cases (3.2% of total) at at fair level of practic and 303 cases (74.4% of total) at good level of a practic. The association between knowledge and attitude by Fisher's Exact Test was significanted ($p \leq 0.05$).

Table 4.11: The association between attitude and practice of pesticide used and exposure of maize farmers (n=407)

Attitude&Practic			Practic		Total
			Fair	**Good**	
Attitude	**Negative level**	Count	0	1	1
		%A	0	100.0	100.0
		%P	0	0.3	0.2
		%Total	0	0.2	0.2
	Neutral level	Count	12	78	90
		%A	13.3	86.7	100.0
		% P	48.0	20.4	22.1
		% Total	2.9	19.2	22.1
	Positive level	Count	13	303	316
		%A	4.1	95.9	100.0
		%P	52.0	79.3	77.6
		%Total	3.2	74.4	77.6
Total		Count	25	382	407
		% A	6.1	93.9	100.0
		% P	100.0	100.0	100.0
		% Total	6.1	93.9	100.0

Variables	Statistic test	Chi-square	p-value
Attitude & Practice	Fisher's Exact Test	10.18	< 0.05

Table 4.12 The association among knowledge attitude and practice of pesticide used and exposure of maize farmers by pearson correlation (n=407)

Variables	Statistic test	Pearson correlation	p-value
Knowledge & Attitude	Pearson correlation	0.37*	< 0.05
Knowledge & Practice	Pearson correlation	0.24*	< 0.05
Attitude & Practice	Pearson correlation	0.20*	< 0.05

Pearson correlation test between knowledge and attitude was significantly positive direction that means high knowledge has affect to positive attitude ($p<0.05$). Pearson correlation test between knowledge and practice was significantly positive direction that means high knowledge has affect to good practice ($p<0.05$). Also, pearson correlation test between attitude and practice was significantly positive direction that means positive attitude has affect to good practice ($p<0.05$) as well.

4.1.6 The result of in-depth interview

Indepth interview was conduted after surveying with the questionnaire by the indepth interview team. The targets populations were head of village and a farmer who was a farmer representation of village. The guidline was established before conducted . The results were summay and rang follow the question of guidline as follow;

Interview some personal data of them which is related to their behavior of maize activities. (cost, family, price, chemical use)

Maize situation in Namtok sub-district

“Last year corn price was quite good about 6.5-7 baht per kilo, it makes farmers financially sound than previous year but it still has high production costs. Over 60% of costs are seed, fertilizer, pesticide and less profit if including the labor cost and the rest we have to pay for Bank for Agriculture and Agricultural cooperatives year by year”

Practice of paraquat use

Interview theirs paraquat exposure situation

“Paraquat in farm maize is inevitable because it is the best term of affordable, easy to use, fast result, save labor and time. The resulting per unit area better than the other way when compared to the same period. In additional, long-term activate so Paraquat exposure is difficult to avoid”

Interview their concern and awareness of consequence of paraquat exposure

“We know the danger when contacting Paraquat but we have no choice and unavoidable”

Interview their practice when they applied pesticide (how, why)

“Almost wear personal protective equipments per doctor recommendation but may not be completed. Some people had removed in between use Paraquat because it is uncomfortable, hot, annoying and inconvenience”

“Most equipment are T-shirt for cover the head, neck and nose, wear long sleeves ,long pants, boots and glasses in some cases but for gloves mostly refused because it's not easy handling”

Interview their opinion about our project and also ask for some comments or advise to improve the suitable intervention program in their area

“It would be good if you have some project to support because never had any organization interest and concern in this regard”

“Very good, but do it seriously and should be launch campaign to reduce the use or stop to use it”

“We strongly agree because people would know the dangers and will help together to fix this problem. Should do both district and province

Interview their need or what they want to see after finished the project

“How to use it safely as far as still use”

“Is it possible to stop farming corn and replace by others crops but the income shall not be less than corn”

"People must know how to protect themselves from exposure Paraquat when needed"

"People must know and understand the dangerous of Paraquat both to the human and environment"

4.1.7 The result of participatory observation

Maize farmers who we observed applying mixing, loading and spraying herbicides in the field did not use appropriate personal protective equipment such as gloves, masks, and goggles. We also observed that maize farmers who did use PPE did not use it properly. For example, some farmers would use a wool hat instead of a mask and goggles. These observations differed from the results of the interiews. We also found that the reason most farmers did not use PPE or did not use PPE properly while applying herbicides was that it was uncomfortable to wear while pick, holding the equipment while wearing gloves and mixing, loading, and spraying, and it was uncomfortable to breathe and difficult to see while wearing a mask and goggles. PPE can also be too expensive to purchase. Therefore, the farmers would use cheaper forms of protection such as wool hat and gloves.

4.2 Result of Phase 2: Qua-si experimental study

Conducted qua-si experimental study in phase 2 was divied into experimental group and control group. The experimental group has 51 participants whose were randomly selected from 407 maize farmers in Namtok sub-district. The control group participants whose were randomly selected from 733 maize farmers in Bouyai sub-district were 58 participants.

4.2.1 The result of the focus group discussion in public meeting workshop

Before conducted meeting, the intervention participants were conducted the focus group discussion. The results of this method were summaried and ranged follow the question of guidline as follow:

1. History of Corn Farm

How long do you farm maize?

“We farm maize about 30 years since father’s generation”

“Farming maize 20-30 years, began growing rice then planted maize and cotton but during the past 15 years has planted only maize”

“We starting planting rice, cotton and another vegetables first including maize then with the good price on the corn and purchasing from merchant. It also yield better plant something else because of favorable terrain

Why farming maize?

“To do otherwise are not as good as maize farming. If not, nothing to eat”

“We have no choice because the area inhospitable for other crops. This area is mountainous and no rivers flowing through and rely on rainfall”

“An obligation to our children”

“There is a legacy”

Do you grow other crops or not?

“7 years ago, starting to grow rubber and now about 20-30% of the rubber plantation, this in turn increased. There is also growing some pumpkins but not much”

2. How do you eliminate weed in maizefield in the past? (How many years and why obsolete)

“We use the hoe for mowing and then burn the grass, afterward we have more space to grow thus we can’t use the same way”

3. Paraquat history in maize farming

What is the advantage of paraquat?

“Start switching to use paraquat about 20 years ago because it was convenient, fast, saved the labor cost and time as well. Cover more area and it also kills the grass for a longer period than the other way. It is also sensitive to maize growing”

Do you have another choice that can be used to prevent and eliminate pests?

"The application of herbs such as neem, chili for spray also other such as gasoline mixed with vinegar but not admire due to slow in more quantities but the advantage is cheap and safe"

4. The impact of Paraquat

Human inpacts

Have any symptoms after spraying Paraquat or not?

"Many symptoms occur while spraying and after spraying such as pain, fatigue, headache, dizziness, nausea, vomiting, bleary, epistaxis , roseola, onychoptosis and muscle pain "

Did you know that Paraquat can be passed into the body?

"It should be able through into the body via mouth nose and body"

"By sweat, drinking water or the liquid spill into the mount while spraying, for the nose should be passed while spraying, especially when windy and thought that would be absorbed through the skin"

Who have been affected by use Paraquat?

"Most certainly who have to be mixed and sprayed and loaded also people who pull the hoses"

"Descendants, people who stay in that area, pets, dogs and cows are affected of course"

Environmental impacts

What is the environmemtal impact of paraquat use?

"Air pollution from dust of spraying Paraquat"

"Contamination in water especially in brooks, swamp, canal because of pouring, washing into the rivers and some areas has a strong smell of chemicals"

"Fish in the brooks, lake it would be contaminated"

"Contamination and residues in vegetables such as eggplant, pepper grown in the farm inevitable for sure"

"Soil degradation due to spray onto the ground also affected to animals in the soil such as earthworms"

5. Skills to use chemicals properly and safely.

Have you ever trained how to use paraquat, where, when and how?

"As remember, no the agency training on this subject at all"

"There were agricultural authorities on 2-3 years ago but not seriously, it is a part of the meeting in the village"

"Content inserted in the training of sufficiency and sustainable agriculture, 3 years ago"

Information about to use Paraquat safely and efficiently, in the past which channel do you gets the information?

"The product label" "Radio and Television"

"Newspapers, books and journals" "Recommendation from chemicals seller"

"Neighbors recommended the purchasing, spraying and mixing"

"Parents, relatives who farm corn as well"

6. Personal protective equipments while using paraquat

What kind of equipments and tools which you used to protect from Paraquat?

"Gloves, cloth for cover the head, boots and wear long sleeve with long pants this likely to be safe"

"Normally use cloth for cover the head, mask with long pants, long sleeves and boots and sometimes use glasses and gloves. Most guys do not like to use gloves"

Problems and barriers to use personal protective equipments

"Hot weather, steep area and inconvenience when remove some equipment such as glasses, mask and gloves"

"We know, it is certainly hazardous to health but in fact can not be practical at all"

Did you know that the use of personal protective equipments will be able to reduce the risk of harm from Paraquat?

"Well known, it reduces the chemicals that may through into the body thus we will try to do as much as possible"

"To prevent the skin, nose and mouth from chemicals"

4.2.2 Personal characteristic of the participants in both experimental group and control group at baseline

The Personal characteristic of the participants in both experimental group and control group at baseline were analyzed show in Table 4.12. The proportion of gender in both group was significantly equal ($p>0.05$). The majority in both groups (50%) were between 45-54 years old. The average age of experimental and control group were 43.7 and 46.1 years old respectively. The average age between experimental and control group was significantly equal ($p<0.05$); besides, more than 50% of both groups were married and head of family. The majority in both groups (>70%) had graduated in grades 1-6. Moerover, the proportion of marital status, family status, and education level in both group were also significantly equal ($p<0.05$). These results demonstreated personal charecteristics of the participant in both groups at the baseline were similar.

Table 4.13 Number and percentage of participants classified by personal characteristics

Characteristics	Experimental group (n=51)		Control group (n=58)		X^2	P-value
	n	%	n	%		
Gender						
male	37	72.5	45	77.6	0.37	0.54
female	14	27.5	13	22.4		
Age*						
25-34	7	13.7	6	10.3	1.59[a]	0.11
35-44	17	33.3	18	31.0		
45-54	25	49.0	27	46.6		
55-64	2	3.9	7	12.1		
Mean ± S.D.	(43.69±8.22)		(46.09±7.49)			
Min - Max	(26-61)		(31-60)			
Marital status						
single	1	2.0	0	0.0	1.15	.28
married	50	98.0	58	100		
Family status						
head of family	28	54.9	42	72.4	3.62	0.16
spouse	13	25.5	9	15.5		
child	10	19.6	7	12.1		
Education level						
grades 1-6	37	72.5	40	69.0	0.47	0.79
grades 7-9	6	11.8	6	10.3		
grades 10-12	8	15.7	12	20.7		

* a= t value of independent t-test

4.2.2 Agricultural characteristics of the participants in both experimental group and control group at baseline

The Agricultural characteristic of the participants in both experimental group and control group at baseline were analyzed show in Table 4.13. The average mean of period of being the maize farmers in the experimental group and the control group were 20.59 and 23.48 years old respectively. The average mean of area of maize farm in both group were 29.14 and 28.45 rais respectively. The average mean of income in both group were 243,087and 216,133 baths respectively. The average mean of expense in both group were 69,658.3 and 115,499.8 baths respectively. The average of all variables in both groups were significantly equal ($p<0.05$) except the annual household expense variable.

Table 4.14 Number and percentage of participants classified by agricultural characteristics

Characteristics	Experimental group (n=51)		Control group (n=58)		t-test	P-value
	n	%	n	%		
Period of being the maize farmer					-1.59	0.12
1-17 yrs	19	37.3	13	22.4		
18-34 yrs	25	49.0	40	69.0		
35-52 yrs	7	13.7	5	8.6		
Mean ± S.D.	(20.59±10.81)		(23.48±7.69)			
Min - Max	(1-52)		(10-45)			
Area of maize farm [a]						
7-24 rai	19	37.3	25	43.1	0.22	0.83
25-42 rai	23	45.1	21	36.2		
43-60 rai	4	7.8	7	12.1		
61-78 rai	5	9.8	5	8.6		
Mean ± S.D.	(29.14±15.8)		(28.45±16.63)			
Min - Max	(10-75)		(10-75)			
Annual household income from cultivatable maize						
50,000 - 166,749	15	29.4	26	44.8	1.21	0.23
166,750 - 283,499	25	49.0	23	39.7		
283,500 - 400,249	10	19.6	5	8.6		
400,250 - 517,000	1	2.0	4	6.9		
Mean ± S.D.	(243,087±108440)		(216,133±121,792)			
Min - Max	(50,000-517,000)		(50,000-580,000)			
Annual household expense for cultivating maize						
10,740 - 70,555	30	58.8	22	37.9	-3.90	<0.05 [b]
70,556 - 130,371	15	29.4	14	24.1		
130,372 - 190,187	4	7.8	10	17.2		
190,188 – 250,003	2	3.9	12	20.7		
Mean ± S.D.	(69,658.3±49,929.9)		(115,499.8±72014.3)			
Min - Max	(10,740-250,000)		(10,740-250,000)			

a. 1 rai = 1,600 m^2

b. statistic was significant

4.2.3 Primary outcome; the paraquat residual concentration in serum by High Performance Liquid Chromatoghaphic (HPLC)

Paraquat residual concentration was conducted by HPLC technique before and after the intervention in both the experimental and control group. Before the intervention, human serum was collected before the maize growing season in 2010 started or after the maize farmers exposed paraquat eight months ago. At this time, paraquat residual concentration in both group were not detected more than the limit of detection (LOD = 0.21 mg/ml). Next, after the intervention, paraquat residual concentration was detected more than the limit of detection 11 cases in both groups. 4 cases (7.8%) were in the experimental group and 11 cases (19%) were in the control group. Proportion of paraquat residual concentration between the experimentalgroup and control group was not significant (p> 0.05).

Table 4.15 Number and percentage of paraquat residual concentration level before and after the intervention in the experimental group and the control group

	Before				**After**				**Z-test**	**P-value**
	Experimental group (n=51)		**Control group(n=58)**		**Experimental group(n=51)**		**Control group(n=58)**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**		
Paraquat residue concentration ≤ LOD*	51	100.0	58	100.0	47	92.2	47	81.0	-1.68	0.093
Paraquat residue concentration >LOD	0	0	0	0	4	7.8	11	19.0		

* LOD (limit of detection) = 0.21 mg/lite

4.2.4 Secondary outcome; Knowledge, Attitude, and Practice of paraquat use **and exposure**

Levels of knowledge, attitude, and practice of paraquat use and exposure in both experimental and control groups were present in Table. 14. Total score of knownledge was classified into three level including low (0-6 score), moderate (7-12 score), and good (13-15 score). The experimental group before intervention, the majority (62.7%) was low level and the average of knowledge was 7.43 score; later on implement the intervention, the majority was moved to moderate level 72.5%. The different average knowledge score was 2.0 score which increased from 7.43 to 9.43. The control group before intervention, the majority (62.1%) was low level of knowledge and the average of knowledge was 7.69 score; later on implement the intervention, the majority was still low level 69.0%. The different average knowledge score was 0.07 score which increased from 7.69 to 7.76.

Total score of attitude was also classified into three level including low (15-44 score), moderate (45-59 score), and good (60-75 score). The experimental group before intervention, the majority (62.7%) was moderate level and the average of attitude was 57.43 score; after the intervention, the majority was moved to good level 92.2%. The different average attitude score was 8.63 score which increased from 57.43 to 66.06. The control group before intervention, the majority (69.0%) was moderate level and the average of attitude was 57.53 score; after the intervention, the majority was still moderate level 53.4 0%. The different average attitude score was 0.94 score which increased from 57.53 to 58.47.

Total score of practice was also classified into three level including low (20-35 scores), moderate (36-47 scores), and good (48-60 scores). The experimental group before intervention, the majority (80.4%) was good level and the average of practic was 50.59 score; after the intervention, the majority was moved to good level 100%. The different average knowledge score was 5.91 score which increased from 50.59 to 56.50. The control group before intervention, the majority (89.7%) was good level and the average of practic was 52.0 score; after the intervention, the majority was in good level 89.7 0%. The different average practic score was -0.02 score which decreased from 52.0 to 51.98.

Table 4.16 Levels of knowledge, attitude, and practice on paraquat use and exposure in both experimental and control groups measured before and after implementing risk communication model

Level of knowledge, attitude, and practice on paraquat use and exposure	Experimental group (n=51)				Control group (n=58)			
	Before intervention		After intervention		Before intervention		After intervention	
	n	%	n	%	n	%	n	%
Knowledge level								
Low	32	62.7	10	19.6	36	62.1	40	69.0
Moderate	16	31.4	37	72.5	22	37.9	17	29.3
Good	3	5.9	4	7.8	0	0	1	1.7
Mean ± S.D.	(7.43±2.57)		(9.43±1.57)		(7.69±1.62)		(7.76±1.75)	
Attitude level								
Low	2	3.9	0	0	0	0	2	3.4
Moderate	32	62.7	4	7.8	40	69.0	31	53.4
Good	17	33.3	47	92.2	18	31.0	25	43.1
Mean ± S.D.	(57.43±5.74)		(66.06±3.63)		(57.53±5.24)		(58.47± 5.52)	
Practice level								
Low (20-35)	0	0	0	0	0	0	0	0
Moderate (36-47)	10	19.6	0	0	11	19.0	6	10.3
Good (48-60)	41	80.4	51	100	47	81.0	52	89.7
Mean ± S.D.	(50.59±3.97)		(56.50±2.79)		(52.00±4.23)		(51.98±3.77)	

The comparisons of mean score of total knowledge score, total right attitude score, and total safety practice score of paraquat use and exposure in the experimental group before and after implementing the risk communication model were analyzed and presented in Table 15. All of average mean score of total knowledge score, total right attitude score, and total safety practice score before and after implementing the risk communication model was significantly increased ($p<0.05$).

Table 4.17 Comparisons of mean score of knowledge, attitude, and practice of paraquat use and exposure in the experimental group before and after implementing the risk communication model (Paired t-test)

Experimental group/ Variables	Total score	Before		After		95% Confidence Interval of the Difference	P-value
		Mean	S.D.	Mean	S.D.		
Total knowledge score	15	7.43	2.57	9.43	1.57	-2.67, -1.33	< 0.05
Total attitude score	75	57.43	5.74	66.06	3.63	-10.01, -7.25	< 0.05
Total practice score	60	50.59	3.97	56.50	2.79	-6.81, -5.04	< 0.05

The comparisons of mean score of total knowledge score, total right attitude score, and total safety practice score of paraquat use and exposure in the control group before and after implementing the risk communication model were analyzed and presented in Table 16. All of average mean score of total knowledge score, total right attitude score, and total safety practice score before and after implementing the risk communication model was not significantly increased ($p<0.05$).

Table 4.18 Comparisons of mean score of knowledge, attitude, and practice on paraquat use and exposure in control group before and after implementing risk communication model (Paired t-test)

Experimental group/ Variables	Total score	Before		After		95% Confidence Interval of the Difference	P-value
		Mean	S.D.	Mean	S.D.		
Total knowledge score	15	7.69	1.62	7.76	1.75	-0.62, 0.49	> 0.05
Total attitude score	75	57.53	5.24	58.47	5.52	-4.34, 0.23	> 0.05
Total practice score	60	52.00	4.23	51.98	3.77	-0.79, 0.83	> 0.05

Comparisons of mean score of knowledge, attitude, and practice of paraquat use and exposure before implementing risk communication model between experimental and control group were analyzed and presented in Table.17. As the result, all of mean score of knowledge, attitude, and practice of paraquat use and exposure between the experimental and the control groups were not significant ($p<0.05$).

