Factors Affecting Adoption of Recommended Crop Management Practices in Paddy Cultivation in Kalutara District, Sri Lanka

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ABSTRACT

The objectives of the research were to: (1) identify the socio-economic factors of farmers in Kalutara district; (2) determine the relationship between socio economic factors and recommended crop management practices; and (3) identify the problems faced by farmers and their suggestions, and alternate solutions to improve adoption of recommended crop management practices in paddy cultivation.

Stratified sampling technique was used to select the sample of 388 farmers. Data were analyzed and presented through frequency, percentages, and arithmetic means. Chi square test at 0.05 of significant level was employed to test hypotheses. Results revealed that the farmers had an average age 52 years and 68% obtained secondary education. The average experience in paddy cultivation was 23.8 years and there was an average of one member supported head farmer in cultivation. The average size of land was 0.87 acre with average profit of Rupees 4854.77 per acre. Majority of owners cultivated their own fields while 52.8% were engaged in off farm employment. About 43% of farmers obtained credit through the government source there was the main source of information. Extension officers visited 82.7% of farmers during last year, and only 27.1% of farmers participated in extension activities. Only 52.6% of farmers were members of farmers' organizations.

Hypotheses testing revealed that adoption of recommended crop management practices significantly related to education, land, land tenure, income, credit, sources of information, extension activities, extension officer visits, and membership of farmers' organizations.

Major problems of farmers were high cost of inputs, drainage and irrigation difficulties, and unavailability of paddy seeds. Farmers suggested government intervention is essential to solve the problems.

Key words: adoption, socio-economic factors, crop management practices, paddy cultivation, extension activities

INTRODUCTION

Rice is the staple food of Sri Lankans. According to the United Nations (UN) (2003) and Emetiyagoda and Wirasinghe (2000), rice is the livelihood of more than 1.8 million farm families. Farthermore, rice is the single most important crop occupying nearly 28% of total agricultural lands in

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Sri Lanka and accounts for 25% of the total employment. Contribution of rice to Gross Domestic Product (GDP) in agricultural sector is 17.5%.

According to the Ministry of Interior Sri Lanka (MISL) (2002), annual per capita consumption of rice is around 92 kg in 2000. Though rice is the staple food of Sri Lanka, the country has to import rice from other countries to fulfill the domestic requirements. Sri Lanka's present annual production of paddy is about 2.8 million metric tons (m.mt). Furthermore, it was revealed that estimated national average yield should increase to 4.1 metric tons per hectare (mt/ha) for national consumption in year 2025 (Dhanapala, 2000).

All provinces in Sri Lanka with different agro-ecological environments cultivate paddy under irrigation and rainfed conditions. Western province of Sri Lanka (Colombo, Gampaha and Kalutara) produces the lowest paddy yields. Among these Kalutara gives the lowest yields ranging from 2.43-2.83 mt/ha (MISL, 2003).

Dhanapala (2000) indicated that yield gap was due to compound effects of many factors attributed to the farmer's perception and adoption of production technologies. In many instances, the predominant factors were weeds, pest and diseases management, fertilizer use, and inefficient management practices.

Council for Agriculture Research Policy (CARP) (1992) illustrated that socio-economic constrains should be taken into consideration as an important factor in adopting existing technology as well as to generate appropriate technology for future paddy cultivation.

STATEMENT OF THE PROBLEM

Western province of Sri Lanka consists of 3 districts Colombo, Gampaha, and Kalutara. Colombo and Gampaha districts produce better paddy yield than Kalutara district. Kalutara produced the lowest paddy yield among the 3 districts.

Adoption of HYV and crop management practices recommended by Department of Agriculture (DOA) did not enable farmers to obtain high yield. Low rice yield in Kalutara district in Sri Lanka might have resulted from low level of adoption or partial adoption of rice management technology such as usage of HYV, collective and timely cultivation, weed management, fertilizer management, soil fertility improvement, pest management and post harvest management.

