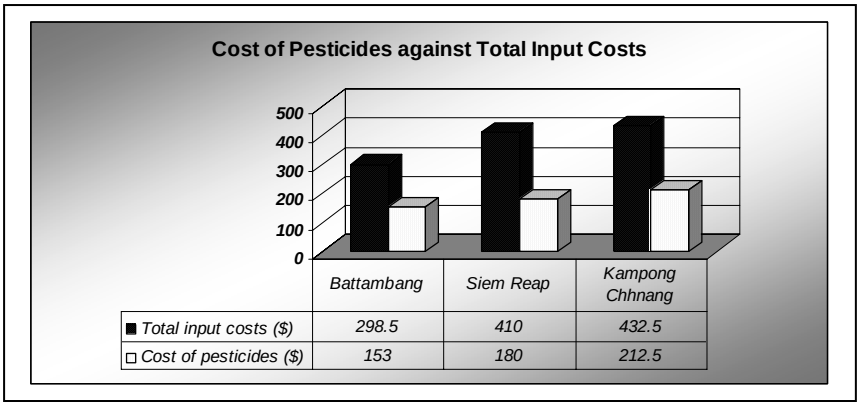
Food and Agriculture Organization
of the United Nations

Participatory Rapid Appraisal of
Mungbean Production and Protection Practices in Cambodia



Cambodia National IPM Programme

March 2009

EXECUTIVE SUMMARY

BACKGROUND

Cambodian farmers around the Tonle Sap Great Lake grow many kinds of crops - such as mungbean, rice, vegetables, sesame, watermelon and corn – after the lake's flood water has receded at the start of the dry season. Normally, farmers do not grow only one crop in their area. Some grow two, three or more depending on prevailing farm cropping systems and local land use patterns. Mungbean is one of the main crops grown in the area, preferred for its quick and relatively high cash return on investment. However, profits are usually greatly reduced due to high pesticides input costs. Mungbean farmers always encounter numerous crop protection problems, most notably infestations of cut worm, army worm and other caterpillars. Farmers use a lot of chemical pesticides to control pest populations. Use of Highly Hazardous Pesticides for pest control in mungbean production is reportedly quite common. Concerned about the reports of increased use of –and exposure to- hazardous agrochemicals, the Cambodia National IPM Program embarked on surveys to better understand the current situation of pesticide distribution and use for control of pest and disease problems in mungbean production. Based on study findings, the National IPM Program would then be in a better position to assess the relevance and nature of any future IPM/Pesticide Risk Reduction training and action research interventions, possibly to be supported by FAO under the ongoing Pesticide Risk Reduction project (GCP/RAS/229/SWE).

SURVEY OBJECTIVES

The survey was conducted in three provinces, (Kampong Chhnang, Battambang and Siem Reap) to identify mungbean farmers' production and crop protection problems and assess their pest management knowledge and practices. The survey was also intended to find out about farmers' knowledge, practices and perception of pesticide use for pest management in mungbean production.

METHODS:

The survey was conducted by the National IPM and Provincial IPM Programme in the above-mentioned provinces (*see map below for survey sites*).

A total of 83 mungbean farmers (23 women) in the three provinces participated in the surveys, using the following Participatory Rural Appraisal (PRA) methods:

1. Focus Group Discussions (FGD):

   . A brief description of the FGD exercises follow:

   - Seasonal Cropping Calendar: Farmers identified the important crops in their area and then they marked for a variety of indicators covering 13 months of an annual cropping cycle. The indicators included, among many other, the cropping season for each important crop, rain, temperature, busy or relaxed periods.

   - Matrix Ranking on the Relative Importance of Various Crops Grown: All participants were asked to mention factors/reasons for choosing certain crops as part of prevailing cropping patterns. The factors (minimum of three and maximum of six) were put in a matrix with the three major crops identified by the farmers. The three crops were ranked for each factor at a time by using peanuts. Each participant received three peanuts per factor. These three seeds were divided among the three crops. The crop that was most favored in relevance to the factor that was being discussed was given most votes, peanut seeds in this case. If all crops score equal for that factor, according to the farmer, they gave each crop just one peanut. The outcome per factor was reviewed by the whole group after all farmers had casted their votes and sometimes the ranking was changed if the whole group agreed that it did not reflect the community perception.

