

Changes in rice farmers' pest management beliefs and practices in Vietnam: an analytical review of survey data from 1992 to 2007

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The changing trends in farmers' pest management beliefs and practices in the Mekong Delta of Vietnam from 1992 to 2007 were explored using 12 survey data sets collected during the period. Farmers' pest management practices, reflected in the number of insecticide sprays they apply in a season, decreased immediately after interventions, such as the mass media campaign, the radio soap opera, and farmer field school training. However after a few years, their insecticide sprays increased as the practices learned were discontinued. Farmers' reliance on pesticides as the main means of pest control had remained relatively unchanged. The discontinuance could be attributed to the lack of repetition and follow-ups after each of the interventions and the increase in frequency of pesticide advertising. Constant repetition, a strategy used in pesticide advertising, seemed to have eroded practices learned and supported availability biases of farmers. The farmers' average age over the period had also remained unchanged, implying that there had also been a turnover of farmers. To sustain pest management interventions, through campaigns, entertainment-education, or season-long training programs, it is important that follow-up programs and repetition strategies be implemented.

The agrochemical era of the 1960s and 1970s is said to have influenced chemical-oriented agricultural research and extension (Rossiter 1975) and this contributed to the rampant pesticide misuse in the Green Revolution. Rice intensification programs in Asia were dominated by campaigns, agricultural subsidies, and bank loans that promoted prophylactic insecticide applications (Kenmore et al 1987, Conway and Barbier 1990, Conway and Pretty 1991). Aggressive advertising and marketing campaigns launched by the pesticide industry also played a significant role. As a result, as much as 80% of the insecticide sprays farmers apply are deemed unnecessary (Heong et al 1995) and, with the poor sprayer equipment they use, more than 75% of the active ingredients do not reach the targets, ending up in the water. In most cases, rice farmers are better off not using them, and ecosystem services that naturally render protection from pest invasions can be better conserved. In the last 20 years, many programs have focused on changing rice farmers' pest management and rationalizing pesticide

use. Perhaps the most dominant program is the FAO-led farmer field schools (FFS) approach (Matteson et al 1994, Matteson 2000) to empower farmers through training to make better decisions. The FFS programs were well funded and conducted training for millions of farmers. These programs were costly, remained dependent on foreign funding, and were rarely sustainable and continued by national extension programs (Feder et al 2003, Bentley 2009).

The use of mass media to improve farmers' pest management decisions was explored in Vietnam (Escalada et al 1999, Huan et al 1999). Print materials, such as pamphlets and posters, billboards, and radio and TV programs were specifically designed to motivate farmers to avoid using insecticides in the first 40 days after sowing. Insecticide applications during this crop period have no economic return to farmers. Instead, the sprays destroy natural biological control linkages, making crops vulnerable to invading pests, such as leafhoppers and planthoppers (Heong and Schoenly 1998). A complementary program using a radio soap opera series was also used (Heong et al 2008). These programs had positive effects on farmers' beliefs, attitudes, and practices, reducing insecticide sprays by more than 50%.

In each of the media projects, pretest and posttest surveys were conducted and, between 1992 and 2007, we carried out 12 such surveys in the Mekong Delta, interviewing a total of 9,067 farmers. Most of the variables in the surveys are similar and in this paper we report an analysis of these data sets, paying particular attention to changes over the 15-year period in rice farmers' pest management practices and attitudes toward pests, natural enemies, and pesticides.

Methods

Table 1 shows the details of the farmer survey data we analyzed. All the surveys were conducted in the same manner. Before each survey, a focus group discussion was conducted and its results were used to develop the questionnaires. The prototype questionnaires were first developed in English, then translated into Vietnamese to be pretested before they were finalized. Enumerators were trained and final-year students from the local agricultural technical colleges were supervised by one of us to ensure quality control. The data obtained were then coded using Microsoft Excel, cleaned up, and then uploaded into SPSS 11.5 (SPSS 2002) for analyses.