In this regard, a study needs to be conducted to answer the following questions: What are the socio-economic factors of the different household farmers in Kalutara District? What are the socio-economic factors affecting adoption of recommended crop management practices? What are the problems faced by farmers in adopting recommended practices? Why do farmers not adopt practice correctly as recommended? Why do they adopt a certain practice partly or part of full package only? Why are the farmers who adopt HYV and recommended practices not able to achieve the expected yields? What are their suggestions to overcome the problems?

OBJECTIVES OF THE STUDY

1. To identify socio-economic factors of the farmers in Kalutara district.
2. To determine the relationship between socio-economic factors and adoption of recommended crop management practices in paddy cultivation.
3. To identify problems faced by farmers and to obtain their suggestions and alternative solutions to the adoption of recommended crop management practices in paddy cultivation.

SCOPE AND LIMITATIONS

This study is emphasized on some-socio economic factors i.e., age of the household head, land size, land tenure, experience, education, farm labour, farm income, off-farm employment, credit, source of information, participation in extension activities, and membership in farmer organization

associated with adoption.

The study area does not represent all the rice growing areas in Sri Lanka. Findings will be most applicable to low country wet zone of Sri Lanka.

The outcomes of the study will be useful for country development planners in undertaking remedial measures to improve the existing situation.

DEFINITION OF TERMS

Socio-economic factors refers to age, education, experience, farm labour, land size, land tenure, off-farm employment, income, credit, source of information, involvement with extension activities, extension officer visits, and farmer organization of farmers.

Adoption of practices refers to the utilization and application of recommended crop management practices.

Recommended crop management practices refers to the five practices selected in this study: adoption of high yielding varieties (HYV), soil fertility improvement and sustenance (organic manure application), weed management, fertilizer management, and pest management practices.

High yielding varieties refers to Bg, Bw, Ld, and At varieties recommended by the Department of Agriculture, Sri Lanka.

Extension officers refers to Krushikarma Paryeshana Nishpadana Sahakara (KPNS) (Village level extension officer) and Agriculture Instructor (A.I) (Officer superior to KPNS who covers a range).

Maha season refers to cultivation of rice from northeast monsoon rains.

Age refers to the age of household head farmer in years.

Level of education refers to the last grade of class attended by household head farmer.

Experience refers to number of years involved in rice cultivation by household head farmer.

Land size refers to area of paddy cultivated by farmer in acres.

Land tenure refers to the status of land ownership of farmers: owner of the land, joint owner, or tenant farmer.

Farm labour refers to a number of family members who worked fulltime in paddy cultivation.

Income refers to the total income after deducting all cash expenses incurred in relation to paddy cultivation in Rupees per acre.

Off-farm employment of farmer refers to any other permanent, casual or temporary employment in an organization and self-employment in addition to farming.

Credit refers to whether farmer obtains credit for paddy cultivation or not during 2003/2004-maha cultivation season.

Sources of information refers to sources that the farmer generally gets information for paddy cultivation i.e., Government sources (extension officers, government offices, media, demonstrations) and Non government sources (farmers, traders, friends and others).

Farmer's participation in extension activities and visits by extension officer refers to participation in farmer training classes, demonstrations, field days by farmer and number of visits by extension officer to farmer during last year.

Membership to an organization refers to member of any paddy farmers' organization.

METHODOLOGY

Out of 20 agriculture ranges in Kalutara district five agriculture instructor ranges (Padagoda, Dodangoda, Warakagoda, Agalawatta, and Bandaragama) were selected through simple random sampling technique. There were 12,875 paddy farmers in selected Agriculture Ranges. Sample size was calculated by using Yamane method came to 388 samples (Yamane, 1973). Stratified random sampling technique was applied to draw the samples and also structured interview schedule was used for data collection. A pilot study was conducted with 20 farmers not included in the sample from the same district before the study and minor changes were

made in the interview schedule.

Data were collected during June and July 2004. Data were analyzed and presented through frequency, percentages, and arithmetic means. Chi-square test was employed to test hypotheses at 0.05 significant level.

Measurement of variables

1. Age: Variable was measured in years. This variable was grouped into: 40 and less than 40 years, 41 to 55 years and above 55 years.

