Food and Agriculture Organization of the United Nations

Pesticide Risk Reduction in South East Asia

Workshop on Pesticide Risk Impact Assessment

23-25 July 2007, HCMC, Vietnam

Workshop Report

Under the project "Pesticide Risk Reduction in South East Asia", an impact assessment workshop was held in Ho Chi Minh City from 23 to 25 July, 2007. It was attended by 10 participants from China, Cambodia and Vietnam. The participants included independent impact assessment leaders from the Royal University of Agriculture in Phnom Penh, the China Agricultural University in Beijing and the Hanoi Agricultural University, as well as country project staff. Resource persons came from the FAO Regional Office and Kasetsart University in Bangkok (see Annex 1).

The workshop programme was divided into four parts: (1) introduction and the first main steps of impact assessment, i.e. (2) target setting, (3) indicator formulation and (4) impact study design (see Annex 2). Each part included introductory presentations by the facilitators, group work of the country teams, and presentations and discussion of the group work results. At the end of the workshop, each country team had formulated a first draft of their impact assessment plan.

INTRODUCTION

Presentation: Principle of Impact Assessment

The classic approach to impact assessment has been derived from economic welfare theory and follows the Pareto principle that lays out a decision rule on which basis public resource allocation decisions can be made. In this concept impact is defined as the change (Waibel, 2004). Assessment or evaluation is defined as judging, appraising, or determining the worth, value or quality of project in terms of its relevance, effectiveness, efficiency and impact (Templeton, 2004). In the conceptual framework, there are five types of evaluation. These are development evaluation, design evaluation, process evaluation, evaluation of program/project management and impact evaluation. In essence, these types of evaluation relate to the information required at the different stages of the research activity (Owen, 1993 cited by Templeton, 2004). There are four main reasons why impact assessment is important. These are to satisfy accountability requirements, as a decision-making tool for investment, to increase awareness of the efficiency and implications of the project and public relations. In conducting impact assessment it is important that a number of standards are observed. At least six aspects that need to be considered: (1) causality (2) transparency (3) significance (4) validity (5) plausibility and (6) good indicators. The double delta approach is a tool suggested as a framework for this workshop.

Presentation: Pesticide Risk

Pesticide risk is defined as the product of a pesticide's hazard and the potential exposure to the chemical. Consequently, risk reduction impact assessment has to assess reductions in either hazard or exposure, or both, and quantify these parameters. To understand the risk of pesticides, it is important to understand the pathways how pesticides move through the environment and come into contact with living beings.

Initially, pesticides pose risks at their sites of sale and storage, and then in the field to applicators, farm workers and bystanders. After application, pesticides may get transported through the environment through drift, runoff or leaching and can come into contact with farm animals, consumers of contaminated food or drinking water, children playing at contaminated swimming sites, or wildlife in remote places. Risk management requires as the first step an assessment of the actual risks, and then risk mitigation through changes in pesticide use, promotion of alternative farming practices, changes in government/policy interventions, education and training.

Group work:
- Make a list of all organisms in the respective project area that are at risk to be harmed from pesticides
- Rank the list from highest to lowest risk
- Is the source of risk mainly from highly hazardous pesticides or from widespread exposure?
- What is the relative importance of human vs. environmental risk in the project area?

The group results showed that the primary pesticide risks were perceived to come from the widespread use of highly hazardous WHO Class I pesticides in the project areas. The groups further listed other organisms that could be potentially at risk, but it was difficult to make accurate assessments without detailed knowledge of the project sites. The discussions made it clear that one cannot talk about risk reduction in general terms, but that one has to address each risk separately as each is dependent on a unique set of local factors that either increase or decrease the risk to a specific exposed population.

It is therefore strongly recommended to conduct an exploratory risk assessment at each project sites in order to understand the pathways of exposure and to assess more accurately which population is most at risk. This should also include an assessment of perceived risks among different populations in a community (e.g. farmers, fishermen, bee keepers, consumers, officials, etc.) as well as reports of actual risks (poisoning cases, fish kills, etc.). The project teams should clearly understand the sources of contamination, chemical release mechanisms, environmental transport media, potential exposure points, and routes of uptake into the final receptors, i.e. populations at risk. This assessment should also include environmental factors such as rainfall, flooding, soil type, land use classifications, watershed characteristics, ground water depth, etc. Project sites should be selected according to existing high pesticide risks to key exposed populations (human and other).

STEP 1: TARGET SETTING

Presentation: Impact Matrix

The most important step in impact assessment is to clearly define the impacts which the project wants to achieve. The impacts are the benefits from risk reduction. If a project reduces risks, but cannot show benefits for health or the environment, then it has had no impact. It is therefore necessary to quantify the benefits and link them plausibly through cause-effect relationships with the relevant project activities (mainly training) that lead to project outputs (e.g. increase in knowledge) which in turn lead to the targeted outcomes/results (reduction of hazard/exposure). The construction of such “impact chains” for each of the targeted impacts helps with focusing project activities and makes a project more effective and efficient, and shows interrelationships and synergies between different activities.

Group Work:

- Construct a rough site model linking sources of contamination to potential exposure points/routes
- Construct a matrix linking project activities to hazard/exposure reduction and specific impact targets

The teams formulated human poisoning related impact targets, as well as one environmental target related to populations of natural enemies. These targets were linked to typical IPM-FFS activities, outputs and outcomes. This exercise showed that the selection of the impact target has direct consequences for the training curriculum and FFS activities. For example, the weekly ecosystem analyses may include risk assessments and calculations (e.g. with the help of EIQ) to deepen the understanding of pesticide risks in order to motivate farmers to implement mitigating actions. Knowing the impact targets and impact chains allows to strengthen the IPM-FFS curriculum and make it more effective.
Risk reduction does not aim at increasing farmer income, even though this would greatly increase the adoption of mitigating measures, such as IPM. Benefits to consumers from the reduction of food residues will be difficult to measure, but they can be perceived as a reduction of the risk that a contaminated product would be confiscated and destroyed and the willingness of consumers to pay higher prices for ‘green’ products.

