Assessing Farmer Attitudes Towards Adoption of Integrated Pest Management Techniques in Sri Lanka

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ABSTRACT

This study examines extent to which crop cultivating farmers in Sri Lanka are willing to adapt to the Integrated Pest Management (IPM) techniques by changing their customarily behavior of applying chemical pesticides to control pests. It uses the primary data collected through questionnaire-based survey with a randomly selected sample of hundred farmers who are currently using chemical pest control measures selected from Kuliyapitiya in the Kurunegala district from May to July, 2005.

It hypothesized that farmer attitudes towards adoption of IPM techniques instead of using chemical control measures regularly are correlated with their socio economic characteristics, including the sex, age, level of education, level of income, extent of land allocated for cultivation etc. Farmer attitudes and perceptions on this change were captured by means of two indexes, called an Additive Index (AI) and a Multiplicative Index (MI). The scores given by respondents to the survey to a set of attitudinal statements explaining this behavior on a Likert-like scale were used for this purpose. Farmers are classified as "high" and "low" responsive to this change based on the values took in these indexes, and which were in turn used to evaluate the impact of each farmer characteristic on this behavior. The results highlights many of these factors have a significant impact on their decisions with respect to adoption of IPM techniques over the chemical methods.

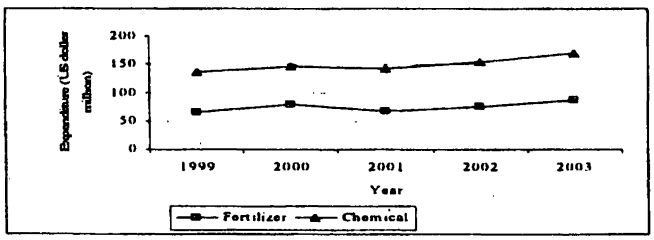
KEY WORDS: Adoption, Chemical pest control measures, Integrated pest management technique, Multiplicative index, Additive index.

INTRODUCTION

Pest control is a critical event to improve the agricultural productivity because it reduces the possible production highly in worldwide. Pests destroy approximately 1/3 of the world's food crop during growth, harvesting and storage (Wiley, 1982). In Sri Lanka 20 percent of crop losses incurred due to aggregate damage caused by insects. Although farmers use different methods, the use of chemical pesticides for pest and disease control of crops remains one of the best known and widely used method in world today (Dissanayake, 2001).

Agro chemicals are very important inputs in the production of many agricultural many agricultural commodities. Chemicals and fertilizer usage is increasing day by day (Central bank, 2003). It shows in Figure-1.

Figure 1- Fertilizer and chemical usage [1999-2003]:



Source: Central Bank (2003)

However, it is well documented that these chemicals have variety of adverse effects on both human health and the environment including contamination of ground water and surface water, chronic and acute health effect on humans' fishery losses, and adverse of other forms of wild life. While it has been shown that farmers are concerned about human health and the environment (Highley and Wintersteen, 1993), little is known is about whether and which farmers would use more environmentally friendly pesticides should they developed.

Integrated pest management (IPM) is a solution to avoid adverse effects of chemical control. IPM can be defined as the one or more management activities that are carried out by farmers that result in the density of potential pest populations being maintained below levels at which they become pests, without endangering the productivity and profitability of farming system as a whole, the health of the farm family and its livestock, and the quality of the adjacent and downstream environments. It focuses on the farmers and their farms, their economics, their health and environment and the difference between organism and the pest. (Wightman, 2001)

Many agricultural countries have done different researches on IPM. Wightman in India has done research on IPM for cotton. Mohan and Usha have done a research on IPM practices for storage pests of pulses. Dhandapani and Murugan have done a research on role of predatory fauna in integrated pest management of rice pests. Although many researches have been done on IPM, still researches have not been done to asses that to what extent farmers willing to adapt IPM from the chemical control measures. The purpose of this research study was to evaluate to what extent farmers are willing to adapt IPM from chemicals and to identify the socio economic characteristics of adopters and non-adopters.

This information can be used by the manufactures, importers of agro chemicals and by that they can predict their future demands and the customers' expectations.