Results

Profiles of farmer respondents in the 12 surveys conducted

The average ages of farmers ranged from 43 to 49 years, which remained relatively stable in the last 15 years (Table 2). This implied that there had been a constant turnover in the farming communities. Farmers' education level of 6 to 7 years also remained relatively unchanged. Similarly, farm sizes remained small, which is attributed to the government's land tenure policy, while yields appeared to have increased slightly.

Table 1. Details of the farmer surveys conducted in the Mekong Delta.

No.	Location	Date	Purpose	No.	Reference
1	6 provinces	May 1992	Baseline	685	Heong et al (1993)
2	Long An Province	Aug 1994	Pretest	633	Escalada et al (1999)
3	Long An Province	Mar 1997	Posttest	628	Escalada et al (1999)
4	Can Tho Province	Aug 2002	Pretest	606	Huan et al (2008)
5	Tien Giang Province	Aug 2003	Pretest	600	Huan et al (2008)
6	Can Tho Province	Feb 2004	Posttest	611	Huan et al (2008)
7	Tien Giang Province	Sept 2004	Posttest	640	Huan et al (2008)
8	Vinh Long Province	May 2004	Pretest	600	Heong et al (2008)
9	Vinh Long Province	July 2005	Posttest	609	Heong et al (2008)
10	Can Tho Province	2006	Pretest	600	Unpublished
11	9 provinces	2006	Monitoring	1,800	Unpublished
12	Can Tho Province	2007	Posttest	602	Unpublished

Table 2. Respondents' profiles in the 12 surveys conducted in the Mekong Delta.

Survey	Age (years)	Education (years) ^a	Farm size (ha)	Yields reported (t ha ⁻¹)
6 provinces	45.2	n.a.	1.6	4.7
Long An Province	43.6	5.5	1.2	3.5
Long An Province	42.5	6.1	1.5	4.2
Can Tho Province	44.3	6.5	0.9	4.6
Tien Giang Province	45.6	6.8	0.8	4.5
Can Tho Province	43.9	6.6	1.1	5.6
Tien Giang Province	47.3	6.9	0.6	5.0
Vinh Long Province	49.4	6.1	0.8	4.8
Vinh Long Province	47.4	7.1	0.8	5.1
Can Tho Province	45.7	6.7	1.2	6.9
9 provinces	45.0	6.9	1.5	4.6
Can Tho Province	46.5	6.8	1.1	7.6

^an.a. = not applicable.

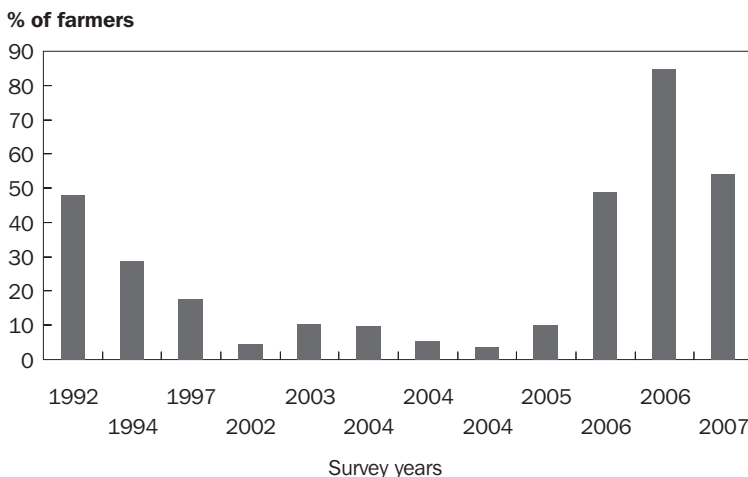


Fig. 1. Percentage of farmers reporting that planthoppers were their most serious pest problem in surveys between 1992 and 2007.

Trends in farmers' pest perceptions

Research has shown that leaf-feeding insects have little impact on rice yields (Graf et al 1992), yet farmers generally spray them because of the highly visible damage (Heong and Escalada 1977). We examined the pests farmers perceived to be most important and found that farmers named planthoppers as the most serious in the early 1990s. This subsequently declined to less than 10% of farmers naming planthoppers as serious but starting in 2006 planthoppers were again named as the most serious by more than 70% of the farmers (Fig. 1).

