Potential effects on rural economies of conversion to sustainable farming systems : a case of Sa See Moom rice farmer group, Kamphaengsaen, Nakhon Pathom province

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Abstract : *The main focus of this study conducted during February 2000 is to present the potential effects of sustainable farming systems on farm household economies using a structured interview schedule in a survey to collect primary data from the total population of 125 farmers holding Sa See Moom Rice Farmer's Group status. Data analysis is done through various statistical measures. The results are revealed to be as follows:*

Most of what the farmers use in the area drawn heavily on the high-input conventional farming practice is found being exceeded over the low-input or sustainable farming practices. This is indicated in terms of productivity, on-farm income, food security, employment opportunity and gross margin. This, of course, partially may be due to the practices originally benign under conditions of the farm-level impacts of low-input rice and other various crops planted for the farm household economies including non cash income, assets and non-cash costs have not been quantified to enable to bring about the productive capabilities and enhance resilience of individuals, groups and organizations to deal with rapidly changing economic and social circumstances resulting from their own unique needs and preferences.

The hypothesis testing, under low-input farming practices, indicates that there is a statistically significant difference in income and employment opportunity due to the land at 0.01 and 0.05 levels respectively. The rest variables including labor, capital, management, and market are found being statistically non significant to cause difference at 0.05 level. Land is accounted for causing 71.0 percent and 13.8 percent of the variation in income and employment opportunity respectively. Similarly, technology is found being a statistically significant to cause difference in cost at 0.05 level. Technology is accounted for causing 14.2 percent of the variation in cost. Under high-input farming practices, out of the variable categories : land, labor, capital, management and market ; only land and technology are found being statistically significant to cause difference in income at 0.01 and .0.05 levels respectively. The

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combination of land and technology is accounted for causing 67.7 percent of the variation in income. Land is also found statistically being negatively significant to cause difference in cost at 0.05 level. Land is accounted for causing 15.6 percent of the variation in cost. None of the output variables, including productivity, income, food security, employment opportunity and cost, is being statistically significant to cause difference in farmers' acceptance.

The findings suggest that continued research-extension-application in insuring essential functions to generate information and organic technologies as effective substitute of chemical inputs, effective policies to support the farmers' decision making to adopt sustainable farming technologies, wise use of land and farming technologies by the farmers to increase income and employment opportunity and implementation of effective extension technique such as training courses, demonstrations, field trips, and group discussions related to sustainable agriculture are some essential recommendations in order to facilitate the adoption of sustainable farming system in the future.

Key words *: rural economies, sustainable farming systems, rice farmers' group, agricultural extension*

1 Introduction

Agriculture is the foundation of Thai economy. It plays an important role in country's food security, earning foreign exchange through food export, and the supply of raw materials for industry.

Thailand is one of the leading food exporting countries in the world. It ranks the tenth in terms of trade surplus for food. It is the world leading exporter of rice, rubber, cassava products, canned pineapple, sugar, poultry and fishery products (Rojanaridpiched et al, 1998).

The modern agricultural technologies (Green Revolution Technology) such as, seeds of high yielding varieties (HYV), chemical fertilizers, and pesticides, have significantly contributed to increase the overall productivity of the agricultural products, and thus enabled the country to achieve self-sufficiency in terms of food and become the food exporter. On the other hand, some of those technologies, such as chemical inputs, have serious negative impacts on the humans, animals, and environment. Thus, the livelihood and the quality of life of Thai people (both present as well as the future generations) are likely to be in Jeopardy (OEPP, 1997).

Therefore, people from all walks of life are raising their voices strongly for the transformation of modern commercial agriculture (i.e. conventional agriculture) into sustainable agriculture.

The 8th National Economic and Social Development Plan (NESDP) has also emphasized to develop the potentialities and creativity of Thai people to plan, develop, and adopt

sustainable agriculture and conserve natural resources and environment in order to have a better quality of life (NESDB, 1997).

2 Statement of the Problem

Thailand is basically an agricultural country, where majority of the people (i.e. 61 per cent of the country's total population) depend on agriculture for their livelihood (DOAE, 1997).

Farmers are the backbone of the nation. They are the farmers, who produce food for all people as well as contribute significantly to the national income. But the socio- economic conditions (i.e., standard of living and the quality of life) of the farmers and their family members is much lower than the other groups of people (i.e., who are engaged in non-agricultural sectors) in the society.

