Factors affecting farmers' income generating in rice seed production towards seed standard, Thamai sub-district, Nakhon Sawan province, Thailand

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ABSTRACT: The objectives of this investigation were to determine general information of farmers in the study areas, the analysis of factors affecting farmers' income generating in major rice seed production towards seed standard, and constraints in rice seed production improvement. The selected sample of 66 rice farmers in Thamai sub-district, Chumsaeng district, Nakhon Sawan province was estimated using the formula developed by Arkin (1974) through multistage sampling technique. Data collection was obtained by interview schedule. Multiple linear regression (MLR) was employed to determine factors affecting farm income generating in major crop year 2013/2014. The results revealed that factors affecting income generating in rice seed production were cost of seed used, cost of pesticide used, depreciation cost, household income, amount of credit, number of native knowledge application, and experiences in training, respectively. The constraints in rice seed production improvement were high cost of input, high cost of fertilizer, low rice price, and also climate variability, respectively. Recommendations for rice seed improvement at the policy level were 1) urgent support research and development in cost reduction technology; 2) enhance on farmers' capability management in farm financial; 3) increasing the efficiency of rice marketing system; and 4) support farmer's knowledge development on rice marketing. Furthermore, recommendations at the implementation level were 1) Farmers should always participate in rice intervention program; and 2) Promote farmers in outreach program by considering factors affecting income generating in rice seed production.
Keywords: farm income generating, rice seed production, seed standard

Introduction

Rice is major economic crop in Thailand. In the past two decades, Thailand's cultivated rice area, harvested area, production and yield per rai (1 rai = 1,600 m^2) has increased continuously. Total cultivated area during 1993 to 2013 increased from 59.25 to 77.27 million rai or around 1.39% per year. Total production increased from 18.45 to 36.84 million tons or around 3.63% per year. The average rice yield increased from 348 kilograms per rai to 504 kilograms per rai or around 1.93% per year. In 2013, Thailand's total cultivated rice area was around 77.27 million rai (12.36 million hectares) (Office of Agricultural Economics [OAE], 2015a, 2015b, and 2015c).

The cultivated area of major rice has only increased marginally because historically farmers have utilized all of the land in their areas. On the other hand, the cultivated areas of second rice have also increased continuously because of the motivational factors such as increasing rice price and the availability of modern farming techniques (Wiboonpongse et al., 2009).

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Concerning demand and supply of Thai rice seed, Bureau of Rice Seed (2010) stated that the demand of rice seed per year is around 1 million ton. While the supply of rice seed that has produced by the government and private sector are around 0.28 million tons, accounting for only 28% of the total demand. Then, nearly most of Thai farmers in the whole country use the poor quality of seed that inevitably lead to the lower yield. These are the serious causals of the imbalance between demand and supply in rice seed affecting Thai rice production and also income generating.

Regarding most serious concern in rice production, from the investigation of Srisuantang, Traimongkolkul and Pakpitjareon (2009), it found that the most constraints is the limited of good quality seed that can not reach both farmers highly demand. A different demand on various cultivars in a different region is also one kind of serious concern in good quality seed supply.

The demand forecast in both quantity and type of cultivars are more dynamic difficult because of many due reasons such as difference environment for each regional, difference demand of customers and also climate variability. In addition, rice weed problem is also directly serious concern in good quality seed production. Furthermore, Bureau of Rice Seed (2010) also pointed out that the good quality seed is the most important factor in rice production improvement because it will lead to low cost and increase productivity.

In accordance with the determinants of income generation in particular for rice production, according to the investigation of Aungsuratana (2000); Mokkamakkul (2002); Marong, Shinkai and Hotta (2007); Ashfaq et al. (2008); Jalil et al. (2012); Pede et al. (2012); Ibrahim, Siwar and Talib (2013); Hassim (2012) found that the positive factors affecting the farmers' income were nuclear household, education level, total cultivated farm size, ownership of land, size of land holding, land rent, annual household income, non-agricultural income, minor occupation, value of farm asset, subsidy recipient, number of part time job of household members, seed cost, fertilizer cost, farm yard manure cost, pesticide cost, irrigation cost, machinery cost, depreciation cost, fixed cost components, cropping intensity, distance from main road location, irrigation system, number of migrant member, raising small livestock, owning a carabao, and crop diversification.