Table 4.19 Comparisons of mean score of knowledge, attitude, and practice of paraquat use and exposure before implementing risk communication model between experimental and control group (Unpaired t-test)

Variables	Total score	Before implementing the risk communication model					
		Experimental group(n=51)		Control group (n=58)		95% Confidence Interval of the Difference	P-value
		Mean	S.D.	Mean	S.D.		
Total knowledge score	15	7.43	2.57	7.69	1.62	-1.10, 0.57	> 0.05
Total attitude score	75	57.43	5.74	57.53	5.24	- 1.93, 4.0	> 0.05
Total practice score	60	50.59	3.97	52.00	4.23	- 3.0, 0.15	> 0.05

Comparisons of mean score of knowledge, attitude, and practice of paraquat use and exposure after implementing risk communication model between experimental and control groups were analyzed and presented in Table.18. As the result, all of mean score of knowledge, attitude, and practice of paraquat use and exposure between the experimental and the control groups were significant ($p<0.05$).

Table 4.20 Comparisons of mean score of knowledge, attitude, and practice of paraquat use and exposure after implementing risk communication model between experimental and control group (Unpaired t-test)

Variables	Total score	After implemting the risk communication model					
		Experimental group(n=51)		Control group (n=58)		95% Confidence Interval of the Difference	P-value
		Mean	S.D.	Mean	S.D.		
Total knowledge score	15	9.43	1.58	7.76	1.75	1.04, 2.31	< 0.05
Total attitude score	75	66.06	3.63	58.47	5.52	5.80, 9.40	< 0.05
Total practice score	60	56.50	2.78	51.98	3.77	3.30, 5.80	< 0.05

Percent difference of before and after mean score of knowledge, attitude, and practice of paraquat use and exposure between the experimental group and the control group were analyzed and presented in Table.19. Mean score of knowledge, attitude, and practice in were increased in both groups except mean score of practice in control group. Percent difference of knowledge, attitude and practice in experimental group were13.33, 11.51, and 9.85 respectively. All of percent differentce of the experimental group were distinctly increased. However, all of percent differences of the control group were not distinctly increased. Moreover, the percent difference of practice of control group was decreased.

Table 4.21 Percent difference of pre- and post- mean score of knowledge, attitude, and practice of paraquat use and exposure in between experimental group and control group

Variables	Total score	Experimental group			Control group		
		Mean score		Percent difference	Mean score		Percent difference
		Before	After		Before	After	
Total knowledge score	15	7.43	9.43	13.33	7.69	7.76	0.47
Total attitude score	75	57.43	66.06	11.51	57.53	58.47	1.25
Total practice score	60	50.59	56.50	9.85	52.00	51.98	-0.03

Comparisons of the difference of mean score of knowledge, attitude, and practice of paraquat use and exposure after implementing the risk communication model between the experimental and control group were analyzed for compairing the diffence of increasing score. All of the difference mean between the experimental group and were significantl ($p<0.05$)

Table 2.22 Comparisons of the difference of mean score of knowledge, attitude, and practice of paraquat use and exposure after implementing the risk communication model between the experimental and control group (Unpaired t-test)

Variables	Compare mean of the difference				
	Diffence mean± S.D.		Independent Sample T-test	95% Confidence Interval of the Difference	P-value
	Experimental group	Control group			
Difference knowledge score	2.00±2.37	0.69±2.11	4.96	1.08, 2.78	<0.05
Difference attitude score	8.62±4.90	0.93±4.00	9.00	6.0 , 9.40	<0.05
Difference practice score	5.92±3.14	-0.01±3.08	9.93	4.80, 7.12	<0.05

4.2.4 Secondary outcome; Proportion of Personal Proective Equipment (PPE) used of maize farmers between experimental group and control group.

Proportion of Personal Proective Equipment (PPE) used was conducted before and after impleting the risk communication model through self report. The objective of this method was to evaluate the PPE used of the maize farmer in both groups for compairing the proportion.

4.2.4.1 Proportion of Personal Proective Equipment (PPE) used of maize farmers between experimental group and control group at the base line.

Self report was conducted in both the experimental group and the control group before implementing the intervention at the time before the growing maize season started in 2011. Self report was desiged to measure number and proportion of PPE use that mean the level of self protection of the maize farmer when they apply paraquat in their farm. Self report was design to measure in 9 equipments including hat, scarf, goggle, glove, mask, Long-sleeve shirt, Trousers, Socks, Boots when mixing, loading, and spraying paraquat. The result of self report was analyzed and present in Table 21.

Hat used, the majority of the experimental group (>60%) used hat when they applied paraquat. The participants of the experimental group were used hat in mixing 60.8%, loading 60.8%and spraying 62.7%. The percentage of hat used in the control group was lower than the experimental group, but when tested the portion by Z- test, the diffence of proportion between two groups was not significant ($p<0.05$) that mean hat used at the base line between two group is not different.

Scarf used, the participants in both groups used scarf when they applied paraquat more than not used. The percentage of scarf used in both group was not distinctly different. As the result when tested the portion by Z- test, the diffence of proportion between two groups was not significant ($p<0.05$) that mean scarf used at the base line between two group is not different.At the base line, the participants in both groups also used goggle, glove, and mask equally proportion. Moreover, they used glove, long sleeve shirt, trousers, socks and boots 100% when they applied pararquat at the baseline.

Table 4.23 Number and proportion of Personal Proective Equipment (PPE) used of the maize farmers between experimental group and control group at the base line.

Type of equipment	When applied	Before applying risk communication model								Z-test	P-value*
		Experimental(n=51)				Control(n=58)					
		Used	%	Not used	%	Used	%	Not used	%		
Hat	Mixing	31	60.8	20	39.2	28	48.3	30	51.7	1.31	0.19
	Loading	31	60.8	20	39.2	28	48.3	30	51.7	1.31	0.19
	Spraying	32	62.7	19	37.3	33	56.9	25	43.1	0.62	0.55
Scarf	Mixing	30	60.8	20	39.2	30	51.7	28	48.3	0.74	0.46
	Loading	26	51.0	25	49.0	29	50.0	29	50.0	0.1	0.92
	Spraying	33	64.7	18	35.3	34	58.6	24	41.4	0.65	0.52
Goggle	Mixing	20	39.2	31	60.8	14	24.1	44	75.9	1.70	0.09
	Loading	23	45.1	28	54.9	16	27.6	42	72.4	1.90	0.06
	Spraying	25	49.0	26	51.0	22	37.9	36	62.1	1.17	0.24
Glove	Mixing	31	60.8	20	39.2	35	60.3	23	39.7	0.05	0.96
	Loading	34	66.7	17	33.3	36	62.1	22	37.9	0.05	0.62
	Spraying	46	90.2	5	9.8	49	84.5	9	15.5	0.89	0.37
Mask	Mixing	31	60.8	20	39.2	34	58.6	24	41.4	0.23	0.82
	Loading	34	66.7	17	33.3	34	58.6	24	41.4	0.87	0.39
	Spraying	34	66.7	17	33.3	34	58.6	24	41.4	0.87	0.39

Type of equipment	When applied	Before applying risk communication model								Z-test	P-value*
		Experimental(n=51)				Control(n=58)					
		Used	%	Not used	%	Used	%	Not used	%		
Long-sleeve shirt	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Trousers	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Socks	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Boots	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-

4.2.4.1 Proportion of Personal Proective Equipment (PPE) used of maize farmers between experimental group and control group after implementing the intervention

After implementing risk communication model, self report was conducted again for measuring the difference of proportion of PPE used between the experimental group and the control group and presented in Table.22. Hat used proportion increased more in the experimental group than in the control group (mixing 80.4%v41.4%, loading 84.3%v41.4%, spraying 94.1v72.4). The difference of proportion of hat used between two groups was significant ($p<0.05$).

All of scarf used, goggle used, glove used, mask used also increased more in the experimental group than the control group. The difference of all proportions of scarf used, goggle used, glove used, mask used between two groups was significant ($p<0.05$).

Table 4.24 Number and proportion of Personal Proective Equipment (PPE) used of the maize farmers between the experimental group and the control group After implementing risk communication model

Type of equipment	When applied	After implementing risk communication model								Z-test	P-value
		Experimental(n=51)				Control(n=58)					
		Used	%	Not used	%	Used	%	Not used	%		
Hat	Mixing	41	80.4	10	19.6	34	58.6	24	41.4	2.5	0.010
	Loading	43	84.3	8	15.7	34	58.6	24	41.4	2.9	0.003
	Spraying	48	94.1	3	5.9	42	72.4	16	27.6	3.0	0.003
Scarf	Mixing	46	90.2	5	9.8	32	55.2	26	44.8	4.0	0.000
	Loading	46	90.2	5	9.8	32	55.2	26	44.8	4.0	0.000
	Spraying	46	90.2	5	9.8	41	70.7	17	29.3	2.5	0.011
Goggle	Mixing	46	90.2	5	9.8	20	34.5	38	65.5	5.9	0.000
	Loading	42	82.4	9	17.6	17	29.3	41	70.7	5.6	0.000
	Spraying	51	100	0	0	30	51.7	28	48.3	5.8	0.000
Glove	Mixing	47	92.2	4	7.8	44	75.9	14	24.1	2.3	0.022
	Loading	46	90.2	5	9.8	41	70.7	17	29.3	2.53	0.011
	Spraying	51	100	0	0	52	89.7	6	10.3	2.36	0.018
Mask	Mixing	51	100	0	0	36	62.1	22	37.9	4.92	0.000
	Loading	51	100	0	0	36	62.1	22	37.9	4.92	0.000
	Spraying	51	100	0	0	45	77.6	13	22.4	3.60	0.000
Long-sleeve shirt	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Trousers	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Socks	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-
Boots	Mixing	51	100	0	0	58	100	0	0	-	-
	Loading	51	100	0	0	58	100	0	0	-	-
	Spraying	51	100	0	0	58	100	0	0	-	-

The proportion of Personal Proective Equipment (PPE) used of the maize farmers in the experimental group before and after implementing the risk communication model was analyzed and presented in Table.23. The highest increased proportion of PPE used was mask in mixing and scarf in loading as 39.2. Next, the second increased proportion of PPE used was goggle in loading as 37.3. Almost all of equipments used in the experimental group were increased proportion of PPE used except long sleeve shirt, trousers, socks, and boots were used 100% since initially.

Table 4.25 Number and proportion of Personal Proective Equipment (PPE) used of the maize farmers in the experimental group before and after implementing the risk communication model

Type of equipment	When applied	Experimental group(n=51)								Difference proportion of PPE used
		Before				After				
		Used	%	Not used	%	Used	%	Not used	%	
Hat	Mixing	31	60.8	20	39.2	41	80.4	10	19.6	19.6
	Loading	31	60.8	20	39.2	43	84.3	8	15.7	23.5
	Spraying	32	62.7	19	37.3	48	94.1	3	5.9	31.4
Scarf	Mixing	30	60.8	20	39.2	46	90.2	5	9.8	29.4
	Loading	26	51.0	25	49.0	46	90.2	5	9.8	39.2
	Spraying	33	64.7	18	35.3	46	90.2	5	9.8	25.5
Goggle	Mixing	20	39.2	31	60.8	46	90.2	5	9.8	51
	Loading	23	45.1	28	54.9	42	82.4	9	17.6	37.3
	Spraying	25	49.0	26	51.0	51	100	0	0	51
Glove	Mixing	31	60.8	20	39.2	47	92.2	4	7.8	31.4
	Loading	34	66.7	17	33.3	46	90.2	5	9.8	23.5
	Spraying	46	90.2	5	9.8	51	100	0	0	9.8
Mask	Mixing	31	60.8	20	39.2	51	100	0	0	39.2
	Loading	34	66.7	17	33.3	51	100	0	0	33.3
	Spraying	34	66.7	17	33.3	51	100	0	0	33.3
Long-sleeve shirt	Mixing	51	100	0	0	51	100	0	0	0
	Loading	51	100	0	0	51	100	0	0	0
	Spraying	51	100	0	0	51	100	0	0	0

Type of equipment	When applied	Experimental group(n=51)								Difference proportion of PPE used
		Before				After				
		Used	%	Not used	%	Used	%	Not used	%	
Trousers	Mixing	51	100	0	0	51	100	0	0	0
	Loading	51	100	0	0	51	100	0	0	0
	Spraying	51	100	0	0	51	100	0	0	0
Socks	Mixing	51	100	0	0	51	100	0	0	0
	Loading	51	100	0	0	51	100	0	0	0
	Spraying	51	100	0	0	51	100	0	0	0
Boots	Mixing	51	100	0	0	51	100	0	0	0
	Loading	51	100	0	0	51	100	0	0	0
	Spraying	51	100	0	0	51	100	0	0	0

The proportion of Personal Proective Equipment (PPE) used of the maize farmers in the control group before and after implementing the risk communication model was analyzed and presented in Table.24. The highest increased proportion of PPE used was glove in mixing and as 39.2. Next, the second increased proportion of PPE used was hat in spraying as 15.5. Almost all of equipments used in the control group were increased proportion of PPE used except long sleeve shirt, trousers, socks, and boots were used 100% since initially.

Table 4.26 Number and proportion of Personal Proective Equipment (PPE) used of the maize farmers in the control group before and after implementing the risk communication model

Type of equipment	When applied	Control group(n=58)								Difference proportion of PPE used
		Before				After				
		Used	%	Not used	%	Used	%	Not used	%	
Hat	Mixing	28	48.3	30	51.7	34	58.6	24	41.4	10.3
	Loading	28	48.3	30	51.7	34	58.6	24	41.4	10.3
	Spraying	33	56.9	25	43.1	42	72.4	16	27.6	15.5

Type of equipment	When applied	Control group(n=58)								Difference proportion of PPE used
		Before				After				
		Used	%	Not used	%	Used	%	Not used	%	
Scarf	Mixing	30	51.7	28	48.3	32	55.2	26	44.8	3.5
	Loading	29	50.0	29	50.0	32	55.2	26	44.8	5.2
	Spraying	34	58.6	24	41.4	41	70.7	17	29.3	12.1
Goggle	Mixing	14	24.1	44	75.9	20	34.5	38	65.5	10.4
	Loading	16	27.6	42	72.4	17	29.3	41	70.7	1.7
	Spraying	22	37.9	36	62.1	30	51.7	28	48.3	13.8
Glove	Mixing	35	60.3	23	39.7	44	75.9	14	24.1	15.6
	Loading	36	62.1	22	37.9	41	70.7	17	29.3	8.6
	Spraying	49	84.5	9	15.5	52	89.7	6	10.3	5.2
Mask	Mixing	34	58.6	24	41.4	36	62.1	22	37.9	3.5
	Loading	34	58.6	24	41.4	36	62.1	22	37.9	3.5
	Spraying	34	58.6	24	41.4	45	77.6	13	22.4	19
Long-sleeve shirt	Mixing	58	100	0	0	58	100	0	0	0
	Loading	58	100	0	0	58	100	0	0	0
	Spraying	58	100	0	0	58	100	0	0	0
Trousers	Mixing	58	100	0	0	58	100	0	0	0
	Loading	58	100	0	0	58	100	0	0	0
	Spraying	58	100	0	0	58	100	0	0	0
Socks	Mixing	58	100	0	0	58	100	0	0	0
	Loading	58	100	0	0	58	100	0	0	0
	Spraying	58	100	0	0	58	100	0	0	0
Boots	Mixing	58	100	0	0	58	100	0	0	0
	Loading	58	100	0	0	58	100	0	0	0
	Spraying	58	100	0	0	58	100	0	0	0

The full compliance of Personal Proective Equipment (PPE) used of the maize farmers in both groups before and after implementing the risk communication model was analyzed and presented in Table.25. Full compliance of PPE used before implementing the risk communication model was 9.8% of experimental group and 0% of control group. There are quit equal of full compliance of PPE used at the base line.

Table 4.27 Number and proportion of Full compliance of Personal Proective Equipment (PPE) used of the maize farmers between the experimental group and the control group before implementing the risk communication model

	Before implementing the risk communication model					
	Experimental group (n=51)		Control group (n=58)		Z test	P value
	N	%	N	%		
Full compliance	5	9.8	0	0	2.44	0.02
Not full compliance	46	90.2	58	100		

Number and proportion of Full compliance of Personal Proective Equipment (PPE) used of the maize farmers between the experimental group and the control group after implementing the risk communication model was analyzed and presented in Table.26. At this time, full compliance of PPE used was 56.9 % of the experimatal group and 10.3% of the control group. Moreover, full compliance of PPE used was significantly defference between group after implementing the risk communication model (p<0.05).

Table 4.28 Number and proportion of Full compliance of Personal Proective Equipment (PPE) used of the maize farmers between the experimental group and the control group after implementing the risk communication model

	After implementing the risk communication model					
	Experimental group(n=51)		Control group(n=58)		Z test	P value
	N	%	N	%		
Full compliance	29	56.9	6	10.3	5.19	0.00
Not full compliance	22	43.1	52	89.7		

Number and proportion of level of symptoms after spraying paraquat within 24 hours of the maize farmers between the experimental group and the control group after implementing the risk communication model was conducted and presented in Table 27. There were 35 symptoms whice base on previous research whice involved with pesticide toxicity and kinetic. Thirty five symptoms was measure by self report which checked by the participants within 24 hours after they already sprayed paraquat at the last culmulative 10 days.

Sweat symptom in both groups was found more than 80% in both mild and moderate level, but in the mild level was found more than the moderate level around 30%. There were significantly equal between group ($p<0.05$). On the other hand, the eyelidtwitches symptom was never found in both groups more than 70%. Only 25% of eyelidtwitches symptom was found in mild and moderate level in both groups. Also, there were significantly equal between group ($p<0.05$).

Bleary symptom was found more than 60% in mild and moderate level in both groups. They were similarly of bleary symptom after spraying paraquat within 24 hours. Also, the burnnose symptom in control group was found more than the experimental group 20%. There were significantly difference ($p<0.05$).

Nosebleed symptom was foung mild in both groups around 10% and found in the control group quite more than the experimental group. However, there were significantly equal($p<0.05$). The sleepless symptom after spraying was also found significantly equal between group ($P<0.05$). Moreover, eyeirritation symptom was found more than 50% in both groups, but, it was found in the control group more than the experimental group and was also significantly difference ($p<0.05$).

Tear dropping symptom was found 44.8% in control group which was significantly higher than the experimental group. Mucus symptom was also found 17%of the severe level, 16% of moderate level and 12% of mild level in the control group and was found significantly higher than the experimental group($p<0.05$).

Slobber symptom was never found more than 90% in both groups; only 7% in the control group and 6% in the experimental were found of mild level. Others symptoms, including dizziness, weakness, headach, parched, dyspnea, shake, muscle weakness, hand shake, cramps, and dermatitis, sorethroat, cough, wheezing, chestpain, nausea, abdominal pain, numbness and diarrhea were mildly found and significantly equal in both groups. On the other hand, epilepsy, coma, senseless and nail removed were never found in both groups.