   - Matrix Ranking on Problems Encountered in Mungbean Production: Every farmer listed major problems encountered in mungbean production and post-harvest of their

agricultural commodities. Then, the whole group selected some serious problems that need to be solved immediately. Next, the farmers made a list of reasons why a problem actually is a problem. They put the problems and reasons in a matrix, and scored the problems per one reason at a time. For scoring, every farmer took peanuts for as many as problems that were selected and divided the 4 or 5 peanuts over the 4 or 5 problems for each reason that was being discussed, according to which problem relates most to the reason given. After completing all the reasons, the whole group discussed the final results of scoring and the results were changed if the whole group agreed that it did not reflect the community perception.

- Gendered Task Distribution Diagram: The men and women were separated to discuss about their tasks in each step of crop production and post harvest management (i.e., from sowing to growing until harvesting and beyond). Every participant in each group determined how much time (proportionally) was spent on each task by men versus the women in the family. Every participant was given four peanuts to put into two columns per crop (no peanut represents no work, 1 peanut less than 25%, 2 peanuts between 25-50%, 3 peanuts between 50-75% and 4 peanuts between 75-100%). The total number of peanuts per cell was counted, and after finishing all tasks, the total number of peanuts per column was calculated, with the final sum count providing a gender-segregated indication of labour distribution in the community.
- Pesticide Exposure: Using a Household Map, farmers provided information on where and how they store pesticide containers and sprayers and on disposal of empty pesticides containers. Using a Body Map, farmers reported on signs and symptoms of pesticide poisoning that they had experienced. A separate exercise was carried out to collect information on routes of pesticide exposure.

2. Individual Interviews:

Individual interviews were conducted with mungbean farmers at their farm or house using a semi-structured questionnaire. Observations were carried out to collect other information and verify those provided by the farmers during the interviews. The respondents were selected randomly among the farmers who have had experiences on mungbean production. A total of 64 farmers were interviewed in the selected provinces. The breakdown follows:

Province	District	Male	Female	Total
Siem Reap (SR)	Sot Nikum	14	10	24
Battambang (BTB)	Ek Phnom	11	09	20
Kampong Chhnang (KCN)	Boribo	05	15	20
Total		30	34	64

3. Informal Interview:

   This activity was aimed at collecting information in an informal way about the perception of community members with regard to agriculture production, especially mungbean production. In each village, mungbean farmers (two men and two women) were interviewed informally related to the cropping pattern, reasons for selecting the crop/variety, problems they faced, solutions to the problems and marketing. Additionally, the interview team also interviewed village leaders in the selected areas for more information.

4. Field observation and transect walk:

   The purpose of the activity was to get acquainted with the physical and functional structure of the village. The survey team walked across the village (built-up and agricultural areas) to observe among others location and situation of houses, schools, cultivated areas, soil conditions, water sources, major production constraints and the solution of farmers to those problems. Discussions were carried out with farmers met during the transect walk to verify observations.

5. Inventory of pesticide shop:

   Interviews were carried out with some pesticide sellers in the areas about agricultural inputs and products sold, source of pesticides, the popular pesticides in the area, etc. The interviewers also listed and observed pesticides that are being sold in those shops.

MAJOR FINDINGS

In the three provinces, information on seasonal patterns showed that *good rain* started from May to July, *much rain* from August to October, *little rain* from November to December, and *no rain* from January to April. The average daily temperature from February to May is around 35^{O}C (high), from June to November around 30^{O}C (moderate), and from November to January around 22^{O}C (cold). The main crops grown around Tonle Sap Great Lake in the surveyed provinces is mungbean, the second is rice, and third is sesame, corn and squash.

Farmers start to grow agriculture crops based on the Tonle Sap Great Lake's receding flood levels and farmers start growing mungbean in December or January and harvest in April or May, sesame and squash from February to June, corn and rice from January to August.

