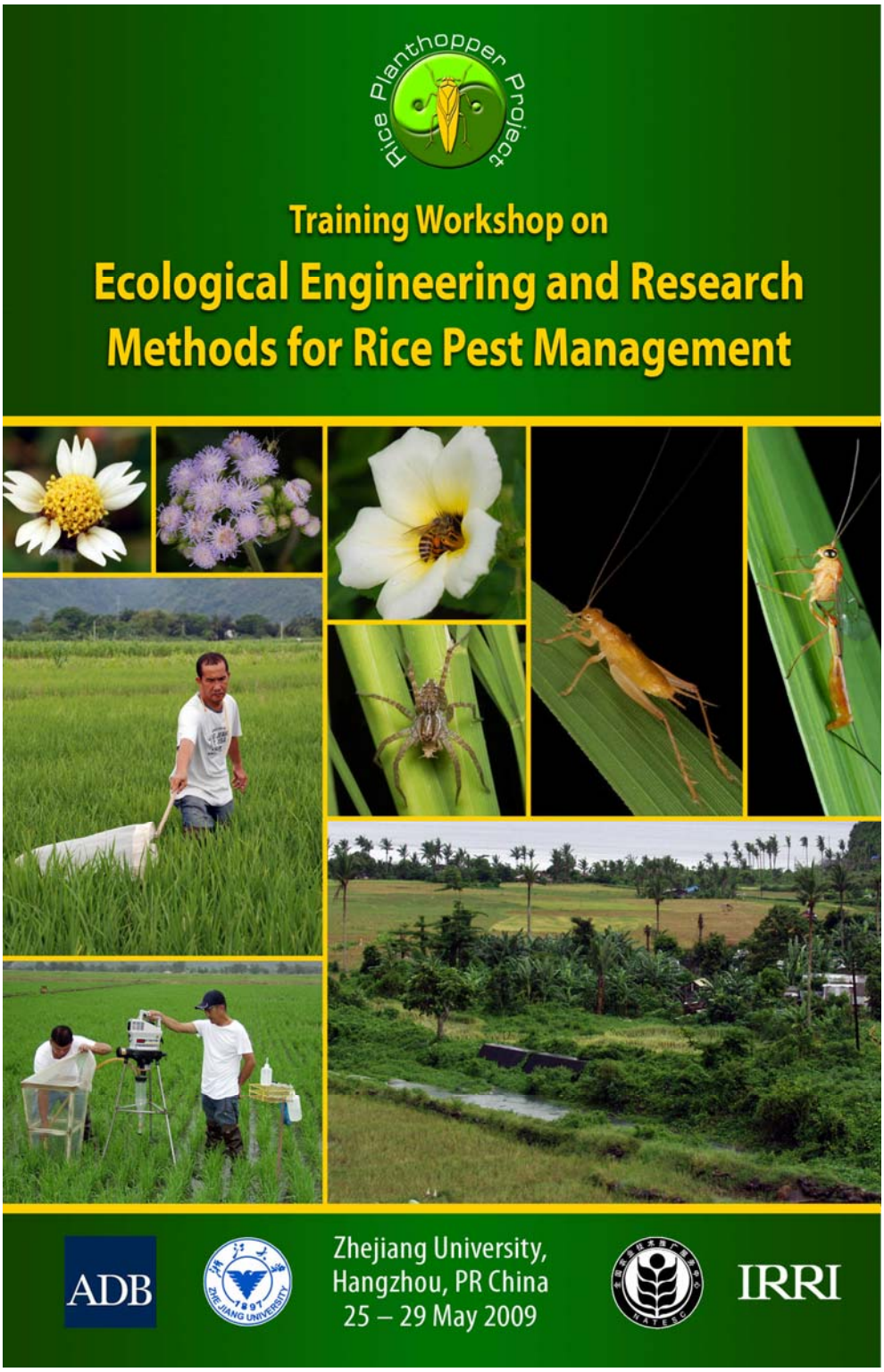
WORKSHOP REPORT



15 June 2009

SUMMARY

The ADB-IRRI planthopper project conducted a training workshop on ecological engineering and research methods for pest management at the Zhejiang University in Hangzhou, China from May 25-29, 2009. The training workshop aimed to develop jointly with partners sustainable ways to prevent planthopper outbreaks by protecting ecosystem services using ecological engineering tools. A total of 30 researchers, extension officials and university lecturers from China, Malaysia, the Philippines, Thailand, and Vietnam participated in the workshop.