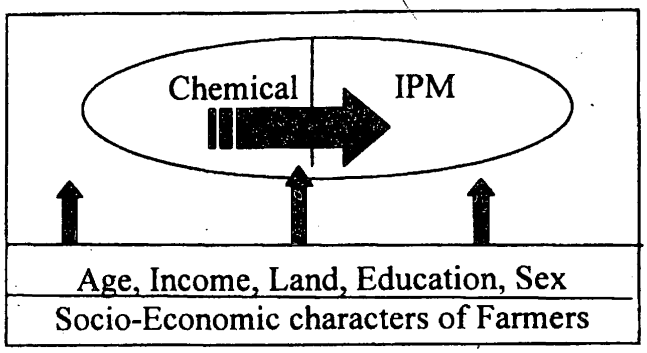
METHODS

In this section we present the methods used to examine the scenario and ways and means used to recognize the situation. Following conceptual framework can be used to explain the change of farmer behavior.

Conceptual Frame Work

Conceptual framework (Figure-2) is used as a model to explain the adoption of farmers towards IPM from chemical pest control.

Figure 2-The conceptual framework:



Currently farmers are using chemical pest control measures. Chemical control measures have benefits as well as the costs. Adoption of IPM technology will take place if expected benefits of IPM are greater than the costs. For that it's necessary to change the perceptions and attitudes of the farmers and they are affected by different socio-economic factors such as age, sex, education, income etc.

An Additive Index (AI) and a Multiplicative Index (MI) were developed to reflect the level of likeability to adopt to IPM from chemical control measures. To develop these indexes, a set of statements[*] (n = 17) explaining various aspects related to the adoption of IPM were used by means of a questionnaire.

To evaluate the performances of the farmers with respect to each statement a Likert-scale was employed (Oppenheim, 1992). The scores given by respondents to the set of statements were used to estimate the Additive index and the Multiplicative index. With these two indexes, two different approaches could be used to estimate the parameters of the variables in the model.

Additive Index (AI)

Formulation of the Additive index was based on the Equation below.

$$AI_i = \sum_{s=1}^{m} a_{is}.X_s / aX$$

Where the term a_{is} denotes the integer score[2] given to a statement (X_s) by the respondent i (i = 1, 2, 3, 4, 5) on the Likert-scale and s represents the number of statements (s = 1, 2, 3...m) used to calculate the index. The term aX represents the "maximum potential score"[3] that can be obtained by a respondent', which in turn be used to normalize the value of the index. With normalization of the index, the values should, theoretically, be range from 0 (minimum) to 1 (maximum) continuously with a certain Mean and Standard Deviation

Multiplicative Index

The Multiplicative index can be derived using the information included in the Equation below:

$$MI_i = (a_{i1}.X_1 * a_{i2}.X_2 * \ldots a_{im}.X_m) / aX$$

Where the term a_i denotes the integer score given to a statement X [X = 1, 2, 3...m) by the respondent *i* (*i* = 1, 2, 3...n) on the Likert-scale. Similar to the Additive index, the term *aX* (i.e. the maximum potential score) [4]is used to normalize the value of the index, and as a result, the values theoretically ranges from 0 to continuously with a certain mean and standard deviation

All statements were given equal weights in estimating the indexes. Thus, the simple average of Likert-scale values normalized by the maximum potential score (*aX*) was taken to develop the indexes.

Data Collection and Analysis

Data collection was carried out during May to July of year 2005. Research study was conducted in Kurunegala district. Farmers who are currently using chemical control measures were interviewed personally using a questionnaire. Sample size was hundred and they were selected randomly. Figure 03-Distribution of Additive Index of Farmers

RESULTS AND DISCUSSION

Descriptive Statistics

Descriptive statistics for the variables included in the two models are presented in Figure-3 and Figure-4. Figure-3 indicates the distribution values of AI and Figure-4 indicates the distribution values of MI.

Distribution curve has been skewed slightly to right side and the skewed is 0.286. Mean value of the AI is 0.48 and minimum and maximum values are 0.227 and 0.624 respectively. 47 percent of farmers' additive index disperses below the mean value of AI and 53 percent of farmers' additive index disperse above the mean value. Mean value of the MI values of farmers is $2.27*10^{-5}$ and the standard deviation is $5.26*10^{-5}$. Dispersion has skewed to left side and the skew ness is 2.83.

[*] The statements used can be provided upon request from the authors

[2] In integer scoring, for example, the researcher can assign a Likert-like scale of strongly agree = 1, agree = 2, neutral = 3, disagree = 4, and strongly disagree = 5 to measure the extent to which a respondent agrees on a given criteria. In doing so, the terms of the scale, and the range of the integers, may be set according to the nature of the question/issue.

[3] For example, given a set of 17 statements with a five-point Likert-scale it would be 5x17 = 85.