STEP 2: IMPACT INDICATORS

Presentation: Indicators

Distinction was made between impact indicators and risk indicators.
Impact Indicators describe what can be observe when the impact target has been reached. Such indicators should be specific, measurable, attainable, relevant and trackable (i.e. ‘SMART’). A good objectively verifiable indicator lists all information required to measure that particular impact target; thus it can become a checklist for the data that need to be collected during impact assessment.
Risk Indicators are index numbers that quantify the pesticide risk; they can be specific to a particular population (e.g. applicator, fish, honey bee, etc.) or may combine different risks into a single index. The numbers are always relative to each other and do not describe the actual probability of harm. There are multiple research efforts worldwide to develop suitable pesticide risk indicators, but so far no indicator model has emerged for widespread application. One simple model is the Environmental Impact Quotient (EIQ) which gives a rough risk assessment based on toxicological and chemical properties of the pesticide and its rate of application. However, the model lacks specificity and does not take many local factors into account that may affect particular risks. It could serve as a suitable first risk assessment in conjunction with other measurements such as poisoning cases, population dynamics or residue data.

Group Work:

- Formulate SMART indicators for each impact target (benefits from risk reduction)
- Specify pesticide risks that are to be reduced in the project and describe how you will quantify them

The groups formulated qualitative and quantitative indicators for the impact targets as well as the major risk reduction outcomes. More efforts could still be made to make the impact target indicators more specific.
Examples of specific indicators would be:

- By the end of 2009, acute pesticide-related poisoning signs and symptoms appearing within 24 hours after application among the FFS participant pesticide applicators and helpers have been reduced by more than x % as compared to the corresponding values collected in 2007.
- By the end of 2009, farm family medical expenses of FFS participants for other than accidents, infectious or chronic diseases (incl. traditional antidotes against poisonings) within a 1 month period have been reduced by more than x % as compared to the corresponding values for the same month in 2007.
- By the end of 2009, the average population of ladybird beetles (adults and instars, all species) collected from 10 randomly selected [specify crop] plants in FFS participant plots and sampled 3 times in weekly intervals within a specific month has increased by more than x % as compared to the corresponding values for the same month in 2007.
- By the end of 2009, the number of empty pesticide containers found along a 1 km route of field borders and water courses in the project site have decreased by more than x % as compared to corresponding observations in 2007.

For pesticide risk impact assessment it is necessary to measure both risk and impact. The following table gives examples of data that would need to be collected for different risk groups:

Risk group	Risk measurement	Impact measurement
Applicator	Pesticide use data time spend with spraying	fewer poisoning signs and symptoms; ChE levels
Farm worker	time in field during REI	fewer poisoning signs and symptoms; ChE levels
Bystander (e.g. children)	time spend in contaminated areas	difficult
Consumer	food harvested within PHI; residues in food	difficult: health improvements ?
Farm animals	exposure time	fewer poisoning signs and symptoms; ChE levels
Fish	disposal and washing practices; residues in surface water	fish population data
Birds	feeding on contaminated grain or poisoned insects or rodents	bird population data
Natural enemies	mobility of natural	natural enemy population

	enemies for escaping exposure after application;	data
Soil microbes	residue levels in soil	rate of nutrient recycling

STEP 3: IMPACT STUDY DESIGN

Presentation: Impact Study Design

The double delta approach is an impact study design to model the effect of FFS – Pesticide Risk Reduction (PRR) training by estimating the difference between success indicators (e.g. amount of chemical pesticides applied) before and after the training for both FFS participants and non-participants (control group) and then comparing the difference between the two groups. Hence, the effect of factors affecting the success indicators of both groups, other than FFS training, is “differenced out”. If, for instance, a drought occurs in the survey region it will have the same effect on the yield of participating and non-participating farmers (Voelker and Waibel, 2007).

The procedure of impact assessment of FFS-PRR can be divided into 6 steps: 1) design impact assessment program, 2) choose indicators, 3) conduct survey, 4) analyse data, 5) compute economic performance indicators, and 6) draw lessons learn.

Presentation: Panel Survey and Questionnaire Design

For a panel data, before and after as well as with and without FFS-PRR information needs to be gathered. A suitable sample size can theoretically be calculated by taking into account three factors: the margin of error, the significance level, and the variance in the primary variables. A sample of about 300 farmers is recommended for an econometric analysis. Data collection can be conducted applying different techniques. Questionnaire can cover the following aspects.

- Interviewee identification
- Household socio-economic data
- Vegetable production activities
- Pesticide use
- Pest and crop management knowledge
- Health information
- Decision making of household
- Species in the farm and surrounding

Presentation: Impact reporting

It is a good idea to draft an outline of the final impact assessment report at the beginning of an impact assessment study so that one knows which additional information needs to be collected in order to put the impact assessment results into context. For example, an impact assessment report should first give a situation analysis describing existing knowledge of actual risk and how people in the project area perceive the risk. Then, the report should describe the project activities leading to the desired impact, showing that they were adequate both in quantity and quality to cause the reported impact. Then, finally, the report describes and discusses the impact study results and draws conclusions for lessons-learned.

Presentation: Impact Case Studies

For environmental and health related impacts, it is often not possible to collect all the information from panel data collection and surveys. Qualitative case studies are particularly useful if they can be linked to quantitative data collected in the panel survey. For example, case studies could describe in depth specific situations for which the survey data give a general assessment of the importance and frequency of occurrence of that "case". Examples were presented of studies investigating the effect of pesticides to different natural enemies (e.g. spiders and ground beetles), maps showing the geographic distribution of pesticide risks in a study area, or the distribution of pesticide risks at a sampling site during different times during a year.