1. <u>Mungbean Cultivation, Yields and Profits:</u>

   Mungbean cultivation starts after water from the lake has receded in December and lasts until April. Mungbean crop duration is generally 75-80 days. The most commonly used varieties are the local Black Pod and White Pod varieties. However, some farmers also use a variety originally imported from Thailand. Farmers use seeds that they have saved. In Battambang, after land preparation farmers broadcast mungbean seeds directly using a seeding rate of 30-40 kg/hectare. In Kampong Chhnang and Siem Reap, farmers use 80kg/hectare, putting 08-10 seeds per hill. In Siem Reap, farmers grow mungbean in very large fields, sometimes up to 30 hectares. They hire labor from other areas for labor-intensive tasks such as growing, weeding and managing the crop from planting

until harvesting. The workers are paid an average of US$ 36.5 monthly and meals as well as accommodation are provided by field owner. In Battambang and Kampong Chhnang province, farmers grow the crop in smaller areas of about 1-3 hectares. Normally, farmers do not water the mungbean crop after planting because the soil provides enough moisture for the crop throughout the season. However, some farmers, who grow mungbean in higher areas that lack of moisture, irrigate twice at seedling stage.

Average Yields and Profits of Mungbean Production

Descriptions	Kampong Chhnang	Battambang	Siem Reap
Yield (ha)	700 kg	900 kg	1000 kg
Market price (per kg)	$0.75	$0.50	$0.70
Income (ha)	$ 525	$ 450	$ 700
Expenses (ha)	$ 432.5	$ 298.5	$ 410
Net profit (ha)	$ 92.5	$ 151.5	$ 290

Mungbean yields in the three provinces range from 700kg-1,000kg per hectare..The market price (per kg) varies from $0.50-$0.75. Labor and pesticides for insect pest control increase the costs of production, with some farmers spraying at weekly intervals. Some farmers reported unprofitable production with net profits ranging from $92.5-$290.

2. Fertilizer use:

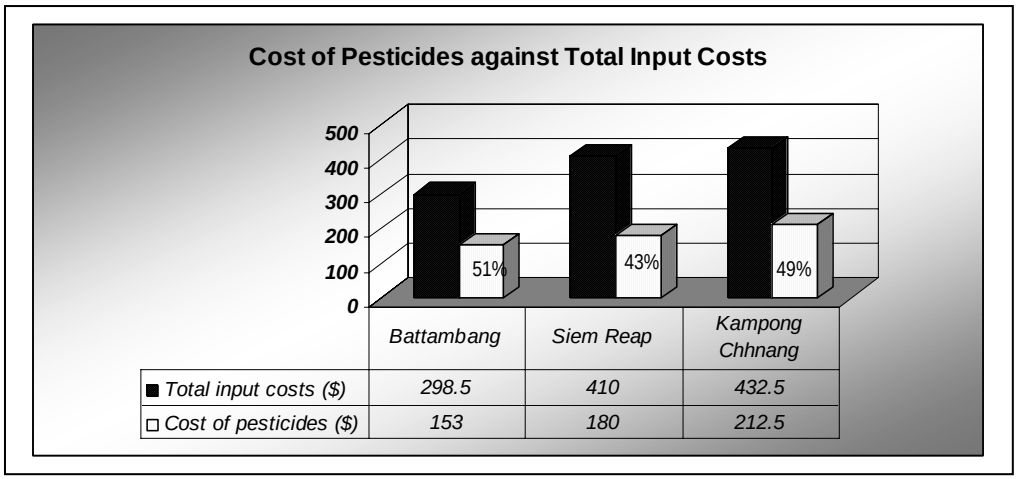
Mungbean areas are flooded every year. The flood brings soil sediments and organic matter that improves the soil texture and fertility so farmers can grow many kinds of crops. Usually, the farmers do not use any fertilizers in mungbean production in the three provinces although a few said that they use cow manure or organic matter mixed with the seeds at time of sowing.

3. Pest and disease problems and solutions:

Insect pests are the most severe problem in mungbean production. The farmers always encounter pests such as army worm (*Spodoptera sp.*), cut worm (*Agrotis sp.*), bean pod borer (*Maruca vitrata*), bean aphid (*Aphisraccivora*), legume shield bugs (*Piezodoras hybneri*), horn worm (*Acherontia spp*), stem borer (*Melanagromyza cleomae*) and rats. Some farmers also face problems with bean mosaic virus, angular leaf spot disease and weeds. To solve the insect pests and disease problems, farmers spray several kinds of chemical pesticides because they do not have knowledge of -nor access to- alternative methods. However, most of the farmers said that the more chemical pesticides they spray, the more pests occur.