On the contrary, the negative factors affecting farmers' income were pesticide input, farm size of rice, the price of fertilizer and wage.

In order to enhance farmers' income generating in rice seed production, the recommendations were proper training of farming community, easy access to input and market and also infrastructure improvement.

Nakhon Sawan province, the study research site, is ranking as number one of the northern region in terms of rice cultivated areas and yield, accounting for around 17% and 15% of the total region, respectively. This province is located in the Chao Phraya River basin that is Thailand's largest and most important geographical unit in terms of land and water resources development. (Hungspreug, Khao-uppatum, and Thanopanuwat, 2000).

In order to find out the solution on Thai rice seed constraints, the investigation on factors affecting farmers' income generating in rice seed production towards seed standard is important. Then, the specific objectives of this investigation are to determine general information of farmers' rice seed production

in the study areas, factors affecting farmers' income generating in major rice seed production, and constraints on rice seed production improvement.

Methodology

Population and sampling technique

Population of study consisted of 736 rice farmers in Thamai sub-district, Chumsaeng district, Nakhon Sawan province in major crop year 2013/2014. Studied sample was selected 66 rice farmers that estimated by using the formula developed by Arkin (1974) through multistage sampling technique in each village, Chumsaeng district, Nakhon Sawan province.

Tool and data collection

Data collection was obtained in major rice crop year 2013/2014 from respective selected rice farmers by means of an interview schedule under closely observation and also in-depth discussion with key persons in the research site. The questions covered the general background of the respondents and their constraints and recommendations in rice seed production improvement. The interview schedule was tested with 30 rice seed farmers in Chedi Hak sub-district, Mueang district, Ratchaburi province. Testing of reliability coefficient (KR20) with the reliability value being 0.89 (Kuder and Richardson, 1937). After tried out, the interview schedule was improved into appropriate form for gathering data in the research site.

Statistical Analysis

The analysis utilized both descriptive and inferential statistics. Frequencies, percentages, arithmetic means, and standard deviations were used to describe their constraints and recommendations. Stepwise multiple linear regression was employed to determine factors affecting income generating in major rice seed production.

Operation Definitions

Farmer refers to rice farmer who cultivate rice as either major or minor occupation in Thamai sub-district, Chumsaeng district, Nakhon Sawan province in major crop year 2013/2014.

Income refers to net income, net earnings, and net profits of rice farmers in major crop year 2013/2014.

Factors affecting income generating refers to farmer's personal background factors, agricultural production factors, physical factors, social factors, economic factors, psychological factors, and institutional factors affecting rice seed income generating.

Net income refers to total gross income generated from rice cultivation by the total variable cost in major crop year 2013/2014 (NI = GI-TVC).

Net earnings refer to total gross income generated from rice cultivation by the total variable cash cost in major crop year 2013/2014 (NE = GI-TV cash cost).

Net profit is determined by deducting gross income of rice cultivation by total production cost in major crop year 2013/2014 (NP = GI- TC).

Results and discussion

General information of farmers' rice seed production in the study areas

As shown in **Table 1**, the average year of farmers' rice cultivation experience was 21.18 years. The average year of seed cultivation experience was 4.36 years. In terms of land tenure status, the average land tenure for seed cultivation was 23.95 rai per household that was similar to the average farm size of northern in Thailand in 2013 was 25.03 (OAE, 2014: 171). Land use in the research site is suitable for rice cultivation. Most population in this community cultivate rice as major or minor occupation. The average number of owned land for seed cultivation was 20.99 rai. Majority of total seed cultivation land is farmers' owned land. This is indicated that most of farmers have been cultivated in their own land that can reduce the risk in farming.

