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Initiatives

Restoration of rice landscape biodiversity by farmers in Vietnam through education and motivation using media

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Abstract

A TV series using entertainment-education principles and broadcast over Vinh Long Television station in Vietnam helped changed rice farmers' beliefs and pest management practices. The evaluation survey conducted two months after the end of the broadcast showed that farmers sprayed significantly less insecticides (19% less), used less nitrogen fertilizer (6% less), and used lower seed rates (12% less). In addition, there were significantly more farmers believing in statements that favor ecological engineering among the viewers than the non-viewers. Viewers scored higher in the belief index compared to the non-viewers by about 14%, indicating that their attitudes towards ecological engineering practices had gained positively. Although there was about a 9% increase in favor of ecological engineering adoption, there are at least two barriers that remain unchanged.

The TV series had succeeded in initiating changes in farmers' beliefs and adoption of ecological engineering practices. This might be due to entertainment-education content and the engagement of key stakeholders and partners in the project process. Decision theories and sociological tools and a six phase engagement process were used to ensure quality partnerships.

Keywords: Rice, entertainment-education, Vietnam, ecological engineering, pest management, perceived barriers.

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1. INTRODUCTION

Rice in Vietnam is grown under intensive cultivation conditions to maximize production. Farmers usually grow two crops a year and in some cases three crops in large continuous areas, applying high levels of chemical fertilizers and pesticides. Pests are often considered to be major constraints to yields and the farmers' main control tactic is spraying pesticides. Because of poor spray equipment and poor knowledge, a large proportion of farmers' sprays are misused (Heong & Escalada, 1997; Bandong *et al.*, 2002). Farmers tend to focus on highly visible leaf damage like that caused by the leaf-feeding caterpillars in the early crop stages. However, this damage has little effect on yields because of plant compensation (Graf *et al.*, 1992). These early season sprays instead destroy biodiversity and biological control ecosystem services and make the rice more vulnerable to more destructive secondary pests such as planthoppers (Way & Heong, 1994; Heong & Schoenly, 1998; Heong, 2009). Believing that rice pests breed in neighboring habitats, farmers also tend to spray these habitats with pesticides. However, the most important rice pests are monophagous and thus such practices are of no use, and do more harm by destroying the rich biodiversity of resident predators and parasitoids.

Mass media campaigns to motivate rice farmers for change have been highly successful in Vietnam. The campaign to reduce early season spraying has helped in reducing farmers' loss aversion attitudes and thus also insecticide sprays by 53% (Escalada *et al.*, 1999; Heong *et al.*, 1998). In a follow up campaign advocating farmers to reduce insecticide sprays, seed and fertilizer rates (locally named "Three Reductions, Three Gains"), farmers reduced their seed and fertilizer rates by 10% and 7% respectively and their insecticide sprays by 33% (Huan *et al.*, 2008). High seed rates used by rice farmers have been known to promote denser crop canopy which coupled with high fertilizer rates and insecticide use have been known to promote pest and disease development (Huan *et al.*, 2005). In 2004, a drama program developed using entertainment-education principles (Singhal & Rogers, 1999) was launched. This program, called locally "My Homeland Story", consisted of 104 twenty-minute episodes broadcast weekly and depicting the daily struggles of village families in rice cultivation, managing pests, dangers of pesticides, social and family lives. An evaluation survey of farmers, conducted six months after the completion of the program, showed that farmers who had listened to at least two episodes of the program reduced their insecticide sprays by 60%, their fertilizer and seed rates by 9% and 33% respectively (Heong *et al.*, 2008).

Encouraged by these successes, we embarked on a TV series to educate and motivate rice farmers to restore biodiversity and ecosystem services by reducing insecticide use and growing nectar rich flowering plants on the rice bunds and margins (Figure 1). The flora on the bunds provide Shelter, Nectar, Alternate hosts and Pollen (abbreviated SNAP) to conserve the natural enemy fauna to protect the rice crop (Gurr *et al.*, 2012). For instance, mymarid parasitoids of planthoppers live on alternative hosts on the bunds (see review by Gurr *et al.*, 2010), crickets that are ferocious predators of pest eggs breed in bund habitats dominated by *Bracharia mutica* and forage in rice fields at night (de Kraker *et al.*, 1999), and spiders also use such habitats for shelter and breeding (Yu *et al.*, 2002). Coupled with withholding insecticide sprays in the early crop stages, biological control services are further enhanced. These practices are referred to as "ecological engineering" and the Ecological Engineering TV series (locally known as *Cong Nghe Sinh Thai*)[1] was developed using entertainment education concepts. The present paper describes the development of the TV series, the motivating messages, the evaluation survey and changes in the key variables monitored.