4. Pesticide use:

Farmers in all three provinces make use of pesticide for pest and disease control. On average, farmers spend US$153-212.50/ha/season, greatly reducing overall profits. Expenditures on chemical pesticides range from 43%-51% of the total cost of production



In Battambang and Kampong Chhnang, farmers use manually operated backpack sprayers. Some farmers have small machine operated backpack sprayers. Farmers mix up to 6 kinds of pesticides, 20 ml each kind with 20 liters of water. Some farmers spray the whole day up to about 30 sprayer-loads/day. A total of 7-10 spray events per cropping season are practiced. During spraying operations, farmers wear only long trousers and a long-sleeved cotton shirt. Exposure to pesticides is very high and all farmers had experienced poisoning signs and symptoms.

In Siem Reap province, farmers use improvised sprayers using hand tractors. The tractors carry long plastic tubes with many holes. The plastic tubes are held by 5-10 or more persons (based on the length of the tube) to spray pesticides. Other farmers use hand tractors with two wings (about 20 meters each) with many holes to spray. This sprayer design needs only two people to carry out the operation. Using the improvised sprayers, the farmers mix 1-3 liters of liquid pesticides and 0.5-1kg of pesticides in powder form with 1,200-1,500 liters of water. Spraying with the tractor reduces exposure to humans but increases exposure of the environment. The sprayer operators' exposure includes spraying upwind.

In the three provinces, the pesticides used in mungbean production belong to WHO categories Class I, II and III. The most commonly used WHO Class I pesticides are:

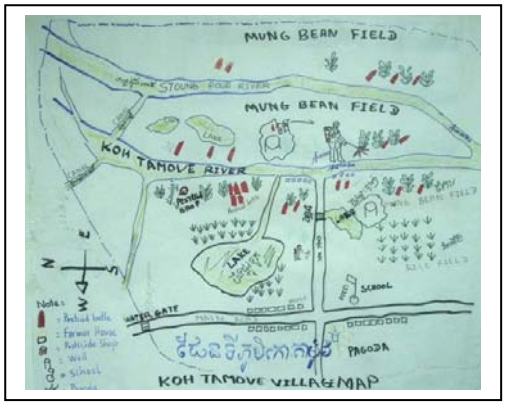
Trade Name	Active Ingredient
U-T 80	organophosphate
Methomyl	methomyl
Fitor	organophosphate
Folidol	organophosphate
Methyl parathion	dimethyl p-nitrophenyl thiophosphate and methyl parathion
Mevinphos	organophosphate
Bifuran 3G	carbofuran
Supracide	methidathion

(*See Section 6 for the list of these pesticides, and other pesticides*).

Farmers buy pesticides from markets or pesticide shops near their farms and store them in their house or cottage (near beds or cooking areas), fields or areas around their houses within easy access to children. Sprayers are usually kept inside the house or make-shift shelters in the field for fear of theft. The farmers dispose of empty pesticide containers in their fields, in the bushes and near to stream or ponds risking environmental contamination. Farmers do not rinse and are unaware of the practice of rinsing pesticide containers prior to disposal.

In Battambang province, empty pesticide containers were carried by floods from one area to another and subsequently buried in the ground after the flood water has receded. Farmers in one village have complained to the village leader to take action about the rubbish (pesticide containers and plastic bags) that left buried in their field from flood waters. The farmers in this village have advised pesticide applicators not to throw or keep pesticide containers in the fields and near canals and wait for the flood to carry them away. Pesticide sprayers are usually rinsed in the Sangke river where farm households get water from for drinking, cooking, washing and where children swim in.

In Kampong Chhnang province, sprayers are rinsed in the stream or river near fields where households get water for use as above-mentioned. The farmers did not report any concern about the contamination of water they are using.



5. Gender Division of Labor in Mungbean Production

From women's perspective, the total work carried out by men in mungbean production ranged from 45%-72% and by women ranging from 28%-55%.