[4] For example, given a set of 17 statements with a five-point Likert-scale it would be $5^{17}=7.62*10^{11}$

Figure 3 - Distribution of additive index of farmers (AI):

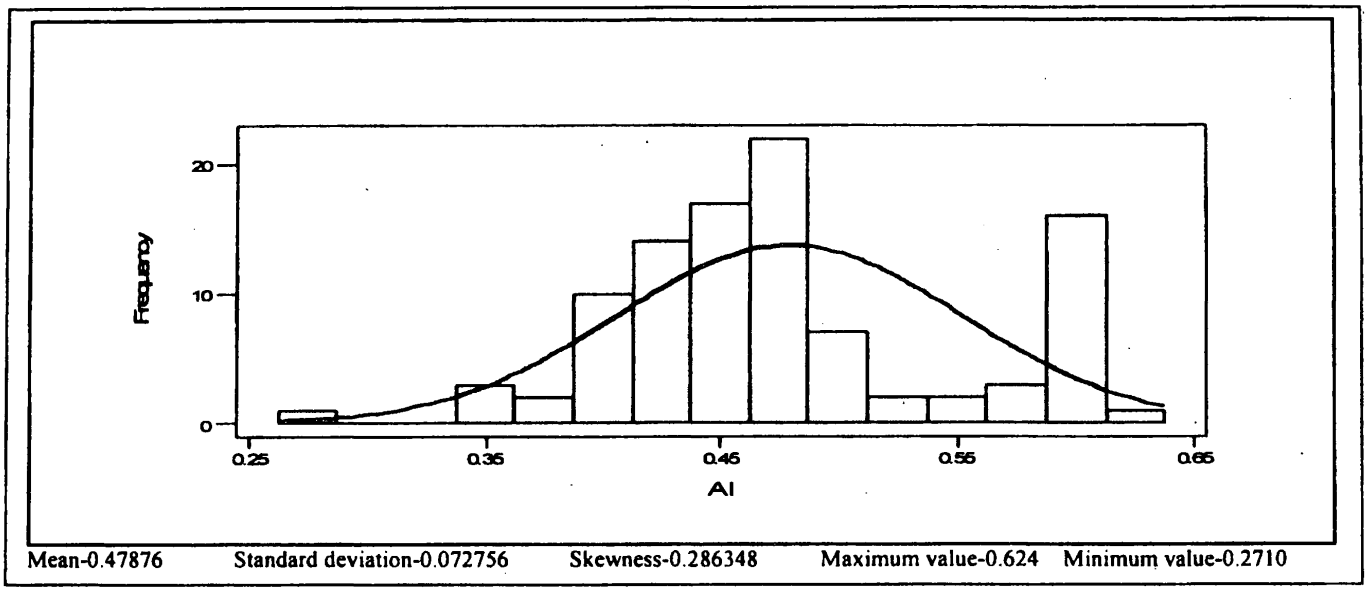
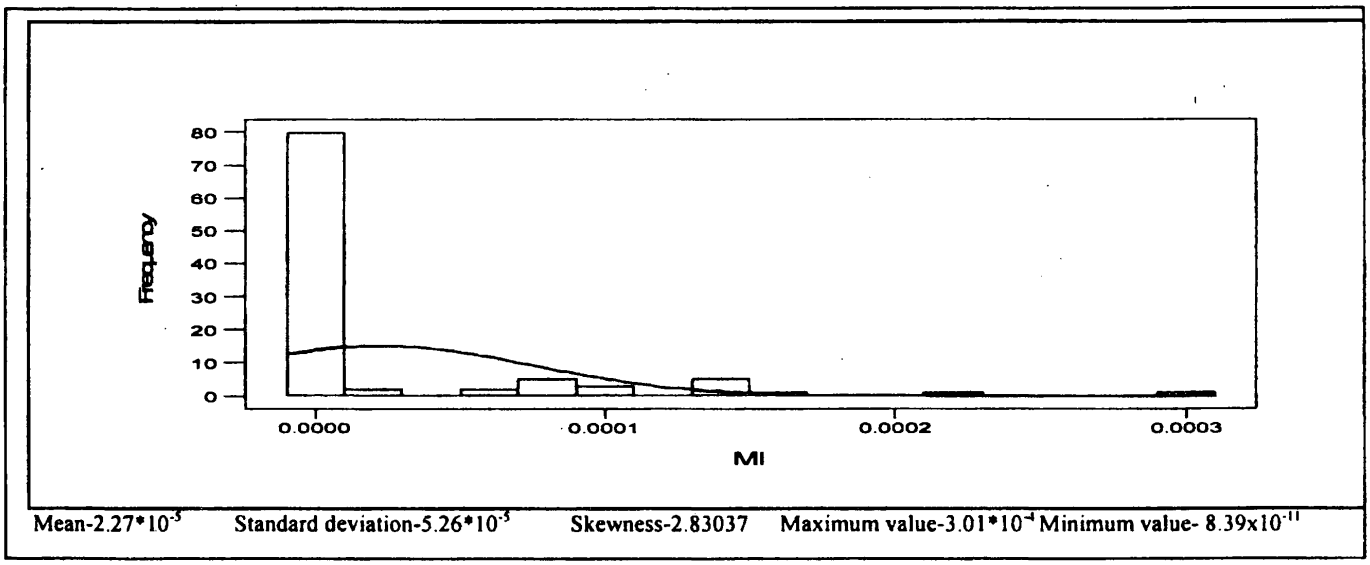