2. Level of education was categorized into 3 groups: grade 5 and lower, grade 6 ะ grade 10, and above grade 10.

3. Experience in paddy cultivation of household head farmer was measured in years. Variable was categorized into: 20 years and less than 20 years and over 20 years.

4. Land size was measured in acres and categorized into 3 groups: 0.5 acre and low, 0.5 to 1 acre, and above 1 acre.

5. Land tenure was grouped as owner, tenant farmer, and joint owner.

6. Farm labour was measured in a number of family members worked in paddy cultivation and was categorized into 2 groups: 1 and less than 1 supporter, and more than 1 supporter.

7. Income was categorized into 3 groups: less than Rs 1500 per acre, Rs 1500 – Rs 5000 per acre and more than Rs 5000 per acre. For analysis these groups were further collapsed into 2 groups: Rs 5000 and lower, more than Rs 5000 per acre.

8. Off-farm employment: The respondents were grouped into groups as employed and un employed for analysis.

9. Credit: Respondents were grouped as credits obtained and not obtained.

10. Source of information: Sources of information were grouped as government sources and non-government sources.

11. Participation in extension activities i.e., demonstrations, trainings, and field days during last year by farmer was measured. Variable was categorized into 2 groups: attended and not attended in such activities.

12. Number of visits to the farm families by extension officer was measured in number of visits during last year. Variable was categorized into 3 groups: one and less than one visit, 2-3 visits, and more than 3 visits.

13. Membership in farmers' organization was categorized into 2 groups: member and non-member.

14. Adoption of high yielding varieties was measured in whether farmer used HYV for cultivation. Two groups were made as those who adopted HYV and not adopted.

15. Adoption of soil fertility improvement and sustenance practices (application of organic manure). Application of organic manure: paddy straw, green manure, cow dung, poultry manure, and burnt paddy husk for paddy cultivation was considered. This variable was categorized into 2 groups: adopted and not adopted for analysis. Application of above mentioned organic manure for paddy cultivation was considered as adopted otherwise not adopted.

16. Adoption of fertilizer management practices. Three attributes: usage of straight fertilizer, number of applications, amounts of fertilizer applied (kg/ha) were considered in this variable. Variable was measured in farmer's adherence to DOA recommendations (DOA, 1998a) on above-mentioned 3 attributes. For analysis variable, it was grouped into 2: adopted and not adopted. Adoption of all 3 attributes to DOA recommendations was considered as adopted, otherwise not adopted.

17. Adoption of weed management practices. This variable was split into 2 sub variables: adoption of cultural and preventive weed control practices and adoption of weedicide recommendation.

17.1 Adoption of cultural and preventive weed control practices. This variable consists of 6 measures: usage of clean seeds, proper land preparation, maintenance of weeds free bunds and canals, prevent weeds from seedling in seed bed, water management, proper cultivars selection (DOA, 1998b). Variable

was categorized into 2 groups: adopted and not adopted for analysis. Adoptions of all 6 cultural and preventive measures were considered as variable was adopted, otherwise not adopted.

17.2 Adoption of weedicide recommendations. Three factors were considered in this variable: the time of application of weedicide (days after sowing), rate of application (ml, l, kg per acre), and dilution (ml, l, kg per acre). Variable was categorized into 2 groups: adopted and not adopted for the purpose of analysis. Adoption of all 3 factors according to DOA recommendations (DOA, 1997), considered as variable was adopted and otherwise not adopted.

18. Adoption of insect pest management practices. This variable contains 8 practices: proper land preparation, weed control, burning of damaged plants and debris, use of recommended varieties, application of recommended fertilizer levels, weeds free surroundings and bunds, pest monitoring, and criteria used to spray insecticides (DOA, 1998b). Variable was categorized into 2 groups: adopted and not adopted for testing of hypotheses. If all 8 practices were properly practiced, variable was considered as adopted and otherwise not adopted.