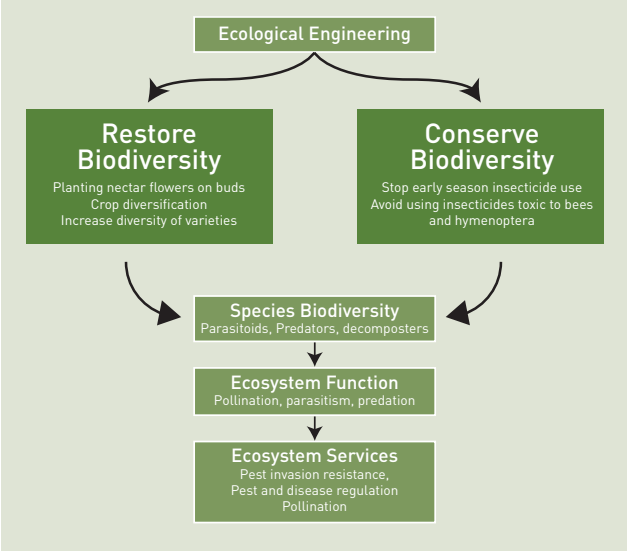

Figure 1: Ecological engineering is both to restore and to conserve biodiversity,ecological functions and ecosystem services.

2. METHODOLOGY

A multi-stakeholder engagement process modified from Escalada and Heong (2012) was adopted in formative research, designing and development of the TV series, the launching program, implementing on-the-ground support and the evaluation survey. The stakeholders involved were drawn from research, universities, extension, the TV station, the video producers and local government officials. A co-funding mechanism was developed in which the Vinh Long Provincial TV station supported the air time and program development management of the forty episodes, the International Rice Research Institute (IRRI) supported the video production and research activities, and the Vinh Long local government co-financed the launching ceremony and on-the-ground activities. The scriptwriters in the video production team, in discussion with the technical team from research and extension, developed the story lines in each episode, and the technical team then edited and finalized the episodes. On-site filming was conducted by the video team, engaging professional actors and actresses, and the scientists. The footages filmed were then edited into the fifteen-minute

1 Awarded the Gold medal in Science Education in the 32nd National Television Festival 19-22 December 2012 held in Vinh City, Nghe An, Vietnam.

episodes for weekly broadcasts. A total of forty episodes were on air each Saturday from 16:40 to 17:00pm and each was repeated the next day (Sunday) at 08:00am. The episodes were then made available on the Vinh Long TV website[2].

3. MONITORING AND EVALUATION

We conducted a series of focus group discussions with farmers in different villages to monitor progress, and using the feedback developed a formal evaluation questionnaire that was translated into Vietnamese and pretested. We employed local university students and trained them to conduct the survey of the 593 farmer households in three provinces. The structured survey instrument was in three parts: i—basic profile information of respondents; ii—the related crop production practices and the respondents' beliefs with regard to pest control; iii—ecological engineering practices and their perceived barriers to adoption. The completed questionnaires were then encoded using the spreadsheet program Excel, the data cleaned and uploaded into SPSS version 15 for analyses.