Presentation: Data Analysis
The double delta approach can be applied using both linear and regression methods. A simple linear approach is to take the mean value of each group's success indicator before and after FFS implementation and then compare the differences in means between the groups. By employing a regression framework the change in success indicators from before to after FFS training is measured as a growth process, which depends on various factors. Most econometrics packages can perform a double delta regression analysis requiring only a dataset of the particular observations of the variables to be included in the model.

Group Work:
- Draft an impact study design
- Draft a profile of sample farmers in sample villages (participants or/and non-participants)
- Draft a profile of sample farmers in control villages
- Draft a suitable sample size
- Draft a work plan for the implementation of the impact assessment study, including responsible institution and estimated budget.

The results of the group work are presented in Annex 3. Since the discussions focused primarily of applicator health risk reduction, more reflections are needed how to collect the necessary information for other risk groups if they will be included in the impact assessment study. The following methods of data collection may be used (list not comprehensive):

Risk group	Questionnaire/Record	Case Studies
Applicator	Pesticide use data farmer records: time sheets to assess exposure during application and within REI	residue data, blood samples sign and symptoms
Farm worker	time spend for mixing pesticides and helping with application; time in field before the end of REI	residue data, blood samples sign and symptoms
Bystander	list of persons in the field: children, visitors, etc.; data on storage and disposal	observations of children playing in potentially contaminated places
Consumer	consumption data of potentially contaminated food or drinking water	residue data for excess MRL in food and drinking water
Farm animals	list of animals in the field, particularly during REI	residue data, blood samples; sign and

		symptoms
Fish	reports of fish kills;	fish catch data
Birds	reports of dead birds;	population counts of indicator species, e.g. insect eating birds
Natural enemies	AESA records	population studies of key species after application
Soil microbes	soil management and composting practices	soil tests

Reference:

Waibel, H. 2004. Principles of Impact Assessment of Research and Development in Agriculture and Natural Resource Management. University of Hannover, Germany.

Templeton, D. 2004. Outcomes: Evaluating Agricultural Research Projects to Achieve and to Measure Impact. In: Impact Assessment Workshop held by Center for Applied Economic Research, Faculty of Economics, Kasetsart University.

Owen, J.M. 1993. Program Evaluation. Allen and Unwin Pty Ltd, Sydney.

Voelker, M. and H. Waibel, 2007. Introduction to the Double Delta Approach. forthcoming IPM Impact Assessment Series, University of Hannover, Germany

Acknowledgements

The workshop facilitators would like to thank the participants and project staff for their active participation and for sharing their experiences. This made the workshop enjoyable and fruitful. Particular thanks goes the project officers in Bangkok and Hanoi who planned and organized this workshop for a job well done.

Bangkok, 28 July 2007

Suwanna Praneetvatakul

Gerd Walter-Echols

Annex 1

Regional Workshop on Pesticide Risk Impact Assessment

23-25 July 2007, HCMC, Vietnam

Actual Programme:

Sunday, 22 July	
	Arrival of participants

Monday, 23 July	
8:00-9:00	Opening Session: Introduction to Workshop –Jan/Dada
9:00-12:00	1: **Introduction** Introduction: Challenges of risk management - Gerd Introduction: Principles of impact assessment – Suwanna *Group Work:* Identification of pesticide risks in the project areas Presentation of group work results
12:00-13:30	Lunch Break
13:30-18:00	2: **Impact Matrix** Introduction: Impact chains and routes of exposure - Gerd *Group Work:* Preparation of project impact matrix Presentation of group work results 3: **Impact Indicators** Introduction: Elements of a "SMART" indicator; challenges of pesticide risk indicators, incl. EIQ - Gerd
18:30	Dinner Cruise

Tuesday, 24 July	
8:00-12:00	*Group Work:* Formulation of project targets and indicators of achievement Presentation and discussion of impact targets and indicators
12:00-13:30	Lunch Break
13:30-18:00	4: **Impact Study Design** *Introduction:* Location, sample size, control - Suwanna 5: **Panel Survey and Questionnaire Design** *Introduction:* Design and implementation of panel survey -Suwanna 6: **Impact Reporting** *Introduction:* Elements of final impact assessment report - Gerd 7: **Impact Case Studies** Introduction: Examples of self assessments and special research studies – Gerd Group Work: Design of Impact assessment studies Presentation and discussion of impact designs: Cambodia and China
18:00	Dinner

Wednesday, 25 July	
8:00-12:00	Presentation and discussion of impact design: Vietnam 8: **Data Analysis and Presentation** *Introduction:* Analytical methods - Suwanna 9: **Impact Assessment Work Plans** *Introduction:* Work plan matrix and checklists - *Group Work:* Preparation of country work plans
12:00-13:30	Lunch Break
14:00-15:30	Presentation of Work Plan
15:30-16:00	Closing
18:00	Dinner

