16

A Socio-Economic Analysis of Farmer's Drop-out from Training Programmes in Integrated Pest Management

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ABSTRACT

This chapter aims to analyze, by using an econometric approach, factors affecting the drop-out of farmers participating in so-called farmer field schools (FFS), a recent approach to training farmers in integrated pest management. The data used in this analysis were collected from a survey of five farmer field schools conducted in the Central Plains and the Northern and North-Eastern regions of Thailand. A total of 124 farmers participated in these field schools on irrigated rice farming during the 1999/2000 cropping season. A multinomial logit model was developed to analyze the data. The results show that pesticide costs, the quality of training, farmers' a priori knowledge on pest and crop management, and opportunity cost of labour are factors determining drop-out. In general, the higher the pesticide use by farmers the more likely they are to participate, while farmers who use little pesticide tend to loose interest in the training. Another factor is the continuity of training. If training takes place on a weekly basis throughout the season, drop-out is less likely to occur. In addition, the more farmers know of crop and pest management before hand, the less they tend to drop out. Alternatively, farmers with a higher opportunity cost of labour also tend to drop-out, apparently valuing the perceived benefits of participating in FFS lower than their income opportunities during the time for training. This latter point shows that farmer training does not only incur costs on the part of the government but also by the farmer (Waibel et al.*, 2001).*

The chapter concludes that in order to make the concept of farmer field schools an effective and efficient extension tool, these have to be well targeted rather than spread randomly over a large number of rural villages. Although the evidence provided here must be considered as preliminary, the results do tend to support the hypothesis that the concept of FFS may not be readily suitable for up-scaling agricultural extension information (Quizon et al.*, 2001). A further lesson that can be drawn from this study regards the equity implications of farmer training. Intellectually challenging and time consuming training, which FFS definitely is, tends to attract only the already more knowledgeable farmers and so is likely to further widen the gap between "good" and "bad" farmer decision-makers. Finally, it must be stressed that the quality of trainers is crucial for training success. Hence, quality control of training needs to be put in place and appropriate incentives for trainers are needed.*

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INTRODUCTION

Training farmers in so-called Farmer Field Schools (FFS) has become a popular tool of integrated pest management in Asia, Latin America and recently also in Africa (Kenmore, 1996; Bentley, 1996; Waibel *et al*., 2001). Contrary to the still widespread top-down training and visit extension systems, the FFS concept relies on the season-long experiential learning of a group of farmers in the field. Such training supposedly stimulates farmers to discover the agro-ecosystem principles which underlie decision-making in crop and pest management, rather than following preset technical recommendations (van de Fliert, 1993). Hence, the FFS approach is a modern form of farmer training following principles of adult-education that includes field-based participatory training. Typically, a group of 25-30 farmers joins the course, which is led by a professional trainer and conducted on a regular basis. The approach is not only being promoted by several donor and development agencies but also increasingly supported by national extension services. In Thailand, the Department of Agricultural Extension (DOAE) has included FFS into the national extension service activities under the responsibility of the Institute of Biological Agriculture and Farmer Field Schools (IBAFFS).

The main factor determining the cost-effectiveness of the training and benefits obtained from this extension concept is farmer participation. One of the questions arising from FFS is whether it is believed to be costly and time-consuming (Heong *et al*., 1998; Quizon *et al*., 2001). During the cropping season, farmers are expected to attend weekly half- to whole-day training sessions in the field, guided by a trainer/facilitator. Since the objective of training is to generate an understanding of principles rather than simply transferring knowledge, farmer participation is a pre-condition for success. Hence, if participants drop-out during the course, the objectives of the training are not being reached and scarce public funds are wasted. On the other hand, if agricultural administrators want to devise effective means to reduce the rate of drop-out, it is important to gain a better understanding of the factors which cause farmers to attend training irregularly or even discontinue the course. Furthermore, knowledge about farmer's demand for training and their participation is crucial for the design of up-scaling strategies for knowledge-intensive agricultural technologies.

Recently, for example, economic researchers from the World Bank have raised doubts as regards the sustainability of the approach (Quizon, *et al*., 2001). Drop-out of participants during the course has a strong influence on the costs and benefits of FFS, and so the reasons for drop-out need to be subject to analysis. It is important to assess realistically the economic and other non-market benefits which can be derived from participating in farmer field schools. Unfortunately, previous studies do not provide clear evidence of these. This study, through a well-planned experimental design has the potential to provide clearer answers. The study on factors affecting drop-out represents the first step in this procedure. Finding ways and means to reduce the rate of drop-out would be fruitful. Hence, information of drop-out determinants is crucial. This chapter aims to analyse factors affecting drop-out of farmers participating in farmer field schools in Thailand.