In the evaluation survey, we introduced belief statements and asked farmers to score how true they were using a response cue card of scores from 1 to 5, where 1 = "Definitely not true", 2 = "In most cases not true", 3 = "Maybe true", 4 = "In most cases true" and 5 = "Always true". We conducted reliability assessments using Cronbach's alpha (Bland & Altman, 1997) to examine for consistency and reliability of the belief statements. The reliability analysis was used to study the properties of a measurement scale and the items that compose the sum of scores. It provides information about the relationships between individual items in the scale and computes the Cronbach alpha that evaluates for internal consistency. The closer the Cronbach's alpha is to 1, the higher is the internal consistency (Gliem & Gliem, 2003). It is widely accepted that if the alpha value is 0.70 or higher for a set of items, it can be considered reliable (Santos, 1999). The belief scores were computed into an index using the equation below:

$$\text{Index} = \frac{(\text{Sum of belief scores} - \text{Minimum sum of scores})}{(\text{Maximum sum of scores} - \text{Minimum sum of scores})}$$

(equation 1)

The index varies from zero to 1.0, where zero indicates the most constraining and unfavorable while 1.0 indicates the most favorable.

We constructed two indices from the belief scores using equation 1 and used them to compare differences in viewers and non-viewers. In addition we compared farmers' responses to key belief statements of the two groups.

4. RESULTS

Of the 593 farmers interviewed, about 41% had not watched any of the TV series episodes (non-viewers). Most farmers (60%) watched five or fewer episodes and only 7% had watched more than fifteen episodes. Farmers who had viewed the TV series sprayed significantly less insecticide (19% less), used less nitrogen fertilizer (6% less), used lower seed rates (12% less) and applied their first insecticide sprays later in the season. The yields of viewers were marginally higher than those of non-viewers (difference of 0.2 t/ha) (see Appendix 1 for details).

Farmers who had watched the TV series could recall what they learned from the series. Table 1 shows the most common lessons farmers cited. Although the idea of growing nectar flowers on the bunds for pest management was only launched in 2011, a higher proportion of TV series viewers had recalled the various lessons they had learned.

Table 1: TV series viewers' recall of what they had learned and benefits from the TV series.

What farmers learned from the TV series	% farmers recalling*
Nectar flowers can attract natural enemies to help pest control.	29.9
Nectar flowers can help reduce insecticide use.	14.8
Flowers on the bunds can help protect the environment.	11.3
Flowers help to beautify the rural landscape.	10.1
Applying "three reductions, three gains"** (Huan *et al.*, 2008).	13.3
If insecticides are to be used, apply them correctly.	11.9
Techniques in flower growing.	9.6
Benefits farmers recalled	
Helped in reducing production costs.	52.2
Helped in reducing chemical inputs.	29.4
Improved environmental protection.	28.0
Increased net incomes.	34.6
Increased natural enemies.	27.7
Reduced pest infestations.	13.0
Reducing labor in pesticide spraying.	11.2

* Note that multiple responses were possible: each farmer may have recalled more than one of the lessons or benefits.

** "Three reductions, three gains" was a program launched by the Ministry of Agriculture and Rural Development of Vietnam in 2004 to motivate rice farmers to reduce seed and fertilizer rates and insecticide sprays. Details in Huan *et al.* (2008).

In addition, the TV series viewers cited various benefits they had obtained from the TV educational series. A high proportion cited reducing production cost, chemical inputs, increasing net incomes and reducing labor costs as benefits.

4.1 BELIEF INDICES

We computed two indices from the belief statements. Those related to ecological engineering beliefs (EEInd) and those

2 http://thvl.vn

related to perceived belief barriers (PBInd) and compared differences between viewers and non-viewers (see Appendix 2 for details).

Perceived barrier attitudes may obstruct or favor the actual adoption even if behavioral and subjective norm attitudes may be favorable. Health communication research has shown that the lack of perceived behavioral control can impede adoption of healthy lifestyle practices (Glanz *et al.*, 2002). For instance a common perceived barrier to joining a gym is that it is expensive despite increased knowledge of the benefits of physical activities.

There were highly significant differences in both indices between viewers and non-viewers. Viewers scored higher (0.73) indicating that their attitudes towards ecological engineering practices had gained positively compared to the non-viewers (0.64) by about 14%. The increase in perceived barriers attitudes was about 9%. It is evident that the TV series had favorably modified farmers' beliefs regarding ecological engineering practices and perceived barriers.

We further analyzed the differences in farmers' beliefs in key belief statements: Table 2 presents beliefs related to ecological engineering practices and Table 3 the beliefs related to perceived barriers.