In his opening address, Dr. Xia Jingyuan, Director General of the National Agro-tech Extension and Service Center (NATESC) emphasized that the major constraint in China's rice production is the planthopper outbreaks due to overuse of pesticides. He stressed that one way to restore ecosystem services is through ecological engineering. He challenged the Chinese participants to realize the importance of this project, to work seriously to achieve good results and to take full responsibility in following the standard procedure that will be developed during the training- workshop.

Dr. KL Heong, the project's principal investigator, introduced the concepts of ecosystem services, DPSIR framework and assessment methods. He stressed the importance of protecting ecosystem services in rice systems by insecticide reduction. The main purpose of ecological engineering, he noted, is to restore or build ecosystem services and resilience to build crop health or system immunity.

His talk was followed by Prof. Geoff Gurr of the Charles Sturt University who discussed basic concepts, research methods and the prospects of using ecological engineering in rice. Dr. Tomas Murray, an expert on pollination from Irelan, covered methods for assessing pollinator diversity and Dr. Finbarr Horgan of IRRI dealt with the importance and methods of insect trappings.

Prof. Jiaan Cheng of Zhejiang University presented the current dilemma of China's pesticide industry and the need for reform. Various ecological research methods were presented by Dr. Zhongxian Lu, Dr. Zeng Rong Zhu and Dr. Yong-gen Lou.

Participants developed work plans to implement ecological engineering in pilot sites in Guilin, Jin Hua (China), Chainat (Thailand) and Cai Be (Vietnam).

Background

Rice cultivation continues to suffer from planthopper outbreaks in many of the intensified areas like China, Vietnam, Korea, Malaysia and the Philippines. With the recent rice crisis, many countries are pressured to intensify production. The key question to pest management scientists is "Can rice production be intensified in a sustainable manner?" Planthoppers are insecticide induced secondary pests that flourish well when ecosystem services are compromised. They are r strategists with high reproductive and mobility capacities, highly adaptable to ephemeral environments and monophagous to rice. As

such, they tend to do well under agronomic practices of intensification that introduce extreme loss in biodiversity and related ecosystem services. The management of planthoppers will need to adopt a more holistic approach in balancing biodiversity needs over a large landscape. The Green Revolution (GR) of the 1970s and 80s were marred by secondary planthopper pest outbreaks triggered by multiple prophylactic insecticide sprays, which caused extreme loss in functional biodiversity of predators, parasitoids and detritivores. In the next GR, coined "Doubly Green Revolution" by Sir Gordon Conway, there is need for scientists to take the lessons learned and develop practical solutions that will continue to sustain rice productivity increase and have high ecological sustainability. However in recent years, planthopper problems in many countries have intensified (see http://ricehoppers.net/?s=outbreaks.).

Ecological engineering is "the design of human society with its natural environment for the benefit of both" and is thus a human activity to enhance ecosystem services. It involves the use of quantitative approaches and ecological theory as well as sociological aspects as part of nature. In pest management, ecological engineering approaches can be applied to focus on developing strategies, techniques, options and policies to enhance naturally occurring ecosystem services to maintain pest populations below economic injury levels at landscape level.

In November 2008, the ADB-IRRI Rice Planthopper Project (RETA 6489) was initiated which aims to reduce vulnerability of crops to pre harvest losses caused by planthopper pest outbreaks". The workshop was one in a series of capacity building activities to ensure smooth implementation of project workplans.

Workshop objectives

1. To provide participants with new concepts and principles of ecological engineering.
2. To introduce new knowledge on field and landscape methods in habitat manipulation.
3. To learn different research methods to quantify ecosystem services and biological control.
4. To plan and develop ecological engineering research experiments to be implemented in the next 12 months.