THEORETICAL FRAMEWORK AND METHODOLOGY

Data Collection

Primary data are the main source of information for the study. A standardized questionnaire was used for collecting primary data by interviewing farmers participating in the farmer field school during the irrigated rice-cropping season in 1999/2000. 125 farmers in five different field schools located in the North, North-east and Central regions of Thailand were surveyed. The interviews were conducted during January and February in 2000 and 2001. As shown in Table 16.1 the actual number of farmers participating in a field school sometimes differed from the target of 25. Details of the questionnaire includes interviewee identification, household socio-economic data (labour, land, income, market, credit, etc.), production activities, decision making of household in production activities, pest management knowledge and attitudes, crop management knowledge and FFS information.

Region/Province of FFS	Number of farmers
Chainat	25
Angthong	23
Kampaengpetch	24
Karasin	36
Udonthani	16
Total	124

Table 16.1
Location of Field School by Province and number of participants

Theoretical Framework

The logit model is based on the cumulative logistic probability function and is specified as follows (Pindyck and Rubinfeld, 1991: 258):

$$P_i = F(Z_i) = F(\alpha + \beta X_i) = \frac{1}{1+e^{-Z_i}} = \frac{1}{1+e^{-(\alpha+\beta X_i)}}$$

P_i is the probability that an individual will make a certain choice, given X_i, i.e. to participate or drop out from the field school, Xi are the independent variables: socio-economic factors that may affect the participation of farmers in the training programme, while e represents the base of the natural logarithms.

If we approximate P_i as follows,

$$\hat{P}_i = \frac{r_i}{n_i}$$

where, r_i represents the number of times the first alternative is chosen by individuals with a given X_i, (e.g. number of farmers drop-out) and n_i is individuals having given X_i.

We can estimate the logit probability model by the following:

$$\log \frac{\hat{P}_i}{1-\hat{P}_i} = \log \frac{r_i / n_i}{1 - r_i / n_i} = \log \frac{r_i}{n_i - r_i} = \alpha + \beta X_i + \varepsilon_i$$

The above equation is linear in the parameters and can be estimated using ordinary least squares or the maximum likelihood procedure.

To extend the binary-choice logit model to three-choice case, we write:

(a) $\log \frac{P_2}{P_1} = \alpha_{21} + \beta_{21} X$,

(b) $\log \frac{P_3}{P_1} = \alpha_{31} + \beta_{31} X$,

where, $P_1 + P_2 + P_3 = 1$

Such models have been applied in similar studies as related to multi-stage technology adoption or in the analysis of contingent valuation studies with discrete revealed amounts of willingness to pay (Shakya and Flinn, 1985; Nkonya, Schroeder and Norman, 1997).

A multinomial logit model is applied to determine the factors that affect drop out from field schools in the study. The model is as follows:

Y = f (PC, D, Kn, FS, ML, Ry)

Where, choices of dependent variable are:

Y = 0, farmers who dropped out from the field school
Y = 1, farmers who partially participated the course
Y = 2, farmers who completed the course

Independent variables are:

PC = pesticide costs (Baht/rai)
D = dummy variable of length of training (short=0, long=1)
Kn = priori knowledge of farmers on pest and crop management
FS = farm size (rai/household)
ML = full-time agricultural labour per unit of agricultural land
Ry = rice yield (kg/rai)

The estimation of the probability for each choice is as follows.

Prob ($Y_i = j$) = $e^{\beta' X_i} / (1 + \Sigma e^{\beta' X_i})$
Prob ($Y_i = 0$) = $1 / (1 + \Sigma e^{\beta' X_i})$

Y_i Choice of dependent variables, i = 0 to j
β' coefficients of independent variables
X_i Mean of independent variables

The analysis was performed using LIMDEP software.

RESULTS

The results of the study include the training participation rate, the socio-economic characteristics of the three groups of farmers, factors affecting the drop-out of farmers and the probability assessment.

Participation Rate

After the completion of the season-long farmer field school (FFS) training, the survey of farmers participating in FFS revealed the degree of participation in the training. Drop out was classified into three categories. As shown in Table 16.2, about one fifth of all participants participated in less than 50 percent of total training periods. Given the nature of the FFS, with emphasis on experiential learning and capturing concepts rather than learning facts, missing half the sessions is unlikely to make participants reach the course objective. Hence these were considered drop-outs. The second group, labeled as partial drop-outs participated in more than half of the sessions but missed at least two of the meetings. The remaining 41 percent of farmers were defined as course completions as they abstained from a maximum in two sessions or participated in between 87.5 percent[3] and 100 percent of sessions. Therefore, the proportion of trainees who at least had a fair chance of grasping the concept of ecology-based pest management was over 80 percent. Admittedly, however, it is difficult to judge the minimum participation required in order for a farmer to be able to benefit from the training and significantly improve his/her pest management decision-making capability. Based on an expert's opinion (the director of the Institute of Biological Agriculture and Farmer Field Schools in the Department of Agricultural Extension), if farmers attend more than 50 percent of seesions, they could catch the most important ideas of the training. However, such judgement necessarily remains subjective and therefore measures to reduce or avoid drop-out are nevertheless necessary. In any case non–attendance increases the unit costs of farmers trained, a figure which raises concern especially among funding agencies (Quizon *et al*., 2000).