The media campaigns paid special attention to reducing early-season spraying of leafhoppers, which is reflected in farmers perceiving leaf feeders as the most important pest. In each campaign, the proportion of farmers that listed leaf feeders as the most important declined by as much as 28% immediately after the launch of the campaign (Fig. 2). Generally, less than 10% of the farmers listed stem borers as the most important and this remained relatively stable over a span of 15 years.

Trends in farmers' pest management and insecticide usage

From 1992 to 2007, farmers continued to remain dependent on pesticides as more than 75% cited these as their primary means of insect control. Although the use of ducks had been cited occasionally, the use of resistant varieties was never mentioned once. Hand picking was cited, especially for snail and weed management. Some 30% to 84% of the farmers believed that insecticide spraying would result in higher yields. At the same time, 47% to 89% of the farmers also believed that insecticide would kill natural enemies.

Farmers' insecticide use in different provinces in Vietnam differed significantly. In Long An Province, where the first media campaign was carried out in 1994 (Escalada et al 1999), farmers' insecticide use declined by 53% immediately after the campaign

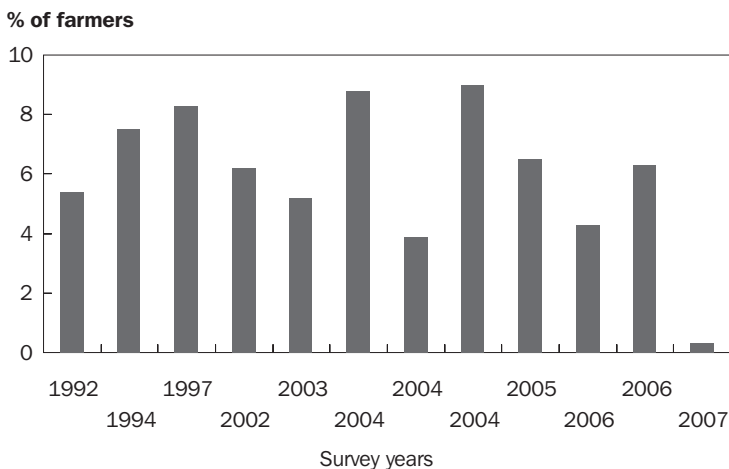


Fig. 2. Percentage of farmers reporting that stem borers were their most serious pest problem in surveys between 1992 and 2007.

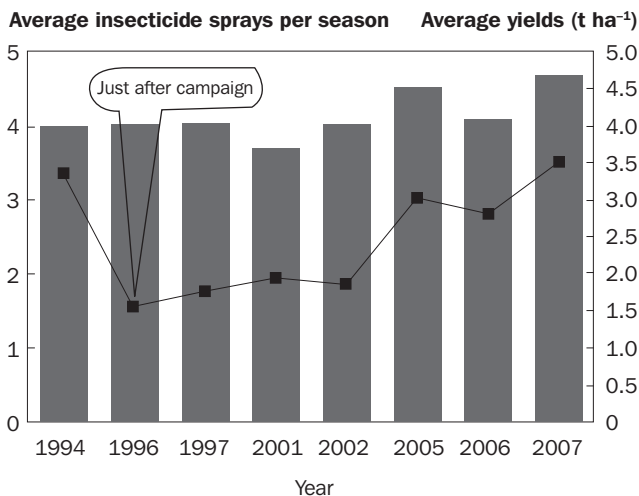


Fig. 3. Farmers' mean number of insecticide sprays and yields from surveys conducted between 1994 and 2007 in Long An Province.

and remained low for about 9 years (Fig. 3), whereas average yields increased moderately. The monitoring surveys in 2007 showed that insecticide sprays had returned to precampaign levels of about 3.5 sprays per season. Similarly, in Can Tho Province, farmers' insecticide use was about 1.2 sprays per season in 2002 and less than 1 per season in 2004, but rose to 1.8 and 2.5 sprays in 2006 and 2007, respectively (Fig. 4).