Resource persons

Prof Geoff Gurr	Applied Ecology, Charles Sturt University Orange, Australia
Prof Jia-an Cheng	Institute of Insect Sciences, Zhejiang University, Hangzhou, PR China
Dr Tomas Murray	Crops Research Centre, Teagasc, Oak Park, Carlow, Co. Carlow, Ireland

Prof Yong-gen Lou	Institute of Insect Sciences, Zhejiang University Hangzhou, PR China
Mr Gui-hua Chen	Plant Protection Station, Jin Hua Zhejiang, PR China
Dr Zhongxian Lu	Zhejiang Academy of Agricultural Sciences Hangzhou, PR China
Dr Zeng-Rong Zhu	Institute of Insect Sciences, Zhejiang University Hangzhou, PR China
Dr Finbarr Horgan	Crop and Environmental Sciences Division International Rice Research Institute Los Baños, Laguna, Philippines
Dr Kong Luen Heong	Crop and Environmental Sciences Division International Rice Research Institute Los Baños, Laguna, Philippines

Participants

China

Mr Yi-ling Xie	Guangxi Provincial Station of Plant Protection
Mr Cheng-sheng Xu	Lingui County Station of Plant Protection
Mr Wen-xing Wu	Lingui County Station of Plant Protection
Mr Hui Yang	Cha Dong Township Station of Agricultural Technology and Extension
Mr Jian-bo Lu	Cha Dong Township Station of Agricultural Technology and Extension
Ms. Xian-xin Li	Cha Dong Township Station of Agricultural Technology and Extension
Ms Rong Guo	National Agricultural Technology Extension and Service Center, Beijing
Mr Xu-song Zheng	Zhejiang Academy of Agricultural Sciences Hangzhou, PR China

Mr Xian-qiao Sun	Jinhua Plant Protection Station, Zhejiang
Mr Jiang-xing Wu	Ningbo Plant Protection Station, Zhejiang
Mr Zhao-pu Peng	Hunan Academy of Agriculture Sciences, Zhejiang
Dr Hua-feng Lin	Anhui Agricultural University, Anhui
Mr Xuehui Jiang	Zhejiang Plant Protection and Quarantine Bureau
Mr Jin-liang Zhu	Jiaxing Plant Protection Station
Mr Wei-xin Shen	Huzhou Academy of Agricultural Sciences, Zhejiang
Mr Ming-long Fu	Cannan Plant Protection Station, Zhejiang
Mr Yong-min Zheng	Liushi Town Agricultural Tech Station, Yueqing, Zhejiang
Mr Gen-xin Zhu	Jindong Plant Protection Station, Jinhua, Zhejiang
Mr Hong-hai Zheng	Xiangshan Agricultural Bureau, Zhejiang
Mr Jian-ren Ye	Wenlin Plant Protection Station, Zhejiang
Ms Lin Zhong	Jiangxi Provincial Plant Protection Bureau, Jiangxi
Dr Qiang Li	Yunnan Agricultural University, Yunnan
Mr Guang-hua Wang	Institute of Insect Sciences, Zhejiang University
Mr Wen-wu Zhou	Institute of Insect Sciences, Zhejiang University
Ms Qiong Yang	Institute of Insect Sciences, Zhejiang University
Ms Xue-qin Wang	Institute of Insect Sciences, Zhejiang University
Malaysia	
Dr Mohd Norowi Hamid	Strategic Resource Research Division MARDI, Serdang, Malaysia
Thailand	
Mr Manit Luecha	Chainat Rice Seed Center
Mr Somsak Thongdeethae	Chainat Rice Research Center

Ms Nalinee Chiengwattana	Chainat Rice Research Center
Mr Chairat Channoo	Chainat Rice Research Center
Vietnam	
Mr Ho Van Chien	Southern Regional Plant Protection Center Long Dinh, Tien Giang
Mr Nguyen Van Khang	Department of Agriculture of Tien Giang My Tho City, Tien Giang
Mr La Pham Lan	Institute for Agricultural Sciences Ho Chi Minh City
Dr Nguyen Van Huynh	Can Tho University, Can Tho Province
IRRI	
Ms Sylvia Villareal	Crop and Environmental Sciences Division
Ms Josie Lynn Catindig	Crop and Environmental Sciences Division