Annex 2

List of Workshop Participants

Country	Name	Address	email
China	Yang Puyun	National Agro-Technical Extension and Service Center Ministry of Agriculture, P.R.China Building no. 20, Maizidian Street, Beijing, China	yangpy@agri.gov.cn
	Liu Wenxin	College of Agriculture and Biotechnology China Agricultural University, Beijing, China, 100094	wenxinliu@sohu.com wenxinliu@cau.edu.cn
	Wang Huasheng	General Station of Plant Protection of Guangxi, Min zhu da dao, Nanning, Guangxi, China 530022 Tel: 13977158928 Fax: 0771 5854244	gxcb@vip.sina.com.cn wangwhs@sina.com.cn
Vietnam	Do Kim Chung	Faculty of Economics and Rural Development Hanoi Agricultural University Gia Lam District, Hanoi, Vietnam	dokimchung@fpt.vn dkchung@hau1.edu.vn
	Tranvan Hieu	FAO-IPM office, Hanoi, Vietnam	tvhieuipm@vnn.vn
	Kristine Stubberud	FAO-IPM office, Hanoi, Vietnam	kristineipm@vnn.vn
	Ly Ngoc Hung	Plant Protection Department (South) 28 Mac Dinh St., Dist 1, Ho Chi Minh city	Kst_pn@hcm.vnn.vn lyngochung@yahoo.com
Cambodia	Chou Cheythyrith	National IPM Program, FAO-IPM Office, Phanom Penh, Cambodia	Thyrith.faoipm@online.com.kb
	Ngin Chhay	National IPM Program, FAO-IPM Office, Phanom Penh, Cambodia	Chhay.ipm@online.com.kb
	Sok Kunthy	Royal University of Agriculture (RUA) Chamcar Daung, Dangkor, Phnom Penh, Cambodia	S_Kunthy2005@yahoo.com
Thailand	Suwanna Praneetvatakul	Department of Agricultural and Resource Economics, Faculty of Economics, Kasetsart University, Bangkok, Thailand	fecoswp@ku.ac.th
FAO BKK	Jan Willem Ketelaar	Team Leader, Intercountry Vegetable IPM Programme, FAORAP, 39 Phra Atit, Bangkok 10200, Thailand	Johannes.Ketelaar@fao.org
	Alma Linda C. Moraces-Abubakar	FAO- IPM Bangkok Project Development Officer	AlmaLinda.Abubakar@fao.org
	Gerd Walter-Echols	Consultant	gerd.walterechols@gmail.com

Annex 3

Group Work Results

CAMBODIA

The Design of Impact Assessment
on Vegetable Farmer Training of Pesticide Risk Reduction Project

1. Location

- The impact study will be carried out in the provinces of Kampong Cham and Battambang.

Sources of risk

The risks are mainly from:

- highly hazardous pesticide: Farmers use highly toxic chemical pesticides.
- widespread exposure: applicators are not aware of toxicity levels of products and appropriate method for using pesticides

Importance of risk

It is depending on locations

- Vegetable areas: human is more important because it has direct affect on applicators and consumers
- Rice and Mungbean: environment and applicator is more important because the products are not directly consuming

2. Sample size

- Four IPM groups, four non-IPM groups and four control groups will be selected for the impact assessment study in the two target provinces.
- Total number of respondents are 300 including 100 IPM farmers, 100 non-IPM and 100 control will be selected for impact assessment.

3. Data and method of data collection

Targets Indicators	Collected Data	Method
By the end of 2009 the vegetable producers (applicators) in the target areas will decrease poisoning case by 50% and expenses on health treatment will also reduce by 50%. (trained applicators)	- Poisoning cases - Expenses of health treatment	- Observation - Case study - Group interview - Individual interview
The trained applicators will reduce type and amount of Class I pesticide by 90%	- Type and amount of pesticides used	- Individual interview - Secondary data - Group interview
70% of trained applicators will appropriately use protecting gears when working with pesticides	- Pesticide spraying practice	- Observation - Individual interview - Group interview
90% of trained applicators will appropriately dispose pesticide containers.	- Disposal practice	- Observation - Individual interview

		- Group interview
80% of trained applicators will increase the use of alternative control methods	- Alternative control methods	- Observation - Individual interview - Group interview - Farm records
Trained applicators will decrease pesticide application by 60%	- Number of pray pesticide per cropping season	- Individual interview - Farm records
90% of trained applicators will follow REI and PHI.	- REI and PHI practice	- Observation - Group interview - Individual interview - Farmer records
EI-Applicators	- Type, active ingredient and amount of pesticide use	- Survey - Farm record - EIQ calculation
Outcome indicators:		
- Change in knowledge	- Natural enemies - Pesticide classes - Danger of pesticides on health - Alternative pest control - Protective gears - Disposal method - REI and PHI	- Pre and post tests - Survey
- Change in practice	- Use softer pesticides and application frequency - Use alternative methods - Use protective gear - Dispose waste properly - Apply PEI and PHI	- Survey - Observation - Farm records -
Output:		
- 3,375 vegetable farmers are trained through FFS and provided follow up activities.		Report
Activities:		
- Organize refresh course for existing IPM Trainers on pesticide risk reduction.		
- Conduct FFS on growing healthy crop and pesticide risk reduction		
- Organize follow up activities for FFS alumni		
- Form FFS alumni associations to produce and market safe vegetable products		
- Exchange visit		
- Organize farmer congresses		
- Conduct bio-control training		
Resources		

- Human resources: trainers		
- Documents		
- Materials		
- Budget		

4. Time frame

- Baseline survey will be conducted before the project implementation (September 2007)
- The post survey will be conducted in May, 2009

5. Data analysis method: Use Excel spread sheet/SPSS analysis

6. Detail Workplan

Activities	2007	2008	2009	Responsible	Budget
Impact assessment workshop	▬			FAO	
Design impact assessment framework	▬			IA expert	USD 3,000
Workshop to finalize IA framework	▬			FAO	
Preparation for data collection	▬			National staff and IA expert	USD 1,500
Collecting baseline data	▬			National staff and IA expert	USD 6,000
Analyze collected data and report	▬			National staff and IA expert	USD 2,000
Meeting to discuss the finding	▬			National staff and IA expert	USD 500
Developing workplan for Impact Assessment			▬	IA expert	USD 3,000
Case study on pesticide diffusion in Mungbean production around Tonle Sab lake, Siem Reap		▬		National staff Expert	USD 5,000
Collecting data			▬	National staff and IA expert	USD 6,000
Analyze collected data and report			▬	National staff and IA expert	USD 3,000
Internal meeting to discuss finding			▬	National staff and IA expert	USD 500
National workshop			▬	IPM Program	USD 4,000

Total USD 34,500.00

Table 1: Sample size (90% confident)

Population (N)	Sample size (n)	Sample size, (%)
50	33	66
100	50	50
200	67	33
500	83	17
1000	91	9
2000	95	4.8
5000	98	2
10000	99	1
50000	100	0.2

CHINA

Risk Assessment:

List of important	Organism	Highly toxic	Exposure	Relative to human	Relative to environment
1	natural enemy	* *	*	*	* * *
2	neutral insects	* *	*	*	* *
3	soil organism	* *	*	*	* *
4	water organism	* *	*	*	* *
5	pollination insects	*	*	*	* *
6	livestock	*	*	*	* *
7	poultry	*	*	*	* *

Note: number of * indicate the degree of importance

General Target: **Improvement** of farmer and consumers' **health & environment**

Farmer	Consumer	Environment
Acute poison cases: **0%**	Products of pesticide residues over MTLs: **0%**	Natural enemies: **>120%**
Medical expenses (related to poison): **<50%**		Earthworms: **>120%**
Application time: **<50%**		Pesticide residue in surface water: **<60%**
WHO class I pesticides: **0%**		Pesticide residue in soil: **<70%**
Protection clothing: **>95%**		Spraying frequencies: **<60%**
Adoption rate of non-chemical alternative measures: **>30%**		

Note: Compared with baseline

Impact chain:

Goals: Improvement of farmer and consumers' health, medical expenses reduced by 50%. Working efficiencies increased by 20%.

Effects: 0% acute poison of farmers and consumers, no products of pesticide residues over MTLs.

Results: Reducing application time of pesticide by 50%,spraying frequencies by 60%, amount by 60%,and eliminating WHO class I pesticides.

Outputs:	GMP, GAP in use of pesticides, and appropriate use of no-chemical control alternative measures.
Activities:	Curriculum of TOT and FFS including identification of pests, pesticides and understanding of the risks of pesticides. Training farmers on the understanding ecosystem and appropriate use of non chemical control technologies.
Inputs:	Advanced sprayers, lower residue and toxic pesticide, sets of protective clothing, Alternative non-chemical control facilities.

IA Design

Site	Nanning, Guangxi	Guilin, Guangxi	Yunnan
Crop	Lettuce	Orange	Vegetable
Samples	IPM:36(4FFS) Non-IPM:36(4FFS hamlets) Control:36(3 hamlets)	IPM:36(4FFS) Non-IPM:36(4FFS hamlets) Control:36(3 hamlets)	Based on case studies: IPM *vs.* CK
Timeframe	2007, baseline survey 2008, FFS training 2009, impact survey Post-2010, long term survey?		2008 1.Impact study on population dynamic of Orius bug in Chinese cabbage related to pesticide risk levels 2.Pesticide residue testing of vegetables produced by IPM vs. CK farmers
Methods	Season-long monitoring; PRA; Secondary data collection; Focus group discussion; Pesticide residue testing		PRA; Focus group discussion; Field monitoring; Pesticide residue testing

Panel data

Categories	Indicator	Methods
Farmers	Spraying frequency	Season-long survey
	Spraying times	Season-long survey
	Amount of pesticides	Season-long survey
	No. Of non-chemical alternative measures:	Season-long survey
	Bio-pesticides quantity	Season-long survey
	High toxicity pesticides	Season-long survey
	Low toxicity pesticides	Season-long survey
	No. of spraying man with Protection clothing	Season-long survey

	Poison cases of pesticide	PRA
Consumer	No. of products of pesticide residues over MTLs.	Lab test
Environment	No. of spiders	Season-long survey
	No. of lady birds	Season-long survey
	Pesticide residue in surface water	Lab test
Farmer attitude	Willingness to use non-chemical pesticide	CVM
	Willingness to use biological controls	CVM
Farmer knowledge	Toxic level of pesticide	Interview
	Kinds of pesticide	Interview
	Mechanism of pesticide	Interview
	Kinds of natural enemies	Interview
Farmer decision making	Decision making in using pesticide	Group discussion
Secondary data	Amount of pesticides	Statistics
	Using of high toxic pesticide	
….	**….**	**…**

Work plan matrix

Activity	**2007**	**2008**	**2009**	**Responsible**	**Budget (USD)**
Field visit to identify study sites				GX-GSPP,YN-GSPP	500
Planning and training workshop				NATESC,CAU,GX-GSPP,YN-GSPP	6000
Designing survey forms and questionnaires				NATESC,CAU,GX-GSPP	
Pre-survey and finalizing survey forms and questionnaires				NATESC,CAU,GX-GSPP	
Developing work plans				NATESC,CAU,GX-GSPP,YN-GSPP	
Secondary data collection				GX-GSPP	1000
Baseline survey				GX-GSPP	9000
Baseline season-long-data collection				GX-GSPP&CT-PPS	
PRA				GX-GSPP&CT-PPS	
Interview of farmer households				GX-GSPP&CT-PPS	
Group discussing				GX-GSPP&CT-PPS	
Building baseline database				NATESC,CAU,GX-GSPP,YN-GSPP	
FFS training				GX-GSPP, YN-GSPP&CT-PPS	10000
Case studies	-			YN-GSPP	6000
Impact survey				NATESC,CAU,GX-GSPP,YN-GSPP	12000
Season-long monitoring				GX-GSPP&CT-PPS	

PRA				GX-GSPP&CT-PPS	
Interview of farmer household				GX-GSPP&CT-PPS	
Group discussing				GX-GSPP&CT-PPS	
Building IA database				NATESC,CAU,GX-GSPP,YN-GSPP	
Data analysis and report				NATESC,CAU,GX-GSPP,YN-GSPP	10000
Data analysis workshop				NATESC,CAU,GX-GSPP,YN-GSPP	
Data analyzing				NATESC,CAU,GX-GSPP,YN-GSPP	
Report and dissemination workshop				NATESC,CAU,GX-GSPP,YN-GSPP	

NATESC
CAU = China Agricultural University
GSPP = General Station for Plant Protection
CT-PPS = County Plant Protection Station

VIETNAM

Focus: BENEFIT FROM RISK REDUCTION (HEALTH AND ENVORONMENT)

Comments:

- Introduce PRR curriculum or incorporation PRR in IPM FFS activities?
- What crop? Fruits or vegetable and fruits?
- Where to conduct? Vegetable and fruits or fruits producing areas?
- Sites to be investigated? (How many and where: Control and experimental villages)
- Sample size (Partipants – Non-partcipants-control)

i. RESEARCH DESIGN AND METHODOLOGY FOR IMPACT EVALUATION

1.1 Site Selection

- Sothern province (Vegetable)
- Hai Duong (lichi)

Reasons
HD: major lichi producing area; High level of pesticide use, No FFS on fruit production
Southern province: 1) Major vegetable producing region, 2) Some communes are not yet covered by FFS; 3) PPSD should be cooperative

1.2 Impact Matrix

Table 1. PRR Impacts Matrix: Health risk indicator

	Verifiable Indicator	Means for Verification
Target Reduction of risks to applicators	- Reduction number of illness of applicators in community A, caused by pesticides from 10% in 2007 to 2% by 2010	- Farmers interviews - Health clinic records - Group discussion
Increased farmers using protective equipments	Increasing number of farmers using safety-protective equipments (Clothing, boosts, grass) from 1% in 2007 to 70% by 2009	- Farmer interviews - Group discussion - Participatory Rapid appraisal (PRA)
Wide use of pesticides (reduced toxicity and increased bio-pesticides)	Reducing number of farmers using WHO pesticides class I from 50% in 2007 to 5% by 2009 Increasing number of farmers using bio-pesticides from 20% to 80% by 2009	- Farmers interviews - Extensionist and PPD staff Interviews
Reduced number of spays	Reducing number of spays from 10 per crop in 2007 to 4 by 2009.	- Farmer interviews - Group discussion - PRA

Increased pre-harvest intervals	Ensuring a Pre-harvest interval from 1 day in 2006 to 5 day 2009	- Farmer interviews - Group discussion - Extensionist and PPD staff interviews
Improved pest management practices	Number of farmers improve their particular management practices (change in percentage)	-
Farmers' attitude and perception changed	Number of Farmers having right perception of bio-pesticides, pesticides safe use increased from 20% in 2007 to 80% by 2008	- Farmer interviews
OUTPUT		
1. Farmers successfully trained in Pesticide hazard and exposures (PHE)	Number of vegetable farmers are successfully trained in PHE in 2008, 75 (3FFS) and 75 in 2009 (3FFS) and 50 in 2010 (2FFS)	- Training reports - Project reports - PRA
2. CIPM successfully established and operated	Number of CIPM established from 2 in 2008 to 4 in 2009 and 2 in 2010.	- Community staff interviews - Trained farmer interviews
ACTIVITY		
1.Training in pesticide hazards and exposure	$, Trainer, fields	
2. Setting up CIPM	$, trained farmers	

Table 2. PRR Impacts Matrix: Environmental risk indicator

	Verifiable Indicator	Means for Verification
Environment conserved and less polluted	- Population natural enemies, - Quality of water, air - ?	- Sample testing - PRA - RAA
Farm practices are changed positively	- Use more bio-pestides (quantity and types) - use less toxic chemicals - Wise use of cultural practice	- Farmer interviews - Group discussion - Participatory Rapid appraisal (PRA)
Farmers' attitude and perception on environment changed	Number of Farmers having right perception of bio-pesticides, pesticides safe use increased from 20% in 2007 to 80% by 2008	- Farmer interviews
OUTPUT		
1. Farmers successfully trained in environmental protection	Number of vegetable farmers are successfully trained in PRR in 2008, 75 (3FFS) and 75 in 2009 (3FFS) and 50 in 2010 (2FFS)	- Training reports - Project reports - PRA
ACTIVITY		
- Agro- Ecosystems	$, Trainer, fields	

- Insect zoos - Soil ecology - Life cycle and food web - Insect pest management		

1.3 Data Collection

1.3.1 Secondary Data Collection

Secondary information for this research include the followings:

- Vegetable production, traditional vegetable cultural practices in Ho Chi Minh Cities
- Government policies on vegetable production
- PRR program and its implementation
- Descriptions of communes under study (demographic information, information on farming communities, village structures..)

These information will be collected from PPD. FAO-IPM, provincial, district plant protection departments, commune levels and other relevant offices.