Farmers' insecticide sprays per season

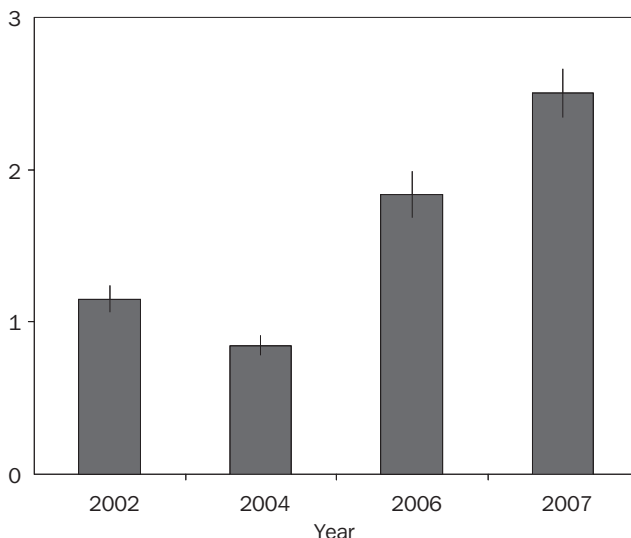


Fig. 4. Farmers' insecticide sprays in surveys conducted between 2002 and 2007 in Can Tho Province.

The types of insecticides used by farmers in the Mekong Delta changed over the 15 years. In the early 1990s, the main insecticides used were organophosphates (44.1%) and in 2007 only 22.5% of the sprays were organophosphates (Table 3). The main active ingredients used in 1992 were WHO Category I pesticides¹ monocrotophos, methyl parathion, and methamidophos. But these chemicals accounted for less than 0.5% of the sprays farmers used in 2007. The use of carbamates had been halved and BPMC remained the main active ingredient. Similarly, the use of pyrethroids declined from 12.4% to 7.9% and cypermethrin remained the main active ingredient used. There had been marked increases in the use of a nereistoxin, cartap, from 6.5% to 22.5%, and neonicotinoids, particularly fipronil and imidacloprid, from 0% to about 5%.

Discussion

From 1992 to 1997, marked reductions in farmers' insecticide use in the Mekong Delta from 3.1 to 1.0 sprays per season were reported (Huan et al 1999). There were also corresponding declines in farmers believing that planthoppers were serious problems. These trends continued until 2004, when opposite trends were observed. The general decline in farmers' insecticides was also reflected in the types of active ingredients used by farmers, which changed from broad-spectrum and highly hazardous compounds, such as monocrotophos and methyl parathion, to carbamates and cartap,

¹Based on WHO classification by hazard: Category Ia is extremely hazardous to human health; Category Ib is highly hazardous; Category II is moderately hazardous; Category III, slightly hazardous; and Category IV, unlikely to present acute hazard in normal use.

Table 3. Main classes of insecticides used by farmers in the Mekong Delta in 1992 and 2007.

Chemical classes	Percent of sprays (multiple responses)	
	1992	2007
Organophosphates	48.1	22.5
Organochlorines	1.2	0.2
Carbamates	32.2	15.8
Pyrethroids	12.4	7.9
Nereistoxins	6.5	22.5
Neonicotinoids	0	4.7

which remained. Starting in 2004, there had been a general increase in farmers' use of neonicotinoids.

These changes could be attributed to a media campaign (Escalada et al 1999) and the implementation of farmer training in farmer field school (FFS) programs (Matteson 2000). The media campaign that started in Long An Province spread through provincial initiated programs and was estimated to have reached about 90% of the Mekong Delta's 2.3 million farmer households. The FFS started in 1992 had trained about 108,000 farmers in the Mekong Delta by 1997 and, assuming that about 30,000 farmers were trained per year, the total number of FFS-trained farmers would have been about 410,000 in 2007, or 18%. FFS-trained rice farmers generally reduced their insecticide use (Matteson 2000). Huan et al (1999) found that farmers in the Mekong Delta who were not exposed to either an FFS or media campaign applied insecticide sprays about 2.1 times, whereas those exposed to the media campaign alone sprayed 1.2 times and those exposed to both the media campaign and FFS training sprayed 0.5 time. Thus, the initial declining trends in farmers' insecticide use in both Long An and Can Tho provinces might be attributed to these two concurrent pesticide reduction activities in the Mekong Delta. Starting in 2005, there were increasing trends in farmers' insecticide use and, by 2007, farmers' insecticide use seemed to have surpassed the levels of precampaign and pre-FFS years.

