AVRDC
The World Vegetable Center

Baseline study design

Safe and sustainable production of vegetable legumes and leafy brassicas in Cambodia, Laos and Vietnam

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Conducted within the context of the BMZ/GIZ-funded project "Attraction in Action: Using pheromones and other safe and sustainable management strategies to reduce losses from insect pests and plant diseases on vegetable legumes and leafy brassicas in Southeast Asia"

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Front picture: Women farmer with spraying equipment on bicycle near Hanoi (January 2015).

1 Introduction

Pesticide use is rapidly increasing in Southeast Asia, which creates much challenges to protect farmers and consumers from potentially harmful effects of pesticide residue exposure. Pesticide use is particularly high on leafy vegetables and vegetable legumes, which are susceptible to a large number of arthropod pests and diseases. Previous studies have shown that farmers in Thailand and Vietnam cultivating yardlong bean rely almost exclusively on the use of synthetic pesticides to manage their pest problems and have little to no knowledge of alternative methods (Schreinemachers *et al.* 2014).

This reality contrasts to principles of integrated pest management (IPM), according to which farmers should carefully monitor pest populations and use biological, cultural and physical methods to control them and only use pesticides as a method of last resort. The application of IPM can be knowledge intensive as it requires a good understanding of the inherent strength of agro-ecosystems to limit pest populations. Such knowledge is not always available and is difficult to transmit and maintain among vegetable growers. Pesticide use, on the other hand, requires relatively little knowledge and can eliminate insect pests instantly. However, the long-term costs of excessive pesticide use and misuse can be substantial (e.g. Praneetvatakul *et al.* 2013 for Thailand).

The objective of the BMZ/GIZ-funded project *Attraction in Action* is to "improve the livelihood of farmers and increase the availability of wholesome vegetables with reduced risk of pesticide contamination through sustainable vegetable legume and leafy brassica production systems in the target countries".[1] The project works in Cambodia, Laos and Vietnam because of its intensive vegetable production systems and recognized misuse of pesticides by farmers. Table 1 lists the main arthropod pests and plant diseases on yardlong bean and leafy brassicas in Southeast Asia.

To reduce the mis-/overuse of pesticides and promote the adoption of safer practices, it is necessary to understand the current situation and to identify possible misconceptions and knowledge gaps. To do this, this study applies the concepts of knowledge, attitudes and practices (KAP). A KAP assessment tells us what people know about the problem, how they feel about it, and how they currently behave. Knowledge here refers to farmers' understanding pests, pesticides and good agricultural practices. Attitudes here refer to farmers' feeling about pesticide safety and IPM and any

[1] The full title is "Attraction in Action: Using pheromones and other safe and sustainable management strategies to reduce losses from insect pests and plant diseases on vegetable legumes and leafy brassicas in Southeast Asia"

preconceived ideas they may towards these and possibly include misconceptions. Practices here refer to the actual behavior (decision, actions) that demonstrate the knowledge and attitudes.

This framework assumes that a change in farmers' practices is the cumulative result of a change in farmers' knowledge and attitudes. The separation between knowledge, attitudes and practices has been frequently employed in studies on pesticide exposure (e.g. Recena *et al.* 2006; Brown and Khamphoukeo 2010; Karunamoorthi *et al.* 2012). The information obtained from such studies is useful to tailor IPM training programs to closing certain knowledge gaps or to correct prevailing misconceptions about pesticides or IPM.

Table 1 Recognized pest and disease problems in yardlong bean and leafy brassicas for Cambodia, Laos and Vietnam

Yardlong bean [1]	Leafy brassicas
Insect pests	Insect pests
Pod borer (*Maruca vitrata*)	Diamondback moth (*Plutella xylostella*)
Armyworm (*Spodoptera litura*)	Armyworm (*Spodoptera litura*)
Bean butterfly (*Lampides boeticus*)	Striped flea beetle *(Phyllotreta striolata)*
Aphids (*Aphis craccivora; A. glycines*)	Cabbage looper
Bean spider mite (*Tetranychus spp*.)	Aphids
American bollworm (*Helicoverpa armigera*)	Cabbage butterfly
Thrips (*Megalurothrips sp.*)	Cabbage webworm
Bean flies (*Ophiomyia phaseoli; Melanagromyza sojae*)	Cabbage head caterpillar
White fly	
Stink bug	
Pod bug	
Plant diseases	Plant diseases
Leaf rust	*Turnip mosaic virus* (TuMV)
Bacterial leaf spot (*Xanthomonas campestris*)	Downy mildew (*Peronospora parasticica*)
Root rot	Damping off (seedling disease)
Damping off (seedling disease)	Bacterial softrot
Bean mosaic virus	Black spot
Powdery mildew	Web blight
Bean anthracnose	Black rot

Source: [1] Taken from Schreinemachers et al. (2014). In grey are pests and diseases not included in this survey.