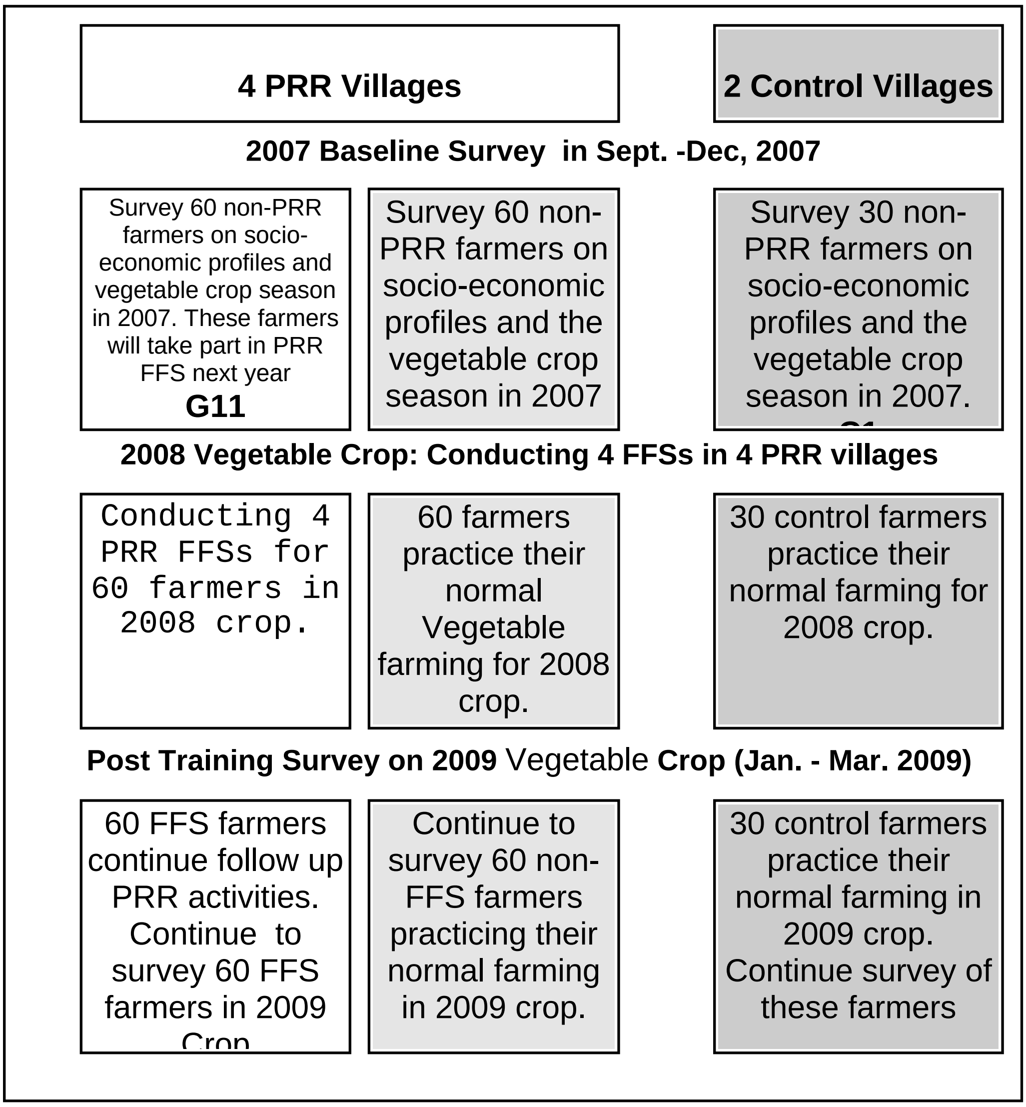
1.3.2 Primary Data Collection

1.3.1 Sample design

Table 2. Sample Size by Village / province

	PRR Group	Non-PRR Group	(Control Group)
4 PRR Villages	60	60	
2 Control Villages			60
Total	60	60	60

Figure 1. The Study Design



Note: G11, G12, G21, G22, C1 and C2 indicate the survey results for each sampled farmer group by each crop season.

1.3.2 Primary Data Collection

- The profiles of villages under study consist of information on demographic information, community structure, social norm, vegetable production, economic well being.
- Information on PRR impacts at community level include i) who organised and supports PRR, ii) formal organisation of farmers to farmer field schools (PRR clubs and their activities), iii) group field studies, iv) community's access to PRR, extension and credits, vi) involvement of women and the poor in PRR activities and vii) PRR impacts at the communities levels.
- Information on vegetable growers and their farm households are crucial for impact assessment. These information will contain i) the profiles of vegetable

growers, ii) household situation and its production pattern, iii) vegetable production practices, iv) pest ad crop management, v) participation in, attitude and perception of PRR; vi) health costs and vii) FFS information and spill-over effects.

The primary information can be obtained through conducting a rural appraisal (RRA), participatory rapid appraisal (PRA) and farm household surveys. RRA employs field observation, key informal interviews and group discussions.

1.3.3 Questionnaire design

Primary data, especially information on vegetable growers and their households are collected by means of a standardised questionnaire through interviewing the sampled respondents. The farm surveys include questionnaire design, pre-testing, sampling techniques and filed surveys.

Parameter	Complex Variable	Simple Variable	Value
1. Vegetable grower Profile	Respondent's Identity	Sex Ethnic	Women, man Kinh, Ede. Mnong
		Age	real figure
		Marital status	single, married. widow, divorced
		Agricultural technical training	Statement of program
		Educational Attainment	number of years attending school
2. Information of farm household	Economic situation	Household class	wealthy, medium, poor
	Demographic information	Household size	number of household members
		Active laborers by gender	number of male and female active laborers
	Main source of income	Crop production Animal husbandry Handicraft, Off-farm job	statement
	Cultivated Land	Total cultivated area Area suitable for vegetable	real figure
		Tenure status by parcel	Owned, rent, bidden
	Vegetable crop sown area	Rainfed, irrigated	real figure
	Crop rotation	rotation types	Statement
	Vegetable output	Yield per cong harvested (Seed)	Kg

Parameter	Complex Variable	Simple Variable	Value
3. Vegetable Production		Price received	000VND/kg
		Return per cong	000 VND
	Main Source of Seed	Owned/Free market/Cooperative, other	Statement
	Inputs used	Seed, Manure, Urea, Phosphorus, Potassium, Green Manure, Pesticide, herbicides	Kilogram/value
		Hired labor for land preparation, weeding, irrigation, harvesting	VND
		Household labor	manday
	Cultural practices	Timing and number of times done for land preparation, fertilization	days before sowing / real figures
		Planting Density	Real figures
		Pre-harvest interval	days
4. Pest and Crop Management in Vegetable Production	Farmers' Perception of Pest Problems	Pest Problems faced	yes/no
		Kinds of insects, diseases weeds, rat, often faced at different growth of vegetable	statement
		Pests and disease caused the biggest damage to vegetable	statement
	Farmers' Perception of Pests	All pests are harmful	yes/no/no opinion
		Identification of natural enemies	statement
		Sources of perception of natural enemies	my owned field observation, mass media, PRR training, relatives, others
	Farmers perception of	Awareness of bio-pesticide Perception of Bio-pesticide	Yes/No Opinion
	Bio-	Ways of pest	Statement