Figure 4- Distribution of multiplicative index of farmers (MI):



Minimum and Maximum MI values are $8.39*10^{-11}$ and $3.01*10^{-4}$ respectively. Majority of the farmers MI values disperse below the mean value. It indicates that majority of the farmers are not willing to change their behavior on pest control measures.

Use of AI to Evaluate Farmer Characteristics

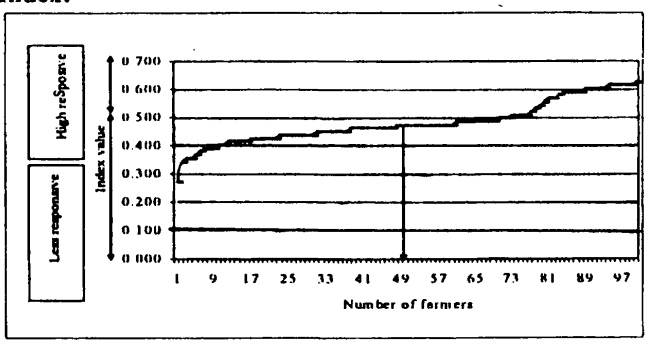
Farmers were classified into two groups assuming that Additive index value between 0.0-0.5 is less responsive to IPM and the Additive index value between 0.5-1.0and is high responsive to the IPM because all the AI values range between 0.0 and the 1.0. Figure-5 shows the distribution of farmers based on AI.

More than 70 farmers' index values are at below the 0.5 level. So Results suggest that approximately 70 percent of farmers are less responsive to IPM and 30 percent of farmers are high responsive to IPM. AI results that majority of farmers are not willing to change their behavior pattern from chemicals to the IPM technique.

Use of MI to Evaluate Farmer Characteristics

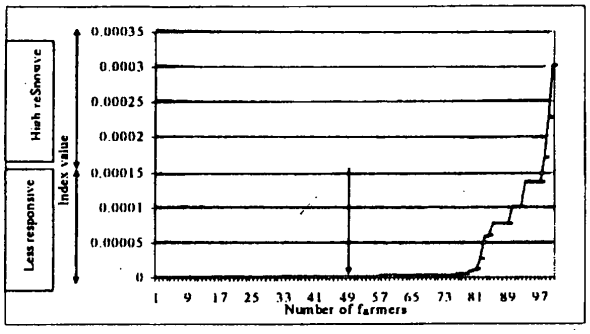
Farmers were classified into two groups assuming that Multjplicative index value between 0.0-0.0001 is less responsive to IPM and the Multiplicative index value between 0.0001-0.0003 is high responsive to the IPM. Figure-6 shows the distribution of farmers based on MI.

Figure 5 - Distribution of Farmers based on Additive Index:



Source: Author

Figure 6-Distribution of farmers based on Multiplicative index:



Source: Author

According to the graph greater than 80 percent of farmers are less responsive toward IPM technique. Approximately 20 percent of farmers are high responsive to IPM.

Impact of Farmers Characteristics

Farmer characteristics have been summarized in Table-2 according to their responsiveness toward IPM technique. This table shows the higher and lower responsive groups characteristics according to AI and MI.

Characteristics of high responsive category

AI results that 52 percent of farmers' age is greater than 50 years, 85 percent of farmers are male farmers, 76 percent of farmers income is greater than 15000 rupees per month, 56 percent of farmers education level is secondary, 62 percent of farmers' income source is only farming, 59 percent of farmers cultivate only one crop, 84 percent of farmers experience is greater than 15 years, 71 percent of farmers cultivation extent is greater than 3 acres, 94 percent of farmers do not receive credit facilities and 83 percent of farmers obtain extension services.