Training workshop outputs

1. DPSIR analytical framework. With BPH problem as an example of a state, a planning exercise using the DPSIR analytical framework was conducted. Each country teams were asked to identify 3 states, their impacts and responses. Below is the result of the planning exercise:

Country	States	Impact	Responses
China	BPH outbreaks	Unstable production	IPM/policy change
	Insecticide resistance	Yield loss	Insecticide rotation
	Biodiversity loss	Decline in bio control	Increase biodiversity/ habitat manipulation
Thailand	BPH outbreaks	Yield loss and high cost	IPM extension
	Loss of resistant variety	Yield unstable	Develop resistant variety
	Pesticide pollution	Loss of environmental	Regulation

		integrity	
Vietnam	Biodiversity loss	Crop vulnerability	Stop subsidy
	BPH outbreaks	Yield loss	Stop pesticide promotion
	Insecticide resistance	Overuse	Increase natural control, insecticide management change

2. The planning exercise based on DPSIR analytical framework developed by each team was later transformed to be measurable.

Country	Problems	Framework element (State)	Indicators	Data source/sampling method
Jinhua	BPH outbreaks	Unstable production, increase cost	Area and density	Field survey
	Pesticide resistance	Increase in LD_{50}	LD_{50}	LD_{50} monitoring
	Pesticide misuse	Increase in times of spray, varieties and dosage of pesticide	Times/varieties/dosage	Farmer survey
	Decline in ecosystem services	Decline in species and natural enemies and their abundance	Species and abundance	Net sweeping, pitfall trap, blow-vac sampling, plant with eggs
	Pesticide residue	Decline in qualification	Quality of residue	Monitoring pesticide
	Increase costs	Increase costs of pesticides and fertilizers	Cost	Farmer survey (include time and variety but not dosage)
	Increase frequency outbreak of SB and LF	Increase frequency of outbreak of SB and LF	Area and diversity	Field survey
	Underground water pollution	Underground water polluted	Content of pesticide	Monitoring pesticide/get data from other department or sources

Guillin	BPH outbreak	Loss of natural control (predator) within rice field	Geographical variation of predator	Collection of spiders, mired and samples form 4 expt. sites
	Wasp, dragonfly	Loss of biodiversity Loss of general aerial predators	Richness (number and size), wasp nests around rice field bunds and non-rice habitats, correlation between wasps indicators, correlation with habitat ecosystem, richness of aquatic and aerial predator of BPH etc, genetic variation of flying general predators (dragonflies, wasps, etc)	Field census, collection of general predator samples from different countries (sweep nets, etc.), taxonomic analysis: CO1, CO11 analysis and etc.
		Loss of natural control (parasitism)	Induced volatiles attracting parasitoids	Collection of rice seeds (varieties) samples; volatile composition analysis; bioassay (Y-tube test), etc.
Thailand	BPH outbreak	Resistant variety Multivariety Bio control Biodiversity	Yield loss % area hopperburn	Sweep net/week Yellow pan trap/week Light trap/day
	Rapid loss of resistant variety	Improve rice variety, Multivariety Ecological engineering	Prolong resistant variety Resistant variety stable more than 5 years	Report of outbreak
	Pesticide pollution	Reduce using pesticide Biodiversity	Increase organism	Sweep net/week Yellow pan trap/week Light trap/day

Vietnam	BPH outbreak	BPH population	%area covered by outbreak-hopperburn	Refer to available data
		Parasitization	No. of parasite species	Plant with egg traps Sweep net No. of pesticide applications
		Predation	No. of predator species	Blow-vac Pitfall traps No. of pesticide applications
	Pollination loss	Reduction in pollination diversity	No. of floral diversity	Blow-vac, net sweep, yellow pan trap, farmer record keeping, pitfall trap
	Pollution	Quality of water	Content of endosulfan	Aquatic fauna No. of pesticide applications

2. Tasks for Ecological Engineering Project

The following tasks are recommended before setting-up the experiment.

a. Identify the experimental site. The site should be at least 20 ha or a minimum of 10 ha.
b. Draw a map of the two sites. This can be done either by physical method or through the use of GIS. The data will be to compute the habitat diversity of the area.
c. Make a survey on the kinds of flower in the area. In general yellow or white flowers of the Family Compositae are of high nectar content.
d. Select 2 to 3 creepers and multiple the seeds for sowing on the rice bunds.
e. In growing the rich-nectar flowering plants, insecticide spraying should be avoided.

