ANALYSIS ON FACTORS AFFECTING THE CONVERSION OF CROP COMPOSITION ON RICE-LAND OF FARMERS IN VIETNAM

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Abstract

Research on factors affecting the conversion of crop composition on rice-land was carried out to study the outcomes of the conversion of crop composition on rice-land as well as to identify the reasons why farmers decided to change their crop composition. The research studied on farmers who had done crop composition conversion on rice-land in Hau Giang province to identify factors affecting the conversion as well as to understand difficulties facing these farming households by using sociological surveys. Results by using Binary Logistic Regression show that the likelihood is 90.6%, in which variables including household's financial resources (X_5), impacts from training courses (X_7), support from the Government and Local authorities (X_8), internal irrigation schemes (X_{11}) and irrigation water (X_{14}) have statistical meanings to conversion of crop composition by farming households. The unstable selling price of products after crop conversion is most concerned by farmers. One of the new approaches of the research is that the research used Binary Logistic Regression to analyze data then to identify factors affecting the outcomes of the crop composition conversion. Results also show that climate change variable has no statistical meaning within the scope of the research.

Keywords: *conversion, crop composition, farming household, impact, rice-land*

1. INTRODUCTION

Crop diversification instead of rice monoculture is the key solution to the current situation of the Mekong Delta which is the bowl rice of Vietnam. This is considered an effective solution to rice farmers with the fact that the increase in rice yield year over year doesn't mean more profits for farmers. Moreover, bad impacts of climate change, more yield loss caused by pests, bad impacts from saline intrusion, droughts etc. are some among many reasons that lead to the need of effective and suitable conversion of crop composition on rice-land. However, in order to have effective and stable crop composition conversion on rice-land there is a need of researches to identify suitable crop compositions as well as to find out factors that affect the conversion for higher profits.

2. MEANS AND RESEARCH METHODS

2.1 Data collection methods

The research collected information from farmers through surveys with prepared questions. Research areas are 3 communes in 3 districts of Hau Giang province with different ecosystems, including: (1) Truong Long commune, Chau Thanh A district which represents for alluvial soil areas with ample water all year round; (2) Vi Tan commune, Vi Thanh Town which represents for areas intruded by salt water; (3) Hoa An commune, Phung Hiep district which represents for aluminous areas. Subjects surveyed in the research are farmers who grow rice and other crops on rice-land.

Secondary data were collected from relevant published papers such as journals of science, books and Hau Giang annual statistics and other documents including Social-economic reports from People Committees of communes, districts, Hau Giang province and from Department of Agriculture and Rural development of Hau Giang province, Plant Protection Department of Hau Giang province.

Primary data to analyze the effectiveness of the conversed crop composition on rice-land were collected by convenience sampling and the law of large number to ensure the accuracy of the research. As mentioned earlier, samples were collected in 3 districts including Chau Thanh A district (n=60),

Phung Hiep district (n=60) and Vi Thanh town (n=60) with the total of 180 samples. Farmers participated in the research were divided into 2 groups, including a group of farmers who cultivate rice only (3 cropping intensity/year) and the other group of farmers who converted crop composition into 2 cropping intensity/year into growing rice and other crops on rice-land.

2.2 Data analysis methods

Data were analyzed by Excel and SPSS software. Descriptive statistic was used to analyze characteristics of researched farmers individually and farming households. Factors affecting the conversion of crop composition were identified by Binary Logistic Regression. In which, dependent variable was considered binary variable, independent variables could be quantitative variables, qualitative variables or categorical variables.

3. RESULTS AND DISCUSSION

3.1 Characteristic of samples

3.1.1 Age

In the research, age of farmers was divided into 4 groups, including: under 30 (group 1) accounted for 4.4%, age from 30 – 45 (group 2) accounted for 32.8%, age from 46 – 60 (group 3) made up 38.9% and above 60 year-old (group 4) made of 23.9%. In which, group 3 was the biggest group (Fig. 1)

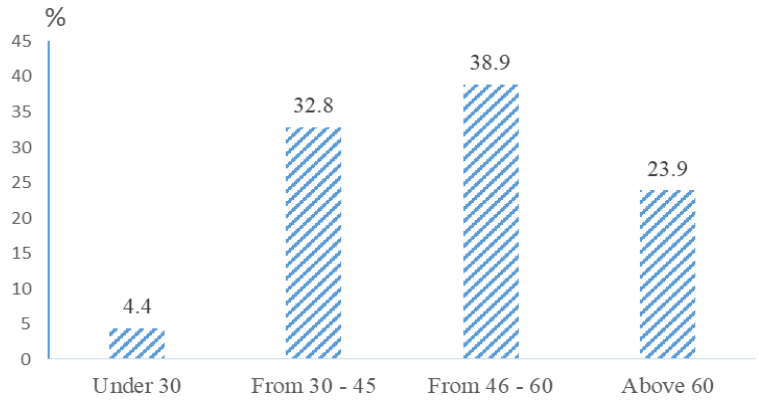

Fig. 1. Age ratio of samples

Source: Survey on 180 farmers in Hau Giang province

Research shows that, farmers aged 45 and above are the main labors in the family and they also are the decision makers who are willing to converse to crop diversification as compared to other groups (Truong Thi Ngoc Chi and Duong Ngoc Thanh, 2012). According to Fig. 1, group of under 30 farmers is the smallest group, accounted for 4.4% only. It means that, young people are not interested in working in agricultural production.