2 Study objectives

The study has two objectives:

1. To quantify baseline indicators for evaluating project outcomes in 3-5 years. Outcome indicators include:

(a) **Pesticide use**, combining data on the amount of pesticides in active ingredients by weight and their toxicity to humans and the environment (Kovach *et al.* 1992; Schreinemachers *et al.* 2011; Sharma *et al.* 2015).

(b) **Crop yield losses from pests** estimated using a pictorial tool (Schreinemachers *et al.* Under review).

(c) **Gross margin** as an indicator of the economic reward for farmers to follow IPM.

2. To improve our understanding of farmers' knowledge, attitudes and practices:

(a) **Knowledge:**

- Ability to separate between beneficial insects and pests
- Ability to match adult insects with their larvae and/or nymphs
- Knowledge about alternative pest management methods and IPM

(b) **Attitudes/perceptions:**

- Perceptions about pesticide risk using a standard list of questions following LePrevost et al. (2011)
- Symptoms regularly observed immediately after spraying (headache, vomiting, dizziness, abdominal pain, skin rashes, blurred vision)

(c) **Practices:**

- Use of protective gear (boots, mask, gloves, hat)
- Safety precautions (eating, drinking, smoking, hand washing, shower, change clothes)
- Disposal of empty pesticide containers
- Frequency of spraying
- Mixing of pesticides
- Days between spraying and harvesting
- Pesticide expenditures and applied pesticide quantity

3 Data collection

Data will be collected for yardlong bean and leafy brassica. Leafy brassica is a diverse category of crops with different meanings in different countries. However, all types of leafy brassicas are largely affected by the same pests and diseases. During the planning workshop in April 2014, the following species of leafy brassica were suggested:

Cambodia: Chinese cabbage, leafy mustard, pak-choi

Laos: Chinese cabbage, leafy mustard

Vietnam: Choisum, leafy mustard ("Cải xanh/cải canh" in Vietnamese)

Including all crops would make it difficult to compare the data and complicate the sampling because the species are grown in different seasons. The survey will therefore focus on leafy mustard because it was listed by all countries as among the most important leafy brassica species. Leafy mustard is cultivated year-round in the target countries, but the cultivation peaks in the cooler period from October to March and is less during the hot and humid season. Yardlong bean cultivation in Laos and Vietnam is mostly during the hot season starting from April; yet in Cambodia it is mostly grown in the cooler season from November to March. Details are shown in Table 2.

Figure 1 Target vegetable species for the survey: yardlong bean (left) and leafy mustard (right)

Table 2 Cropping calendars for yardlong bean and leafy brassicas in Cambodia, Laos and Vietnam

Leafy mustard	Regular season	Off-season
Vietnam	Oct - Mar	Apr - Sept
Cambodia	Nov - Mar	Apr - Oct
Lao PDR	Oct - Mar	Apr - Sept
Yard-long bean	Regular season	Off-season
Vietnam	Apr - Jun	Nov - Feb
Cambodia	Nov - Mar	Apr - Oct
Lao PDR	Apr - Oct	Nov - Feb

Data will be collected in two steps. First, focus group discussions with small groups of men and women farmers and individual in-depth interviews will be organized to improve our general understanding of the situation. Second, a structured questionnaire survey will be conducted in purposively selected villages from the main growing areas of each crop in each country.

Leading questions for the in-depth group interviews:

1. What are the main pests and disease problems in yard long bean / leafy mustard?
   How are these managed?
   Howe effective are these methods?
2. Did you practice any pest control techniques to reduce the need of using pesticides?
   Which ones? How effective were these?
   Have you heard about integrated pest management? What do you think about it?
3. Are both men and women involved in the cultivation?
   What are the different responsibilities of men and women?
   For which activities are women better? And which activities are better done by men?
4. Who gives you advice about crop protection issues?
   What advice do you normally get?
   How satisfied are you with this?
5. How concerned are people in the village with the effect of pesticides on their health?
   What health problems you know of are related to pesticide use?
   Have any pesticide-related accidents happened in your village?
   Have you tried to reduce risk? How?
6. Do you have any suggestions for our work?

Do you have any questions to us?

4 Sampling strategy

1.1 Sample size and study locations

Data are to be collected through a stratified random sample yardlong bean and leafy mustard growers per country. The target is to collect 150 samples per crop per country as shown in Table 3. The sample must be representative for the main production area and main production season in the country. The sample size is based on logistical and budgetary considerations rather than an exact calculation based on observed variation in the data, which is not possible at this stage.

Table 3 Proposed sample size

Crop	Cambodia	Laos	Vietnam	Total
Yardlong bean	150	150	150	450
Leafy mustard	150	150	150	450
Total	300	300	300	900

Table 4 list the locations targeted by the project, which reflect the main production areas for these crops. A maximum of 10 farmers per village and per crop should be interviewed for this study, which therefore gives a minimum of 15 villages per country per crop. This is because the incidence of pest and disease incidence might vary between locations -- farmers in the same village typically have very similar problems.