Mass media channels are generally important at the knowledge stage in the innovation-decision process (Rogers 1995). Large audiences could be rapidly reached, spreading the new information, which could lead to changes in some attitudes. The rapid adoption of "no early spray" after the 1994 campaign, which reduced insecticide sprays by > 50% (Escalada et al 1999), illustrated this change in attitudes. However, discontinuance, a decision to reject an innovation after having previously adopted it (Rogers 1995), can often affect adopters. This is clearly evident in Long An and Can Tho provinces, where farmers' insecticide use trends declined after the campaigns, followed by an increase. Discontinuance is especially rapid when there is an abundance

of conflicting messages through mass media and marketing networks of pesticide companies.

In the Mekong Delta, 12 provincial TV stations in Long An, Tien Giang, Ben Tre, Dong Thap, Vinh Long, Tra Vinh, An Giang, Kien Giang, Hau Giang, Can Tho, Soc Trang, and Bac Lieu broadcast pesticide advertisements aimed at farmers. Each of these TV stations broadcast an average of three pesticide advertisements a day. Similarly, radio stations in the Mekong Delta reinforced TV ads by airing at least two pesticide ads per day. For both radio and TV, insecticides were more frequently an advertised product.

Modern-day advertising generally uses conditioning to create associations between products and consumer needs (Kincheloe and Horn 2006). Knowing that these kinds of connection are usually temporary, companies follow Pavlov's ideas of repetition and continually advertise to keep these associations in farmers' minds. Although the insecticide reduction campaigns had initially caused farmers to adopt "no early spray" practices and reduced their sprays, the lack of repetition and reinforcements had resulted in discontinuance. The need for continuous repetition, motivation, and reinforcement to sustain a learned behavior such as stopping unnecessary insecticide spraying and IPM practices is supported by Bandura's (1977) "Social Learning Theory," in which he emphasized the need to keep the learning going by various forms of reinforcements. The chemical industry, on the other hand, employs repetition in all its advertising campaigns and is thus able to establish higher credibility and brand familiarity.

Advertisements are repeated endlessly not only to attract new customers but also to reassure current customers. Sandman (2000) noted that repetition creates a direct relationship between the product and the fulfillment of customers' needs. Most advertising is targeted at customers who have already decided to buy the product and is intended to reinforce their decision and strengthen their behavioral commitment.

Another factor that could be contributing to the discontinuance of learned practices in the Mekong Delta is the turnover of farmers. The surveys showed practically no change in farmers' age, which could mean that the farmers trained in FFS or exposed to the "no early spray" campaigns might have moved on. This adds further to the need for repetition and continuous reinforcement programs to sustain gains obtained through training and campaign efforts.

Discontinuance could also be farmers' decisions being influenced by availability bias (Tversky and Kahneman 1974). Farmers tended to assess the frequency of pest losses as more common because of repetition and better recall. The repeated reminders through advertisements and pesticide salesmen and newspaper reports of pest outbreaks could play a significant role in farmers' erroneous judgments. Here, the lack of repetitions and follow-up after the "no early spray" campaign and the intensive IPM training would result in high discontinuance.

Planthoppers are secondary pests often induced by prophylactic insecticide usage that destroy the basic ecosystem services that control them (Heong and Schoenly 1998, Gallagher et al 1994). With the discontinuance of the "no early spray" and IPM practices, the increase in insecticide use motivated by continuous advertising by the

chemical industry seems likely to intensify the planthopper. The increasing trend in the use of neonicotinoids as prophylactic applications is another concern as planthoppers can develop resistance rapidly under such high selective pressures. Evidence of multiple-fold resistance developing in some rice-growing areas is reported by Matsumura et al (this volume).

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Notes

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