Furthermore, most of farmers cultivated RD41 in major crop 2013/2014, accounting for 53.03%. The rest were RD 31, RD 47, and RD 49 accounting for 37.88%, 7.58%, and 4.55%, respectively. Farmer's decision on rice seed cultivar depends on the collector because they have to buy the seed from collector and sell their yield back. Majority of them cultivated rice seed by transplanting machine method because of lower cost, time saving and also labor saving, accounting for 95.45%. The rest was parachute method, accounting for 4.55%.

Table 1 General information of farmers' rice seed production in the study areas

n = 66

Item	Minimum	Maximum	$\overline{X}$	S.D.
Experience in rice cultivation (year)	2	60	21.18	13.76
Experience in rice seed cultivation (year)	1	14	4.36	3.31
Number of total land tenure for seed cultivation (rai/household)	3	80	23.95	19.50
Number of owned land for seed cultivation (rai/household)	3	80	20.99	16.80

Source: Survey (2015)

Factors affecting farmers' income generating in major rice seed production towards seed standard

The multiple linear regressions (MLR) was employed to test factors affecting farmers' farm income. The independent variables and the dependent variables as presented in **Table 2**, the relationship between independent and dependent variable was estimated by stepwise regression model to find out an appropriate suited model based on the principle of regression equation that the least independent variables determine the best variation of dependent variables. The form and variables will be explained as follows:

$$lnY_i = \beta_o + \beta_2 lnX_{2i} + \beta_3 lnX_{3i} + \ldots + \beta_{ki} lnX_{ki} + u_i$$

Table 2 Factors affecting farmers' farm income generating in Thamai Sub-district, Nakhon Sawan Province

n = 66

Variables	Unit[1/]	Mean	S.D.
Total cost of seed used (X_1)	Baht per rai	692.25	349.66
Household income(X_2)	Baht per year	11,143.26	2,503.04
Total cost of pesticide used (X_3)	Baht per rai	552.74	331.23
Amount of credit (X_4)	Baht	169,320.00	83,712.66
Number of native knowledge application (X_5)	Time per year	1.52	0.755
Total of depreciation cost (X_6)	Baht per rai	290.28	379.76
Experiences in training (X_7)	Year	1.73	1.26
net income (NI/Y_1)	Baht per rai	5,956.01	2,582.56
net earnings (NE/Y_2)	Baht per rai	6,749.50	2,517.28
net profit (NP/Y_3)	Baht per rai	4,815.42	2,629.76

[1/]Baht = Thai Baht (THB), Baht per rai calculated from major crop year 2013/2014

Source: Survey (2015)

Factors affecting net income

Based on the result as presented in **Table 3**, the best equation of net income function can be explained in the equation below:

$NI = 7{,}789.485 - 2.198X_1 + 0.002X_2 - 2.042X_3 - 0.003X_4$

Based on the analysis, the result of R-square (R^2) was 0.407. It indicated that 4 factors of cost of seed used combination with household income, cost of pesticide used and amount of credit had work well in explaining the variation of net income up to 40.70% (F = 10.486, P = 0.000). It can be pointed out that the less cost of seed used combination with the less cost of pesticide cost and the more amount of credit with the more household income, the more net income is.

Therefore, based on existing condition that verified by the results, the appropriate prototype model of net income in the study areas can be determined by 4 factors. The prototype can be encouraged by selection the farmers who are in the condition of higher household income, and less amount of credit. Besides that, they also must be in condition of less cost of seed used, and less cost of pesticide used.

Table 3 Parameter estimate results of farmers' net income function

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7,789.485	783.738		9.939	.000
Cost of seed used	-2.918	.749	-.308	-2.936	.005
Household income	.002	.001	.355	3.398	.001
Cost of pesticide used	-2.042	.758	-.271	-2.693	.009
Amount of credit	-.003	.001	-.240	-2.332	.023
R = 0.638	R^2= 0.407	Adjusted R^2= 0.369	F = 10.486	Sig F.= .000***	

***statistically significant level at the 0.001

Source: Complied from data survey (2015)

Factors affecting net earnings

Based on result of the study as presented in **Table 4**, the best equation of net earnings function can be explained in the equation below:

$NE = 8{,}115.622 - 2.775X_1 + 732.714X_5$

Based on the analysis, the result of R-square (R2) was 0.253. It indicated that there were 2 factors of cost of seed used combination with number of native knowledge application had work well in explaining the variation of net earnings up to 25.30% (F = 10.689, P = 0.000). It can be pointed out that the less cost of seed used combination with the more number of native knowledge application, the more net earnings is.

