

Rice farmers' decision making and practices in pest and nutrient management in the Lao PDR

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Abstract

The use of insecticides by rice farmers in the Lao PDR is low compared to other Asian rice growing countries, although there is an indication of an increasing trend towards insecticide use at present. Low use of pesticide in Laos may be due to farmers' lack of resources to purchase as well as the unavailability of the pesticides. The objective of this study was to investigate rice farmers decision-making beliefs and practices regarding the use of insecticides and nutrient management.

Insects were ranked as the most serious pests by respondents in all study sites. Most farmers' sprays target control of the slender rice bugs. Most farmers strongly believe that insects decrease rice production and have to be controlled with insecticides. The agricultural extension workers seem to have highly influenced the farmers. It is evident that appropriate training of extension workers on ecological principles in integrated pest management (IPM) and insecticide use is important for implementation of sustainable pest management practices by rice farmers in Laos. IPM concepts should be established as the social norm and motivation of extension workers at national, provincial and district levels.

Rice farmers in Laos can potentially become victims of pesticide misuse just like farmers elsewhere in Asia. Strategic efforts will need to be developed and implemented if such scenario is to be prevented. As commercialization increases, the pesticide trade will inevitably increase. There is need to establish comprehensive pesticide policies to regulate imports, processing and marketing of the products. An extension program to educate extension workers and farmers on the health hazards and ecological principles related to pesticide use will be beneficial. Similarly, educational programs for agricultural colleges, schools and exploration of non face-to-face approaches like posters, radio, television, journals, comic strips could be used to encourage more benign plant protection practices.

Introduction

Rice is the single most important crop in the Lao PDR. In 1999, the area planted to rice was approximately 717,600 ha, representing more than 80% of the cropped land area nationally. Approximately 83% of rice production came from cropping activity in the wet-season lowland ecosystem accounting for about 67% of the total area and 71% of the production. Approximately 84% of the wet-season lowland rice area is located in the central and southern agricultural regions, mainly in provinces adjacent to the Mekong River. Savannakhet province, in the lower, central agricultural region, with 103,400 ha in 1999 (21.7% of the total area), has the largest area of wet-season lowland rice of any single province. The area planted to rice under irrigated conditions in the 1999 dry season was approximately 87,000 ha. More than 64% of the area irrigated was in the central agricultural region.

In the wet-season lowland environment, farmers rate insect pests among the top three production constraints in almost all rice producing provinces of the Mekong River Valley (Lao-IRRI, 1996). Drought was the only other factor to be consistently ranked as being more important than insect pests. Most pests perceived as problems are those, which are highly visible, with the majority of farmers believing that leaf-feeding insects cause yield loss (Rapusas *et al.*, 1997). The perception of the importance of insect pests on production is not associated with high levels of pesticide use (Heong *et al.*, 2000), despite the fact that most farmers strongly believe that insects decrease production and should be controlled with insecticides. The low use of pesticides in Laos is probably due to the farmers' lack of resources to purchase them, and unavailability of the pesticides.

Despite the perception of the importance of insect pests in limiting yield, attempts to demonstrate their economic impact have generally not been successful. However, it is acknowledged that the rice gall midge (*Orseolia oryzae*) is economically important in some areas, mainly in the central agricultural regions (Inthavong, 1999). Another insect pest, which is increasingly cited by farmers as causing substantial yield loss in provinces of the Mekong River Valley is the rice bug (*Leptocorisa spp.*; Inthavong *et al.*, 2000). It is acknowledged that on a localized basis at least, the rice bug is a problem, which appears to be increasing in importance from year-to-year.

As with the wet-season lowland environment, surveys of farmer perceptions of the importance of insect pests in the dry-season irrigated environment, revealed that farmers rate them as among the top three production constraints (Lao-IRRI, 1998). Of more recent significance in dry-season irrigated areas (and areas double cropped in the wet-season) are the rice bug, the golden apple snail and the brown plant hopper (Agricultural Extension, 1994). In both the wet-season and dry-season environment, the diseases rice blast, bacterial leaf blight, brown spot and bakanae are recorded and can occasionally become important on a localized basis, although they are not regarded a serious overall constraints to production.