Table 4.29 Number and proportion of level of symptoms after spraying paraquat within 24 hours of the maize farmers between the experimental group and the control group after implementing the risk communication model

Symptom	Experimental group (51 cases)								Control group(58 cases)								Fisher's Exact Test	p-value
	Level of symptom after spraying within 24 hours																	
	Never		Mild		Moderate		Severe		Never		Mild		Moderate		Severe			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Sweat	5	9.8	12	23.5	34	66.7	0	0.0	4	6.9	19	32.8	35	60.3	0	0.0	1.30	0.61
Eyelid twitches	38	75.0	9	17.6	4	7.8	0	0.0	42	72.4	8	13.8	8	13.8	0	0.0	1.14	0.61
Bleary	17	33.0	21	41.2	10	19.6	3	5.9	15	25.9	25	43.1	11	19	7	12.0	1.65	0.65
Burn nose	31	61.0	20	39.2	0	0.0	0	0.0	28	48.8	18	31	12	20.7	0	0.0	11.86	0.00*
Nose bleed	48	94.0	2	3.9	1	2.0	0	0.0	52	89.7	4	6.9	2	3.5	0	0.0	0.79	0.76
Sleepless	33	65.0	12	23.5	5	9.8	1	2.0	40	69	12	20.7	5	8.6	1	1.7	0.54	0.95
Eye irritation	23	45.0	17	33.3	10	19.6	1	2.0	14	24.1	20	34.5	16	27.6	8	14	8.77	0.03*
Tear drop	34	67.0	10	19.6	7	13.7	0	0.0	27	46.6	13	22.4	13	22.4	5	8.6	7.39	0.05*
Mucus	36	71.0	7	13.7	7	13.7	1	2.0	32	55.2	7	12.1	9	15.5	10	17	7.71	0.05*
Slobber	48	94.0	3	5.9	0	0.0	0	0.0	54	93.1	4	6.9	0	0.0	0	0.0	0.05	0.83
Dizziness	26	51.0	13	25.5	9	17.7	3	5.9	23	39.7	13	22.4	12	20.7	10	17	3.90	0.28
Weakness	0	0.0	25	49	17	33.3	9	18	0	0.0	24	41.4	22	37.9	12	21	0.66	0.72
Headach	20	39	23	45.1	8	15.7	0	0.0	20	34.5	26	44.8	12	20.7	0	0.0	0.55	0.79
Parched	25	49	19	37.3	6	11.8	1	2	22	37.9	28	48.3	6	10.3	2	3.5	1.92	0.62
Dyspnea	34	67	10	19.6	7	13.7	0	0.0	34	58.6	13	22.4	11	19	0	0.0	0.84	0.65

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Symptom	Experimental group (51 cases)								Control group(58 cases)								Fisher's Exact Test	p-value
	Level of symptom after spraying within 24 hours																	
	Never		Mild		Moderate		Severe		Never		Mild		Moderate		Severe			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Shake	33	65	15	29.4	3	5.9	0	0.0	35	60.3	16	27.6	7	12.1	0	0.0	1.20	0.59
Muscle weakness	27	53	18	35.3	6	11.8	0	0.0	28	48.3	22	37.9	8	13.8	0	0.0	0.30	0.90
Handshake	42	82	6	11.8	3	5.9	0	0.0	50	86.2	6	10.3	2	3.4	0	0.0	0.56	0.85
Cramp	28	55	15	29.4	4	7.8	4	7.8	45	77.6	10	17.2	3	5.2	0	0.0	8.40	0.03
Dermalallergic	23	45	16	31.4	6	11.8	6	118	26	44.8	15	25.9	7	12.1	10	17	0.89	0.84
Epilepsy	51	100.0	0	0.0	0	0.0	0	0.0	51	100.0	0	0.0	0.0	0.0	0.0	0.0	-	-
Coma	51	100.0	0	0.0	0	0.0	0	0.0	51	100.0	0	0.0	0.0	0.0	0.0	0.0	-	-
Senseless	51	100.0	0	0	0	0	0	0	51	100.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-
Vomiting	44	86	6	11.8	1	2	0	0	52	89.7	4	6.9	2	3.5	0	0	1.05	0.63
Sorethroat	38	75	8	15.7	5	9.8	0	0	41	70.7	13	22.4	4	6.9	0	0	1	0.59
Cough	30	59	15	29.4	5	9.8	1	2	34	58.6	10	17.2	7	12.1	7	12	5.55	0.13
Wheezing	39	77.0	9	17.7	3	5.9	0	0.0	49	84.5	7	12.1	2	3.4		0.0	1.22	0.58
Chestpain	35	69.0	11	21.6	4	7.8	1	2.0	32	55.2	14	24.1	7	12.1	5	8.6	3.36	0.35
Nausea	36	71.0	14	27.5	1	2.0	0	0.0	47	81.0	10	17.2	1	1.7	0	0.0	1.91	0.48
Abdominal pain	45	88.0	4	7.8	1	2.0	1	2.0	50	86.2	7	12.1	1	1.7	0	0.0	1.81	0.72
Numbness	34	67.0	7	13.7	10	19.6	0	0.0	48	82.8	10	17.2	0	0.0	0	0.0	13.6	0
Diarrhea	49	96.0	1	2.0	1	2.0	0	0.0	56	96.6	1	1.7	1	1.7	0	0.0	0.51	1.0
Wobble	47	92.0	3	5.9	1	2.0	0	0.0	56	96.6	2	3.5	0	0.0	0	0.0	1.54	0.51
Nail removed	51	100.0	0	0.0	0	0.0	0	0.0	58	100.0	0	0.0	0	0.0	0	0.0	-	-

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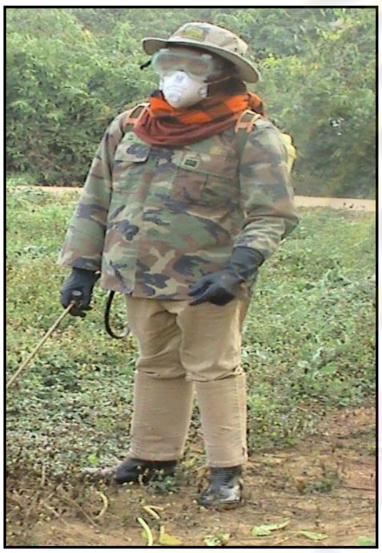
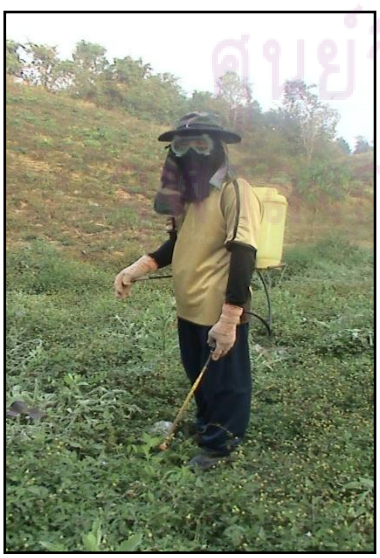
4.2.5 Secondary Outcome: Photoghaphy evaluation

Photoghaphy evaluation is one of evaluation process which was used for confirming the compliance PPE use through the visual evidence in the participants of intervention group after they passed workshop training and received media which communicated in the household and community. The pictures as below are some maize farmers whose were the research and team random selected to take photo when they applied paraquat in the maize field.



This picture showed a male participant in the intervention group used full compliance of Personal Protective Equipment (PPE) including hat, goggle, mask, long sleeve shirt, long pants, gloves, socks and boots after the intervention done.

Picture 4.14



This picture showed a male participant in the intervention group used almost full compliance of Personal Protective Equipment (PPE) including hat, goggle, mask, long sleeve shirt, long pants, socks and boots, but he use glove gloves which improper to protect.

Picture 4.15

This picture showed a femal participant in the intervention group used full compliance of Personal Protective Equipment (PPE) including hat, goggle, mask, long sleeve shirt, long pants, gloves, socks and boots after the intervention done.

Picture 4.15

This picture showed a male participant in the intervention group used almost full compliance of Personal Protective Equipment (PPE) including goggle, mask, long sleeve shirt, long pants, gloves, socks and boots, except hat,after the intervention done.

Picture 4.16

This picture showed a male participant in the intervention group used full compliance of Personal Protective Equipment (PPE) including hat, goggle, mask, long sleeves shirt, long pants, gloves, socks and boots after the intervention done.

Picture 4.17

CHAPTER V
DISCUSSION, CONCLUSION & RECOMMENDATION

5.1 Discussion

1) Background and general information of pesticide used and exposure in the maize farmers in Namtok sub-district, Nanoi district, Nan Province, Thailand.

According to the first objective of this study which was to provide the background and general information of pesticide used and exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan Province, Thailand. We found the total response was 73.3% (407 cases) that indicated high intension to participate in this study. 27.7 % was lost to participate, because they didn't stay in the community at that time. Some people went to work in other area of Thailand such as Bangkok, Pathumthani, Samutprakan, and the other provinces in the East region of Thailand. This finding is the normal situation in almost rural area of Thailand and consistent with general population study in Thailand (Vorawan Chandoeyvit, 2005) and the others contries particularly in southeastasia and developing country.

The average age of maize farmers was 43.52 years old that was the general working age. Over 70% of the respondent maize farmers were male, couple, and head of family and they had educated in primary school more than 60%. All of them owned the properties and more than 60% owned less than 40 rais of properties. They have many activities of maize production including reclaim, sowing, apply fertilizer, spraying pesticide, harvest, mill and pack, and distribute and sale production. Normally, this finding illustrates situation in farmers' society in rural area of Thailand.

Moreover, they experience many problems from their occupation such as high price of fertilizer, price of agricultural product trend to decrease and problem of weed, pest and outbreak disease of blight. The favorite pesticides which were used in maize field were paraquat and glyphosate, because the major enemy of maize was weed. The favorite of pesticide application was spraying because it was convenient and appropriate to wide and large growing areas.

The self report of toxicity symptom due to pesticide use and exposure, was reported a few symptom (i.e.headache, fatigue, drowsiness, sweating, nausea, throat irritation, and tears) and moderate symptom (i.e. nausea, vomiting, dull eyes, trembling, cramps, shortness of breath, chest dense, neurological , pupil narrowed chest, and sweat a lot) by maize farmers, because some maize farmers did not use PPE, used PPE improperly, and low personal hygiene when and after they applied pesticide in theirs field, whereas the majority of the interviewed maize farmers knew that wearing PPE can protect the body from the adverse health effects of pesticide, but no one took precaution unless they knew about the exact health effect. As concluded by the in-depth interviewers, the reason for not using and improperly using PPE among maize farmers who knew the benefit of the PPE, could be attributed to careless, discomfort, cost, or unavailability of PPE. The present findind is inconsistent with the study from Sri Lanka (Sivayoganathan, 1995) and USA (Perry and Marbell, 2000).

Matthews G.A. 2007 also reported adverse effects in the 12 months preceding the survey, 19 % of respondents reported minor symptoms following pesticide exposure requiring no or self-medication, 6% reported moderate incidents requiring a visit to the doctor and 1% reported serious incident requiring hospitalisation. The main symptoms reported were nausea, headache, tiredness and skin irritation. OP and carbamate insecticides were reported as associated with these symptoms in around 70% of the reports.

Ntow et al. (2006) and Dasgupta et al. (2007) also reported that headaches and feeling weakness (fatigue) were the most common complaints, which could be also due, in many hot climates, to long exposure to sun/UV radiation, especially if no head protection is worn. The odour of some pesticides or co-formulants also elicits a feeling of nausea even if the chemical is not highly toxic. Lack of understanding the need for personal protection is illustrated in some countries by the belief that the younger person is stronger and in some way immune (Palis et al., 2006). In the survey in Brazil by Recena et al. (2006), which was not confined to manual equipment, over 90% of the respondents had used a Class I insecticide (methamidophos) and 59.6% reported adverse symptoms. The high incidence of poisoning symptoms in the Recena et al. (2006) survey may be due to inadequate personal protection, as 63.7% did not wear boots and only 15.9% wore gloves. A range of studies reviewed by Keifer (2000) had indicated that using PPE was effective in reducing exposure, but no controlled studies had addressed reducing pesticide poisonings. Nevertheless, there is circumstantial evidence that the risk of poisonings is higher where Class I pesticides are used and where PPE is not worn.

Moreover, many factors influencing toxicity might be affected of pesticide poisoning symptoms among maize farmers such as the pathway of administration (whether the toxin is applied to the skin, ingested, inhaled, injected), the time of exposure (a brief encounter or long term), the number of exposures (a single dose or multiple doses over time), the physical form of the toxin (solid, liquid, gas), the genetic makeup of an individual, an individual's overall health, and many others. These factors can describe more understanding about pesticide poisoning symptoms among maize farmers while and after they exposure pesticide.

2) The association among knowledge, attitudes, and practices of pesticide used and exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan province, Thailand

According to the first objective of this study which also to assess the association among knowledge, attitudes, and practices with pesticide used and exposure in the maize farmers at Namtok sub-district, Nanoi district, Nan province, Thailand. We found almost 50% of maize farmers have high knowledge, 70 % have positive attitude and 94% have good practices of pesticide use and exposure. These findings are affected from many factors such as a well education in the community, ability to access to many sources of pesticide information and long range of pesticide use. A high level of literacy was record among maize farmers, because 60% of respondants had graduated in primary school that mean majority of them can read and write Thai language. Additional, they can access to many sources of pesticide information which were available in the community, therefore high knowledge, positive attitude and good practice were possible in this community.

Moreover, when we assessed the associations among knowledge, attitude, and practice by using Pearson correlation, we found the association between each variable were positive significantly ($p<0.05$). These finding mean the high kwonledge have affected to increase positive attitude and good practices and the positive attitude have affect to good practices as well.

This study were consistent with Rampai study (Rampai, 1996) which the knowledge, attitude, and practice were evaluated among durian growers in Rayong province. They found majority of durian growers have high knowledge, positive attitude and good practice of pesticide use and exposure and also found significantly the associations between knowledge and attitude. Moreover, in Chiang Mai, an assessment of knowledge, attitude and practice was done among Hmong vegetable growers (Teradate and Prasert, 1998), they found 47.1 % of vegetable growers have moderate knowledge, 76.0% have neutral attitude and 63.6 % have high practice of pesticide application and also found significantly the association among knowledge, attitude, and practice.

All finding of the associations of knowledge, attitude, and practice were consistent with the theory of attitude (Surapong S, 1990). This theory was concluded the continous interactive among three variables. After the audient received the message or media, their knowledge will emerge. Then, the emerging knowledge has affected to positive attitude and finally the attitude has affected to good practice.

3. Effectiveness of risk communication model in the maize farmers at Namtok sub-district, Nanoi district, Nan Province, Thailand.

Phase 2 was conducted qua-si experimental. The target population was divided into 2 groups including the intervention and the control group. The risk communication model (the intervention) was assigned in the intervention group, whereas the control group was not gotten the intervention. The evaluation of the implementation of risk communication model was the answer of the third study objective. The purposive of risk communication was to decrease paraquat exposure in the maize farmers of the intervention group.

After implementing the intervention, the evalution between the experimental group and the control group was conducted for measuring the effectiveness of the intervention. Key indication performance of the effectiveness of the intervention was divied into 2 levels including primary outcome and secondary outcome. The primary outcome was the paraquat residues concentration which measured in both group before and after intervention. The secondary outcomes were the knowledge, attitude, practice, proportion of personal protective equipment (PPE) used, proportion of full compliance of personal protective equipment (PPE) used and proportion of poisoning toxic symptoms of paraquat exposure after they sprayed complete cumulative 10 days, after that blood collection was done within 24 hours.

The finding of the paraquat residues concentration in human serum was the primary outcome of risk reduction of paraquat exposure. The finding of the paraquat residues concentration in human serum at the baseline was not detected less than LOD (0.21 mg/l) in both groups, because at that time the participants in both groups did not expose paraquat 10 months ago or recent exposure on June 2010. In addition, the normal human excretory system can eliminate paraquat via the faeces and urine every day which consistent with one recommendation of treatment in severe cases that suggest to on set the elimination be normal for getting rid of paraquat out of body. However, the value of undetectable paraquat residues in serum is not exact value of the paraquat residues in the serum. Perhap, it has residues very slightly value in the serum, but limit of detection (LOD) of HPLC technique in this study can not detect. Generally, the most of HPLC method was conducted in the patients who have acute poisoning through intension ingestion paraquat or high dose exposure, but this study was conducted in the first time of Thailand which focused on long term exposure with low dose in maize farmers.

The finding of the paraquat residues concentration in human serum after intervention was conducted High Performance Liquid Chromatographic (HPLC) method after the maize farmers in both groups just exposed paraquat culmuative complete 10 days or immediately exposure. The result was rarely found in both groups after intervention. In the experimental was found 4 persons (7.8%) while the control group was found 11 persons (19.0%) at the upper level than LOD. At the begining, the statistic test was planed to use unpaired t-test for compairing average of the paraquat residues concentration between the experimental group and the control group, but the data distribution of paraquat residues concentration in both groups isn't normal distribution. Also, the cases who were detected residues paraquat concentration upper than LOD were very small. Therefore it is not appropriate and not enough for parametric test, Z-test was used to analyze instead. We found the diffence of the proportion between both groups was almost significant (p=0.093). Limit of detection of HPLC technique in this study was 0.21 mg/ml, therefore the results of paraquat residues concentration of all participants whose did not detect lass than LOD were reported at 0.21 mg/ml. There are not the exactly value of paraquat residues concentration. There is one of unexpected outcome and limitation of this study. However, HPLC technique which used this condition of this study was conducted the first time in Thailand and the first time in the maize farmers who exposed paraquat interm of occupational exposure or sub-chronic exposure.

Moreover, this finding can explain more through the different aspects of the contact between participants and hazardous those are potentially important in exposure analysis (Sexton et al., 1995). We found the similar aspects in both groups that included agent, source, exposure routes, exposure duration, exposure frequency, exposure setting, exposed population, geographic scope, and time frame. Agent in both groups was paraquat that is similar used in maize field by maize farmers in both group. Source of exposure in both groups was happened in the maize field where maize farmers always applied paraquat. Exposure routes, the main route of exposure in both groups of maize farmers to paraquat is via the skin or dermal contact. Exposure duration, exposure frequency, exposure setting, exposed population, geographic scope, and time frame in both group of this study were similar, because the characteristics were matched by age, gender, period of being maize farmers already. On the other hand, the different between experimental group and control group was assignment the intervention which was affected to significantly increase knowledge, attitude and practice and also to significantly increase full compliance of PPE use. These findings confirmed the risk communication model was affected to reduce paraquat exposure in the maize farmer.

This finding consistent with the study in Malaysian rubber plantations, exposure is likely to be greater than in most other situations (Swan, 1969). Weed control is required continuously for 10 months of the year, and the herbicide is applied by knapsack sprayers during the entire working day, 6 days a week. The high temperature and humidity together with the light clothing of the sprayers increase the potential risk of dermal exposure. In 1965, a study was carried out on a team of 6 sprayers, and in 1967 on 4 teams, to estimate the efficacy of protective measures. The operators used spray dilutions containing paraquat at 0.5 g/litre, for 12 weeks. Attention was paid to personal hygiene. Each man was given a thorough physical examination and urine samples were taken before spraying began and at weekly intervals throughout the study. Paraquat analyses were carried out using the method of Calderbank and Yuen (1965). Chest X-rays were taken before the study started and at the end of the 6th and 12th weeks. In the course of the 2 studies, a total of 528 urine samples were examined. Paraquat was found on 131 occasions, the maximum concentration detected being 0.32 mg/litre in the first study and 0.15 mg/litre in the second. Average urine levels of paraquat of 0.04 mg/litre were found in the 1965 study, and of 0.006 mg/litre in the 1967 study. After spraying ceased, these levels declined steadily to become undetectable within a week - with one exception. It was concluded that the workers were not subjected to hazardous levels of paraquat.

Moreover, many studies tried to measure the effectiveness of intervention by measuring biomarker after intervention. In 1999, Gomes and team conducted retrospective cohort study of self-reported safety and hygiene behavior among 529 farm workers whereas unstated number of controls consisted of nonexposed workers. They assigned intervention including use of glove, shoes, scarves, hand washing and hygienic practices after pesticide applications. They assessed outcome by pesticide exposure as estimated by AChE levels. They found exposed workers had mean hemoglobin corrected

AChE of 29.96, but they unstated number of unexposed workers had a mean hgb adjusted AChE of 32.1 ($p<0.0001$). They, also found gloves, scarves, shoes, better training, better hygiene practices all predicted significantly higher AChE (presumably indicating less exposure). The first one comment of Gomes study was similar to one of limitations of this study. There are self-reported of the quantity, patterns and types of pesticides used and use of personal protective equiptments. The weakness of self-reported was recall bias, so closed mornitoring should conduct together. This study was used participatory observation by village health volunteers to double check the real situation as well. This method help to reduce recall bias of self-reported. The second one comment of Gomes study was different when compare of this study. In Gomes study, they measure a single time of AChE after pesticide application and focused on organophosphates, but in this study, we measured couble times before and after paraquat application in both groups.

The objectives of why this research implemented the risk communication model into the community were to increase the knowledge level for changing the negative attitude to positive attitude and wrong practices to right practices when the maize apply paraquat in the field. Then, the first one of the secondary outcomes was the kownledge of paraquat use and exposure that was conduted by questionnairs after intervention in both groups. In the experimental group before intervention, the majority (62.7%) was low level and the average of knowledge was 7.43 score; later on implement the intervention, the majority was moved to moderate level 72.5%. The different average knowledge score was 2.0 score which increased from 7.43 to 9.43. In the control group before intervention, the majority (62.1%) was low level of knowledge and the average of knowledge was 7.69 score; later on implement the intervention, the majority was still low level 69.0%. The different average knowledge score was 0.07 score which increased from 7.69 to 7.76. Average mean score of total knowledge score between before and after implementing the risk communication model in the experimental was significantly increased ($p<0.05$), but, in the control group was not significantly increase($p>0.05$).