Therefore, based on existing condition that verified by this results, the appropriate prototype model of net earnings in the study areas can be determined by 2 main factors of social and agricultural production factors. The prototype can be encouraged by selection the farmers who are in the condition of higher number of native knowledge application. Moreover, they also must be in condition of less cost of seed used.

Table 4 Parameter estimate results of farmers' net earnings function

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	8,115.622	681.129		11.915	.000
Cost of seed used	-2.775	.793	-.388	-3.500	.001
Number of native knowledge application	732.714	298.370	.270	2.456	.017
R = 0.530	R^2= 0.253	Adjusted R^2= 0.230	F = 10.689	Sig F.= .000***	

***statistically significant level at the 0.001

Source: Complied from data survey (2015)

Factors affecting net profit

Based on result of the study as shown in **Table 5**, the best equation of net profit function can be explained in the equation below:

$NP = 6.054.808 - 2.189X_{1-} 1.950X_6 + .002X_{2-} 1.644X_3 + 416.695X_7$

Based on the analysis, the result of R-square (R^2) was 0.50. It indicated that 5 factors of cost of seed used combination with depreciation cost, household income, cost of pesticide, and experiences in training used had work well in explaining the variation of net profit up to 50.00% (F = 12.006, P = 0.000). It can be pointed out that the less cost of seed used combination with the less depreciation cost, the less cost of pesticide used, the more household income, and the more experiences in training, the more net profit is.

Therefore, based on existing condition that verified by the findings, the appropriate prototype model of net profit in the study areas can be determined by 5 factors. The prototype can be encouraged by selection the farmers who are in the condition of higher household income, and higher experiences in training. Furthermore, they also must be in condition of less cost of seed used, less depreciation cost and less cost of pesticide used.

Regarding factors affecting farmers' income generating interms of NI, NE, and also NP, from the related research papers, Aungsuratana (2000) confirmed that income was factors affecting net

earnings and net profit. Moreover, Hassim (2012) also pointed out that fertilizer cost, depreciation cost, and annual household income were also factors affecting net earnings and net profit.

In addition, Ashfaq et. al. (2008), and Jalil et. al. (2012) also confirmed that cost of seed was the crucial factor affecting rice seed income.

Table 5 Parameter estimate results of farmers' net profit function

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.054.808	949.567		6.376	.000
Cost of seed used	-2.189	.751	-.297	-2.913	.005
Depreciation cost	-1.950	.651	-.288	-2.994	.004
Household income	.002	.001	.273	2.913	.005
Cost of pesticide used	-1.644	.751	-.212	-2.188	.033
Experiences in training	416.695	206.040	.204	2.022	.048
R = 0.707	R^2= 0.500	Adjusted R^2= 0.458	F = 12.006	Sig F.= .000***	

***statistically significant level at the 0.001

Source: Complied from data survey (2015)

Constraints on farmers' rice seed production

Regarding rice seed production improvement in the study areas, the investigation found 4 important problems that accounting for more than 50% of respondents as shown in **Table 6**. These were high cost of input, high cost of fertilizer, low rice price, and also climate variability, respectively.

From those serious concerned, the farmers are anxious in their production cost reduction by they are trying to produce compost to reduce cost of fertilizer and also by using their own family labor to reduce labor cost.