Gender Division of Labor in Mungbean Production in Three Provinces (From Women's Perspective)

Activities	Seed selection		Seed sowing		Land preparation (inc. cutting the forest)		Spraying pesticide		Weeding		Harvesting		Threshing		Drying the seeds		Transporting/ Selling		Other operations (e.g., irrigation, fertilizer application)		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Group 1 – 4 farmers: Kampong Klaing commune, Sot Nikum district, Siem Reap	38	62			100	0	50	50	25	75	25	75	75	25	50	50	50	50			52	48
Group 2 – 9 farmers: Kampong Klaing commune, Sot Nikum district, Siem Reap			83	17	50	50	50	50	17	83	17	83	50	50			50	50			45	55
8 farmers: Prek Loung commune, Ek Phnom district, Battambang			97	3	100	0	75	25	50	50	50	50					59	41			72	28
6 farmers: Prek Trop village, Prek Norin commune, Ek Phnom district, Battambang			100	0	100	0	58	42	33	67	25	75									63	37
5 farmers : Koh Tamove village, Kampong Prah KorKy commune, Boribo district, Kampong Chhnang			50	50	55	45	50	50			30	70					50	50			47	53
5 farmers : Stoung Chrov village, Kampong Prah Koky commune, Boribo district, Kampong Chhnang			30	70	78	22	90	10	90	10	50	50					50	50			65	35

According to men, the total work they carry out in mungbean production ranges from 44%-65% while for women this ranged from 35%-56%.

Gender Division of Labor in Mungbean Production in Three Provinces (From Men's Perspective)

Activities	Seed selection		Seed sowing		Land preparation (inc. cutting the forest)		Spraying pesticide		Weeding		Harvesting		Threshing/ cleaning		Drying the seeds		Transporting/ Selling		Other operations (e.g., irrigation, fertilizer application)		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Group 1 – 9 farmers: Kampong Klaing commune, Sot Nikum district, Siem Reap	25	75			75	25	50	50	25	75	25	75	50	50	50	50	50	50			44	56
Group 2 – 11 farmers: Kampong Klaing commune, Sot Nikum district, Siem Reap			100	0	68	32	50	50	36	64	27	73	50	50			50	50			54	46
12 farmers: Prek Loung commune, Ek Phnom district, Battambang			45	55	100	0	77	23	52	48	45	55	50	50			100	0	55	45	65	35
12 farmers: Prek Trop village, Prek Norin commune, Ek Phnom district, Battambang			64	36	57	43	70	30			50	50	50	50			50	50	50	50	56	44
16 farmers : Koh Tamove village, Kampong Prah KorKy commune, Boribo district, Kampong Chhnang			42	58	77	23	89	11	42	58	44	56					48	52	68	32	59	41
15 farmers : Stoung Chrov village, Kampong Prah Koky commune, Boribo district, Kampong Chhnang			50	50	74	26	88	12			50	50					33	67			59	41

In effect, men carryout more work in mungbean production especially in terms of land preparation. In three out of six groups surveyed, 100% of the land preparation was done only by men. The rest of the work (e.g., seed sowing, weeding, harvesting, threshing, selling and other operations like fertilizer application) was done by both men and women almost equally.

Pesticide application was also done by both men and women. From the women's perspective, men carry out about 50%-75% while women carry out about 25%-50% of the spray operations. According to men, they did 50%-89% of the spray operations while women did 11%-50%. While men carried out more of the spray events, up to 50% of the pesticide spraying was done by women.

6. Pesticides and Applicator's Health: Most farmers have limited knowledge on pesticide hazards and risk of exposure. They are willing to buy pesticides that are highly toxic and they do not care about pesticide exposure to their body and the environment. They rely solely on -and have no alternatives to- use of chemical pesticides for mungbean production. Farmers mix many kinds of pesticides in high doses especially in Battambang and Kampong Chhnang (see Section 4: Pesticide Use). Some farmers said that when they feel sick, presumably resulting from pesticide poisoning, that they take only sugar, candy or soft drinks and they can be healed.