There were significantly more farmers believing in statements that favor ecological engineering among the viewers than the non-viewers. The largest difference was in the belief that "flowers on the bunds can help farmers reduce insecticides", (37.6% of viewers and 21.1% of non-viewers). This difference is consistent with the reduction in insecticide sprays of viewers. The next belief of significance was "flowers on the bunds are homes to spiders and predators", (35.9% of viewers and 21.5% of non-viewers).

Table 2: Key beliefs related to ecological engineering practices and comparison between viewers and non-viewers of the TV series in percent of farmers who said that the statements were "always true".

Belief statements	% farmers believing statement is always true		χ 2
	Viewers	Non-viewers	
Flowers on bunds can attract bees and parasitoids to protect rice.	32.2	21.1	25.7 **
Flowers on bunds are homes for spiders and predators.	35.9	21.5	30.6 **
Flowers on bunds help farmers reduce insecticide use.	37.6	21.1	24.8 **
Flowers on bunds can help reduce planthopper pest outbreaks.	30.8	19.8	13.2 *
Flowers on bunds make rice landscapes beautiful.	68.3	55.4	19.6 **

Note: * = significant at p = 0.05, ** = significant at p = 0.01.

On perceived barrier beliefs, the differences between viewers and non-viewers were slight and were not significant. There were no significant differences in most of the beliefs except for two: "Flowers on the bunds attract more pests and diseases", which changed favorably from 7.4% of non-viewers to 5.7% of viewers, and the companion statement "Non-rice habitats are sources of rice pests and diseases" which changed favorably from 9.9% of non-viewers to 8.5% of viewers. Two beliefs changed negatively, although these differences were not significant. This implied that some of the perceived barriers to adopting ecological engineering practices had remained anchored. Some perceived barriers were difficult to modify because they were concerned about the physical conditions of their fields, like "the bunds are too narrow".

Table 3. Comparison of key perceived barrier beliefs between viewers and non-viewers of the TV series in percent of farmers who said that the statements were "always true".

Belief statements	% farmers believing statement is always true		χ 2
	Viewers	Non-viewers	
Flowers on bunds attract more pests and disease to rice.	5.7	7.4	21.0 **
Non-rice habitats are sources of rice pests and diseases.	8.5	9.9	28.9 **
Flowers on bunds will die when we burn straw after harvest.	30.8	35.5	2.3 ns
Bunds are for walking and planted flowers will not survive.	16.5	15.7	2.3 ns
Bunds are too narrow, no place to grow flowers.	20.8	18.6	5.7 ns

Note: ns = not significant, * = significant at p = 0.05, ** = significant at p = 0.01.

5. DISCUSSION

The comparison of beliefs and practices between viewers and non-viewers of the TV series revealed some evidence of change. The TV episodes had focused on providing information and motivation for farmers to modify their beliefs, adopt the growing of flowering plants on the bunds and reduce seed and fertilizer rates and insecticide sprays. There are significant reductions in these inputs among viewer farmers, and they also had slightly higher yields. Since farmers' adoption is the net outcome of several key belief attributes, we computed two indices to compare viewers and non-viewers. We found that farmers' attitudes towards ecological engineering practices were favorably improved among the viewers. In addition, significantly more viewers had favorable attitudes towards insecticide reduction and growing of nectar-rich flowers. The perceived barrier index among viewers was also favorably increased, although this index had remained just slightly above 0.5, an indicator of indifference. It was quite apparent that some perceived barriers could not be modified, such as "bunds are too narrow". The TV series had a stronger effect on farmers' beliefs in insecticide use, and this was reflected in significant reductions in insecticide use. Some beliefs related to the growing of flowers on the bunds were

also favorably modified. However, unless some of the key perceived barriers could be overcome or additional motivation introduced, like paying farmers for environmental services (FAO, 2007), adoption of flower growing on the bunds as an ecological engineering method would probably not increase markedly. Among the issues that would need to be addressed are the bunds' width and straw burning. Ideally, we should consider modifying the geometry of the rice landscape with a well-balanced mosaic of paddy fields and other habitats to maximize biological control. However, since most rice fields had been established decades ago, only small adjustments are possible, but a well-balanced landscape should be considered and form the basis of new rice land developments.