Attitude level was the second one variable of the secondary outcome. In the experimental group before intervention, the majority (62.7%) was moderate level and the average of attitude was 57.43 score; after the intervention, the majority was moved to good level 92.2%. The different average attitude score was 8.63 score which increased from 57.43 to 66.06. In the control group before intervention, the majority (69.0%) was moderate level and the average of attitude was 57.53 score; after the intervention, the majority was still moderate level 53.4 0%. The different average attitude score was 0.94 score which increased from 57.53 to 58.47. The comparisons of mean score of total positive attitude score of paraquat use and exposure in the experimental group before and after implementing the risk communication modelwas significantly increased ($p<0.05$),but, in the control group was not significant.

Practice was the third one of the secondary outcome. Total score of practice was also classified into three levels including low, moderate, and good. The experimental group before intervention, the majority (80.4%) was good level and the average of practic was 50.59 score. After intervention, the majority was moved to good level 100%. The different average practice score was 5.91 score which increased from 50.59 to 56.50. The control group before intervention, the majority (89.7%) was good level and the average of practic was 52.0 score; after the intervention, the majority was in good level 89.7 0%. The different average practic score was -0.02 score which decreased from 52.0 to 51.98.

The comparisons of mean score of total practice score of paraquat use and exposure in the experimental group between before and after implementing the risk communication model was significantly increased ($p<0.05$),but, in the control group was not significant. Because of the intervention, the practice was instictly postsitive changing that can improve the participants when they applied paraquat in the field. All significantly increase results which demonstrated distinctly effectiveness of the intervention in the experimental group when compared with the control group.

These finding were consistent with Wutthichai Jariya (Wutthichai J, 2006). The study was conducted by quasi-experimental research design with a control group. The effectiveness was assess pre and post questinnairs on knowledge, attitude, and practice. The result revealed the experimental group had significantly higher mean score of knowledge, attitude, and practice than that before receive the program ($p<0.001$). On the other hand, the mean score of the control group had not significantly difference ($p>0.05$). Finally, they concluded the participatory learning program was effective increasing knowledge, attitude, and practice in the experimental group.

Proportion of Personal Proective Equipment (PPE) used was conducted before and after impleting the risk communication model by self report. The objective of this method was to evaluate the PPE used of the maize farmer in both groups for compairing the proportion. Self report was design to measure in 9 equipments including hat, scarf, goggle, glove, mask, long-sleeve shirt, trousers, socks, and boots when they mixed, loaded, and sprayed paraquat. At the base line, the participants in both groups used hat, goggle, glove, and mask equally proportion. Also, they used glove, long sleeve shirt, trousers, socks and boots 100% when they applied pararquat at the baseline. After implementing risk communication model, self report was conducted again. We found proportion of all PPE used in the experimental group increase higher than the control group. The difference of all proportions of scarf used, goggle used, glove used, mask used between two groups was significant ($p<0.05$).

This finding was directly affected by risk communication model, because all content of model focus on encouraging the participants in experimental group compliance to use personal protective equipments (PPE) including public meeting workshop, production and distribution new and existing media which including VCD of risk communication, household poster, public service announcements document, fact sheet, manual of of pesticides use correctly and safety. Public meeting workshop was the most popular and effectiveness way to communicate directly and rapidly, because this way was closed and applied two ways communication into the audiences. There is used in the general formal education system. Also, risk communication by VCD can enhance their interesting to study and compliance to practice, because VCD was the multiple media which design to show visual and instinct of sound and movement picture and also simple design to easy understand by matching with the background of participant's education.

However, this study should consider some aspects to discuss for recommodation to conducted further study, to sustain this model in this area, to fulfill this study, to generalize or extend this model into the other areas where have experienced same problem and have similar living condition or almost.

According to Kasutaga Kogi research study in 2005 (Kasutaga K, 2005), we found the key point that related to this study. There are two ways of positive feature of small work place in the participatory programmes for occupational risk reduction. First, local key persons are ready to accept local good practices conveyed through personal, informal approaches. For this point should be note to extend to the next step of this study after communicating directly into the susceptible group. Local key person who influence to the encourage the community to change behavior after receive and accept the message such as head of sub-district, head of village, monk, health officer, local governor, should focus on risk communication. Thus, illustrated information on local good practice conveyed through group discussion is likely to be accepted. Second, farmers are capable of understanding technical problems affecting routine work and taking flexible action living to solving them. This point was similar to some session of risk communication model especially in the public meeting workshop. We also provide three session including susceptibility to paraquat exposure session, peer norms for safe paraquat handling, and skill training to increase self-efficacy beliefs into the experimental participants of understanding risk analysis for training solving skill.

The important points of the effectiveness of risk communication model were how to sustain it in this area and how to generalize in other area. Sustainable should be considered to extend risk communication model coverall community by trained participants. This method was consistent with Tsuyoshi Kawakami study (Tsuyoshi K et.al, 2008). They used WIND (Work improvement Neighbourhood Development) to train farmer volunteers. Then, trained farmer volunteers trained neighbouring farmers and expand theirs networks. For generalization, risk communication should be adopted into the formal education since primary school particular in the experienced problem areas. Also, should be adopted into the National program of agricultural safety in Thailand.

5.2 Limitation of this study

There are several limitations of this study should be noted as follow.

1. Selection bias; the research design in phase 1 (cross-sectional study) was conducted by the purposive sample technique that was selected only Namtok sub-district, Naoi district, Nan province. That might not be provincial and national representation. However, the appropriate reason why this study was selected this area to study was which more than 90% of household in Nantok sub-district was the maize farmer and also has the characteristic consistent with the objective of this study. Moreover, this area never done this matter before and also limit of time and cost.

2. Limitation of control; quasi experimental study design was conducted in pahse 2 in this study, so the limitation of this design in this study was uncontrollable external confounder and external co-intervention such as the information of paraqaut which came form the other mass media including radio, television, newspaper, other documents that the community can access.

3. Limitation of detection; the primary outcome of this study was paraquat residues concentration in human serum which was measured by High Perfomance liquid Chromatoghaphy (HPLC). Limit of detection (LOD) of this study condition was detected paraquat residues concentration in human serum at 0.21 mg/ml. Unfortunatly, only 15 cases (14%) of both groups was detected upper than LOD after intervention that caused to interfere statistic analysis. The caused of limit of detection which detected only 0.21 mg/ml was limited of method condition and limited of the material which used to analyze including stationary phases, mobile phases and the column, and a detector.

5.3 Conclusion

1. Risk communication model may not affected to significant decrease paraquat residual in the experimental group when compared with the control group.

2. Risk communication model was affected to significant increase the knowledge, attitude, and practice of paraquat use and exposure in the experimental group when compared with the control group.

3. Risk communication model was affected to significant difference and increase full compliance of PPE use both before and after intervention in the experimental group when compared with the control group.

4. Risk communication model may not affected to significant decrease paraqaut poisoning symptoms after intervention in the experimental group when compared with the control group.

5.4 Future Research

The future research which should be as follow:

1. The risk communication model of this study should implement in the other areas where the participants have similar characteristics and living for generalization this model to the other area.

2. Future research should consider the appropriate method of measuring the paraquat residues concentration in human body.

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Appendices

Appendix A

Appendix A: Phase 1 Questionnaires (English version)

The questionnaires will be purposed to interview Maize farmers in Namtok subdistrict, Nanoi district, Nan Province Thailand.

Instruction: Please check / into the ☐ or write down the blank

Part 1: General information

1. Age_____________years
2. Gender ( ) Male ( ) Female
3. Marital status ( ) Single ( ) Couple ( ) Dower ( ) Divorce ( ) Separate
4. Weight__________Kg
5. How many members in this household_________persons.
6. How many members are the maize farmer______person.
7. How long have you live in this area____________years
8. How long have you grown the maize years
9. Family status ( ) Head of family ( ) couple of head family ( ) Children
   ( ) Parent ( ) A relation ( ) resident
   ( ) laborer ( ) Other………
10. Education level ( ) Never ( ) Primary school ( ) First 3 years of secondary school
    ( ) Second 3 years of secondary school ( ) a diploma
    ( ) Bachelor ( ) higher than bachelor ( ) others………
11. Income and expenditure per household per year

Average income per year (bath/year)			**Average Expenditure per year (bath/year)**		
No.	List	Bath	No.	List	Bath

12. Property of maize land_________Rais

13. Occupation Problem (can choose more than 1 choice)

( ) Weed and pest outbreaks ( ) Degenerate soil

( ) Decrease in agricultural product process

( ) High price of fertilizers and pesticides

( ) Lack of water ( ) Lack of knowledge of culture

14. What did your activities that related in maize producer? (Can choose more than 1 choice)

( ) Reclaim Sowing ( ) Applying fertilizer

( ) Spraying pesticides ( ) Harvesting crops

( ) Milling and packing crops ( ) Distribution and sale

PART 2: Weed, Insect, and pesticide use data

15. What name of insect is you found in the maize field?

1.______________________________

2.______________________________

3.______________________________

16. What name of insect is you found in the maize field?

1.______________________________

2.______________________________

3.______________________________

17. What pesticide name is you use in the maize field?

No	Name	Amount	Cost	Times, hour, day	Month	Type*	Method**

* 1.Insecticide 2.Herbicide 3. Plant disease

** Type of application 1. Spraying 2. Spraying dust 3. Fuming 4. Spraying smog 5.spinkle 6. Smear

18. Who did spray pesticide in maize field? (Can choose more than 1 choice)

( ) Sprayed by yourself

( ) Rent other person to spray

19. Have you ever a congenital disease?

( ) Never

( ) Ever (please fulfill name of disease)__________How long_________years

20. Have you ever symptom of pesticide poisoning within last year?

( ) Never ( ) moderate symptoms

( ) Few symptoms ( ) Severe symptom

21. How did you solve the problem when you got symptom of pesticide poisoning?

( ) Not thing special ( ) Self administered drub and herbal remedies

( ) Alternative medicines ( ) Health center ( ) Private clinic

( ) District hospital ( ) Provincial hospital

22. Source of pesticide information (Can choose more than 1 choice)

( ) Radio ( ) TV ( ) Document/article ( ) Broadcast tower

( ) Neighbor ( ) Agricultural office ( ) Public health office

( ) Pesticide salesman ( ) Community header ( ) Health volunteer

26. Have you ever screened cholinesterase since last year?

( ) Never ( ) Ever but not kwon result

( ) Ever and normal ( ) Ever and not normal ( ) Ever and non safety result

Part 3: Knowledge of pesticide use

27. How many route the pesticide can go inside the body? What?

( ) Ingestion ( ) Ingestion and inhalation

( ) Ingestion inhalation and dermal ( ) only dermal

28. What is disadvantage of pesticide use?

( ) harm to human body who ate pesticide ( ) harm to any living thing

( ) No have disadvantage ( ) harm to weed and plants

29. What is paraquat?

( ) Herbicide ( ) Insecticide

( ) Chemical which use to treat plant diseases such as fungus

( ) Fungicide

30. How to correct pesticide use?

( ) 1.Proper insecticide ( ) 2.Follow Neighbor suggestion

( ) 3. Choose chemical which can kill many kinds of weed

( ) 4.Proper budgets and time

31. When you want to buy pesticide, should you considerate?

( ) 1.Date, Month, Year when the product produced and expired

( ) 2.Choose correct kind and calculate amount the chemical which you want to apply

( ) 3.Choose chemical which can kill many kinds of weed

( ) 4.Both 1 and 2 are correct

32. How to known toxicity of pesticide?

( ) 1. Read label beside product or observe risk picture and symbol

( ) 2. Smell If heavy smell that mean high dangerous

( ) 3.Ask and perceive from neighbor ( ) 4. Lab test

33. What is the correct method of pesticide use?

( ) 1. Use high dose when have many kind of weed, insect, and diseases

( ) 2. Follow product label

( ) 3. Mix many kind of pesticide for preventing reaction drug

( ) 4. Up to user

34. How to correct mix pesticide?

( ) 1. Mix all chemical into sprayer then fulfill water

( ) 2. Mix all chemical in container, then fulfill into sprayer

( ) 3. Mix all chemical into sprayer which water full, then shake sprayer

( ) 4. All choice can do, up to user

35. Where is the pesticide residual after spraying?

( ) 1. Residual in human, soil, water, air and plant which contacted pesticide when spray

( ) 2. Residual only in plant

( ) 3. No residual anywhere

( ) 4. Residual only in human

36. What is the correct practice when you was spraying pesticide?

( ) 1. Cover mask and glove, closed dressing, and wearing boot

( ) 2. Spraying beyond windward

( ) 3. Smoking and fume a lot for preventing breathing into

( ) 4. Cover only glove

37. What are the correct practices after pesticide used?

( ) 1. Immediately, clean container and material in the river and channel

( ) 2. Immediately, take a bath, but wear old dressing and then continuous working

( ) 3. Clean material with detergent, take a bath, shampoo, and then change new dress

( ) 4. Can do every choice

38. How to storage residual pesticide product?

( ) 1. Storage in kitchen

( ) 2. Storage in norstrum box

( ) 3. Separate storage in special box and close the door

( ) 4. Storage in anywhere

39. How to manage pesticide packet after it was finished?

( ) 1. Burn and bury

( ) 2. Leave in the river near land field

( ) 3. Clean and clear then storage ( ) 4. Leave anywhere in land field

40. What is symptom of long term pesticide exposure?

( ) 1. Fidget and deliriousness

( ) 2. Abdominal pain and dizzy

( ) 3. Spin, dizzy, be parched

( ) 4. Often vomit

41. How to practices the first aid if you acute exposed pesticide?

( ) 1. Take a drug

( ) 2. Chang cloth which dirty then take a bath immediately

( ) 3. Relieve cloth

( ) 4. Go to hospital

42. How to practices the first aid if you drunk pesticide?

( ) 1. Vomit will be done

( ) 2. Eat egg white

( ) 3. Relieve cloth

( ) 4. Go to hospital

Part 4: Attitude towards pesticide use

Attitude items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
43. Pesticide can only enter the body by ingestion*					
44. Pesticides only harm insects, not humans*					
45. Should you increase the amount of pesticides used at anytime*					
46. Various pesticide mixture is effectiveness of pesticide use and no disadvantage*					
47. Using wood-based chemical mixture is safety than using hand					
48. Over mixture more than label recommendation should increase yield*					
49. If you stand above the wind when spraying pesticide, don't concern about clothes*					
50. Pesticides harm humans and the environment					
51.You should drink coconut water after pesticide exposure to excrete toxins					
52.You should drink water after pesticide exposure to excrete toxins					

Attitude items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
53. Exercise can excrete pesticide toxins through sweat					
54. While you are spraying pesticides, you should not wear clothes *					
55. Pesticide can residues in agricultural product and its harm to consumer					
56. Pesticides are not the only way to eradicate pests					

Part 4: Practices toward pesticide use

Practice	**never**	**Some times**	**usually**
	1	**2**	**3**
57. Should learn about appropriate type of pesticide			
58. Should select pesticide follow neighbor advised*			
59. All label and instructions should be read and followed			
60. All equipment and materials should be checked before use			
61. Humans and animals should be prohibited from the spraying area			
62. Gloves and masks should be worn when spraying and mixing			
63. Real and fake pesticides should be confirmed by smelling the chemical*			
64. Pesticides should be mixed by hand*			
65. Various pesticides should be mixed together to make them more effective in eradicating weeds and pests*			
66. Should closely wear cloths while spraying			
67. Boots should be worn during spraying			
68. You should smoke and drink while spraying*			
69. Pesticides should be sprayed when windy*			
70. You should stand in the wind while spraying, unless use protective equipments			
71. Pesticide containers can be cleaned in the river after use*			
72. Pesticide containers can be left in the river after use*			

Practice	never	Some times	usually
	1	2	3
73.Wash pesticide applicators with detergent before storage			
74. Cloths worn during spraying should be removed immediately			
75. Pesticides should be stored in cabinets			
76. Empty pesticide containers should be burried or burned			
77. Your hands and face should be washed with soup before eating			

Appendix B

Appendix B. Phase 1 Questionnaires (Thai version)

แบบสัมภาษณ์เกษตรกรชาวไร่ข้าวโพด

ในโครงการวิจัยการประเมินการสัมผัสความเสี่ยง และการสื่อสารความเสี่ยงของการใช้สารเคมีกำจัดศัตรูพืช

ในการทำไร่ข้าวโพดของเกษตรกรในพื้นที่ ตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน

คำชี้แจง

1. แบบสัมภาษณ์ที่ใช้สัมภาษณ์เฉพาะเกษตรกรผู้ทำไร่ข้าวโพด

2. แบบสัมภาษณ์นี้มีจำนวนทั้งสิ้น จำนวน 11 หน้า แบ่งออกเป็น 4 ส่วน ดังนี้

ส่วนที่ 1 ข้อมูลทั่วไป จำนวน 14 ข้อ

ส่วนที่ 2 ข้อมูลศัตรูพืชและการใช้สารกำจัดศัตรูพืช จำนวน 8 ข้อ

ส่วนที่ 3 ข้อมูลด้านความรู้เรื่องการใช้สารกำจัดศัตรูพืช จำนวน 16 ข้อ

ส่วนที่ 4 ข้อมูลด้านความเชื่อและทัศนคติในการใช้สารกำจัดศัตรูพืช จำนวน 14 ข้อ

ส่วนที่ 5 ข้อมูลด้านการปฏิบัติตนในการใช้สารกำจัดศัตรูพืช จำนวน 21 ข้อ

รวมทั้งสิ้น จำนวน 73 ข้อ

3. ให้ใส่เครื่องหมาย (/) ลงใน ❍ หน้าข้อความ และ เติมข้อความในช่องว่าง (.........)

4. คำ ว่า “**สารเคมีกำจัดศัตรูพืช**” ในแบบสัมภาษณ์ หมายถึง สารเคมีที่ใช้ในการกำจัดศัตรูพืช ซึ่งได้แก่ ยาปราบวัชพืช ยาฆ่าหญ้า ยาฆ่าแมลง ศัตรูพืช ยาฆ่าเชื้อรา ยกเว้น สารเคมีที่ใช้ในการบำรุง หรือเสริมเพื่อการเพิ่มผลผลิต

หมายเลขรหัสผู้ให้สัมภาษณ์ ☐☐☐

บ้านเลขที่..................... บ้าน......................หมู่ที่................ตำบล น้ำตกอำเภอ นาน้อย จังหวัด น่าน

วัน/เดือน/ปี ที่สัมภาษณ์....../....../...........

ลายมือชื่อผู้ถูกสัมภาษณ์แสดงความยินดีและยินยอมในการให้ข้อมูล...

สำหรับเจ้าหน้าที่ลงข้อมูล

<u>ส่วนที่ 1</u> ข้อมูลทั่วไป

1.1 อายุ .... ปี — Age [ ][ ]

1.2 เพศ ❍ 1 ชาย ❍ 2 หญิง — Gender [ ][ ]

1.3 สถานภาพ ❍ 1 โสด ❍ 2 คู่ ❍ 3 หม้าย

❍ 4 หย่า ❍ 5 แยก — Status [ ][ ]

1.4 น้ำหนัก.................กิโลกรัม — Weight [ ][ ]

1.5 จำนวนสมาชิกในครัวเรือน ....คน — Fm_no [ ][ ]

1.6 จำนวนสมาชิกในครัวเรือนที่ทำไร่ข้าวโพด ....คน

Mai_mem

1.7ท่านอยู่ในชุมชนนี้มากี่ปี.............ปี

Long_stay

1.8 ท่านทำไร่ข้าวโพดมานานกี่ปี.............ปี — Mai_ys [ ][ ]

1.9 สถานภาพในครอบครัว — Fstatus [ ][ ]

❍ 1 หัวหน้าครอบครัว ❍ 2 คู่สมรส

❍ 3 บุตร ❍ 4 บิดา / มารดา

❍ 5 ญาติ ❍ 6 ผู้อาศัย

❍ 7 คนงาน / ลูกจ้าง ❍ 8 อื่นๆ............