   The Body Map was used to ask participants to provided information on the signs and symptoms of pesticide poisoning that they had experienced after using pesticides. Most participants were not aware that the sign and symptoms reported (see table below) were related to pesticide poisoning.

Signs and Symptoms	**Koh Tamove KCN**	**Stoung Chrov, KCN**	**Bak Rotes, BTB**	**Prek Trop, BTB**	**Group 1 SR**	**Group 2 SR**
Dizziness	16/23 = 69 %	9/20=45 %	18/20= 90%	12/20= 60%	5-10%	100%
Loss of consciousness			1/20= 10%			
Headache		17 /20 =85 %		11/20 =55 %	5-10%	100%
Excessive sweating	12/23 = 52%	14/20 =70%	15/20= 75%	8/20= 40%	5-10%	
Burning/ stinging/ itchy eye		15/ 20 =75 %	7/20= 35%	13/20= 65%	5-10%	
Red eyes		15/20 =75 %	7/20= 35%	1/20=5%	5-10%	
Twitching eyelids				1/20= 5%		
Excessive tearing		12 /20 = 60%	1/20= 10%		5-10%	
Blurred vision		12 /20 =60 %				

Runny nose		15 /20 = 75%	1/20= 10%		5-10%	
Burning nose		9 /20 45 %	12/20= 60%		5-10%	
Excessive salivation	1/20 = 4.3%	16 /20 =80 %	8/20= 40%		5-10%	100%
Cough		15 /20 =75%	14/20= 70%	11/20=55 %	5-10%	
Dry throat		16 /20 =80 %	16/20= 40%	18/20=90 %		
Sore throat			16/20= 80%	13/20= 65%	5-10%	
Chest pain/ tightness		17 /20 =85 %	12/20= 60%	16/20=80 %	5-10%	
Shortness of breath		15 /20 =75 %		1/20=5 %		
Wheezing		1/20 =5 %				
Vomiting	3/23 =13 %	9/20 45 %	3/20= 15%	5/20=25 %	5-10%	100%
Nausea					5-10%	100%
Diarrhea	1/23 = 4 %	12/20 =60 %		1/20=5 %	5-10%	100%
Staggering gait	5/ 23 =21 %	16/20 =80 %	9/20= 45%		5-10%	100%
Exhaustion		17 /20 =85 %		16/20=80 %	5-10%	
Stomach cramp	6 /23 =39 %	14 /20 =70 %	9/20= 45%		5-10%	
Numbness	3 /23 =13 %	14 /20 =70 %	15/20= 45%	7/20=35 %	5-10%	
Tremor			6/20= 30%			
Muscle weakness	9/ 23 = 39 %	6/20 =30 %	8/20= 40%	2/20= 10 %	5-10%	
Muscle cramps		5/20 =25 %	9/20= 45%	8/20=40 %	5-10%	
Skin rashes		10/20 =50 %			5-10%	
Itchy skin		1/20 =5 %	9/20= 45%		5-10%	

<u>Note:</u> In Siem Reap province, the team was able to do the exercise on body map of signs and symptoms of pesticide poisoning with the field owners/managers. The data reported on were based on experiences of their workers.

The differences in the signs and symptoms experienced could be attributed to the kinds of pesticides used and different levels of pesticide exposure at the different survey locations. The differences could also be attributed to the equipment used for spraying pesticides. As mentioned in Section 4, in Battambang and Kampong Chhnang, farmers use manually operated backpack sprayers and are carrying out the operations for the whole day whereas in Siem Reap, farmers use improvised sprayers using hand tractors and complete the operations

in a shorter time. Hence the farmers in Battambang and Kampong Chhnang reported experiencing more signs and symptoms. It is also possible that because the field owners/managers (not the sprayers themselves) provided the data for Siem Reap, they could not give as much details as those who participated in the two other provinces.