This condition is clearly reflected by the per capita income. The per capita income of farmers is only 12,524 baht where as that of the others is 156,440 baht (DOAE, 1997).

In such condition, there is a great need for the farmers to increase production and income in order to improve the quality of life of their family members and bridge the existing socio-economic gap between the farmers and other groups of people in the society. At the same time, there is also a need for the transformation of current modern agricultural production system into sustainable agriculture in order to maintain the sustainability of natural resources and environment, and the well-being of the people (both producer and consumer) to cope with the rapid changes under globalization.

The transformation process of current agriculture into sustainable one at full scale is not possible unless and until, the sustainable agriculture either more profitable or at least as much productive and profitable as current (modern) agriculture.

Therefore, from this perspective, the researcher's main point of interest is to find out "what will be the potential effect of the transformation or conversion of current (modern) agriculture into sustainable agriculture on the rural economies?"

3 Objectives and scope of the study

The main objective of the study is to assess the potential effects of sustainable farming system on farm household economies (i.e. productivity, income, food security, employment opportunity and cost).

Since, there may be several types of potential effects on the rural economies of conversion to sustainable farming system. But all effects cannot be studied by any single study. So, due to limited time and budget, the scope of the study has been confined to the economic perspective only. As a consequence, this study has focused on the potential economic effects of sustainable farming system on the farm household economies.

In general, the findings of this study are expected to be useful and applicable not only in the context of Sa See Moom but also in the context of the whole Thailand as well as other Asian countries having similar conditions. But specifically, as the nature, magnitude, causes and solutions of the problem vary according to the place, time, needs, expectations, resources and goals of the people as well as changing socio-economic, cultural and political environment of the society, the usefulness and applicability of the result of this study will depend upon the situation.

4 Methodology

The study has been conducted in the Sa See Moom Rice Farmer's Group of Sa See Moom sub-district, Kamphaengsaean district, Nakhon Pathom province, Thailand. All members of the rice farmer group (i.e.175) have been considered as both the population as well as the respondents for this study. But out of the total respondents, the data have been collected only from 125 respondents, because the rest of the farmers have changed their business and left the group. Survey research design has been employed to collect the data. The interview schedule consisting of both open as well as close ended questions has been used as research instruments to collect the data. The interview schedule has been presented into the five parts. They are : (1) current socio-economic status of the farmers, (ii) low-input/high-input farming system, (iii) rural economies, (iv) farmer's acceptance, and (v) problems and suggestion. In order to determine the validity and reliability of the research instrument, the schedule has been pretested with 21 farmers of Thung Luke Nok sub-district of Kamphaengsaen district prior to using it in the real survey work for collecting primary data. After analysis, the schedule has been found valid and reliable.

After collecting the data, based on the cost involved in per rai of land (1 Rai = 0.16 hectares) for chemical inputs used by the respondents in the farming, the respondents have been divided into two groups, i.e. high-input user and low-input user. The average of the cost of chemicals for per rai of land has been found out for all the respondents. The farmers who have used money $\leq$ (less than or equal to) average of the cost of chemicals have been considered as low-input user where as those farmers who have used > (more than) the average have been considered as high-input user. Then, the influence of independent variables over dependent variables has been analyzed group wise. The data have been analyzed by employing SPSS/FW (Statistical Package for Social Science for Window). Frequency count, percentage and arithmetic mean have been used to describe the socio-economic status of the farm households. Similarly, multiple regression has been employed to determine the influence of independent variables on the dependent variables to test the hypotheses. Five percent level ($\propto$ = .05) has been considered as the minimum level of significance for testing the hypotheses. The gross margin has been employed to determine the profitability of the farming systems.

5 Result and discussion

The result of the study have revealed that :

The maximum, average and minimum productivity of rice are 1200 kg, 525.57 kg and 100 kg per rai respectively under low-input farming condition whereas the maximum, average and minimum productivity of rice under high-input farming condition are 1285.30 kg, 628.21 kg and 266 kg per rai respectively (Table 1).

The maximum, average and minimum on-farm income under low-input farming condition are 50,000 baht, 13,084.38 baht and 540 baht per annum respectively. Similarly, the maximum, average and minimum on-farm income under high-input farming condition are 160,000 baht, 18,793.40 baht and 1,000 baht per annum respectively (Table 2).