An important first step towards designing sustainable pest management approaches in Laos is thus to understand farmers' decision-making and practices in pest and nutrient management. The main objectives of this study are to develop a baseline of current decision-making and practices, and to determine the main psychological factors influencing insect management decisions.

Methods

Study sites

The study was carried out in four provinces that are important rice areas in the Lao PDR. Most of the areas were rainfed lowlands with some areas irrigated.

Farmer survey questionnaire

The survey questionnaire was developed using the conceptual framework described by Heong and Escalada (2000). The questionnaire instrument was developed after focus group discussions and exploratory surveys had been conducted. Drafts of the questionnaire were prepared in English, translated into Lao and pre-tested before it was finalized. Data was collected through the use of the questionnaire administered by trained technicians and directly supervised by one of the authors. A total of 500 farmer respondents stratified by the four study sites were randomly selected for the interviews.

Each respondent was asked individually how true each statement was using descriptor phrases on prompt cards in a 5-points Likert scale. The descriptors were "never true", "in most cases not true",

“may be true”, “in most cases true” and “always true”. Subject norms were measured by assessing each respondent’s perception of what is expected of him or her with regards to insecticide spraying frequency. The reference groups used were neighbor, pesticide dealer, extension, training and others.

Statistical analyses

The data were coded using the spreadsheet program EXCEL and error checked using the EXPLORE procedure in SPSS for Windows before statistical analyses.

Results

Profile of farmer respondents

The profiles of the respondent farmers in the four study sites are summarized in Table 1. Most respondents were between 21 and 71 years of age. Farmers in Vientiane Municipality were slightly younger. The average education was about 4.8 years in Vientiane Municipality, 3.7 years in Vientiane province, 4.3 years in Savannakhet province and 4.9 years in Champassak province. Farm sizes were small. The largest were found in Vientiane province (1.71 ha), followed by Savannakhet province (1.47 ha), Vientiane Municipality (1.21 ha), and Vientiane province (1.09 ha), respectively. Years of farming experiences were between 19.3 and 25.5 years. The sowing rates reported by respondents were significantly different between study sites. They were highest in Champassak (73.2 kg/ha) followed Vientiane province (71.6 kg/ha) and Savannakhet province (67.4 kg/ha). Farmers from Vientiane Municipality (63.2 kg/ha) reported the lowest sowing rate.

Table 1. Profile of farmers interviewed in four study sites in the Lao PDR.

		Vientiane Munic. N=100	Vientiane Prov. N=100	Savannakhet Prov. N=150	Champassak Prov. N=150
Age	Mean	42.7	46.5	45.3	47.2
	Median	43	47	45	47
	Mode	45			
	Range	21-64	24-70	19-71	23-66
Education (years)	Mean	4.8	3.7	4.3	4.9
	Median	5	4	4	5
	Mode	4			
	Range	0-11	0-11	0-11	0-8
Farm size (ha)	Mean	1.21	1.09	1.47	1.71
	Median	1	1	1.2	1.6
	Mode	1			
	Range	0.4-3	0.3-2.5	0.5-4	0.5-5
Rice farming	Mean	20.6	19.3	25.5	25.6
	Median	21	18.7	25.2	26
	Mode	20.7	18.1	25	25.8
	Range	2.3-41	3.7-38	5.25-49.3	2.5-50
Experience (years)	Mean	62.3	71.6	67.4	73.2
	Median	62	72	67	73
	Mode	61.5	71.3	66.8	72.6
	Range	52-80	50-90	60-80	60-85

Pest and nutrient management

Table 2 shows that insects were considered the most serious pests, followed by weeds and disease, respectively. More than 77.5 % of farmers did not use any insecticides, the highest report coming from Champassak province followed by Savannakhet (67.3%), Vientiane municipality (53.3%) and 34.4% in Vientiane province. The mean number of sprays was highest in Vientiane province (52.1%) with most farmers spraying once. Among the farmers who sprayed, a large proportion applied between booting to heading stages. Their most common targets were rice bugs, gall midge and stem borers (Table 3). Most farmers (25.7%) sprayed for rice bug during heading stages while gall midge (1.5%) and stem borer (4.1%) were sprayed mainly in the tillering stage. Few farmers were recorded spraying to control leaf folders between seedling and booting stages were (Table 4).