Table 6 Constraints in rice production improvement

n = 66

Item	Constraints	
	No.	Percentage
High cost of input	39	59.09
High cost of fertilizer	37	56.06
Low rice price	37	56.06
Climate variability	34	51.52

Source: Survey (2015)

Synthesis of approaches in rice seed production income generating improvement for farmers

Based on the empirical evidence from this investigation indicated that approaches in rice seed production income generating improvement that should be promoted to relevant agencies at the policy oriented level and implementation oriented level as shown in Figure 1. Regarding the policy level, the recommendations should focus on: 1) research and development on

technology of cost reduction. This is because the findings found that high cost of input and high cost of fertilizer are the main constraints that more than 50% of respondents have been faced, 2) providing the continuity operating program to enhance the farmer capability management in farm financial, and helping farmer to plan in debt management. It is because this investigation found that the amount of credit is the independent variable that was being negative significant relationship to the variation of net income, 3) increasing the efficiency of rice marketing system, in particular providing the reasonable price and also prevent the risk of price such as promoting seed future market, providing efficient and reliable up-to-date rice market information for farmer, and setting information center in community, and 4) support farmer's knowledge development on rice marketing by promoting appropriate rice seed price, providing rice market information, and also facilitating farmer to access to rice market. It is because the price fluctuation is also serious constraints in the research site and it directly affecting farmers' income.

At the implementation level should focus on 1) rice seed farmers should always participate in rice intervention program that concern agencies provide them. It can help farmer to improve their production and lead to increase income. This is because this investigation found that factor affecting net profit was the experience in training with positive statistically significant. It can complied that the more experience in training is, the more net profit is, and 2) to extend rice seed production and also enhance income generating of the similar cases, the concern factors affecting rice seed yield that should be aware were fertilizer and rice seed land, respectively. In addition, crucial factors affecting income generating were cost of seed used, cost of pesticide used, household income, number of native knowledge application, experiences in training, depreciation cost, and amount of credit, respectively.

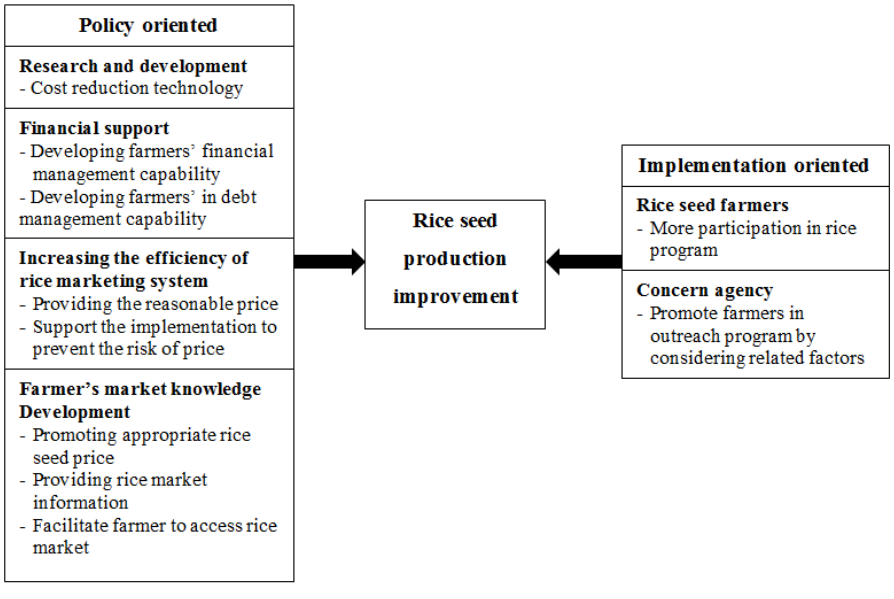

Figure 1 Policy oriented and implementation oriented model

Source: Survey (2015)

Conclusions

This study investigated factors affecting income generating in major rice seed production towards standardization. The findings pointed out that concerned agencies wishing to increase farmers' income generating in rice seed production in terms of net income should consider the cost of seed used combination with the cost of pesticide cost and some general background of farmer including household income and the amount of credit. While in terms of net earnings should focus on cost of seed used combination with native knowledge application. Moreover, net profit should acknowledge on cost of seed used combination with cost of pesticide used, depreciation cost, household income, and also experiences in training as well.

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