RESULTS AND DISCUSSION

General background of respondents

Almost half of the farmers (43.8%) were between 40 and 55 years old while 41.8% of the respondents were above 55 years and only 14.4% were 40 years and below. The majority of farmers (59.8%) obtained lower secondary education (Grade 6-10). Approximately 23% of the respondents obtained only primary education (Grade 1- 5), while 8.8% had no formal education. Around 7% of the farmers had upper secondary education (Grade 11-12), while remaining 1.5% had diploma or degree. Overall 68% of the respondents had achieved an education above grade 5 level and 91.2% had formal education (Table 1).

Farmers 21.1% had less than 10 years of experience in paddy cultivation. Approximately 29% had 10 to 20 years of experience, while 50.3% had more than 20 years of experience. Farmers (43.8%) cultivated paddy lands of 0.5 acres to 1 acre. Approximately 40% of the respondents cultivated 0.5 ac or less than 0.5 ac of paddy land, while 16.3% cultivated lands measuring more than one acre. Owners (53.6%) cultivated their own land, while 29.6% were tenant farmers. The rest (16.8%) were joint owners who cultivated in a rotational basis (Table 1).

Findings revealed that farmers (40.5%) had one member actively supported head farmer while 30.9% of head farmers did not have any member to support him in paddy cultivation. Farmers (26.5%) had two actively supporters and 2.1% of farmers had more than 2. Majority of farmers (52.8%) were engaged in some other occupation in addition to farming while 47.2% of the farmers were not employed outside. Many farmers (48.2%) received profit over Rs 5000 per acre. About (31.7%) of farmers obtained profit between Rs 1500 – Rs 5000 per acre, while the remaining (20.1%) received a profit less than Rs 1500. The farmers (56.7%) did not obtain credit for the 2003/2004-maha-cultivation season while the rest (43.3%) obtained credit from different sources (Table 1).

Majority of farmers (72.9%) had not taken part in any extension teaching activities: farmer training, field days, demonstrations, during last year. Approximately 27% of farmers had participated at least once in extension teaching activities. According to this study extension officer had not visited 17.3% of farmers during last one year. Approximately 16% of the farmers were paid one visit, while 43.5% of farmers were visited 2-3 times. The rest of the respondents (23%) was visited more than 3 times during last one year. In this study majority of farmers (52.6%) had membership in farmers' organization and the rest (47.4%) had no membership (Table 1).

More than 50% of farmers obtained information from government sources mostly about crop management practices not including the fertilizer

Table 1 Profile of the respondents.

(n=388)

Socio-economic characteristics	No.	%
1) Age		
40 years and below	56	14.4
40 – 55 years old	170	43.8
Above 55 years old	162	41.8
2) Level of education		
No education	34	8.8
Primary education (Grade 1-5)	90	23.2
Lower secondary education (Grade 6-10)	232	59.8
Upper secondary education (Grade 11-12)	26	6.7
Higher education (Diploma, Degree)	6	1.5
3) Experience		
10 years and below	82	21.1
More than 10 – 20 years	111	28.6
Above 20 years	195	50.3
4) Land size		
0.5 acre below	155	39.9
More than 0.5 – 1 acre	170	43.8
Above 1 acre	63	16.3
5) Land Tenure		
Owner	208	53.6
Tenant	115	29.6
Joint owner	65	16.8
6) Family labour (No of members actively supported)		
No supporter	120	30.9
1 supporter	157	40.5
2 supporter	103	26.5
More than 2 supporters	8	2.1
7) Off farm employment		
Employed	205	52.8
Not employed	183	47.2
8) Income (Profit over cash cost)		
Rs 1500 and less	78	20.1
More than Rs 1500 – Rs 5000	123	31.7
Above Rs 5000	187	48.2
9) Credit		
Obtained	168	43.3
Not obtained	220	56.7
10) Participation in farmer training/ field days / demonstrations		
Attended	105	27.1
Not attended	283	72.9
11) Number of visits by extension officer to farmer's field		
No visit	67	17.3
1 visit	63	16.2
2 – 3 visits	169	43.5
More than 3 visits	89	23
12) Membership in farmers organization		
Member	204	52.6
Non member	184	47.4

management practices. In many instances, extension officer was the main source of information to farmers (Table 2).