MI results 92 percent of farmers age is less than 50 years. 96 percent of farmers are male farmers, 82 percent of farmer income is greater than 15000 rupees per month, 66 percent of farmer education level is secondary, 79 percent of farmer income source is only farming, 88 percent of farmers cultivate only one crop, 92percent of farmers experience is greater than 15 years, 88 percent of farmers' cultivation Extent is greater than 3 acres, 92 percent of farmers don't receive credit facilities, and 83 percent of farmers obtain extension services.

Characteristics of low responsive category

AI results that 73 percent of farmers' age is less than 50 years, 90 percent of farmers are male farmers, 83 percent of farmers income is greater than 15000 rupees per month, 54 percent of farmers education level is secondary, 52 percent of farmers income source is farming and others, 57 percent of farmers cultivate more than one crop, 97 percent of farmers experience is greater than 15 years, 71 percent of farmers cultivation extent is greater than 3 acres, 99 percent of farmers do not receive credit facilities and 85 percent of farmers obtain extension services.

Table 2- Farmers' characteristics:

Farmer Characteristics		Additive Index		Multiplicative Index	
Variable		Higher Rate	Lower Rate	Higher Rate	Lower Rate
Age (years)	>50	0.52	0.27	0.08	0.33
	< 50	0.48	0.73	0.92	0.67
Gender	Male	0.85	0.90	0.96	0.82
	Female	0.15	0.10	0.04	0.18
Income (Rupees)	> 15000	0.76	0.83	0.63	0.82
	< 15000	0.24	0.17	0.37	0.18
Income Source	Only farming	0.62	0.48	0.79	0.43
	Farming& other	0.38	0.52	0.21	0.57
Education	Primary	0.44	0.46	0.34	0.39
	Secondary	0.56	0.54	0.66	0.61
Crops cultivate	One crop	0.59	0.43	0.88	0.41
	More than one	0.41	0.57	0.12	0.59
Experience (Years)	>15	0.84	0.97	0.92	0.79
	<15	0.16	0.03	0.08	0.21
Extent of cultivation (acres)	<3	0.29	0.29	0.12	0.33
	>3	0.71	0.71	0.88	0.67
Credit facilities	Yes	0.06	0.01	0.00	0.08
	No	0.94	0.99	1.00	0.92
Extension services	Yes	0.83	0.85	0.75	0.75
	No	0.17	0.15	0.25	0.25

Source: Author

MI results 67 percent of farmers age is less than 50 years. 82 percent of farmers are male farmers, 82 percent of farmers income is greater than 15000 rupees per month, 61 percent of farmers education level is secondary, 57 percent of farmers income source is farming and others, 59 percent of farmers cultivate more than one crop, 79 percent of farmers experience is greater than 15 years, 67 percent of farmers cultivation extent is greater than 3 acres, 92 percent of farmers don't receive credit facilities and 75 percent of farmers obtain extension services.

CONCLUSION

AI suggests that approximately 70 percent of farmers are less responsive to IPM and 30 percent of farmers are high responsive to IPM and MI suggests that approximately 80 percent of farmers are less responsive toward IPM technique and 20 percent of farmers are high responsive to IPM.

Conceptually, the Multiplicative index can be considered a better tool than the Additive index to evaluate the level responsiveness of individual farmers because a poor performance of a farmer with respect to one or more of the indicators will result in a lower index value with the former than with the latter. For example, in terms of the approach that used in this particular analysis (i.e. measuring the level of responsiveness of farmers by evaluating their performance with respect to 17 statements), if farmer attitudes well in 15 areas (i.e. high scores given to the Likert Scale) out of the 17 statements and very poorly in the other two areas (i.e. low scores given to the Likert Scale), the low scores obtained by these two statements would inevitably reduce the index value to a greater extent (since the scores from each and every statement were multiplied consecutively to obtain Equation) than a farmer who performs averagely in every area considered.

On the other hand, the value of the Additive index for this particular farmer could be higher than the farmer performing averagely since the higher scores given to the other 15 statements can neutralize the effect of the low scores given to the two statements.

Therefore Multiplicative index gives better results than additive index. So approximately 20 percent of farmers are higher responsive towards IPM.

As socio-Economic characteristics of high responsive farmers, age is less than 50 years, gender as male, income is greater than 15000 rupees per month, education level is at secondary level, income source is only farming, cultivate only one crop, Farming experience is greater than 15 years, cultivation extent is greater than 3 acres, they receive extension services and don't receive credit facilities can be identified. Therefore by increasing farmers' level of education, reducing the number of crops they cultivate and increasing the cultivation extent farmer behavior can be changed.

There are some limitations for this research such as unavailability of data, lack of funds etc. For further studies logistic regression analysis can be done.

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