1.10 ระดับการศึกษา — Edu [ ][ ]

❍ 1ไม่ได้เรียน ❍ 2 จบประถมศึกษา (ป 1 – ป 6)

❍ 3 จบมัธยมต้น/เทียบเท่า ❍ 4 จบมัธยมปลาย/ปวช/เทียบเท่า

❍ 5.จบอนุปริญญา/ปวส ❍ 6 จบปริญญาตรี/เทียบเท่า

❍ 7 สูงกว่าปริญญาตรี ❍ 8 อื่นๆ (ระบุ).................

1.11 รายได้-รายจ่าย ครัวเรือนเฉลี่ย / ปี — Income [ ][ ][ ][ ][ ][ ] Expense [ ][ ][ ][ ][ ][ ]

รายได้ครัวเรือนเฉลี่ย................. บาท / ปี			รายจ่ายครัวเรือนเฉลี่ย................. บาท / ปี		
ที่	รายการ	จำนวน (บาท)	ที่	รายการ	จำนวน (บาท)
1			1		
2			2		
3			3		
4			4		
รวม			รวม		

1.12 ที่ดินที่ใช้ทำไร่ข้าวโพดในครัวเรือนทั้งหมดกี่...................... ไร่ Ld_mai

1.13 ปัญหาการเรื่องการประกอบอาชีพ (ตอบได้มากกว่า 1 ข้อ)

- ❍ 1 ปัญหาศัตรูพืช / โรคระบาด Prob1
- ❍ 2 ปัญหาขาดแคลนน้ำ Prob2
- ❍ 3 ปัญหาสภาพดินเสื่อมโทรม Prob3
- ❍ 4 ปัญหาราคาผลผลิตต่ำ Prob4
- ❍ 5 ปัญหาเรื่องราคาปุ๋ย / สารฆ่าแมลง มีราคาแพง Prob5
- ❍ 6 ปัญหาเรื่องขาดความรู้ในการเพาะปลูก/การใช้ปุ๋ย /การใช้สารกำจัดศัตรูพืช Prob6

1.14 ท่านเกี่ยวข้องกับการทำไร่ข้าวโพดในขั้นตอนและกิจกรรมใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

- ❍ 1 ถางป่าและไถพรวน Mai_act1
- ❍ 2 การหว่านหรือหยอดเมล็ด Mai_act2
- ❍ 3 การใส่ปุ๋ย Mai_act3
- ❍ 4 การพ่นสารเคมีป้องกันและกำจัดศัตรูพืช Mai_act4
- ❍ 5 การเก็บเกี่ยวข้าวโพด Mai_act5
- ❍ 6 การสีและการบรรจุ Mai_act6
- ❍ 7 การขนส่งและการขาย Mai_act7

<u>ส่วนที่ 2</u> ข้อมูลศัตรูพืชและการใช้สารกำจัดศัตรูพืช

2.1 ปัญหาศัตรูพืชในไร่ข้าวโพดของท่านคืออะไร (ท่านสามารถตอบได้มากกว่า 1 ข้อ)

❍ แมลง (ระบุ) Insect_prob

1) ……………………................. Insecta1

2) ………………………………… Insecta2

3) ………………………………… Insecta3

❍ วัชพืช (ระบุ) Herb_prob

1) ……………………............. Herb1

2) …………………………….. Herb2

3) …………………………….. Herb3

❍ โรคพืช (ระบุ) Weed_prob ☐☐

1) ……………………............... Weed1 ☐☐

2) ……………………………… Weed2 ☐☐

3) ……………………………… Weed3 ☐☐

2.2 สารเคมีกำจัดศัตรูพืชที่ท่านใช้ ในการทำไร่ข้าวโพดคือ (สามารถระบุได้มากกว่า 1 ชนิด)

ที่	**Chem_n** ชื่อสารเคมี	**Amount** ปริมาณสารเคมีที่ใช้ทั้งหมดในการทำไร่ข้าวโพดใน 1 ปี (จำนวนลิตร)	**Cost** ราคาทั้งหมด (บาท)	**Time** 1.จำนวนครั้งที่ใช้ **Hour** 2.ครั้งละกี่ชั่วโมง **Day** 3.ใช้ห่างกันกี่วันในแต่ละครั้ง	**Month** เดือนที่ใช้สารเคมี (เดือนอะไร)	**Type** ประเภทของสารเคมีที่ใช้ *	**Method** รูปแบบการใช้ **
1				1………………… 2………………… 3…………………			
2				1………………… 2………………… 3…………………			
3				1………………… 2………………… 3…………………			
4				1………………… 2………………… 3…………………			
5				1………………… 2………………… 3…………………			

*** ประเภทของสารเคมีที่ใช้** (1) ยาฆ่าแมลง (2) ยาฆ่าหญ้า (3) ยาโรคพืช (4) อื่นระบุ

*** *รูปแบบการใช้** (1)การพ่นยาน้ำหรือสารละลายยา (2) การพ่นผงยา (3) การรมหรืออบ (4) การพ่นหมอก (5) การโรยหรือหว่าน (6) การป้ายทา

2.3 การพ่นสารกำจัดศัตรูพืชในไร่ข้าวโพด ใครเป็นผู้ทำการฉีดพ่น (สามารถตอบได้มากกว่า 1 ข้อ)

❍ 1 ฉีดพ่นเอง Method_sp1 ☐☐

❍ 2 จ้างบุคคลอื่นฉีดพ่นให้ Method_sp2 ☐☐

2.4 ท่านมีโรคประจำตัวหรือไม่ Disease ☐☐

❍1 ไม่มี Dis_n ☐☐

❍2 มี (ระบุ)....................................เป็นเวลา................ปี Dis_long ☐☐

2.5 ท่านเคยมีลักษณะอาการของการเกิดพิษจากสารกำจัดศัตรูพืช หรือไม่ Syptom ☐☐

❍ 1 ไม่เคย (ข้ามไปข้อ 2.7)

❍ 2 เคยมีอาการเล็กน้อย (ปวดศีรษะ อ่อนเพลีย มึนงง เหงื่อออก น้ำตาไหล ระคายคอ คลื่นไส้)

❍ 3 เคยมีอาการปานกลาง (คลื่นไส้ อาเจียน ตามัว ตัวสั่น แน่นหน้าอก ตะคริว หายใจถี่ เกิดอาการทางประสาท ม่านตาหรี่ เหงื่อออกมาก)

❍ 4 เคยมีอาการรุนแรง (หายใจไม่สะดวก เป็นลม ชัก หมดสติ ชีพจรเต้นช้า หัวใจล้มเหลว สั่นตามกล้ามเนื้อตัวเย็น)

2.6 ท่านแก้ปัญหาเมื่อมีอาการแพ้สารกำจัดศัตรูพืชอย่างไร (ตอบได้มากกว่า 1 ข้อ)

❍ 1 ปล่อยให้หายเอง Sol1 ☐☐

❍ 2 ซื้อยามากินเองหรือรักษากันเองโดยสมุนไพร Sol2 ☐☐

❍ 3 ไปหาหมอพื้นบ้าน หรือเพื่อนบ้านช่วยรักษาให้ Sol3 ☐☐

❍ 4 ไปสถานีอนามัย Sol4 ☐☐

❍ 5 ไปคลินิกเอกชน Sol5 ☐☐

❍ 6 ไปโรงพยาบาลอำเภอ Sol6 ☐☐

❍ 7 ไปโรงพยาบาลจังหวัด Sol7 ☐☐

2.7 ท่านเคยได้รับข่าวสารในเรื่องเกี่ยวกับสารเคมีกำจัดศัตรูพืชจากแหล่งใด (ตอบได้มากกว่า 1 ข้อ)

❍ 1 วิทยุ Info1 ☐☐

❍ 2 โทรทัศน์ Info2 ☐☐

❍ 3 เอกสาร / สิ่งพิมพ์ Info3 ☐☐

❍ 4 หอกระจายข่าวในหมู่บ้าน Info4 ☐☐

❍ 5 เพื่อนบ้าน Info5 ☐☐

❍ 6 เจ้าหน้าที่เกษตร Info6 ☐☐

❍ 7 เจ้าหน้าที่สาธารณสุข Info7 ☐☐

❍ 8 ผู้จำหน่ายสารเคมี Info8 ☐☐

❍ 9 ผู้นำชุมชน Info9 ☐☐

❍ 10 อาสาสมัครสาธารณสุข Info10 ☐☐

2.8 ในรอบ 1 ปี ที่ผ่านมา ท่านเคยตรวจเลือดหาสารเคมีตกค้างหรือไม่ Cloline

❍1 ไม่เคย

❍2 เคย แต่ไม่ทราบผล

❍3 เคย แต่ผลปกติ

❍4 เคย และพบว่ามีการสะสม

❍5 เคย และพบว่าไม่ปลอดภัย

<u>ส่วนที่ 3</u> ความรู้เรื่องการใช้สารกำจัดศัตรูพืช

3.1 สารเคมีกำจัดศัตรูพืชสามารถเข้าสู่ร่างกายได้กี่ทาง ทางใดบ้าง K1

❍ 1 ทาง คือ ทางปาก

❍2 ทาง คือ ทางปาก ทางลมหายใจ

❍3 ทาง คือ ทางปาก ทางผิวหนัง ทางลมหายใจ

❍4 อื่น ๆ ระบุ ....

3.2 การใช้สารเคมีกำจัดศัตรูพืชมีผลเสียอย่างไร K2

❍ 1 เป็นอันตรายต่อร่างกายของผู้รับประทาน

❍ 2 เป็นอันตรายต่อสิ่งมีชีวิตทุกชนิด

❍ 3 ไม่มีผลเสียอย่างไร

❍ 4 อื่น ๆ ระบุ ....

3.3 พาราครอท เป็นสารเคมีกำจัดศัตรูพืชประเภทใด K3

❍ 1 ฆ่าหญ้า

❍ 2 ฆ่าแมลง

❍ 3 สารเคมีที่ใช้รักษาโรคของพืช เช่น เชื้อรา

❍ 4 อื่น ๆ ระบุ....................

3.4 ท่านมีวิธีการเลือกใช้สารเคมีกำจัดศัตรูพืชที่ถูกต้องควรทำอย่างไร K4

❍ 1 เลือกให้ตรงกับแมลงศัตรูพืช

❍ 2 เลือกโดยเพื่อนบ้านแนะนำ

❍ 3 เลือกชนิดที่สามารถกำจัดศัตรูพืชได้หลายอย่าง

❍ 4 อื่น ๆ ระบุ....................

3.5 การเลือกซื้อสารเคมีกำจัดศัตรูพืช ท่านควรพิจารณาองค์ประกอบของผลิตภัณฑ์อย่างไรบ้าง K5

❍ 1 ดูวัน เดือน ปี ที่ผลิต และหมดอายุ

❍ 2 เลือกซื้อให้ตรงประเภทที่ต้องการใช้ และคำนวณปริมาณที่ต้องการใช้

❍ 3 เลือกชนิดที่สามารถกำจัดศัตรูพืชได้หลายอย่าง

❍ 4 ถูกทั้งข้อ 1 และ 2

3.6 ท่านทราบได้อย่างไรว่าสารเคมีกำจัดศัตรูพืชชนิดใดมีอันตรายต่อร่างกาย มากน้อยอย่างไร K6 ☐☐

❍ 1 อ่านจากฉลาก หรือ ดูจากรูปสัญลักษณ์รูปหัวกระโหลก

❍ 2 ทราบได้จากกลิ่น เช่น ถ้ามีกลิ่นรุนแรงจะมีอันตราย

❍ 3 สอบถามหรือรับทราบจากเพื่อนบ้าน

❍ 4 อื่น ๆ ระบุ ....

3.7 วิธีการใช้สารเคมีกำจัดศัตรูพืชที่ถูกต้อง ควรปฏิบัติอย่างไร K7 ☐☐

❍ 1 เมื่อศัตรูพืชมากจะใช้สารเคมีมากกว่าฉลากที่ระบุ

❍ 2 ใช้ตามฉลากระบุ

❍ 3 ใช้สารเคมีหลายชนิดรวมกันเพื่อป้องกันการดื้อยา

❍ 4 อื่น ๆ ระบุ ....

3.8 การผสมสารเคมีกำจัดศัตรูพืชที่ถูกต้องควรทำ อย่างไร K8 ☐☐

❍ 1 เทสารเคมีกำจัดศัตรูพืช ทั้งหมดในเครื่องพ่นแล้วเติมน้ำให้เต็ม

❍ 2 ผสมสารเคมีกำจัดศัตรูพืช ทั้งหมดในภาชนะที่ใช้ผสมก่อนแล้ว
จึงเทใส่เครื่องพ่น

❍ 3 เทสารทั้งหมดใส่ในเครื่องพ่นที่มีน้ำอยู่แล้วยกเครื่องพ่นเขย่าให้
สารเคมีละลายเข้าด้วยกัน

❍ 4 อื่น ๆ ระบุ ....

3.9 สารเคมีกำจัดศัตรูพืช ขณะฉีดพ่นออกไปแล้ว สารตกค้างอยู่ที่ใดบ้าง K9 ☐☐

❍ 1 สะสมในดิน ในน้ำ ในอากาศ และพืชที่ถูกฉีดพ่น

❍ 2 สะสมอยู่ในพืชที่ถูกฉีดพ่นเท่านั้น

❍ 3 ไม่มีการสะสมในที่ใดๆ เลย

❍ 4 อื่น ๆ ระบุ ....

3.10 ขณะฉีดพ่นสารเคมีกำจัดศัตรูพืช การปฏิบัติตัวที่ถูกต้องควรทำอย่างไร K10 ☐☐

❍ 1 ใช้ผ้าปิดจมูก สวมถุงมือและเสื้อผ้ามิดชิด ใส่รองเท้าบู๊ต

❍ 2 ฉีดพ่นเหนือลม โดยไม่ต้องสวมใส่เครื่องป้องกันใดๆเลย

❍ 3 สูบบุหรี่พ่นควันออกมาก ๆ เพื่อป้องกันสารสูดหายใจรับสารเคมีเข้าไป

❍ 4 อื่น ๆ ระบุ ....

3.11 หลังใช้สารเคมีกำจัดศัตรูพืช ควรปฏิบัติตนอย่างไร K11 ☐☐

❍ 1 ล้างภาชนะอุปกรณ์ในแม่น้ำ ลำคลองที่อยู่ใกล้ทันที

❍ 2 อาบน้ำ ใส่เสื้อผ้าชุดเดิม ทำ งานอื่น ต่อไป

❍ 3 ล้างภาชนะด้วยผงซักฟอก อาบน้ำ สระผมเปลี่ยนเสื้อผ้าใหม่ทันที

❍ 4 อื่น ๆ ระบุ ....

3.12 สารเคมีกำจัดศัตรูพืช ที่เหลือจากการใช้แล้วควรเก็บอย่างไร K12

❍ 1 เก็บไว้ในห้องครัว

❍ 2 เก็บไว้ในตู้ยาสามัญประจำ บ้าน

❍ 3 แยกเก็บใส่ตู้เก็บสารเคมีโดยเฉพาะ ปิดกุญแจ

❍ 4 อื่น ๆ ระบุ ……………………………………..

3.13 กระป๋องหรือขวดหรือซองที่บรรจุสารเคมีกำจัดศัตรูพืช ที่ใช้หมดแล้วควรทำอย่างไรK13

❍ 1 นำไปเผาหรือฝัง

❍ 2 ทิ้งตามแม่น้ำลำคลองใกล้แปลงหอม

❍ 3 ล้างให้สะอาดแล้วเก็บไว้ใช้

❍4 อื่น ๆ ระบุ ……………………

3.14 ผู้ที่ได้รับพิษสารเคมีกำจัดศัตรูพืช สะสมนาน ๆ จะมีอาการอย่างไ K14

❍ 1 กระวนกระวาย คุ้มคลั่ง

❍ 2 ปวดท้อง หน้ามืด

❍ 3 เวียนศีรษะ หน้ามืด ตาลาย คอแห้ง

❍ 4 อื่น ๆ ระบุ ………………

3.15 การปฐมพยาบาลเบื้องต้น เมื่อถูกสารเคมีกำจัดศัตรูพืชหกรดเสื้อผ้า
ควรทำอย่างไรเป็นอันดับแรก K15

❍ 1 หายามารับประทาน

❍ 2 เปลี่ยนเสื้อผ้าที่เปรอะเปื้อนออกพร้อมอาบน้ำทันที

❍ 3 คลายเสื้อผ้าให้หลวม

❍ 4 อื่น ๆ ระบุ ………………

3.16 การปฐมพยาบาลเบื้องต้น เมื่อดื่มหรือทานสารเคมีกำจัดศัตรูพืชเข้าไป
ควรทำอย่างไร K16

❍ 1 เมื่อผู้ป่วยกินสารพิษเข้าไป ควรทำให้อาเจียน

❍ 2 ให้ผู้ป่วยรับประทานไข่ขาวดิบ

❍ 3 ให้ผู้ป่วยดื่มน้ำเกลืออุ่น (เกลือ 1 ช้อนโต๊ะ)

❍ 4 ปฏิบัติทุกข้อตามลำดับ

<u>ส่วนที่</u> 4 ทัศนคติและความเชื่อในการใช้สารกำจัดศัตรูพืช

ข้อ	**ข้อคำถาม**	ไม่เห็นด้วยอย่างยิ่ง **1**	ไม่เห็นด้วย **2**	ไม่แน่ใจ **3**	เห็นด้วย **4**	เห็นด้วยอย่างยิ่ง **5**	
4.1	สารเคมีกำจัดศัตรูพืชเข้าสู่ร่างกายคนเราได้โดยการกินเท่านั้น						A1
4.2	สารเคมีกำจัดศัตรูพืชเป็นอันตรายต่อแมลงที่เป็นศัตรูพืชเท่านั้น ไม่เป็นอันตรายต่อมนุษย์แต่อย่างไร						A2
4.3	การใช้สารเคมีกำจัดศัตรูพืชบ่อย ๆ ครั้งจะต้องเพิ่มปริมาณมากขึ้นเรื่อย ๆ ป้องกันการดื้อยา						A3
4.4	การผสมสารเคมีกำจัดศัตรูพืชหลาย ๆ ชนิด (มากกว่าคำแนะนำ ในฉลาก) เข้าด้วยกันทำ ให้การกำจัดศัตรูพืชได้ผลดียิ่งขึ้น และไม่มีผลเสียแต่อย่างไร						A4
4.5	การใช้ไม้คนสารเคมีกำจัดศัตรูพืช แทนการใช้มือ ทำให้ปลอดภัยจากการสัมผัสสารเคมี						A5
4.6	การผสมสารเคมีกำจัดศัตรูพืชในปริมาณที่มากกว่าที่ฉลากกำหนดทำให้ได้ผลผลิตพืชสูง						A6
4.7	การพ่นสารเคมีกำจัดศัตรูพืชถ้าหากอยู่เหนือทิศทางลมแล้วไม่ต้องใช้อุปกรณ์ป้องกัน						A7
4.8	สารเคมีกำจัดศัตรูพืชเป็นอันตรายต่อสิ่งมีชีวิตและสิ่งแวดล้อม						A8
4.9	เมื่อรู้สึกว่าได้รับสารเคมีกำจัดศัตรูพืช ควรดื่มน้ำมะพร้าวเพื่อขับพิษสารเคมีกำจัดศัตรูพืชออกจากร่างกาย						A9
4.10	ควรดื่มน้ำมาก ๆ หลังจากสัมผัสสารเคมีกำจัดศัตรูพืชเพื่อให้พิษของสารเคมีกำจัดศัตรูพืชหมดไปจากร่างกาย						A10
4.11	การออกกำลังกายเพื่อให้เหงื่อออกเป็นการขับพิษสารเคมีกำจัดศัตรูพืชออกจากร่างกาย						A11