Adoption of crop management practices

Table 3 illustrates the level of adoption of crop management practices.

Study reveals 96.4 % of respondents cultivated HYV, while 3.6 % cultivated traditional varieties. Farmers mentioned high yields, unavailability of traditional varieties, and better response to fertilizers as reasons to cultivate HYV. Less pest and diseases, tasty, and ability to compete with weeds were the main reasons to cultivate traditional varieties.

Farmers (23.7%) adopted soil fertility improvement and sustenance practice while 76.3% did not adopted the practice. The main reasons for adoption of recommendation was due to long-term benefits i.e., improvement of soil fertility, less insect pests damage and improvement of response to fertilizer. Inquiry from farmers revealed 3 main reasons: cost time limited, no time, and not enough family labour for non-adoption.

According to this study 27.8 % of farmers adopted all three components of fertilizer management practices, while 72.2 % did not adopted recommended fertilizer management practices correctly. Inquiry from farmers revealed that increased yields and profit were the main reasons for adoption of recommendations. Main reasons for non-adoption of recommendations were due to misconceptions and financial constrains of farmer.

This study revealed 11.6 % of farmers adopted preventive and cultural weed control practices, while 88.4 % did not implement practices correctly. Farmers mentioned less weeds, better growth, and increased yields as reasons for adoption. High input cost; labour, part time farming and scarcity of suitable varieties were the main reasons for non-adoption.

According to the study 43.8 % of farmers who used weedicides adopted weedicide recommendations, while 56.2 % did not. Inquiry

Table 2 Sources of information on crop management practices.

Sources of information	High yielding varieties		Soil fertility improvement and sustenance practice		Fertilizer management practices		Weeds management and weedicides		Insect pest management and insecticides	
	No.	%	No.	%	No.	%	No.	%	No.	%
Government sources	198	52.9	303	78.1	190	49.5	200	51.4	200	51.4
Extension officer		36.4		32.7		35.7		33.2		33.7
Government office		12.8		3.9		12.0		13.9		13.4
Media		2.4		30.7		1.8		2.8		2.8
Demonstrations/training		1.3		10.8		-		1.5		1.5
Non government sources	176	47.1	85	21.9	194	50.5	188	48.6	188	48.6
Farmers		47.1		21.9		32.0		20.4		20.6
Family member		-		-		5.5		-		-
Fertilizer dealer		-		-		13.0		-		-
Pesticide dealer		-		-		-		15.6		15.4
Spray operator		-		-		-		12.6		12.6

from farmers revealed that good weed control and increased yields were the main reasons for adoption. High cost of weedicides and lack of adherence to recommendations were the main reasons for non-adoption.

Study revealed 14.4 % of farmers adopted insect pest management practices correctly, while 85.6 % did not adopted the practices correctly. Farmers mentioned less chemicals requirement, increased profit and increased yields were the main reasons for adoption. High input cost, part time farming, lack of technically qualified manpower, and scarcity of suitable varieties were the main reasons for non-adoption.

Relationship between socio-economic factors and adoption of recommended crop management practices

The chi square test indicated that there were no significant relationships between age, experience, labour, and off farm employment with adoption of recommended crop management practices. Table 4 illustrates the chi square test results of relationship between socio economic factors and recommended crop management practices.

Level of education was significantly related to the adoption of soil fertility improvement and sustenance practices, and adoption of fertilizer management practices at 0.05 significant level.

Land was significantly related to the adoption of soil fertility improvement and sustenance practice, adoption of cultural and preventive weed control practices, and adoption of weedicide recommendations at 0.05 significant level.

Land tenure was significantly related to the adoption of fertilizer management practices and adoption of insect pest management practices at 0.05 significant level.

Income was related to the adoption of soil fertility improvement and sustenance practices, adoption of fertilizer management practices, and adoption of weedicide recommendations at 0.05 significant level.

Credit was related to the adoption of soil fertility improvement and sustenance practices, and adoption of Cultural and preventive weed control practices at 0.05 significant level.