Parameter	Complex Variable	Simple Variable	Value
	pesticides, pesticide exposure and hazards	exposure and hazards	
	Pest Management Practices	Farmers' Reaction to pest problem	do sometinh/ do no thing
		Control measures applied	multiple choice: early land preparation, crop rotation, use of resistant varieties, water control,
		Names of varieties planted	Statement
		Factors motivating selection of varieties	multiple choice: yield, disease resistance, seed availability, get used to
		Perception of disease, pests that varieties by crop season could resist to	Statement
	Farmer' reaction to pest problems	Farmers' reaction to pests appeared in the field	multiple choice: spray, hand-picking, baiting, discussion with relative or PPD staff, PRR farmers; do nothing
		Farmers' reaction to knowing Neighbor spraying, pest radio broadcasting	single choice: subjective spraying, objective spraying, not spray, discussion with relative, PRR Clubs, do nothing
	Pesticides use	-Number of sprays, -Names of pesticides -Applied for what diseases or insects at different growth by crop season -Amount of high toxicity pesticides and bio-pesticides used	Real number Statement Statement Cc or bottle/packages or gram
		Who decide spraying	Man/ women, growers
		Mode of sprays	hired/yourself
		Cost of spray if hired by crop season	dong/cong
		Source of pesticides if spray by yourself	pesticide sale agents, extension agents, PRR clubs, village headmen,

Parameter	Complex Variable	Simple Variable	Value
			markets, Neighbor
		The most important consideration in deciding type of pesticide to be purchased	single choice: effectiveness, advertisement, packaging, price, PRR clubs
		The most important source of pest control advise	single choice: pesticide sale agent, relatives, Neighbor, mass media, FFS, PRR clubs
5. Farmers' Participation PRR Farmer Field school	Perception of PRR	Awareness of PRR	yes/no
	Participation in PRR activities	Participation in FFS	Yes/ no
		Participation in CIPM	yes/no
		CIPM Activities if participated	List of CPRR activities (PRR club, meetings, ..), number of farmers instructed about PRR by the farmer
	Perception of PRR benefits	Gain from PRR program	yes/no/ do not know
		Better understanding PRR and skills for crop management	increased knowledge of agro-ecosystem, pesticide and human health relation Increased self-confidence Number of PRR farmers getting advice, Frequency of advice to others
		Perception of Economic Benefits gained from PRR	multiple choice: increase in yield, pests under control, reduction of pesticide costs, more farm income
		Perception of Social Impact from PRR	Multiple choice: Poverty reduction, gender equity,
		Perception of Environmental Impact from PRR	number of natural enemy wild species, better soil fertility, ways of pesticide store disposal treatment

Parameter	Complex Variable	Simple Variable	Value
		Perception of Institutional Impact from CPRR	Accessing credits, technology, seeds, output sale, planning, more understanding ecosystems through PRR clubs
	Farmers' recommendation for PRR improvement	more training need, more communication, Booklets, Advertisement	multiple choice
	Participation in CPRR	Farmers willingness to participate CPRR	yes/no/ maybe
		Reasons for no participating if not participate in CPRR	statement
6. Health Effects	Health	Number of lost work days due to sickness	real figure
		Pesticides relation to human health How it relates	Yes/ no/ no answer Statement
		Use safety equipments	Yes/no
		Use of WHO pest. Class I	Yes/no
		Amount of P Class I used	Packages/ bottle/cc
7. Environmental impacts		Use of bio –pesticide Money spent	Yes / no VND
	Expenditure	Pesticide related health expenditure	real figure
		• Number of highly toxicity pesticides used for crop • Amount of pesticide by types used per crop • Number of sprays /crop • Increased number of natural enemies, • Increased wild life (frogs, birds, bees) in the fields • Number of farmers stored pesticide with right method • Number of farmers keep disposals at right place	Frequencies Gram/ Cc/ Times Pest population Wildlife population Frequencies

1.4 Data Processing

Collected secondary and primary data will be re-checked, edited and analysis. A coding book corresponding with a set of questionnaire will be prepared. Then, database will be developed using SPSS 10.0 for Windows. Analysis will be done through the help of SPSS 10.0 software.

1.5 Methods of Analysis

Descriptive statistics: means, standard deviation, frequencies and crosstab will be employed to analysis the farm household, crop performance, farmers' behaviours, FFS and SVP follow-up activities.

II. EXPECTED RESULTS

2.1 Outputs

The research is expected to obtain the following outputs: A Report on Impact Assessment of Vegetable PRR in Ha noi or/and Ha noi Cities.

2.2 Outline of Draft Assessment Report

1. Introduction
    - 1.1 Research Rationale
    - 1.2 Research Objective
    - 1.3 Scope of the Study

2. Vegetable PRR Programs in HO Chi Minh and Hanoi Cities
    - 2.1 Vegetable Production
    - 2.2 Implementation of PRR Programs
3. Research Design and Methodology
    - 3.1 Site Selection
    - 3.2 Analytical Framework
    - 3.3 Data Collection
    - 3.4 Data Processing
    - 3.5 Methods of Analysis

4. A Profile of Vegetable Farmers
    - 4.1 Information on Respondents
    - 4.2 The Farm Household
    - 4.3 Vegetable Production practices
    - 4.4 Pest Management Practices
    - 4.5 Pest risks
    - 4.5 Participation in PRR
5. PRR Impacts
    - 5.1 Knowledge impacts - Cultural practice impacts
    - 5.2 Pesticide Exposure and Hazard impacts
    - 5.3 Environmental Impact
    - 5.4 Health Impacts

6. Conclusions and Recommendation

III. WORK PLAN

Main Activity	$	Who ?	07	2008				2009			
			Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Proposal Development Questionnaire development Site Selection Training of Field enumerators	8000	HAU HAU HAU									
Baseline Survey and PRA Data Processing Baseline Research Development Conducting IPM FFS	9000	HAU HAU PPD									
Special studies and 2rd survey Follow-up activities Database development, processing Impact analysis	1500 0	HAU PPD HAU									
Final Report development	4000	HAU									
Total	3600 0										