Group of farmers	Participation rate (%)	Number of farmers	Percentage
Cancel and Drop-out	<50	24	19.35
Partial participate	50-87.5	49	39.52
Course completion	87.6-100	51	41.13
Total		124	100.00

Table 16.2
Farmers participation in all farmer field schools studied

[3] 87.5 percent is calculated as 14 out of the total 16 periods of FFS, based on the idea that farmers are permitted to miss two training periods. So, when the farmers miss only one or two classes, they are considered as in the course completion group.

Socio-Economic Characteristics

Comparing the three groups of participants (drop-out, partial participation and course completion) shows that there is no difference in terms of the participants' age (Table 16.3). A different result is found in terms of experience in farming: farmers who complete the course on average have less farming experience. This result would suggest that experienced farmers perceive they have less to gain than less experienced farmers. However, this variable was not used in the model since it is correlated with the variable "knowledge of pest and crop management". When considering the gross income from rice there is no significant difference among the three groups. There is also no consistency in the direction of income differences, which in any case are less than five percent (Table 16.3). When comparing the off- and non-farm incomes, no difference can be found between the drop-out and course completion groups while this is clearly higher in the partial participation group. This indicates a high opportunity cost of labour for this group to participate in the training and it might be a reason why those farmers cannot always come. On the other hand, these might also be the ones who are the most innovative and active. They decide to select only those meetings which they find relevant (it is a general procedure that the trainer/facilitator announces the content of the following class). Further explanations of the variables are given with the results of the multinomial logit model.

	Drop-out	**Partial participate**	**Course complete**
Age (years)	42.00	43.49	42.55
	12.54	*12.03*	*9.91*
Experience in farming (years)	23.88	26.96	13.49
	14.45	*13.49*	*12.75*
Gross Return of rice	41,183.50	44,630.26	43,685.06
(Baht/household)	*25,621.07*	*38,755.99*	*34,539.09*
Off- and Non-farm income	27,379.17	36,627.96	28,052.35
(Baht/household)	*41,640.75*	*42,118.80*	*30,794.27*
Farm size (rai)	19.11	29.13	20.50
	12.99	*24.44*	*12.32*
Rice yield (kg/rai)	625.24	433.42	543.56
	361.29	*246.81*	*290.09*
Pesticide costs	1,463.57	1,783.97	1,249.07
(Baht/rai)	*1,686.02*	*3,728.98*	*1,476.01*
Knowledge of crop and pest	15.71	16.14	16.18
management (score)	*3.06*	*2.87*	*2.96*

Note: Standard deviation in italics.

Table 16.3
Descriptive Statistics of socio-economic characteristics of farmers in farmer field schools

Factors Affecting Participation of FFS

Of the variables hypothesized as possible explanations of drop-out and included in the model, only some give statistically significant results. Setting the drop-out group as a base (Y=0), the amount of money farmers spend for pesticides and the length of training are the main factors affecting drop-out. Both variables have the positive sign. The variables "knowledge of pest and crop management", "farm size", "man-land ratio" show the positive sign while rice yield as a measure of productivity and the progressiveness of farmers show a negative sign (Table 16.4). The positive sign of pesticide costs indicated as those farmers who spend more on pesticides may show a higher interest given that the course content is highly focused on pesticide reduction. In terms of the length of training, based on the curriculum of the course in the study area, courses can be classified into two types: the full or long period of 16 weeks and the half or short period of 8 weeks. It was found that the period of training has significantly influenced the drop-out of farmers. The long period with regular weekly training sessions tends to make farmers stay in the training; the short training period, where considerable uncertainty often exists as regards to whether or not the training actually takes place, tends to induce the drop-out of farmers. The knowledge of farmers on pest and crop management before they attended the field school training also influences drop-out. It is found that farmers with better knowledge before the training tend to continue the training whereas farmers who know less initially trend to drop-out. Furthermore, a small man-land ratio (e.g. 0.05 person per rai) tends to increase the probability of drop-out. This indicates that farmers with more area per household member are more likely to face labour shortage, i.e. their opportunity costs of labour are higher compared to the large man-land ratio (e.g. 1 person per rai).