ข้อ	ข้อคำถาม	ไม่เห็นด้วยอย่างยิ่ง 1	ไม่เห็นด้วย 2	ไม่แน่ใจ 3	เห็นด้วย 4	เห็นด้วยอย่างยิ่ง 5	
4.12	ขณะพ่นสารเคมีกำจัดศัตรูพืชไม่ควรสวมเสื้อเพราะอึดอัด						A12
4.13	สารเคมีกำจัดศัตรูพืช จะสามารถตกค้างในผลผลิตและเป็นอันตรายต่อผู้บริโภค						A13
4.14	เกษตรกรสามารถใช้วิธีการอื่นๆ ในการกำจัดศัตรูพืชนอกจากการใช้สารเคมีกำจัดศัตรูพืชเพียงอย่างเดียว						A14

<u>ส่วนที่ 5</u> การปฏิบัติตนในการใช้สารกำจัดศัตรูพืช

ข้อ	ข้อคำถาม	1 ทำเป็นประจำ	2 ทำเป็นบางครั้ง	3 ไม่ทำเลย	
ก่อนใช้					
5.1	ศึกษาชนิดของสารเคมีกำจัดศัตรูพืชให้เหมาะสมกับชนิดของศัตรูพืช				P1
5.2	เลือกใช้สารเคมีกำจัดศัตรูพืชตามคำแนะนำของเกษตรกรเพื่อนบ้าน				P2
5.3	อ่านฉลากคำแนะนำก่อนใช้ปฏิบัติตามคำแนะนำในฉลากทุกขั้นตอน				P3
5.4	ควรสอบเครื่องมือและอุปกรณ์ก่อนออกปฏิบัติงาน				P4
5.5	นำบุคคลที่ไม่เกี่ยวข้องและสัตว์เลี้ยงออกจากบริเวณที่จะพ่นสารเคมี				P5
ขณะใช้					
5.6	สวมถุงมือขณะฉีดพ่นหรือขณะผสมสารเคมีใช้ผ้าปิดปากและจมูกหรือใส่หน้ากาก				P6
5.7	สูดดมสารเคมีกำจัดศัตรูพืชเพื่อตรวจเช็คดูว่าเป็นของจริงหรือของปลอม				P7

5.8	ผสมสารเคมีด้วยมือ**เปล่า**				P8
5.9	ผสมสารเคมีหลายๆชนิดเข้าด้วยกันเพื่อเพิ่มประสิทธิภาพในการกำจัดศัตรูพืช				P9
5.10	สวมเสื้อผ้าที่มิดชิดป้องกันสารเคมีขณะฉีดพ่นสารเคมี				P10
5.11	สวมรองเท้าบู๊ตขณะพ่นสารเคมี				P11
5.12	สูบบุหรี่หรือดื่มน้ำ ขณะฉีดพ่นสารเคมี				P12
5.13	พ่นสารเคมีกำจัดศัตรูพืช ขณะลมแรง				P13
5.14	ยืนอยู่เหนือทิศทางลม ขณะพ่นสารเคมีไม่ใช่อุปกรณ์ป้องกัน				P14
หลังใช้					
5.15	ล้างภาชนะบรรจุสารเคมีกำจัดศัตรูพืชลงในแหล่งน้ำ				P15
5.16	ทิ้งภาชนะบรรจุสารเคมีกำจัดศัตรูพืชลงในแหล่งน้ำ				P16
5.17	ล้างภาชนะด้วยผงซักฟอกก่อนเก็บ				P17
5.18	ถอดชุดที่สวมใส่ขณะพ่นสารเคมีด้วยผงซักฟอกทันทีหลังเสร็จงาน				P18
5.19	เก็บสารเคมีในตู้สำหรับเก็บสารเคมี				P19
5.20	ภาชนะที่ใส่สารเคมีกำจัดศัตรูพืชที่ใช้หมดแล้วนำไปฝังหรือเผา				P20
5.21	ล้างมือและหน้าด้วยสบู่ก่อนรับประทานอาหาร				P21

Appendix C

Appendix C. แบบทดสอบความรู้ ทัศนคติ และการปฏิบัติ ของสารพาราควอทในเกษตรกรชาวไร่ข้าวโพด

แบบทดสอบความรู้ ทัศนคติ และการปฏิบัติ ของสารพาราควอทในเกษตรกรชาวไร่ข้าวโพด

ในโครงการวิจัยการประเมินการสัมผัสความเสี่ยง

และการสื่อสารความเสี่ยงของการใช้สารเคมีกำจัดศัตรูพืช

ตำบลน้ำตก อำเภอนาน้อย จังหวัด น่าน

คำชี้แจง

1. แบบทดสอบที่ใช้ทดสอบเกษตรกรชาวไร่ข้าวโพดในตำบลน้ำตก และตำบลบัวใหญ่ที่ได้รับการคัดเลือกเข้าร่วมโครงการวิจัย

2. แบบสัมภาษณ์นี้มีจำนวนทั้งสิ้น จำนวน 8 หน้า แบ่งออกเป็น 3 ส่วน ดังนี้

ส่วนที่ 1 แบบทดสอบความรู้เกี่ยวกับสารพาราควอท จำนวน 15 ข้อ

ส่วนที่ 2 แบบทดสอบทัศนคติต่อการใช้สารพาราควอท จำนวน 15 ข้อ

ส่วนที่ 5 แบบทดสอบการปฏิบัติตนในการใช้สารพาราควอท จำนวน 20 ข้อ

รวมทั้งสิ้น จำนวน 73 ข้อ

หมายเลขรหัสผู้ให้สัมภาษณ์ | | | |

บ้านเลขที่…………… บ้าน……………...หมู่ที่…………….ตำบล น้ำตกอำเภอ นาน้อย จังหวัด น่าน

วัน/เดือน/ปีที่สัมภาษณ์……………...

ลายมือชื่อผู้ถูกสัมภาษณ์แสดงความยินดีและยินยอมในการให้ข้อมูล...

ส่วนที่ 1 แบบทดสอบความรู้เรื่องสารพาราควอท

คำชี้แจง จงวงกลมเลือกคำตอบที่ถูกต้องที่สุดเพียงหนึ่งข้อ

1.สารพาราควอทได้ถูกสังเคราะห์ขึ้นมาครั้งแรกเมื่อปีพุทธศักราชอะไร?

ก. ปี พ.ศ. 2425 ข. ปี พ.ศ. 2455

ค. ปี พ.ศ. 2505 ง. ปี พ.ศ. 2516

2.ประเทศและบริษัทอะไรได้นำสารพาราควอทมาใช้ในการเกษตรกรรมเป็นครั้งแรก? เมื่อปีพุทธศักราชอะไร?

ก. ประเทศเยอรมัน, บริษัทซินเจนต้า, ปี พ.ศ. 2505

ข. ประเทศอิตาลี, บริษัทไอซีไอ, ปี พ.ศ. 2515

ค. ประเทศอังกฤษ, บริษัทไอซีไอ, ปี พ.ศ. 2505

ง. ประเทศสหรัฐอเมริกา, บริษัทไอซีไอ, ปี พ.ศ. 2515

3.ชื่อทางการค้าของสารพาราควอทที่เป็นที่รู้จักกันดีโดยทั่วไป ชื่ออะไร?

ก. ไกลโฟเซส ข. กรัมม๊อกโซน

ค. ไอโซโพรพิลแอมโมเนียม ง. ดีดีที

4.ปัจจุบันมีจำนวนกี่ประเทศที่ได้ประกาศห้ามใช้สารพาราควอทโดยเด็ดขาด? และประเทศไหนเป็นประเทศล่าสุดที่มีการประกาศห้ามใช้โดยเด็ดขาด? เมื่อปีพุทธศักราชที่เท่าใด?

ก. 4 ประเทศ, สิงคโปร์, พ.ศ. 2548 ข. 5 ประเทศ, อินโดนีเซีย, พ.ศ. 2550

ค. 6 ประเทศ, สิงคโปร์, พ.ศ. 2551 ง. 7 ประเทศ, มาเลเซีย, พ.ศ. 2548

5.ข้อใดเป็นผลกระทบต่อสิ่งแวดล้อมจากพิษของสารพาราควอทที่ไม่ถูต้อง?

ก. สารพาราควอทสามารถปนเปื้อนและตกค้างในดินได้นาน

ข. สารพาราควอทสามารถสะสมในสัตว์

ค. สารพาราควอทไม่มีพิษต่อผึ้ง แต่มีพิษปานกลางต่อปลา

ง. สารพาราควอทมีพิษต่อการเจริญเติบโตของตัวอ่อนของกบ

6. สารพาราควอทออกฤทธิ์ต่อวัชพืชอย่างไร?

ก. พาราควอทออกฤทธิ์โดยการทำลายวัชพืชบริเวณที่ถูกสาร ซึ่งจะไปทำลายระบบการสังเคราะห์แสงของพืช

ข. พาราควอทออกฤทธิ์โดยการทำลายระบบดูดซึมของวัชพืช ทำให้เกิดการขาดน้ำ

ค. พาราควอทออกฤทธิ์โดยใช้หลักการเพิ่มอุณหภูมิ โดยทำให้วัชพืชมีอุณหภูมิสูงขึ้น

ง. พาราควอทออกฤทธิ์โดยการทำลายระบบการลำเลียงและขนส่งน้ำและอาหารของวัชพืช

7. สารพาราครอทสามารถผ่านเข้าสู่ร่างกายได้กี่ทาง? อะไรบ้าง?

ก. ทางปาก โดยการดื่ม กินสิ่งที่มีสารพาราควอทปนเปื้อนอยู่ และการดื่มสารพาราควอทโดยเจตนาเพื่อฆ่าตัวตาย

ข. ซึมผ่านทางผิวหนัง โดยเฉพาะผิวหนังที่มีบาดแผล

ค. ทางลมหายใจ โดยการหายใจเอาละอองของสารพาราควอทที่ปนเปื้อนในอากาศขณะการพ่นสารเคมี

ง. สามารถเข้าได้ทั้ง สามทาง ทั้งทางปาก ทางผิวหนัง และทางลมหายใจ

8. การเข้าสู่ร่างกายของสารพาราควอทจากการทำการเกษตรกรรม โดยส่วนมากมีโอกาสผ่านเข้าทางไหนมากที่สุด?

ก. ทางปาก ข. ทางผิวหนัง

ค. ทางลงหายใจ ง. ถูกทุกข้อ

9. อวัยวะใดของคนที่มักถูกทำลายโดยพิษของสารพาราควอทเป็นอวัยวะแรก ทั้งพิษแบบเฉียบพลันและพิษแบบเรื้อรัง?

ก. ปอด ข. ตับ

ค. ไต ง. ม้าม

10. การกระจายตัวของสารพาราควอทเข้าสู่อวัยวะต่างๆ ในร่างกาย อาศัยตัวกลางใด?

ก. น้ำดี ข. กระแสเลือด

ค. กรดในกระเพาะอาหาร ง. ฮอร์โมน

11. ข้อใดคือกล่าวถึงกลไกของการเกิดพิษของสารพาราควอทในร่างกายที่ถูกต้อง?

ก. ทำปฏิกิริยากับออกซิเจน เกิดอนุมูลอิสระ และจะออกฤทธิ์ไปทำลายผนังเซลล์ของอวัยวะต่าง ๆ ทั่วร่างกาย โดยเฉพาะปอด ทำให้เกิดพังพืดจนเกิดการล้มเหลวของปอด

ข. ทำปฏิกิริยากับคาร์บอนไดออกไซด์ เกิดการแตกตัวของเม็ดเลือดแดง

ค. ทำลายระบบต่อมหมวกไต ทำให้ไตวายได้

ง. ทำให้เกิดหัวใจล้มเหลวเกิดขึ้นได้ หากได้รับในปริมาณมากๆ

12. อาการของผู้ที่ได้รับพิษเรื้อรังจากการสัมผัสสารพาราควอทเป็นระยะเวลานาน คือ?

ก. แผลพุพอง ข. เล็บหลุด

ค. เลือดกำเดาไหลได้ ง. ถูกทุกข้อ

13. การเสียชีวิตของผู้ป่วยที่ได้พิษของสารพาราควอท มักจะเกิดขึ้นจากการได้รับสารผ่านเข้าสู่ร่างกายผ่านทางใดมากที่สุด?

ก. ทางปาก จากการดื่มกิน

ข. ทางผิวหนังจากการเกษตรกรรม

ค. ทางลมหายใจ จากการฉีดพ่น

ง. มีโอกาสเท่ากันทั้งสามทาง

14. สัญลักษณ์รูปภาพนี้บนฉลากผลิตภัณฑ์พาราควอท มีความหมายอย่างไร?

ก. ระวังอันตราย เนื่องจากเป็นวัตถุไวไฟ

ข. เก็บสารเคมีให้มิดชิด ใส่กุญแจ ห่างจากเด็ก

ค. ระวังอันตราย ห้ามรับประทาน

ง. สารอันตรายต่อคนและสัตว์ที่สัมผัส

15. ข้อใดเป็นทางเลือกที่ดีที่สุดในการหลีกเลี่ยงอันตรายจากสารพาราควอท?

ก. ไม่ใช้สารพาราควอทเลย โดยเปลี่ยนมาใช้วิธีป้องกันและกำจัดวัชพืชโดยวิธีธรรมชาติ

ข. ใช้สารพาราควอทเท่าที่จำเป็นเท่านั้น

ค. ใช้สารเคมีอื่นๆที่มีพิษน้อยกว่าสารพาราควอท

ง. ใช้สารพาราควอทอย่างระมัดระวัง โดยใช้เครื่องป้องกันตัวเองอย่างรัดกุม เช่น สวมหมวก แว่นตา ถุงมือ หน้ากาก รองเท้า เสื้อแขนยาว กางเกงขายาว ในขณะฉีดพ่น

ส่วนที่ 2 แบบวัดทัศนคติต่อการใช้และพิษภัยของสารพาราควอท

คำชี้แจง เลือกทำเครื่องหมาย / ในช่องที่ตรงตามทัศนคติของท่าน ในแต่ละข้อ

ข้อ	ข้อความ	ไม่เห็นด้วยอย่างยิ่ง 1	ไม่เห็นด้วย 2	ไม่แน่ใจ 3	เห็นด้วย 4	เห็นด้วยอย่างยิ่ง 5
4.1	ก่อนการตัดสินใจที่จะนำสารพาราควอทไปใช้ในการกำจัดวัชพืชในไร่ข้าวโพด เกษตรกรควรจะศึกษาประวัติและความเป็นมาของสารพาราควอทเสียก่อน					
4.2	การกำหนดให้มีชื่อสามัญของสารเคมีทางการเกษตร มีผลดีต่อการเลือกซื้อและเลือกใช้ของเกษตรกร					
4.3	สารพาราควอทมีประโยชน์ต่อการทำการเกษตรกรรมในแง่ของการประหยัดแรงงาน เวลา และต้นทุน ในการผลิต					
4.4	การใช้สารพาราควอทไม่มีผลลกระทบต่อสุขภาพของมนุษย์และสิ่งแวดล้อม					
4.5	ปัจจุบันได้มีการพัฒนาการรักษาผู้ป่วยที่ดื่มสารพาราควอทเข้าไปในปริมาณที่มาก ให้สามารถหายเป็นปกติได้แล้ว					
4.6	สารพาราควอทมีพิษไม่รุนแรง ดังนั้นเกษตรกรสามารถใช้ได้โดยไม่ต้องใช้ความระมัดระวัง และไม่ต้องปฏิบัติตามคำแนะนำอย่างเคร่งครัด					
4.7	พาราควอท เข้าสู่ร่างกายได้หลายทาง เช่น การดื่มกิน การหายใจละอองสารเข้าไป หรือทางผิวหนังและตา					
4.8	การผสมสารพาราควอทในปริมาณที่มากกว่าที่ระบุไว้ในฉลาก จะช่วยทำให้ประสิทธิภาพในการกำจัดวัชพืชดีกว่าการผสมสารในปริมาณที่ระบุไว้ในฉลาก					
4.9	การคำนึงถึงสภาวะอากาศในขณะฉีดพ่นสารพาราควอทในไร่ข้าวโพด เป็นข้อปฏิบัติที่ควรคำนึงถึงเป็นอย่างยิ่ง					
10	ควรอ่านฉลากและข้อควรปฏิบัติที่ข้างผลิตภัณฑ์ที่บรรจุสารพาราควอท ก่อนใช้และปฏิบัติตามคำแนะนำอย่างเคร่งครัด					
11	การผสมสารเคมีตัวอื่นร่วมกับสารพาราควอทหลายๆตัวจะทำให้ประสิทธิภาพของสารเคมีเพิ่มมากขึ้น					
12	น้ำที่ใช้ผสมสารพาราควอทสามารถใช้น้ำอะไรก็ได้ ไม่มีผลต่อประสิทธิภาพของสารเคมี					

ข้อ	ข้อความ	ไม่เห็นด้วยอย่างยิ่ง 1	ไม่เห็นด้วย 2	ไม่แน่ใจ 3	เห็นด้วย 4	เห็นด้วยอย่างยิ่ง 5
13	การสวมเครื่องมือป้องกันตัวในขณะใช้สารพาราควอทในทุกๆ ขั้นตอน จะช่วยให้เกษตรกรลดความเสี่ยงจากการสัมผัส และการเกิดพิษของสารพาราควอทได้					
14	ภายหลังจากการฉีดพ่นสารพาราควอท ต้องมีการติดป้ายหรือเครื่องหมายแสดงให้เห็นว่าเป็นแปลงที่ใช้สารเคมีกำจัดศัตรูพืช					
15	ภาชนะที่บรรจุสารเคมีที่ใช้หมดแล้วอย่าทิ้งไว้ต้องเผาหรือฝังทำลาย โดยในการฝังเกษตรกรอาจใช้ปูนขาว หรือถ่านใส่ด้วย เพื่อให้ดูดซับสภาพความเป็นพิษให้ลดน้อยลง					

ส่วนที่ 3 แบบทดสอบการปฏิบัติการใช้สารพาราควอท

คำชี้แจง เลือกทำเครื่องหมาย / ในช่องที่ตรงตามการปฏิบัติของท่านตามความเป็นจริงในการใช้สารพาราควอท

ข้อ	ข้อคำถาม	1 ทำเป็นประจำ	2 ทำเป็นบางครั้ง	3 ไม่ทำเลย
5.1	ผลิตภัณฑ์สารพาราควอทที่ซื้อผู้ผลิตได้ปิดฉลากไว้อย่างชัดเจน เกี่ยวกับชื่อทางการค้า ชื่อสามัญ ทะเบียนวตถุอันตราย วันที่ผลิต ชื่อสถานที่ผลิตและจำหน่าย ไม่ซื้อสารเคมีที่แบ่งขาย			
5.2	ก่อนซื้อสารพาราควอทจะต้องตรวจภาชนะบรรจุอย่างระมัดระวัง และผู้ซื้อไม่ควรรับสินค้าที่เสียหาย มีรอยแกะ ไม่มีฉลากปิด ฉลากภาษาต่างประเทศ ไม่มีชื่อผู้ผลิ ต และต้องพิจารณาจากแถบสีและสัญลักษณ์ รูปภาพประกอบที่ฉลากข้างภาชนะบรรจุสารเคมีด้วย			
5.3	อ่านฉลากคำแนะนำให้เข้าใจก่อนใช้ และปฏิบัติตามคำแนะนำในฉลากทุกขั้นตอนอย่างเคร่งครัด			
5.4	ขณะทำการขนส่งต้องไม่วางสารพาราควอทไว้ใกล้กับผู้โดยสาร สัตว์เลี้ยงหรืออาหาร และต้องไม่ให้สารเคมี รั่วไหลออกมาปนเปื้อนผู้โดยสาร สิ่งของเครื่องใช้ หรืออาหาร			
5	เก็บสารพาราควอทไว้ในที่มั่นคงแข็งแรง แยกออกจากอาคารอื่น เป็นเอกเทศ และต้องมีกุญแจล็อคห่างไกลจากเด็กและสัตว์เลี้ยง			