Under low-input farming condition, 78.1 per cent of the respondents have the sufficient food for the whole year whereas 21.9 per cent of the respondents have not sufficient food for the whole year. Similarly, under high-input farming condition, 82.0 per cent of the respondents have sufficient food for the whole year whereas 18.0 per cent of the respondents have not sufficient food for the whole year. On an average, the respondents have food security for 10.39 months and 10.53 months under low-input farming condition and high-input farming condition respectively (Table 3.)

Under low-input farming condition, 64.1 per cent of the respondents have sufficient job for the whole year in their farm whereas 35.9 per cent of the respondents have not sufficient job for the whole year in their farm. Under high-input farming condition, 65.6 per cent of the respondents have sufficient job for the whole year in their farm whereas 34.4 per cent of the respondents have not sufficient job for the whole year in their farm. On an average, the respondents have job in their farm for 10.09 months and 10.33 months under low-input farming condition and high-input farming condition respectively (Table 4)

The maximum, average and minimum cost of production of rice are 1,408 baht, 667.01 baht and 310 baht per rai respectively under low-input farming condition. Under high-input farming condition, the maximum, average and minimum cost of production of rice are 1,940 baht, 1,015.17 baht and 538.7 baht per rai respectively (Table 5).

The maximum, average, and minimum gross margin under low-input farming condition are 4,436 baht, 1,443.44 baht and – 976 baht per rai respectively whereas under high-input farming condition, the maximum, average and minimum gross margin are 4,025.30 baht, 1,447.48 baht and –66.50 baht per rai respectively (Table 6)

Out of all independent variables, such as land, labor, capital (credit and technology), management and market, non of them has been found statistically significant to cause difference in productivity and food security at 0.05 level of statistical significance under both low-input farming condition as well as high-input farming condition. There might be some

other variables responsible for causing variation in productivity and food security which are not included in this study.

None of the independent variables such as land, labor, capital (credit and technology) has been found statistically significant to cause difference in employment opportunity at 0.05 level of statistical significance under high-input farming condition. There might be some other variables responsible for causing variation in the employment opportunity which are not included in this study.

Out of independent variables, such as land, labor, capital (credit and technology), management and market, only land has been found statistically significant to cause difference in income at 0.01 level of statistical significance under low-input farming condition. Land is accounted for causing 71.0 percent of the variation in income (Table 7).

Out of independent variables, such as land, labor, capital (credit and technology), management and market, only land has been found statistically significant to cause difference in employment opportunity at 0.05 level of statistical significance under low-input farming condition. Land is accounted for causing only 13.8 of the variation in employment opportunity (Table 8). There might be some other variables responsible for causing 86.2 per cent variation in employment opportunity which are not included in this study.

Out of independent variables, such as land, labor, capital (credit and technology), management and market, only technology has been found statistically significant to cause difference in cost at 0.05 level of statistical significance under all variable low-input farming condition. The technology is accounted for causing 14.2% of the variation in cost (Table 9). There might be some other variables responsible for causing 85.8% variation in cost which are not included in this study.

Out of independent variables, such as land, labor, capital (credit and technology), management and market, only land and technology have been found statistically significant to cause difference in income at 0.01 and 0.05 levels of statistical significance respectively under high-input farming condition. The analysis has indicated that the combination of land and technology is accounted for causing 67.7 per cent of the variation in income (Table 10).

Out of independent variables, such as land, labor, capital (credit and technology), management and market, land has been found negatively significant to cause difference in the cost at 0.05 level of statistical significance under high-input farming condition. Land is accounted for causing 15.6% of the variation in cost (Table 11). There might be some other variables responsible for causing 84.4% of the variation in cost which are not included in this study.

None of the output variables such as productivity, income food security, employment opportunity and cost, has been found statistically significant to cause difference in farmer's acceptance for the conversion of high-input farming system into low-input farming system at 0.05 level of statistical significance. There might be some other variables responsible for causing variation in the farmer's acceptance which are not included in this study.

TABLE 1 FARM PRODUCTIVITY UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION.

S.No	Name of commodity	Yield (kg/Rai)			
		Low-input condition		High-input condition	
1	Rice	$(\bar{x})$ = Max = Min =	525.57 1,200.00 100.00	$(\bar{x})$ = Max = Min =	628.21 1285.30 266.00

TABLE 2 ON-FARM INCOME UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION.