Source of information was related to the adoption of soil fertility improvement and sustenance practices, adoption of fertilizer management practices, adoption of Cultural and preventive weed control practices, and adoption of insect pest management practices at 0.05 significant level.

Participation in extension activities was related to the adoption of soil fertility improvement and sustenance practices, adoption of fertilizer management practices, adoption of Cultural and preventive weed control practices and adoption of insect pest management practices at 0.05 significant level.

Visits by extension officer were related to the adoption of soil fertility improvement and sustenance

Table 3 Adoption of crop management practices.

Crop management practices	Adoption of crop management practices			
	Adopted		Not adopted	
	No.	%	No.	%
Use of high yielding varieties	374	96.4	14	3.6
Soil fertility improvement and sustenance practices	92	23.7	296	76.3
Fertilizer management practices	100	27.8	260	72.2
Cultural and preventive weed control practices	45	11.6	343	88.4
Weedicide recommendations	84	43.8	108	56.2
Insect pest management practices	56	14.4	332	85.6

Table 4 Relationship between socio-economic factors and adoption of crop management practices

Socio economic factors	Adoption of crop management practices (c^2)					
	High yielding varieties sustenance	Soil fertility improvement & practices	Fertilizer management control practices	Cultural & preventive weed	Weedicide recommendations practices	Insect pest management
Age	0.774	0.060	0.052	1.481	0.073	0.019
Education	2.190	7.502 *	7.035 *	0.350	0.487	2.411
Experience	7.318	2.540	0.760	0.957	2.630	3.315
Land size	4.515	6.809 *	1.315	17.417 *	10.883 *	1.809
Land tenure	1.115	3.755	9.739 *	1.693	4.005	7.019 *
Labour	0.038	1.984	0.541	2.846	0.945	1.077
Off farm employment	1.708	1.798	2.055	0.005	1.818	3.444
Income	2.240	17.797 *	94.298 *	37.549	4.860 *	52.284
Credit	0.001	5.996 *	0.400	11.332 *	2.579	0.048
Source of information	0.001	5.538 *	13.030 *	14.024 *	3.034	16.692 *
Extension activities	0.234	29.172 *	9.727 *	4.317 *	1.967	6.508 *
Extension officer visits	3.645	21.943 *	17.138 *	13.420 *	2.525	17.467 *
Membership in Farmers' organization	0.550	15.801 *	9.735**	2.875	0.857	4.780 *

Note: * significant level at .05

practices, adoption of fertilizer management practices, adoption of Cultural and preventive weed control practices and adoption of insect pest management practices at 0.05 significant level.

Membership in farmers' organization was related to the adoption of soil fertility improvement and sustenance practices, adoption of fertilizer management practices, and adoption of insect pest management practices at 0.05 significant level.

Problems and suggestions of farmers pertaining to paddy cultivation

The study found six important problems: high cost of fertilizers and agro chemicals (72.2%), high prices and lack of quality paddy seeds (44.3%), irrigation and drainage problems (43.8%), shortage of labour and high rates of labour and tractors (28.6%), cultivation problems (28.1%), and lack of suitable varieties (27.3%). Farmers expect government to bare the major responsibility of solving problems. Some of the problems will be able to solve by group action of farmers. Therefore strengthening of farmers' organizations will be able to minimize some problems and the rest has to be undertaken by respective government agencies (Table 5).

Table 5 Problems and suggestions.

(n =388)