ข้อ	ข้อคำถาม	1 ทำเป็นประจำ	2 ทำเป็นบางครั้ง	3 ไม่ทำเลย
6	ควรสอบเครื่องมือและอุปกรณ์ฉีดพ่นสารพาราควอทให้อยู่ในสภาพดี ไม่รั่ว หรือชำรุด			
7	นำบุคคลที่ไม่เกี่ยวข้องและสัตว์เลี้ยงออกจากบริเวณที่จะพ่นสารพาราควอท			
8	ต้องใช้ชุดป้องกันอันตรายจากสารเคมี ใส่เสื้อแขนยาว กางเกงขายาว สวมหน้ากาก ใส่ถุงมือ ใส่รองเท้าบู๊ท หรือถ้าไม่สะดวกผู้ฉีดพ่นต้องหาทางใดๆก็ได้ที่หลีกเลี่ยงการสัมผัสสารเคมีให้ได้มากที่สุด			
9	สูดดมสารพาราควอทเพื่อตรวจเช็คดูว่าเป็นของจริงหรือของปลอม			
10	ห้ามใช้มือผสมสารพาราควอทโดยเด็ดขาด			
11	ผสมสารพาราควอทร่วมกับสารเคมีอื่นๆ หลายๆชนิดเข้าด้วยกันเพื่อเพิ่มประสิทธิภาพในการกำจัดศัตรูพืช			
12	ขณะผสมสารพาราควอทต้องเตรียมน้ำสะอาดไว้ใกล้ๆตัว เพราะหากเกิดอุบัติเหตุสารเคมีกระเซ็นเข้าตาจะช่วยให้สามารถใช้น้ำดังกล่าวทำความสะอาดได้ทันที			
13	อย่าสูบบุหรี่ กินอาหาร หรือดื่มน้ำระหว่างผสม หรือพ่นสารพาราควอท			
14	พ่นสารเคมีกำจัดศัตรูพืช ขณะลมแรง เพราะจะช่วยให้ฝอยละอองของสารกระจายครอบคลุมพื้นที่ได้รวดเร็วและทั่วถึงได้เร็วขึ้น			
15	ขณะฉีดพ่นสารพาราควอท ผู้พ่นต้องอยู่เหนือลมเสมอ			
16	ควรฉีดพ่นสารพาราควอทในขณะที่ลมสงบ หรือลมพัดในทิศทางเดียวกันอย่างสม่ำเสมอ หรือพ่นในเวลาเช้าและเย็นเท่านั้น			
17	ล้างภาชนะบรรจุสารพาราควอท และอุปกรณ์ที่ใช้ในการฉีดพ่นลงในแหล่งน้ำธรรมชาติในบริเวณใกล้เคียง			
18	สารพาราควอทที่ผสมแล้ว และเหลือจากการฉีดพ่น ควรทิ้งในที่ๆจัดเตรียมไว้เพื่อการทิ้งโดยเฉพาะ			
19	ต้องอาบน้ำชำระร่างกาย และซักทำความสะอาดชุดที่ใส่ฉีดพ่นสารเพาราควอททันทีภายหลังการฉีดพ่น			
20	ภายหลังจากการฉีดพ่นสารเคมีแล้ว ต้องมีการติดป้ายหรือเครื่องหมายแสดงให้เห็นว่าเป็นแปลงที่ใช้สารพาราควอท			

Appendix D

Appendix D. Guideline for focus group discussion for Maize farmers

Introduction

- Introducing facilitator and describing the reason and objective for the discussion group
- Letting them introduce themselves and breaking the ice before the discussion

1. The reason why use paraquat in maize fields.
   - Asking their individual why use paraquat in maize growing fields within group
   - Asking their alternative way if not use paraquat within group
   - Discussion about the problem of paraquat use in maize fields within group
2. Awareness of adverse health effect of paraquat exposure
   - Asking their individual adverse health effect of paraquat exposure and sharing within group
   - Asking their health problem solving and discussing within the group
   - Discussion about the health consequence of paraquat exposure in their opinion
3. Paraquat application in real situation (How, why)
   - Asking how their applied paraquat in real situation and sharing within group
   - Asking why choose and discussing within the group
   - Discussion about the problem when applied paraquat in their experience
4. Experience of Personal Protective Equipment(PPE) (How, why)
   - Asking their Experience of Personal Protective Equipment (PPE) and sharing within group
   - Discussion about the problem when applied paraquat in their experience

Appendix E

Appendix E. Guideline for In-depth interview for Maize farmers

Introduction

- Introducing interviewer and give some information about the project
- Telling the scope of interview briefly
- Letting them ask some question (if any)

Warm up

- Interview some personal data of them which is related to their behavior of maize activities. (recent cost, family, price, chemical use)

Practice of pesticide use

- Interview their paraquat exposure situation
- Interview their concern and awareness of consequence of paraquat exposure
- Interview their practice when applied pesticide (how,why)
- Interview their opinion about our project and also ask for some comments or advise to improve the suitable intervention program in their area
- Inteview their need or what they want to see after finished the project

Comment

- Opened for discussing

Close interviews

Appendix F

<u>Appendix F. Guideline for participatory observation for Maize farmers when they will apply paraquat</u>

Direction: checklist the following item and taking note for more described detail:

1. Surrounding observation, before preparing
    - Real situation of household
    - Real situation of maize field
    - Place Storage of paraquat product
    - Other person related
2. Preparing (Mixing, loading)
    - Before mixing "Are they read label?"
    - How they mix?
    - How they load?
    - How they protect theirself?
3. Spraying
    - How they spray?
    - How they protect theirself?
    - What equipment do they use to protect?
    - Do they correct apply?
    - What is the problem when they spray?
4. After spraying
    - What are they doing first and after?
    - How they clean and clear their equipment?
    - Resting, Eating, drinking

Appendix G

Appendix G. Self report of Personal Protective Equipment (PPE) (a)

Code of participant

No. of household………………....No. of village …………..Sub-istrict…………………

Age………………………Gender…………………………..

Instruction:

Please check / into table for selecting the protective equipment when you applied herbicide.

The self report (Before and after intervention)

Protective equipment (PPE)	Recently used(last year)					
	Mixing		Loading		Spraying	
	Yes	No	Yes	No	Yes	No
1. Hat						
2. Scarf						
3.Goggle						
4.Glove						
5. Long-sleeved Shirt						
6. Long Pants						
7. Socks						
8. Boot						

Appendix H

Appendix H. วิธีเก็บและส่งตัวอย่างน้ำเหลือง เพื่อการตรวจวิเคราะห์สารพาราควอท

อุปกรณ์และน้ำยาที่ใช้

1. ใบส่งตัวอย่างทางชีวภาพ

2. แอลกอฮอล์ 70% (ยกเว้นกรณีที่ต้องการตรวจ แอลกอฮอล์และสารกลุ่มแอลกอฮอล์และสารกลุ่ม แอลกอฮอล์ในเลือด)

3. ผ้าก๊อซ หรือ สำลีที่สะอาด

4. ถุงมือ

5. สายยางรัดแขน

6. ชุดเจาะเลือดมีเข็มสองปลายพร้อม

7. Vacuum tube ชนิดพลาสติก

7.1 ชนิดฝาจุกสีเขียว (เคลือบ heparin) หรือฝาจุกสีม่วง (เคลือบ EDTA) ใช้สำหรับเก็บตัวอย่างเลือด (whole blood) สำหรับการส่งวิเคราะห์ Organic solvent , โลหะหนัก, สารแปรรูป, Pesticide และเอ็นไซม์

7.2 ชนิดฝาจุกสีแดง (ไม่มีสารกันเลือดแข็ง) ใช้สำหรับเก็บตัวอย่างน้ำเหลือง (Serum) สำหรับการตรวจวิเคราะห์โลหะหนัก และเอ็นไซม์

8. ตะแกรงใส่หลอด Vacuum tube (rack)

9. ปากกาสีแบบคงทน (Permanent pen)

10. กระติกน้ำแข็ง

11. ถุงน้ำแข็ง (ice pack)

วิธีเตรียมกลุ่มเป้าหมาย

1. ให้คนงานล้างแขนและมือทั้งสองข้างด้วยสบู่ ล้างด้วยน้ำประปาที่สะอาด แล้วตามด้วยน้ำกลั่น (ถ้ามี)

2. ปล่อยแขนและมือให้แห้งเองระวังไม่ให้มีการปนเปื้อน

วิธีการเจาะเลือด

1. ใช้สายยางรัดเหนือตำแหน่งที่จะเจาะหลายๆนิ้วเช็ดทำความสะอาดบริเวณที่จะเจาะเลือดด้วยแอลกอฮอล์ให้สะอาด รอจนแอลกอฮอล์ระเหยแห้งจนหมด

2. เจาะเลือดตรวจเส้นเลือดดำด้วย vacuum tuber โดยหมุดเกลียวเข็มให้เข้ากับ holder (เป็นพลาสติกคล้าย Syringe ที่ดึงเอา plunger ออก) โดยเข็มนี้จะเป็น 2 ปลาย ปลายด้านหนึ่งใช้เจาะเข้าเส้นเลือดดำ อีกด้านหนึ่งหุ้มไว้ด้วยยาง เมื่อต่อเข็มเข้า holder และปลายด้านนั้นอยู่ holder เมื่อแทงเข็มเข้าเส้นเลือดแล้วจึงใส่หลอด สุญญากาศ เลือดคนงานจะไหลเข้าสู่หลอดสุญญากาศ เมื่อหมดสุญญากาศเลือดจะหยุดไหล จากนั้นจึงดึงเอาหลอดเลือดออกพร้อมถอดเข็มออกจากแขน

3. *ถ้าใช้ Vacuum tube ฝาจุกสีเขียว หรือฝาจุกสีม่วง* ใช้พลิกหลอดเลือดกลับไป-มา เบาๆ อย่างน้อย 10 ครั้ง เพื่อให้เลือดผสมกับสารกันเลือดแข็งได้ดีที่สุด *ถ้าใช้ Vacuum tube ฝาจุกสีแดง* ให้นำหลอดเลือด วางตั้งทิ้งไว้ในตระแกรง (rack) เฉย ๆ เพื่อให้น้ำเหลืองแยกชั้นออกจากเม็ดเลือดแดง

4. เขียนหมายเลขกำกับบนหลอดเลือด พร้อมบันทึกรายละเอียดลงในใบส่งตัวอย่างทางชีวภาพ

วิธีการนำส่ง

1. เรียงหลอด Vacuum tube ในตะแกรงตามลำดับหมายเลขที่บันทึกในใบส่งตัวอย่างทางชีวภาพ

2. ในกรณีที่ไม่มีตะกรงใส่หลอดเลือด อาจใช้วิธีการมัดหลอดเลือดมัดละ 10 หลอด ด้วยหนังยาง โดยเรียงหมายเลข 1-10 เป็นมัดที่ 1, หมายเลข 11-20 เป็นมัดที่ 2 ทำอย่างนี้ไปเรื่อยๆ จนหมด

3. นำตะแกรงเลือดใส่กระติกน้ำแข็งพร้อม ice pack ส่งห้องปฏิบัติการทันที

4. ในกรณีที่ ส่งตัวอย่างเลือดไม่ทันในวันนั้น

4.1 สำหรับตัวอย่างที่ส่งตรวจวิเคราะห์ Organic Solvent , สารแปรรูป และ Pesticide ให้แช่ตัวอย่าง ในตู้เย็น –20 C หรือ ช่องน้ำแข็ง แล้วนำส่งในวันรุ่งขึ้น โดยแช่เย็นขณะนำส่ง

4.2 สำหรับตัวอย่างที่ส่งตรวจวิเคราะห์ โลหะหนัก และเอ็นไซม์ ให้แช่ตัวอย่าง ในตู้เย็น –4 C หรือ ช่องธรรมดา และนำส่งในวันรุ่งขึ้น โดยแช่เย็นขณะนำส่ง

Appendix I

Appendix I. Informed Consent Form A (English version)

Address ……………………

Date ………………………

Code number of participant …………………………………………………

I who have signed here below agree to participate in this research project

Title: Risk Reduction of Paraquat Exposure through Risk communication Model in Maize Farmers at Namtok Subdistrict, Na Noi District, Nan Province, Thailand

Principle researcher's name: Mr. Denpong Wongwichit

Contact address: The college of public health sciences, Chulalongkorn University, 10th fl., Institute Building 3, Soi Chulalongkorn 62 Phyathai Rd., Bangkok 10330, Thailand

Address of home: 67 Moo 7 Nanoi sub-district, Nanoi district, Nan Province 55150, Thailand

Tel. of workplace 0-5478-9299 **Tel. of home** 0-5478-9299

Tel. of mobile 085-7101981 **E-mail address:**pupra2002@hotmail.com

I have been informed about rationale and objective(s) of the project, what I will be engaged with the details risk/harm and benefit of this project. The researcher has explained to me and I clearly understand with satisfaction.

I willingly agree to participate in this project and I have the right to withdraw from this research project at any time according to my will with no need to give reason. This withdrawal will not negative impact upon me.

Researcher has guaranteed that procedure(s) acted upon me would be exactly the same as indicated in the information. Any of my personal information will be **kept confidential.** Results of the study will be reported as total picture. Any of personal information which could be able to identify me will not appear in the report

I willingly agree to participate in this project and consent the researcher to collect blood and urine. Two times of 10 ml of blood (2 teaspoons) and 30 ml of urine (6 teaspoons) will be taken for paraquat residual analysis.

If I am not treated as indicated in the information sheet, I can report to the Ethical Review Committee for Research Involving Human Research Subjects, Health Sciences Group, Chulalongkorn University (ECCU). Institute Building 2, 4 Floor, Soi Chulalongkorn 62, Phyat hai Rd., Bangkok 10330, Thailand, Tel: 0-2218-8147 Fax: 0-2218-8147 E-mail: eccu@chula.ac.th,

I also have received a copy of information sheet and informed consent form

……………………………………. **………………………**

Place/date ( )

Name of research subject

……………………………………. ………………………

Place/date (Mr. Denpong Wongwichit)

Name of research subject

……………………………………. …………………………

Place/date ( )

Name of research subject

Appendix J

Appendix J. หนังสือแสดงความยินยอมเข้าร่วมการวิจัย (Thai version)

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

ทำที่...

วันที่............เดือน....................พ.ศ. ....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย…...............……

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วม โครงการวิจัย

ชื่อโครงการวิจัย: การลดความเสี่ยงจากการสัมผัสสารพาราควอทของเกษตรกรชาวไร่ข้าวโพด โดยใช้รูปแบบการสื่อสารความเสี่ยง ณ ตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน ประเทศไทย

ชื่อผู้วิจัย นายเด่นพงษ์ วงศ์วิจิตร นิสิตปริญญาเอก วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์ มหาวิทยาลัย

ที่อยู่ที่ติดต่อที่ทำงาน: วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย ชั้น 10 อาคารสถาบัน 3 ซ. จุฬาฯ 62 ถ.พญาไท แขวงวังใหม่ เขตปทุมวัน กทม. 10330

ที่อยู่ที่ติดต่อที่บ้าน: 67 หมู่ที่ 7 บ้านนาหล่าย ตำบลนาน้อย อำเภอนาน้อย จังหวัดน่าน

โทรศัพท์ (ที่ทำงาน) 0-5478-9109 **โทรศัพท์ที่บ้าน** 0-54780-9299

โทรศัพท์มือถือ 085-7101981 **E-mail address:** pupra2002@hotmail.com

ข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมในโครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย โดยข้าพเจ้ามีสิทธิถอนตัวออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

ข้าพเจ้ายินดีเข้าร่วมการวิจัยครั้งนี้ ภายใต้เงื่อนไขที่ระบุไว้ในเอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย และยินยอมให้เก็บตัวอย่างเลือด จำนวน 10 มิลลิลิตร หรือ จำนวน 2 ช้อนชา, และปัสสาวะจำนวน 30 มิลลิลิตร หรือ 6 ช้อนชา เพื่อเอาไว้ใช้ในการศึกษาวิจัยต่อไปเกี่ยวกับการตรวจหาปริมาณการตกค้างของสารพาราควอทในซีรั่มและปัสสาวะ

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ชั้น 4 อาคารสถาบัน 2 ซอยจุฬาลงกรณ์ 62 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330

โทรศัพท์ 0-2218-8147 โทรสาร 0-2218-8147 E-mail: eccu@chula.ac.th

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ.. ลงชื่อ..

(..) (..)

ผู้วิจัยหลัก ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ..

(..)

พยาน

Appendix K

<u>Appendix K. รายละเอียดโปรแกรมและกระบวนในการประชุมเชิงปฏิบัติการ</u>

กำหนดการการประชุมเชิงปฏิบัติการในงานวิจัยเรื่องการลดความเสี่ยงจากการสัมผัสสารพาราควอท โดยรูปแบบการสื่อสารความเสี่ยง ในเกษตรกรชาวไร่ข้าวโพดตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน	
เวลา/วันที่	**วันที่ เดือน พ.ศ. 2553**
08.00-08.30	ลงทะเบียน
08.30-08.45	พิธีเปิดโดยสาธารณสุขอำเภอนาน้อย
08.45-09.00	นายก อบต.น้ำตก พบปะเกษตรกรชาวไร่ข้าวโพดกลุ่มเป้าหมาย
09.00-09.15	ละลายพฤติกรรม โดยทีมวิทยากรกลุ่มสัมพันธ์
09.15-09.45	ทำแบบทดสอบก่อนอบรมเรื่องสารพาราควอท
09.45-10.15	ชี้แจงงานวัตถุประสงค์การวิจัย และรายละเอียดของกิจกรรมในงานวิจัย โดยคุณเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ
10.15-10.25	พักรับประทานอาหารว่าง
10.25-11.30	Fogus group discussion แบ่ง 6 กลุ่ม ตามแนวประเด็นคำถาม
11.30-12.00	รับชมวีดีโอเรื่อง "สารเคมีภัยเงียบ"
12.00-13.00	พักรับประทานอาหารกลางวัน
13.00-14.00	พิษวิทยาของสารพาราควอทและผลกระทบต่อสุขภาพ โดยนายสำราญ ดีอาษา เภสัชกรชำนาญการ สำนักงานสาธารณสุขจังหวัดน่าน
14.00-14.20	สันทนาการ โดยวิทยากรกลุ่มสัมพันธ์
14.20-15.30	ผลกระทบของสารพาราควอทต่อสิ่งแวดล้อม โดย นายมานิตย์ ธนะวงศ์ นักวิชาการสิ่งแวดล้อมชำนาญการ สิ่งแวดล้อมสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม จังหวัดน่าน
15.30-15.40	พักรับประทานอาหารว่าง
15.40-16.30	งานอาชีวอนามัยกับเกษตรกรชาวไร่ข้าวโพด โดย อาจารย์วันเพ็ญ ทรงคำ คณะพยาบาลศาสตร์ มหาวิทยาลัยเชียงใหม่

กำหนดการการประชุมเชิงปฏิบัติการในงานวิจัยเรื่องการลดความเสี่ยงจากการสัมผัสสารพาราควอท

โดยรูปแบบการสื่อสารความเสี่ยง ในเกษตรกรชาวไร่ข้าวโพดตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน

เวลา/วันที่	**วันที่ เดือน พ.ศ. 2553**
16.30-17.00	ซักถามปัญหา
08.30-09.00	ลงทะเบียน,สันทนาการ โดยวิทยากรกลุ่มสัมพันธ์
09.00-10.30	หลักการประเมินความเสี่ยงจากการสัมผัสสารพาราควอท
	โดย อาจารย์ดอกเตอร์วัฒน์สิทธิ์ ศิริวงศ์ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย
10.30-10.45	สันทนาการ โดยวิทยากรกลุ่มสัมพันธ์
10.45-12.00	แนวทางการวินิจฉัย การปฐมพยาบาล และการดูแลรักษา ผู้ป่วยที่ได้รับพิษจากสารพาราครอท
	โดยแพทย์หญิงพนิดา ยงสกุล โรจน์ นายแพทย์ประจำโรงพยาบาลชุมชนอำเภอนาน้อย จังหวัดน่าน
12.00-13.00	พักรับประทานอาหารกลางวัน
13.00-13.15	สันทนาการ โดยวิทยากรกลุ่มสัมพันธ์
13.15-14.30	ข้อปฏิบัติในการใช้สารพาราควอทอย่างถูกต้องและปลอดภัย
	โดย นายเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ
14.30-14.45	พักรับประทานอาหารว่าง
14.45-16.00	หลักในการใช้อุปกรณ์ในการป้องกันตัว และการสาธิตวิธีการใช้ที่ถูกต้องและปลอดภัย
	ชี้แจงการประเมินผลงานวิจัย
	วิธีการปฏิบัติการตรวจสอบความเป็นพิษในร่างกายด้วยตนเอง
	การประเมินตนเองของเกษตรกรจากการใช้เครื่องป้องกันตัว
	การประเมินผลการประชุมเชิงปฏิบัติการ
	โดยนายเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ
16.00-16.30	ซักถามปัญหา ปิดการอบรม