The routes of pesticide exposure include:

Routes of exposure	**Koh Tamove, Kampong Chhnang**	**Stoung Chrov, Kampong Chhnang**	**Bak Rotes, Battambang**	**Prek Trop, Battambang**
Smoking	0	1/20 = 5%	8/20 = 40%	8/20 = 40%
Sraying upwind	23/23 = 100%	16/20 = 80%	14/20 = 70%	20/20 = 100%
Pesticides on hands when mixing	13/23 = 57%	16/20 = 80%	20/20 = 100%	20/20 = 100%
Leaking tank	4/23 = 17%	16/20 = 100%	20/20 = 100%	20/20 = 100%
Wet back	23/23 = 100%	16/20 = 80%	10/20 = 50%	20/20 = 100%

5. Inventory of pesticide shops:

   There were some small pesticide shops in the survey villages or in the local market near the mungbean fields. In these shops, the sellers sell pesticides imported from Thailand and Vietnam with other items such as groceries, soft drink, seeds or fertilizers. Some sellers sell pesticides only during the mungbean season. Some farmers buy pesticides from the local shops and some buy from markets at district or provincial level. Still some other farmers in Siem Reap buy pesticides from sellers who sell pesticides on the boat.

   A summary of pesticides in the shops and farmers use in survey area is provided in table below:

WHO Category (based on active ingredient)	Trade Name	Common Name	Target Pests (based on farmers report)
Class I	Fitor	Mevinphos	Army worm (*Spodoptera sp.*)
	UT. 80	Methamidophos	Cutworm (*Agrotis sp.*)
	Methomyl	Methomyl	Cutworm (*Agrotis sp.*)
	Vifuran 3 G	Carbofuran	Horn worm (*Acherontia spp*)
	Supracide	Methidathion	Aphid (*Aphisraccivora*)
	Phosdrin	Mevinphos	Army worm (*Spodoptera sp.*) Cutworm (*Agrotis sp.*)
	Mevinphos	Mevinphos	Army worm (*Spodoptera sp.*) Cutworm (*Agrotis sp.*)

	Methyl parathion	Parathion methyl	Cutworm (*Agrotis sp.*) Leaf folder
	Folidol	Parathion-methyl	Cutworm (*Agrotis sp.*) Leaf folder
	Methamidophos	Methamidophos	Army worm (*Spodoptera sp.*) Cutworm (*Agrotis sp.*)
Class II	First 20EC	Fenvalerate	Stem borer (*Melanagromyza cleomae*)
	Match 50EC	Lufenuron	Aphid (*Aphisraccivora*)
	Folitec	Fenvalerate	Legume shield bug (*Piezodoras hybneri*)
	Motox 5 EC	Alpha Cypermethrin	Aphid (*Aphisraccivora*)
	Netoxin 95 WP	Nerestoxin	Army worm (*Spodoptera sp.*)
	Tilt Super 300EC	Propiconazole	Leaf spot
	Perkill 50EC	Permethrin	Army worm (*Spodoptera sp.*)
	Hopsan 75ND	Phenthoate	Army worm (*Spodoptera sp.*)
	Cymerin 10EC	Cypermethrin	Aphid (*Aphisraccivora*)
	Cypermethrin	Cypermethrin	Pod borer (*Maruca vitrata*)
	ANCO 720 DD	2,4 D	Weeds
	Visher 25ND	Cypermethrin	Pod borer (*Maruca vitrata*) Aphid (*Aphisraccivora*)
	Videci	Deltamethrin	Horn worm (*Acherontia spp*)
	Chlorpyrifos	Chlorpyrifos	Pod borer (*Maruca vitrata*)
	Karate 2.5 EC	Lambda-cyhalothrin	Aphid (*Aphisraccivora*) Army worm (*Spodoptera sp.*)
	2,4-D	2,4 D	Weeds
	Padan 95WP	Nerestoxin	Aphid (*Aphisraccivora*) Horn worm (*Acherontia spp*)
	Regent	Fipronil	Aphid (*Aphisraccivora*) Horn worm (*Acherontia spp*)
	Cabendazim	Cabendazim	Pod borer (*Maruca vitrata*) Cutworm (*Agrotis sp.*)
	Cyhalothrin	Cyhalothrin	Pod borer (*Maruca vitrata*) Cutworm (*Agrotis sp.*)
	Acetamiprid	Acetamiprid	Aphid (*Aphisraccivora*) Horn worm (*Acherontia spp*)
	Oshin 20WP	Dinotefuran	Aphid (*Aphisraccivora*) Horn worm (*Acherontia spp*)