Table 2. Farmer ranking of most important pests in the four study sites in the Lao PDR.

Province	Most serious	Second most serious	Third most serious
Vientiane Municipality	Insects	Weeds	Diseases
Vientiane	Insects	Diseases	Weeds
Savannakhet	Insects	Weeds	Diseases
Champassak	Insects	Diseases	Weeds

Table 3. Frequencies and timing of insecticide applications reported by farmers.

	Vientiane Munic.	Vientiane Prov.	Savannakhet Prov.	Champassak Prov.
<i>Insecticide use frequencies</i>	%	%	%	%
None	53.3	34.4	67.3	77.5
1	29.7	52.1	20.2	18.1
2	11.5	11.4	5.1	3.1
3	4.9	2.1	2	1.3
>3	0.6	0	6.4	0
<i>Timing of first</i>				
Seedling (0-20 DAT)	0	6.1	0	2.7
Tillering (21-40 DAT)	10.3	7.5	22.7	11.8
Booting (41-60 DAT)	15.7	29.4	10.4	29.3
Heading (61-70 DAT)	0.8	31.8	32.7	2.5

Table 4. Target pests of pesticide applications at various crop stages

Pests	% of farmers spraying in each crop stages				Total
	Seedling	Tillering	Booting	Heading	
Rice bugs	0	0	0.7	37	37.7
Gall Midges	0.2	1.5	0	0	1.7
Stem borers	0.5	3.8	0.3	0	4.6
Leaf folders	0.5	5.1	2.8	0	8.4
Grasshoppers	2.3	0.3	0	0	2.6
Brown plant hoppers	0.2	2.8	0	0	3.0
Thrips	4.0	3.1	0	0	7.1
Snails	1.5	0	0	0	1.5
Crabs	1.5	3.4	0	0	4.9
Others	0	0.3	0	0	0.3

Attitudes towards cultural, nutrient and insect management

Farmers in the four study sites responded differently to the belief statements used. Significantly, most farmers believed that to increase yields it is necessary to use more insecticides; that there is a need to kill all insect pests and that loss from insect damage is important. Table 5 shows the responses of farmers to those statements. Farmer responses were significantly higher (71.4%) in Vientiane province, followed Savannakhet province (63.2%), Vientiane Municipality (61.5%) and Champassak province (54.1%).

Farmers seem to strongly believe that to increase yields, one needs to use fertilizer. In Savannakhet 97.2% believe this, followed by Champassak (95.5%), Vientiane Municipality (95%) and Vientiane province (89.7%). Most farmers in all sites seem to have good knowledge that applying compost will improve soil fertility and also that to increase yields it is necessary to use extra fertilizer. However, farmers have little knowledge of cultural practices and pest management. Most farmers believe the impact of cultural practices of pest management, such as a high seed rate will increase yield and cause more disease problems. This is similar to the statement that excess fertilizer will lead to weed problems. However, most farmers believe that weed control must be carried out before fertilizer application.

Table 5. Comparison of farmers' attitudes toward cultural practices, nutrient and pest management and rice yields.