Appendix L

Appendix L ประเด็น วัตถุประสงค์ วิทยากร และสื่อ ในการบรรยายที่ใช้ในการประชุมเชิงปฏิบัติการ

1. การสนทนากลุ่มในเกษตรกรชาวไร่ข้าวโพด

วัตถุประสงค์ของการทำวิจัยแบบสนทนากลุ่ม (Focus group discussions)

เพื่อศึกษาความคิดเห็น ทัศนคติ ความรู้สึก การรับรู้ ความเชื่อ และพฤติกรรมในการใช้สารพาราควอทในการทำไร่ข้าวโพดจากกลุ่มเกษตรกรชาวไร่ข้าวโพด

ประชากรกลุ่มเป้าหมาย

เกษตรกรชาวไร่ข้าวโพด ในตำบลน้ำตก ที่ได้รับการคัดเลือกเป็นผู้มีส่วนร่วมในการวิจัย จำนวน 62 คน เป็นผู้ชาย 48 คน ผู้หญิง 14 คน โดยจะทำการแบ่งกลุ่มเป็น 6 กลุ่มๆละ 10-11 คน

ผู้ดำเนินการสนทนากลุ่ม

กลุ่มที่ 1 นายเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ สำนักงานสาธารณสุขอำเภอนาน้อย จังหวัดน่าน

กลุ่มที่ 2 นางศิริลักษณ์ คำชมพู พยาบาลวิชาชีพชำนาญการ กลุ่มงานเวชปฏิบัติครอบครัวและชุมชน โรงพยาบาลชุมชนอำเภอนาน้อย จังหวัดน่าน

กลุ่มที่ 3 นางอภิญญา น้ำผึ้ง พยาบาลวิชาชีพชำนาญการ สถานีอนามัยตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน

กลุ่มที่ 4 นางพิชญา รินทา พยาบาลวิชาชีพชำนาญการ กลุ่มการพยาบาลโรงพยาบาลชุมชนอำเภอ นาน้อย จังหวัดน่าน

กลุ่มที่ 5 นายณรงค์ ถาต๊ะวงศ์ หัวหน้าสถานีอนามัยตำบลน้ำตก อำเภอนาน้อย จังหวัดน่าน

กลุ่มที่ 6 นางวนิดา วงศ์วิจิตร พยาบาลวิชาชีพชำนาญการ กลุ่มการพยาบาล โรงพยาบาลชุมชนอำเภอนาน้อย จังหวัดน่าน

ผู้บันทึกเสียงและภาพเคลื่อนไหวและภาพนิ่ง

นายวิชานุสรณ์ ปันนิตามัย เจ้าหน้าที่เวชสถิตปฏิบัติการ

นายอภิเดช เหงาจุ๊ นายช่างเทคนิค โรงพยาบาลชุมชนอำเภอนาน้อย จังหวัดน่าน

ช่วงแนะนำตัว

1. ผู้ดำเนินการสนทนากลุ่ม (Moderator)ทำการแนะนำตัวเอง และ ทำการอธิบายเหตุผลและวัตถุประสงค์ของการดำเนินการสนทนากลุ่มในครั้งนี้
2. ผู้ดำเนินการสนทนากลุ่มเชิญให้สมาชิกในกลุ่มทุกคนแนะนำตัวเอง เพื่อสร้างความคุ้นเคยและสร้างบรรยากาศที่เป็นมิตร

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แนวคำถาม (Guidelines)

ประเด็นที่ศึกษา	คำถาม/(ประเด็นซักต่อเนื่อง)
1. ประวัติของการทำไร่ข้าวโพด	1. ท่านทำไร่ข้าวโพดมานานเท่าไร เพราะเหตุใดจึงต้องทำไร่ข้าวโพด(มีการปลูกพืชชนิดอื่น) 2. ในอดีตใช้วิธีการใดในการกำจัดศัตรูพืชในไร่ข้าวโพด(ใช้มานานกี่ปี ทำไมเลิกใช้)
2.ประวัติการใช้สารพาราควอทในการทำไร่ข้าวโพด	1. เพราะเหตุผลใดจึงมีการนำเอาสารพาราควอทมาใช้ในการทำไร่ข้าวโพด (มีข้อดีกว่าวิธีอื่นอย่างไร และมีข้อเสียอย่างไร) 2. มีวิธีการอื่นอีกหรือไม่ ที่สามารถใช้ในการป้องกันและกำจัดศัตรูพืช(มีข้อดี ข้อเสียอย่างไร และเพราะอะไร)
3. ผลกระทบที่เกิดจากการใช้สารพาราควอทในการทำไร่ข้าโพดต่อมนุษย์	1.ท่านเคยมีอาการผิดปกติหลังการฉีดพ่นสารพาราควอท หรือในรอบหลายปีที่ผ่านมาหรือไม่ (เมื่อไร มีอาการอย่างไร) 2. พาราควอทสามารถส่งผลกระทบต่อมนุษย์ได้อย่างไรบ้าง (บอกอาการ) 3. สารพาราควอทสามารถผ่านเข้าสู่ร่างกายได้กี่ทาง (ทางไหนบ้าง อย่างไรบ้าง) 4. ประชากรกลุ่มไหนบ้างที่ได้รับผลกระทบจากการสัมผัสสารพาราควอท ต่อสิ่งแวดล้อม 4. สารพาราควอทส่งผลกระทบต่อสิ่งแวดล้อมได้อย่างไร(ผ่านทางใดบ้าง โดยวิธีใด)
4. ทักษะความปลอดภัยในการใช้สารพาราควอท - การฝึกอบรม - ช่องทางที่ได้รับการสื่อสาร	1. ท่านเคยได้รับการฝึกอบรมในการใช้สารพาราควอทในไร่ข้าวโพดหรือไม่ (ที่ไหน เมื่อไร โดยใคร) 2. การรับรู้ ข้อมูล ข่าวสาร เกี่ยวกับการใช้สารพาราควอทอย่างปลอดภัยและมีประสิทธิภาพ ท่าได้รับรู้จากทางไหน
5. การใช้เครื่องป้องกันตัวเองในขณะที่ใช้สารพาราควอท	1. เครื่องมือที่ใช้เป็นประจำ (ใช้อะไรบ้าง เพราะเหตุใดจึงเลือกใช้อุปกรณ์ชิ้นนั้น) 2. ปัญหาและอุปสรรคในการใช้เครื่องป้องกันตัว 3. การใช้เครื่องมือป้องกันตัวจะสามารถความเสี่ยงจากพิษของสารพาราควอทได้ อย่างไร

*** ควรใช้เวลาในแต่ละประเด็น ไม่เกิน 15 นาที ***

2. การชมวีดีทัศน์เรื่อง “สารเคมีภัยเงียบ”

วัตถุประสงค์

1. เพื่อสื่อสารให้เกษตรกรได้รับชม รับรู้ และเรียนรู้ถึงความเสี่ยงและพิษภัยของการใช้สารกำจัดศัตรูพืชในการเกษตรกรรม จากเหตุการณ์จริงที่เกิดขึ้น
2. เพื่อสร้างความตระหนักต่อความเสี่ยงและพิษภัยของสารกำจัดศัตรูพืช และกระตุ้นให้มีการใช้เครื่องป้องกันตัวจากการใช้สารกำจัดศัตรูพืชอย่างถูกต้องและปลอดภัย

สื่อประกอบ

วีดิทัศน์เรื่อง “สารเคมีภัยเงียบ” ความยาวประมาณ 18 นาที โดยมีเนื้อหาครอบคลุมถึง สาเหตุและความจำเป็นในการใช้สารกำจัดศัตรูพืช สถานการณ์ในการใช้ภายในประเทศไทย และกรณีตัวอย่างของผลกระทบต่อคน สัตว์ และสิ่งแวดล้อม ของสารเอนโดซัลแฟนในไร่ปลูกเม็ดมะม่วงหินมะพาน ที่ประเทศอินเดีย

3. การบรรยายเรื่อง พิษวิทยาของสารพาราควอท และผลกระทบต่อสุขภาพต่อมนุษย์

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้ เละความเข้าใจในพิษภัยของสารพาราควอทที่มีต่อมนุษย์ โดยเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้ ประวัติความเป็นมาของของสารพาราควอท, กลไกและกระบวนการเกิดพิษในมนุษย์ พิษในระยะสั้นและระยะยาว และข้อมูลอื่นๆที่ผลกระทบต่อมนุษย์ โดยเวลาที่ใช้ในการบรรยาย ประมาณ 1 ชั่วโมงครึ่ง

วัตถุประสงค์

เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดมีความรู้ ความเข้าใจ ในหลักการทางพิษวิทยาของสารพาราควอทที่มีต่อมนุษย์

วิทยากร

นายสำราญ ดีอาสา เภสัชกรชำนาญการ กลุ่มงานคุ้มครองผู้บริโภค สำนักงานสาธารณสุขจังหวัดน่าน

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

4. การบรรยายเรื่อง ผลกระทบของการใช้สารพาราควอท ต่อสิ่งแวดล้อม

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้ เละความเข้าใจ ผลกระทบของสารพาราควอทต่อสิ่งแวดล้อม โดยเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้ ผลกระทบที่เกิดจากสารพาราควอทต่อสิ่งแวดล้อม เช่น ในน้ำ อากาศ ดิน และสัตว์ทดลองต่างๆ การตกค้างของสารเคมีในนสิ่งแวดล้อมสามารถตกค้างได้นานเท่าไร การสลายตัวของสารเคมีทำได้โดยวิธีใด โดยเวลาที่ใช้ในการบรรยาย ประมาณ 1 ชั่วโมงครึ่ง

วัตถุประสงค์

เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดมีความรู้เรื่องผลกระทบของสารพาราควอทต่อสิ่งแวดล้อม

วิทยากร

นายมานิตย์ ธนะวงศ์ นักวิชาการสิ่งแวดล้อมชำนาญการ สำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อมจังหวัดน่าน

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

5. การบรรยายเรื่อง งานอาชีวอนามัยกับเกษตรกรชาวไร่ข้าวโพด

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้เละความเข้าใจ ในเรื่องงานอาชีวะ อนามัยกับเกษตรกรชาวไร่ข้าวโพด โดยเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้ สถานการณ์ของงานอาชีวอนามัยในงานเกษตรกรรม สถิติ ชนิด ประเภท การเฝ้าระวังและป้องกัน การเกิดอุบัติเหตุในขณะทำการเกษตรกรรม การประยุกต์หลักการทางอาชีวอนามัยกับเกษตรกรชาวไร่ข้าวโพด และการปรับปรุงสภาพความเป็นอยู่ และสภาพการทำงานของเกษตรกรชาวไร่ข้าวโพด โดยเวลาที่ใช้ในการบรรยาย ประมาณ 1 ชั่วโมงครึ่ง

วัตถุประสงค์

1.เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดมีความรู้ความเข้าใจในหลักการของงานอาชีวะ อนามัยในการเกษตรกรรม

2.เพื่อให้เกษตรกรชาวไร่ข้าวโพดสามารถประยุกต์ใช้หลักการปรับปรุงสภาพความเป็นอยู่ และสภาพการทำงานของเกษตรกรในชีวิตประจำได้

วิทยากร

นางสาววันเพ็ญ ทรงคำ อาจารย์ประจำคณะพยาบาลศาสตร์ มหาวิทยาลัยเชียงใหม่

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

6. การบรรยายเรื่อง หลักการประเมินความเสี่ยงจากการสัมผัสสารพาราควอท

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้เละความเข้าใจ ในหลักการประเมินความเสี่ยงจากการสัมผัสสารพาราควอท โดยเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้ การประเมินความเสี่ยงต่อการสัมผัสสารพาราควอท ขั้นตอนการประเมินความเสี่ยง โดยเน้นไปในกรณี การประเมินการสัมผัสสารพาราควอทในการฉีดพ่นในไร่ข้าวโพด โดยเวลาที่ใช้ในการบรรยาย ประมาณ 1 ชั่วโมงครึ่ง

วัตถุประสงค์

1.เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดมีความรู้ความเข้าใจในหลักการประเมินความเสี่ยงจากการสัมผัสสารพาราควอทที่เกิดจากการฉีดพ่นในไร่ข้าวโพด

วิทยากร

อาจารย์ ดร.วัฒน์สิทธิ์ ศิริวงศ์ ผู้ช่วยคณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

7. การบรรยายเรื่อง แนวทางการวินิจฉัย การปฐมพยาบาล และการดูแลรักษาภาวะเป็นพิษจากพาราควอท

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้เละความเข้าใจ ในแนวทางการวินิจฉัย การปฐมพยาบาล และการดูแลรักษาภาวะเป็นพิษจากพาราควอท โดยเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้ การรักษาภาวะเป็นพิษจากการกินพาราควอท การปฐมพยาบาลเบื้องต้น โดยเวลาที่ใช้ในการบรรยาย ประมาณ 1 ชั่วโมงครึ่ง

วัตถุประสงค์

1.เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดมีความรู้ความเข้าใจในการการปฐมพยาบาลเบื้องต้นจากภาวะเป็นพิษจากพาราควอทได้ในชีวิตจริง

วิทยากร

แพทย์หญิงพนิดา ยงสกุลโรจน์ นายแพทย์ประจำโรงพยาบาลชุมชนอำเภอนาน้อย จังหวัดน่าน

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

8. การบรรยายเรื่อง ข้อปฏิบัติในการใช้สารพาราควอทอย่างถูกต้องและปลอดภัย

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้เละความเข้าใจ ในข้อปฏิบัติในการใช้สารพาราควอทอย่างถูกต้องและปลอดภัย โดยเวลาที่ใช้ในการบรรยาย ประมาณ 2 ชั่วโมง และมีเนื้อหาครอบคลุมในประเด็นต่างๆ ดังนี้

1. การเลือกซื้อ การขนส่ง สารกำจัดศัตรูพืช
2. การเก็บสารกำจัดศัตรูพืช
3. สัญลักษณ์รูปภาพ
4. การใช้อุปกรณ์ป้องกันสารกำจัดศัตรูพืช
5. การทำงานของเครื่องพ่นสารกำจัดศัตรูพืช
6. การใช้เครื่องพ่นอย่างปลอดภัย
7. การป้องกันการรั่วซึม
8. การดูแลรักษาเครื่องพ่น
9. ปัญหาทั่วไปของถังพ่นสารและวิธีการแก้ไข
10. การล้างภาชนะบรรจุสารกำจัดศัตรูพืช
11. การทำลายภาชนะบรรจุสารำจัดศัตรูพืช

วัตถุประสงค์

1.เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพดในการใช้สารพาราควอทที่ถูกต้องและปลอดภัยและสามารถนำไปปฏิบัติได้จริง

วิทยากร

นายเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ สำนักงานสาธารณสุข อำเภอนาน้อย จังหวัดน่าน (ผู้วิจัย)

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

9. การบรรยายเรื่อง หลักในการใช้อุปกรณ์ในการป้องกันตัว และการสาธิตวิธีการใช้ที่ถูกต้องและปลอดภัย และ ชี้แจงการประเมินผลงานวิจัย

เป็นการบรรยายเพื่อสื่อสารให้กลุ่มเป้าหมายได้มีความรู้เละความเข้าใจ หลักในการใช้อุปกรณ์ในการป้องกันตัวเมื่อมีการใช้สารพาราควอท โดยทำการสาธิตตัวอย่างจากเกษตรกรอาสาสมัคร และนำเสนอข้อมูลจากงานวิจัยอื่นๆ เป็นกรณีตัวอย่าง เพื่อสร้างแรงจูงใจในการใช้อุปกรณ์ นอกจากนั้นยังเป็นการชี้แจงการกรอกแบบฟอร์มการประเมินตัวเองต่อการใช้เครื่องมือป้องกันตัวเอง และ การชี้แจงแบบประเมินการเฝ้าระวังสุขภาพด้วยตนเองของเกษตรกรจากพิษสารเคมีกำจัดศัตรูพืช เพื่อสร้างความเข้าใจในการกรอกแบบฟอร์ม

วัตถุประสงค์

1.เพื่อให้ความรู้แก่เกษตรกรชาวไร่ข้าวโพด ให้มีความรู้ความเข้าใจต่อหลักในการใช้ อุปกรณ์ในการป้องกันตัวเมื่อมีการใช้สารพาราควอทที่ถูกต้องและปลอดภัย

2.เพื่อกระตุ้นให้เกษตรกรเกิดการยอมรับการใช้อุปกรณ์ป้องกันตัวในขณะใช้สารพาราควอท

3. เพื่อให้ผู้มีส่วนร่วมในการวิจัยเข้าใจในวิธีการกรอกแบบฟอร์มในการประเมินตัวเอง

วิทยากร

นายเด่นพงษ์ วงศ์วิจิตร นักวิชาการสาธารณสุขชำนาญการ สำนักงานสาธารณสุข อำเภอนาน้อย จังหวัดน่าน (ผู้วิจัย)

สื่อที่ใช้ประกอบในการบรรยาย

แฟ้มนำเสนอแบบ Power point presentation ประกอบคำบรรยาย

สื่อที่ใช้ประกอบการจัดประชุมเชิงปฏิบัติการ

1. คู่มือการใช้สารกำจัดศัตรูพืชอย่างถูกต้องและปลอดภัย โดยซินเจนต้า
2. คู่มือการจัดการความปลอดภัยด้านสารเคมี สำหรับองค์กรปกครองส่วนท้องถิ่นโดยสำนักพัฒนาคุณภาพสินค้าเกษตร กรมส่งเสริมการเกษตร พ.ศ. 2550
3. วีดิทัศน์ เรื่องสารคดี “ภัยเงียบจากสารเคมี” โดย สถาบันชุมชนเกษตรยั่งยืน
4. Fact Sheet เรื่อง ความจริงของพาราควอท” โดย นายเด่นพงษ์ วงศ์วิจิตร

VITAE

Name Denpong Wongwichit

Date of Birth January 27, 1973

Place of Birth Nan Province, Thailand

Education

2008-2011 Doctor of Philosophy, College of Public Health Sciences, Chulalongkorn University, Thailand

1999-2000 Master of Public Health, Graduate school, Chiang Mai University, Chiang Mai, Thailand

1995-1999 Bechelor of Public Health Sukhothaithammatirat University, Thailand

1991-1993 Certificate of Public Health The College of Public Health, Ministry of Public Health, Thailand

Professional experience

2004-Present Public Health Technical Officer, Professional Level (K2) Nanoi District Health Office, Nan Province, Thailand

1993-2004 Public Health Officer, Operational Level (O1) Namtok Sub-district Health Center, Nanoi District, Nan Province

Presentation experience

2 October 2009 Poster presentation Entitled " **Herbicide Exposure to Maize Farmers in Northern, Thailand: Knowledge, attitude, and Pratices**" in the 9th Annual Conference of Public Health Sciences "public Health Sciences in Economic Downturn"

1-2 March 2010 Oral presentation Entitled "**Herbicide Exposure to Maize Farmers in Northern, Thailand: Knowledge, attitude, and Pratices**" in the 1st International Conference on Environmental Pollution, Restoration, and Management. Ho Chi Minh City, Vietnam.

4-7 November 2010 Poster presentation Entitled "**Herbicide Exposure to Maize Farmers in Northern, Thailand: Knowledge, attitude, and Pratices**" in the 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues. Xiamen, Chaina.