Table 4 Tentative research sites

Cambodia	Laos	Vietnam
▪ Kandal province ▪ Kampong Chhnang province ▪ Svay Rieng province	▪ Peri-urban Vientiane (Hadxaifong and Chanthabouly districts) ▪ Vientiane province (Viengkham / Keo Oudom and Kasy districts)	▪ Peri-urban Hanoi (Gia Lam, Dan Phuong and Thanh Tri districts) -50% of the sample ▪ Hung Yen province -50% of the sample

It is important that the team survey communicates with the project implementation team in selecting survey sites. Baseline data should reflect the situation before IPM training is provided and

technologies are applied by the farmers. Villages with ongoing IPM activities or IPM activities of other projects should therefore be excluded. The survey should not only target those villages in which the project plans to introduce IPM, but also include non-targeted villages as a control.

The following strategy can be used for selecting the sample:

1. It will be checked with the project colleagues if they have already selected villages for implementing on-farm trials or conducting IPM training. Some or all of these villages can be selected for the survey as long as project activities have not already started.
2. Additional villages can be randomly selected from the target areas in Table 4. To do this, make a list of villages in which farmers grow yardlong bean and/or leafy mustard. This can be done with a local extension officer. Give each village a random number and sort the list in ascending order by this number. Then contact the first 10-15 villages on each list.
3. Visit each village and construct a list of farm household growing either yardlong bean or leafy mustard. Randomly select 10 households from this list and approach them for an interview. If a household is unavailable or unwilling to participate, then randomly select another household.
4. Expand the number of villages until a total number of 150 households has been interviewed.
5. The sampling of households growing leafy mustard and yardlong bean should be done separately. Even if a farmer grows both crops, only ask him or her about one unless the farmer is coincidentally selected for both surveys.

5 Time plan for the study

Data collection for the study will be completed in 2015. Because the same data are collected in each country, analyses will be done only once on the combined data set. The results of the study are to be published as a journal article and submitted for peer-review. The article will be jointly authored by the local partners who collected the data and AVRDC scientists. A draft paper should be available in early 2016 with a final paper ready in mid-2016.

References

Brown, P. R., and Khamphoukeo, K. 2010. Changes in farmers' knowledge, attitudes and practices after implementation of ecologically-based rodent management in the uplands of Lao PDR. *Crop Protection* 29(6), 577-582.

Karunamoorthi, K., Mohammed, M., and Wassie, F. 2012. Knowledge and Practices of Farmers With Reference to Pesticide Management: Implications on Human Health. *Archives of Environmental & Occupational Health* 67(2), 109-116.

Kovach, J., Petzoldt, C., Degni, J., and Tette, J. 1992. A method to measure the environmental impact of pesticides. *New York's Food and Life Science Bulletin 139, New York Agricultural Experiment Station, Cornell University, Ithaca, NY, 8 pp*.

LePrevost, C. E., Blanchard, M. R., and Cope, W. G. 2011. The Pesticide Risk Beliefs Inventory: A Quantitative Instrument for the Assessment of Beliefs about Pesticide Risks. *International Journal of Environmental Research and Public Health* 8(6), 1923-1935.

Praneetvatakul, S., Schreinemachers, P., Pananurak, P., and Tipraqsa, P. 2013. Pesticides, external costs and policy options for Thai agriculture. *Environmental Science & Policy* 27, 103-113.

Recena, M. C. P., Caldas, E. D., Pires, D. X., and Pontes, E. R. J. C. 2006. Pesticides exposure in Culturama, Brazil - Knowledge, attitudes, and practices. *Environmental Research* 102(2), 230-236.

Schreinemachers, P., Sringarm, S., and Sirijinda, A. 2011. The role of synthetic pesticides in the intensification of highland agriculture in Thailand. *Crop Protection* 30(11), 1430-1437.

Schreinemachers, P., Srinivasan, R., Wu, M.-H., Bhattarai, M., Patricio, R., Yule, S., Quang, V. H., and Hop, B. T. H. 2014. Safe and sustainable management of legume pests and diseases in Thailand and Vietnam: a situational analysis. *International Journal of Tropical Insect Science* 34(2), 88-97.

Schreinemachers, P., Swaminathan, B., Boopathi, N. M., Ha, V. C., Kenyon, L., Praneetvatakul, S., Sirijinda, A., Tuan, N. L., Ramasamy, S., and Wu, M.-H. Under review. Farmers' perceptions and management of plant viruses in vegetables and legumes in tropical and subtropical Asia. *Crop Protection*.

Sharma, R., Peshin, R., Shankar, U., Kaul, V., and Sharma, S. 2015. Impact evaluation indicators of an Integrated Pest Management program in vegetable crops in the subtropical region of Jammu and Kashmir, India. *Crop Protection* 67, 191-199.

Annex: Questionnaire

Separate file.