3. Work plan

	2009												2010								
Activities	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**
Jinhua																					
Workshop					X	X							X								
Finalize protocol and send out																					
Baseline						X	X	X	X												
Habitat manipulation				X	X	X	X														

BPH dynamics (light trap, density, area)					X	X	X	X	X	X	X						X	X	X	X	X
Ecosystem services						X	X	X	X	X	X						X	X	X	X	X
Pesticide misuse (Times/varieties/dosage survey)						X	X	X	X	X	X					X	X	X	X	X	X
Pesticide residue (Monitoring pesticides)											X										
Farmer costs (Agro chemicals/pesticide and fertilizers)						X	X	X	X	X	X					X	X	X	X	X	X
dynamics of SB and LF						X	X	X	X	X	X					X	X	X	X	X	X
Underground water pollution(Monitoring pesticide)												X									
Field day (famer school)									X											X	
Follow up workshop																X					
Guillin																					
Workshop					X																
Finalise protocol and send out																					
Resource person Meeting						X															
Site selection						X															
BPH and natural enemy survey								X	X	X						X	X	X	X	X	X
Flora and arthropoda survey						X										X				X	
weed plant						X	X								X				X	X	
farmer interview(pesticide use)							X				X								X		
Set up light traps								X	X	X						X	X	X	X	X	X
farmer training								X	X								X	X		X	X
farmer's day										X											
Data record								X	X		X	X			X	X	X		X	X	X
Review workshop											X										
SHOW AND TELL																			X		
Follow up workshop																					
Thailand																					
Workshop					X																
Finalize protocol and send out					X																
Baseline survey						X															
Collect seed and plant of flora						X	X														
Growing fora							X	X													
Rice seed bed						X							X								
Growing rice							X	X	X	X				X	X	X	X				
Sampling pest and NE																					
- Sweep net							X	X	X	X	X	X	X	X	X	X					
- Yellow pan trap								X	X						X	X					

- Bait trap						X	X	X	X	X	X	X	X	X	X	X	X				
-Light trap	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Detritivor						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Identified pest and NE							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Field day																					X
Analyze data											X	X						X	X		
Writing report												X							X	X	
Follow up workshop																					
Vietnam					X																
Training/Workshop						X															
Work plan						X															
Resource person Meeting						X															
Site selection						X	X														
Flora assessment						X	X														
Historical profile of selected sites							X														
Site preparation									X												
Experiment establishment							X	X	X												
Weed flower seed multiplication								X	X												
Field play out									X	X											
Site Mapping						X	X	X	X	X	X	X	X	X	X	X	X	X			
Set up light traps										X											
Seed weed flower sowing											X										
Rice sowing											X	X	X	X	X	X	X				
Field assessment							X														
Farmer training															X						
Field day						X	X	X	X	X	X	X	X	X	X	X					
Data analysis (light trap and field data)															X	X					
Report writing																	X				
Review and planning workshop																					

4. Manual to standardize sampling protocol for the pilot project

A manual of the sampling protocol on pitfall trap, yellow pan trap, blow-vac, and sweep netting will be developed. This will enable the different country teams to get common data sets which can be analyzed and written up for peer-reviewed journals.

5. Other issues

The following are proposed for the next Ecological Engineering meeting:

a. Introduce new techniques
b. Biodiversity analytical tools training - how to transform spreadsheet data into a meaningful one
c. Further taxonomic consultation

d. Mapping technique where insects are to be coded

The budget allocation will be consolidated for each country teams.