Probability Assessment

An analysis of the probability of farmers participating in the FFS with various scenarios compared to the base situation will allow us to draw some conclusions as regards possible measures to reducing drop-out:

1. Regular season-long training (16 weeks) conducted on a weekly basis, which is one measure of training quality will reduce the probability of drop-out by 53 percent (Table 16.5).
2. Selecting the more knowledgeable farmers to attend field schools will reduce the probability of drop-out group by a similar level as training quality (Table 16.5).
3. The probability of drop-out will decline by 80 percent if farmers with a more favorable man-land ratio (e.g. 1 person/rai) are selected for field schools (Table 16.5).
4. The probability of drop-out declines by 84 percent for farmer participants with larger farms (defined as larger than 100 rai). Conversely, the probability of drop-out increases by 39 percent for small farmers (defined as 5 raior less) (Table 16.5). Most likely small farmers are those who are less commercially orientated and who may also be part-time farmers.
5. Finally, the probability of drop out declines by 41 percent for farmers with low yield (assumed at 200 kg/rai) while the probability of drop out increases by 54 percent with farmers who have high yields (assume at 1,000 kg/rai) (Table 16.5). This result is surprising and deserves further investigation. It may however be correlated with farm size whereby larger farms tend to have lower per unit yields.

Variables	Drop-out (Y_i=0)	Partially participated (Y_i=1)	Course completion (Y_i=2)
Constant	0.3003	-0.2229	-0.7735
Pesticide costs (Baht/rai)	-0.00004	0.0001	-0.00006
	(-2.542)	(2.427)	(-0.913)
Length of training	-0.2114	0.1499	0.0615
Short, D=0; Long, D=1	(-3.137)	(1.231)	(0.366)
Knowledge of crop and pest	-0.0157	0.0117	0.0040
management (score)	(-2.163)	(0.690)	(0.172)
Farm size (rai)	-0.0029	0.0055	-0.0025
	(-1.439)	(1.108)	(-0.344)
Full-time agricultural labour	-0.2471	0.4311	-0.1840
per land ratio	(-1.546)	(1.101)	(0.325)
Rice yield (kg/rai)	0.0002	-0.0007	0.0005
	(2.455)	(-2.803)	(1.418)
Number of observations		124	
Log likelihood		-115.22	

Note: Data in the table are coefficient of partial derivatives of probabilities with respect to the vector of characteristics.
Data in parentheses are t-values.

Table 16.4
Results of marginal effect from multinomial logit model

Scenario	Drop-out	Partial participation	Course completion	Total
Base situation	0.153	0.400	0.448	1.00
Long length of training (D=1)	0.072	0.466	0.462	1.00
High knowledge of pest management (score=23)	0.072	0.470	0.458	1.00
High ratio of agricultural labour per unit of land (ratio=1)	0.031	0.725	0.244	1.00
Low ratio of agricultural labour per unit of land (ratio=0.05)	0.191	0.339	0.470	1.00
Large farm size (100 rai)	0.024	0.777	0.199	1.00
Small farm size (5 rai)	0.213	0.302	0.485	1.00
Low rice yield (200 kg/rai)	0.090	0.629	0.281	1.00
High rice yield (1,000 kg/rai)	0.236	0.137	0.627	1.00

Table 16.5
Probability of farmers participated in Farmer field school if situations change

CONCLUSION

As shown by this study, pesticide costs and quality of training as measured by the number of weeks and the regularity by which the training is being conducted are the main factors which stimulate farmers to stay on the training course. This allows two somewhat preliminary conclusions. First, given the high costs of FFS relative to ordinary agricultural extension activities, this approach may not be economically justifiable as a nationwide programme. It is more likely to yield high benefits in areas of pesticide overuse. It may also be successful with farmers who practice intensive methods of farming or those who so far have ignored economic considerations in the application of pesticides. Second, a high quality of training is a pre-condition for FFS to be effective. This means FFS cannot be a cheap affair. It needs to be well equipped and trainers need to be given sufficient incentives and support.

Another interesting issue arises from the observation that farmers with better knowledge before the training also tend to be less likely to drop out. It indicates that FFS requires some minimum level of knowledge for farmers to be able to benefit. Hence, the question must be asked whether such training will widen the gap between knowledgeable and less knowledgeable farmers. Also one can ask whether the FFS requires something like a "pre-school" to be able to live up to its full potential.

Finally, on the issue of opportunity cost of labour, it shows that there are also costs of training on part of the farmer. The true costs of FFS exceed those indicated in the budgetary statements of government and international donor agencies. This corresponds with the findings of Waibel *et al.* (2001) from a study in Egypt.

RECOMMENDATIONS

1. Specify the target group of FFS according factors likely to create incentive for participation, e.g. farmers with high pesticide use levels.
2. Maintain quality control of training by providing sufficient budget and incentive for trainers to perform. Also regularly monitor training success of FFS.
3. Develop and implement complementary measures to increase demand for FFS-type of training by removing hidden pesticide subsidies through crop protection policy reform.

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