S.No	Commodity	Income (Baht per annum)			
		Low-input condition		High- input condition	
1	Rice	$(\bar{x})$ = Max = Min =	13,084.38 50,000.00 540.00	$(\bar{x})$ = Max = Min =	18,793.40 160,000 1,000

TABLE 3 FOOD SECURITY STATUS UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION.

S.No	Type of farming system	Food security status	
		Sufficient for the whole year	Not sufficient
1	Low-input farming	50 (78.1%)	14 (21.9%)
		$(\bar{x})$ = 10.39 month, Max = 12 months, Min = 1 months	
2	High-input farming	50 (82.0%)	11 (18.0%)
		$(\bar{x})$ = 10.53 months, Max = 12 months, Min = 1 months	

TABLE 4 EMPLOYMENT OPPORTUNITY UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION.

S.No	Type of farming system	Job opportunity	
		Throughout the year	Not throughout the year
1	Low-input farming	41 (64.1%)	23 (35.9%)
		$(\bar{x})$ = 10.09 month, Max = 12 months, Min = 2 months	
2	High-input farming	40 (65.6%)	21 (34.4%)
		$(\bar{x})$ = 10.33 months, Max = 12 months, Min = 4 month	

TABLE 5 PER UNIT FARM PRODUCTION COST UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION

S.No	commodity	Production cost (Baht /Rai)			
		Low-input condition		High input condition	
1	Rice	$(\bar{x})$ = Max = Min =	667.01 1,408.00 310.00	$(\bar{x})$ = Max = Min =	1,015.17 1,940.00 538.7

TABLE 6 PER UNIT GROSS MARGIN UNDER LOW-INPUT AND HIGH-INPUT FARMING CONDITION.

S.No	Type of farming system	Gross margin (Baht/Rai)	
1	Low-input farming	$(\bar{x})$ =	1,443.44
		Max =	4,436.00
		Min =	-976.00
2	High-input farming	$(\bar{x})$ =	1,447.48
		Max =	4,025.30
		Min =	-66.50

TABLE 7 INFLUENCE OF LOW-INPUT FARMING SYSTEM VARIABLES ON INCOME.

Low-input variables	Regression co-efficient	R2	Adjusted R2	F	Sig.
Land	.829	.710	.679	23.226	.000**
Labor	-.149				.057
Capital	-.132				.072
- Credit	-.095				.192
Technology	.102				.238
Management	-.068				.415
Market					
Constant (a) 8123.215					

* Statistical significance at 0.05 level ** Statistical significance at 0.01 level

TABLE 8 INFLUENCE OF LOW-INPUT FARMING SYSTEM VARIABLE ON EMPLOYMENT OPPORTUNITY.

Low-input variables	Regression co-efficient	R2	Adjusted R2	F	Sig.
Land	.307	.138	.048	1.526	.017*
Labor	-.111				.406
Capital	.075				.548
- Credit	.015				.903
Technology	.018				.901
Management	-.189				.188
Market					
Constant (a) 13.224					

* Statistical significance at 0.05 level ** Statistical significance at 0.01 level

TABLE 9 INFLUENCE OF LOW-INPUT FARMING SYSTEM VARIABLES ON COST.

Low-input variables	Regression co-efficient	R2	Adjusted R2	F	Sig.
Land	.061	.142	.052	1.572	.627
Labor	.018				.890
Capital	.008				.947
- Credit	.270				.033*
Technology	-.109				.462
Management	-.172				.230
Market					
Constant (a) 853.292					

* Statistical significance at 0.05 level ** Statistical significance at 0.01 level

TABLE 10 INFLUENCE OF HIGH-INPUT FARMING SYSTEM VARIABLES ON INCOME.

High-input variables	Regression co-efficient	R2	Adjusted R2	F	Sig.
Land	.825	.677	.642	18.902	.000**
Labor	-.101				.237
Capital	.072				.363
- Credit	.163				.047*
Technology	.029				.780
Management	-.101				.325
Market					
Constant (a) 7822.322					

* Statistical significance at 0.05 level ** Statistical significance at 0.01 level

TABLE 11 INFLUENCE OF HIGH-INPUT FARMING SYSTEM VARIABLES ON COST.