The TV series did succeed in initiating changes in farmers' beliefs. Among the main factors that contributed to the success were the engagement and participation of key stakeholders. To ensure that we had quality partnerships, we used decision theories and sociological tools and a six phase engagement process (Escalada & Heong, 2012). The process focused on jointly identifying the issues, needs and opportunities, developing and evaluating intervention options and prototype materials, and developing hypotheses, instruments and data for evaluation. In the first three phases, partners participated in focus group discussions and scoping studies to assess issues, needs and key opportunities in terms of communication. For instance, partners found that farmers were unable to see, understand or appreciate parasitism, but they knew and appreciated bees. This was discussed in a workshop and since parasitism by hymenopteran parasitoids is believed to be a vital function for biological control services (Gurr *et al.*, 2010) we "distilled" science knowledge into simple rules. For example, parasitoids were called "small bees" that "eat pests" and should therefore be conserved. The cluster of simple rules that partners developed was "Flowers along bunds bring in bees and their relatives"; "The bee relatives attack eggs that planthoppers lay"; and "Insecticides will kill bees and their relatives".

In the fourth phase, farmers were invited to evaluate the growing of nectar flowers on bunds, and through further focus group discussions with participating farmers we developed deeper understanding of their beliefs on the practices and the barriers to adoption. Phase five focused on developing key communication messages for the TV series. The three main messages developed were:

- Flowers in rice environments attract and support bees and beneficial insects to protect rice from invading planthoppers.
- Insecticide use is reduced to avoid killing bees and beneficial insects.
- Incomes are increased.

The brand name of "Cong Nghe Sinh Thai" was also developed by partners in this phase (Escalada & Heong, 2012). The TV series was launched in a formal event broadcast live nationwide over Vinh Long TV, and followed by other publicity activities to popularize the series. The final phase was the evaluation of the impact of the TV series on farmers' beliefs and practices where partners jointly conducted the survey and shared the results. The six phase multi-stakeholder participatory process helped to engage stakeholders in all stages of the development of the approach and gained buy-in from policy makers, research, extension and farmers.

An important challenge will be the longer-term sustainability of the TV series. The radio soap opera launched in 2004 was on air for 104 episodes and a continuation program supported through a World Bank Development Market Place Award broadcast another 135 episodes. The present TV series has been on air for forty episodes and we expect a continuation of the series for another twenty episodes funded by a German project called LEGATO. The challenge now is to mainstream such programs into the TV station's regular programming. To maintain a long TV series will require funding. A further threat to sustain the gains made by the TV series is "advertising piracy" where the TV series is being used to advertise new pesticides.

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Appendices

APPENDIX 1: PROFILES OF VIEWERS AND NON-VIEWERS, THEIR INPUT PRACTICES AND YIELDS.

Parameters	Viewers	Non viewers	F values	Sig
Sample size (N)	351	242		
Age (years)	49.2	49.7	0.24	ns
Years in rice farming (years)	24.5	23.8	0.50	ns
Education (years)	8.1	7.0	18.3	**
Yield last season (t/ha)	6.1	5.9	4.6	*
Seed rate (kg/ha)	167.4	186.7	26.5	**
Nitrogen application (kg/ha)	88.9	94.3	4.1	*
Number of insecticide sprays last season	2.1	2.6	21.1	**
Day of first insecticide application	31.0	26.7	22.0	**
% farmers with no insecticide application	8.0	4.1		

Note: ns = not significant, * = significant at p = 0.05, **= significant at p = 0.01.

APPENDIX 2: COMPARISON OF THE BELIEF INDICES OF ECOLOGICAL ENGINEERING AND PERCEIVED BARRIERS BETWEEN VIEWERS AND NON-VIEWERS OF THE TV SERIES ON ECOLOGICAL ENGINEERING.

	Ecological engineering (EEInd)			Perceived barriers (PBInd)		
Number of belief statements	9			8		
Cronbach reliability index	0.912			0.752		
	Viewers	Non-viewers	F value	Viewers	Non-viewers	F value
Index values	0.73	0.64	21.6**	0.59	0.54	9.7**

Note: ** = significant at p = 0.01.