Problems	No. of times mentioned	%	Suggestions
High cost of fertilizers and agro chemicals	280	72.2	* Provide input at subsidized rates
Irrigation and drainage problems.	172	44.3	* Government should maintain anicuts, major irrigation and drainage canals. * Organize farmers to maintain minor canals.
High cost, and shortage of quality paddy seeds.	170	43.8	* Supply quality seed paddy by DOA for a reasonable rate. * Train farmers for self-seed paddy production. * Organize farmers' organizations to produce seed paddy.
Shortage of labour, high rates of labour and tractors.	111	28.6	* Provide tractors to farmers' organizations or govijana kendraya.
Problems in cultivation (pest and diseases, fertilizer, and soil problems).	109	28.1	* Regular farmer training on problems. * Demonstrate new technologies in farmer's fields
Lack of suitable varieties for suit the local conditions	106	27.3	* Introduce varieties suits to the area
Farmers refrain from cultivating paddy lands	66	17.01	* Take action according to agrarian development act
Problems in obtaining cultivation loans	46	11.9	* Provide loans by state banks on easy terms
Lack of interest of younger generation towards agriculture	36	9.3	* Introduce new technology to make farming profitable * Demonstrate new technologies in farmer's fields
In efficiency of officers	36	9.3	* Disciplinary action against inefficient officers
Damages cause by wild boars and free rearing cattle	30	7.7	* Re issue of fire arms to licenses holders * Take action according to law (confiscate cattle)
Floods	22	5.67	* Introduce suitable varieties which can tolerate floods

Note: One respondent replied more than one

CONCLUSION AND RECOMMENDATION

Results reveled that average age was 52 years and 68 % obtained secondary education. The average experience in paddy cultivation was 23.8 years and an average of one member supported head farmer in cultivation. The average size of land was 0.87 acre with average income Rupees 4854.77 per acre. Majority of owners cultivated their own fields while 52.8 % were engaged in off farm employment. The 43 % of farmers obtained credit and government source was the main source of information except for the fertilizer management practices. Extension officer had visited 82.7 % of farmers during last year, and only 27.1 % of farmers had participated in extension activities. Moreover, 52.6 % of farmers were members of farmers' organizations.

Adoption levels of recommended crop management practices were less than 50 % except for high yielding varieties. Farmer's level of education, land, land tenure, income, credit, source of information, participation in extension activities, extension officer visits, and membership in farmers' organization were factors relating to farmer's adoption of crop management practices.

The problems such as high cost of fertilizers and agro chemicals, high prices and lack of quality paddy seeds, irrigation and drainage problems, shortage of labour and high rates of labour and tractors, cultivation problems, lack of suitable varieties and credit affects the adoption. Farmers expect government intervention to solve the problems.

In order to improve adoption of crop management practices, the following recommendations should be considered.

1. Making credit available to farmers is an important way of increasing the adoption of recommended crop management practices. It is important, however terms of credit reflect farmers' socio economic circumstances. The current requirement that farmers must have sureties and bonds, limits their participation in credit. Therefore, these requirements should be reviewed in order to allow more farmers to participate in credit program, which includes credit for inputs and farm power.

2. Another important factor affecting adoption was government source of information that of extension officer. Therefore, DOA should update extension officers' knowledge on latest innovations through regular training programs and similar activities.

2.1 DOA should train fertilizer and pesticide dealers on recommendations and spray operators on pesticide recommendations as they play a role of opinion leader.

2.2 Programs on printed and electronic media should be evaluated and redesigned in a manner to suit farmers. Broadcasting time has also to be adjusted to suit farmers' convenience.

3. Capacity building of extension staff and facilitating extension officer with transportation and required training materials would increase the number of adopters.

4. Farmers organizations should be strengthen and motivate to better serve farmers in providing information on improved practices, organize farm inputs (fertilizers, paddy seeds and pesticides) for concessionary prices, and sharing of resources. Information packages about integrated crop management programs should be given to farmers' organizations regularly.

5. Encouraging and training farmers for value addition and produce value added products could increase income from paddy. Development of entrepreneurship skills of farmers will lead to market their products and innovate new products. Increase in income would motivate farmer to gain more yields by adopting recommendations.

6. Researchers and extension staff have to work jointly to solve farmers' field problems as early as possible to minimize losses.

7. Farmers have to adopt practices as a system or as a package rather than just portion of it.

Suggestions for future study

In depth study has to be done over a number of seasons to identify specifically:

1) Influence of physical and biological factors on adoption;

2) Other socio-economic factors such as knowledge on rice farming practices of farmer, social status, indebtness, sociability of extension agent, farmer's interaction with peer groups, readability and reading habit of farmer which may explain the adoption of recommended crop management practices.

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