High-input variables	Regression co-efficient	R2	Adjusted R2	F	Sig.
Land	-.314	.156	.062	1.658	.024
Labor	.220				.114
Capital	.110				.389
- Credit	-.043				.743
Technology	.169				.314
Management	-.270				.106
Market					
Constant (a) 1317.942					

* Statistical significance at 0.05 level ** Statistical significance at 0.01 level

6 Conclusion

Based on the findings of the study, it can be concluded that :

low-input (sustainable) farming system is slightly less productive and profitable as compared to the high-input (conventional) farming system. The reason may be that most of the low-input users have not been found to use the low-input farming technologies such as organic manures, legume based crop rotation, and integrated pest management due to which the low-input farming system which could not express its full potential in terms of productivity and income.

Out of all input variables such as land, labor, capital (credit and technology), management and market, only land and technology have been found statistically significant to cause difference in the output variables. Land has been found statistically significant to cause difference in income, employment opportunity and cost. Technology has been found statistically significant to cause difference in income and cost.

Under the low-input farming condition, land has been found statistically significant to cause difference in income and employment opportunity at 0.01 and 0.05 level of statistical significance respectively which means that the income and employment opportunity can be increased by increasing the land size. Similarly, technology has also been found statistically

significant to cause difference in cost at 0.05 level of statistical significance which means that the use of technology can increase the cost.

Under high-input farming condition, the land and technology have been found statistically significant to cause difference in income at 0.01 and 0.05 level of statistical significance respectively which means that the income can be increased by increasing the use of the combination of the land and technology. Land has also been found negatively significant to cause difference in the cost at 0.05 level of statistical significance which means that an increase in land size decreases the cost.

7 Recommendations

In order to facilitate the adoption of sustainable farming system in the future, the following recommendations have been made :

1. As this study has indicated that income and employment opportunity can be increased by increasing the use of land and technology, putting a large amount of land under cultivation may create another environmental problems. So, the emphasis here should concentrate on the main problem directly affecting the achievement of sustainable land use and development strategy to advance the achievement of land and technology. Accordingly, it should focus on how to deal with them in order to increase income and employment opportunity contributing to improve rural economies with significant responsibilities in the development process, thereby increasing the likelihood of its being positively received by the group and of helping to ensure sustainable resource development.

2. For this group with so many requirements demanding all or more of the resources that priorities must be determined and followed, the recommended criteria thus place due emphasis on a positive intellectual approach via effective and efficient policy strategies, plans, and local farm programs to provide a foundation in strengthening and enhancing a continually updated supply of information-technology for the farmers' group and an informational servicing capability specification of activities and functions to be performed as central to replace the current high-input (conventional) farming system with low-input (sustainable) farming system with the short-term rural economic viability.

3. The emphasis should be on questions and issues concerning the :

inter-relatedness of such units and dimensions of the overall system (structure) as research-extension-farmer—linkages, training, social organization and management mechanisms involving a knowledge of the overall social, economic, cultural background of the society in addition to its agricultural pattern. These concerns call for a greater scope, intensity, and quality of effort of extension programs if farmers are to receive relevant and realistic assistance and advice on a firsthand and timely basis with reliable information and other services. This is necessary for the extension strategies and continued training technique to assure coherence and efficiency of effort, and relevance and effectiveness of results in performing the true functions of practical work in relation to the practical needs that people collectively provide for supporting themselves in what they want to do in the environment and

conditions on which they work at the farmers level to integrate farming system rather than rice monoculture.

4. Future strong productive research-extension-application development linkages should be strengthened seriously with special attention to forge practical experiences both technical agriculture and integration function concerning sustainable resource management to deal with only as to complete the systems paradigm. This, of course, could be visualized as being important not only with the extension agencies but also with all other agencies including credit agencies, farmers organizations, marketing agencies, and even private organizations dealing with agricultural development at the local community. This suggests that the communication interaction stance must also carry over into the action taken to generate reliable information and organic technologies as effective substitute of chemical inputs, effective policies and management mechanisms. This in essence is to support the farmers' decision making to adopt sustainable farming technologies, wise use of land and technologies by the farmers to improve farm productivity to increase income and employment opportunities apart from implementation of effective extension strategies, methods, techniques, and devices such as continued training, demonstrations, field trips, and group discussions related to sustainable resource management practices in agriculture as being central requirements. To insure that this activity is properly oriented to the intended information users they should participate in all operational decisions on what is done on their behalf and how findings are to be effectively used.

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