Statements	Vientiane M. Vientiane P. Savannakhet Champassak			
	% of farmers who strongly agreed to the statements			
<i>Impact of insecticide and fertilizer on yields:</i>				
To increase yield need to use more insecticide	61.5	71.4	63.2	54.1
To get high yields, all insect pests need to be killed	90.1	87.5	92.7	80.7
To increase yields need to use fertilizer	95	89.7	97.2	95.5
To increase yields need to use extra fertilizer	91.1	83.1	90.1	92.7
More nitrogen will produce more filled grains	55.1	31.2	39.3	41.3
More filled grains means higher yields	95	89.1	97.2	98
Applying compost will improve soil fertility	71.4	83.1	94	82.7
Rice plants will give a good yield even without any fertilizer	25.3	11.1	28.5	19.2
<i>Impact of cultural, nutrient and pest management on yields:</i>				
Using a high seed rate will increase yield	37.5	48.2	29.5	22.0
High seed rate increases diseases incidence	11.6	30.2	24.6	12.1
Weed control must be done before fertilizer applications	81.2	67.4	71.4	83.1
Excess fertilizer will lead to weed problem	27.3	12.1	6.3	10.6
Applying excess fertilizer will increase disease incidence	25.5	33.2	47.3	19.8
Applying excess fertilizer will increase pest problem	14.7	22.9	36.9	15.3
Applying fertilizer and pesticides together save time and labors	37.6	69.3	79.1	48.7

Subject norm attitudes

Among the reference groups used in subjective norm evaluation between pest and fertilizer management, in almost all study sites, extension had the most influence followed by pesticide dealers, neighbors and training (Table 6).

Table 6. Reference groups' subjective norm in 4 study sites

Reference groups	Vientiane Munic.	Vientiane Prov.	Savannakhet Prov.	Champassak Prov.
<i>% Influence of subject norm</i>				
<i>Pest management</i>				
Neighbours	13	15	35	40
Pesticide dealer	22	29	31	29
Extension	55	40	27	19
Training	10	16	7	12
<i>Nutrient management</i>				
Neighbors	18	36	11	27
Pesticide dealer	35	17	40	38
Extension	30	26	35	24
Training	17	21	14	11

Discussion

Insecticide use of rice farmers in Laos is low compared to other Asian rice growing countries. However, if compared to 1996, insecticide use had more than doubled by 2001. This may be an indication of an increasing trend towards insecticide use (Heong *et al.*, 2001). About 15% of the sprays were targeted in the early crop stages for gall midge, stem borer and leaf folders. Most sprays (37%) were applied in heading stage for the control of the slender rice bugs, *Leptocorisa spp.* The main insecticide used had not changed much from the past two years ago. Sprays for the control of the slender rice bugs are also of questionable benefits as no measurable reduction in yield could be recorded (Van Den Berg and Soeharbi, 2000).

In all study sites, farmers' spray frequencies were directly related to beliefs and also spraying frequencies were strongly correlated with the subject norm, indicating the extent to which the farmers feel what others think about spraying or pressure is highly influential. It appears that influences of the reference groups are important in farmers' decisions. The most influential reference group appears to be the extension workers, implying that farmers believe that extension workers expected them to spray in most cases (Heong *et al.*, 2000). It is evident that appropriate training of extension workers on ecological principles in integrated pest management (IPM) and insecticide use is important for sustainable pest management practices of rice farmers in Laos. IPM concepts should be established as the social norm and motivation of extension workers at national, provincial and district levels.

Laotian farmers' attitudes towards insects and insecticide use as well as risk perceptions are similar to those in the Philippines (Heong and Escalada, 1999). Rice farmers in Laos can potentially become victims of pesticide misuse just like farmers elsewhere in Asia (Heong and Escalada, 1997). Strategic efforts will need to be developed and implemented if such a scenario is to be prevented. As commercialization increases, the pesticide trade will inevitably increase. There is a need to establish comprehensive pesticide policies to regulate imports, processing and marketing of the products. Weak

national pesticide policies in Laos will further promote pesticide sales and misuse similar to Thailand (Oudejans, 1999). An extension program to educate extension workers and farmers on the health hazards and ecological principles related to pesticide use will be beneficial. In countries where extension plays both the advisory and marketing roles in pest control, pesticide misuse had always been extensive (Norton *et al.*, 1991). In addition, where pesticide purchase is incorporated into farm credits and subsidy schemes pesticide misuse is often promoted (Oudejans, 1999).

The Lao government plans to intensify rice self-sufficiency and in the near future, it will be important that the lessons regarding pest management and pesticide policies be learned from experiences in other countries and that implemented rice intensification programs are taken into account as important components of the national strategic plan for sustainable agricultural development to ensure that pesticide misuse is avoided.

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