	Decis 2.5EC	Dethamethrin	Pod borer (*Maruca vitrata*) Cutworm (*Agrotis sp.*)
	Apache	Emamectin benzoate	Cutworm (*Agrotis sp.*) Army worm (*Spodoptera sp.*)
Class III	Actara 25 WG	Thiamethoxam	Aphid (*Aphisraccivora*) Pod borer (*Maruca vitrata*)
	Atabron 5EC	Chlorfluazuron	Stem borer (*Melanagromyza cleomae*)
	Pestop	Monosultap	Horn worm (*Acherontia spp*)
	Fomesafen	Fomesafen	Weeds
	Pantonga	Quizalofop	Weeds
	Abamectin	Abamectin	Aphid (*Aphisraccivora*)
	Citrameth-Luxen	Abamectin	Aphid (*Aphisraccivora*)
	ONECIDE 15 ND	Fluazifop-butyl	Weeds
U (Product unlikely to present acute hazard in normal use)	Amokbo	Buprofezin	Aphid (*Aphisraccivora*)
	Anvil 5 SC	Hexaconazol	Leaf spot
	Mancozeb	Mancozeb	Leaf spot

6. Conclusions

Every year, mungbean is grown after water has receded on several hundred hectares of fertile soil around the Tonle Sap Great Lake. Normally, mungbean farmers do not use fertilizer or irrigate the crop during production. The most important pest and disease problems experienced in mungbean production include: army worm, cut worm, bean pod borer, bean aphid, legume shield bugs, horn worm, rats, bean mosaic virus and angular leaf spot disease. Farmers depend solely on chemical pesticides for pest and disease control because they do not have knowledge of -nor have access to- alternatives for pest management. Farmers lack knowledge and information about pesticides and use highly hazardous products and dispose of pesticides and containers everywhere in the fields near canal/steam or ponds and around their houses. The lack of knowledge about the impacts of pesticide use and storage/disposal of containers results in exposure risks not only to the farmers but also to other vulnerable groups in the communities particularly women and children. This is particularly important when one looks at the pesticide contamination of the water sources used by both agriculture and non-agriculture populations. All farmers had experienced signs and symptoms of pesticide poisoning but were not aware of the relationship between pesticide use and the signs and symptoms experienced.

Pesticide use around the Tonle Sap Great Lake exposes humans and bio diversity in the lake to pesticide risks and contaminates the water that millions of Cambodian people are using and deriving their livelihoods from.

7. Recommendations

- Given that the survey found that pesticide use in mungbean production is quite rampant, both in terms of input costs as well as exposure to farmers and the environment, it would make sense to assist mungbean farmers reduce use of pesticides through IPM and Pesticide Risk Reduction training and action research.
- National IPM Programme staff with farmers should set up experiments on mungbean production as to try out techniques to improve production and identify environmentally-sound non-chemical alternatives for pest management. The most relevant and urgent experiments to be designed should address the following priority problems identified by farmers: insect pest and disease, management options like the use of resistant varieties, suitable spacing and seeding rate, soils and nutrient management.
- The field studies above-mentioned could be structured (like a pilot FFS) to allow farmers to meet weekly during the entire cropping season to develop mungbean IPM, to implement the field studies and to learn more about crop production and pesticide risk reduction.
- The curriculum of such action research-oriented training should address pesticide risk reduction. Key risky behaviors identified include, among others: use of highly toxic pesticides, mixing many kinds of pesticides, handling of pesticides during mixing and application without protection, storage of pesticides in and around homes and within easy access of children, disposal of pesticide containers around homes and in the fields near water sources. The curriculum should include Structured Learning Exercises that generate knowledge and promote practices that could potentially reduce risk associated with the distribution and use of pesticides among mungbean growing rural communities.
- Pesticide use in mungbean fields and other areas around Tonle Sap Lake should be regulated and strictly monitored because of its serious effects on fresh water fish and biodiversity in the Lake as well as the contamination of water that many Cambodian people are using. There is a need to explore and link-up with existing projects working on this topic for synergies and as to reach a wider group of farmers and communities who are at most risk as well as to achieve more impact in efforts to address biodiversity loss in the Tonle Sap Lake resulting from pesticide use.