3.1.2 Education background

About education background, 46.6% of surveyed farmers attended primary school while 33.3% of them completed secondary education and 17.2% went to high school. Besides, farmers who are illiterate make up 3.9% (Fig. 2). In the researched areas, it is a fact that labors in the agricultural production don't have sufficient education. This can lead to difficulties in acquire new knowledge or in applying new technologies in production.

It is a fact that lack of basic education acts as the biggest barrier for farmers to acquire new knowledge, to apply science in agricultural production. The reason is without education farmers may not know how to maximize profits from the money they invested in agriculture. Another consequence

is that they would face difficulties in applying new technologies. However, according to research by Truong Thi Ngoc Chi and Duong Ngoc Thanh (2012), farmers who completed elementary and secondary education are best suitable for technology transfer training courses in agricultural production.

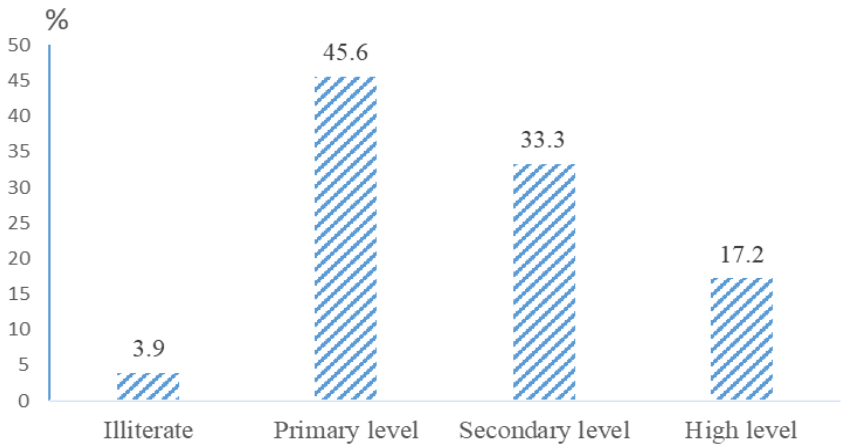

Fig. 2. Education backgrounds of farmers

Source: Survey on 180 farmers in Hau Giang province

3.1.3 Size of agricultural land

Research found out that there are 69.3% of farming households who converted less than 0.5 hectare of their land from growing rice only to mix with other crops and only 5% of households who use more then 1 hectare of land to grow rice and other crops. In rural areas, land is the most precious asset, however the majority of farming households own less than 0.5 hectare of land and they are poor and average families. Without resources the main labors of these families couldn't find a long-term job. As the result, these families couldn't escape from poverty.

3.1.4 Agricultural production experience

According to collected data, the number of farmers who have more than 20 years experience of growing rice are 112, accounted for the highest ratio of 62.2%, farmers with 11 from 20 years experience make up 29.4%, 7.8% of farmers have 5 to 10 years experience and only 0.6% of them have less 5 years experience. About farmers who grow other crops, farmers who have less than 5 years experience make up the biggest part of 57.8% while 25.6% of farmers who have 5 to 10 years experience and only 1.1% of farmers have more than 20 years experience of growing other crops.

These numbers show that farmers' experience in cultivating rice is rather high. They have experience in weed and pests control as well as apply techniques in growing rice. However, as the farmers have much experience in growing rice they tend to be rather conservative and less willing to change or to apply new techniques in production. Therefore, to start growing other crops on rice-land is a challenge for farmers as they don't have adequate knowledge of relevant techniques or don't have experience in pests control for other crops which is different from pests control for rice.

3.1.5 Reasons for conversion of crop composition on rice-land

Results of survey on the reasons of changing from growing rice only into crop rotation between rice and other crops show that higher profit is the main reason. In this research, the option higher profit was most selected by farmers as the reason why they converted their crop composition, accounted for 57.3% while 17.4% of them said that they followed their neighbors as they saw good results from the conversion by their neighbors.

According to Fig. 3, bad impacts from plant diseases on yields of 3 crops of rice per year were also the reason why farmers had to change to crop diversification, accounted for 14%. Besides, climate change was also one of the reasons, but accounted for 10% only. Also according to the farmers, they have yet seen any impacts from the Government's policies to decide whether to converse crop composition. Research also found out that, local Agriculture Extension Departments haven't played any role as well as local Authorities haven't had much support for farmers in the conversion of padding production to other crops.

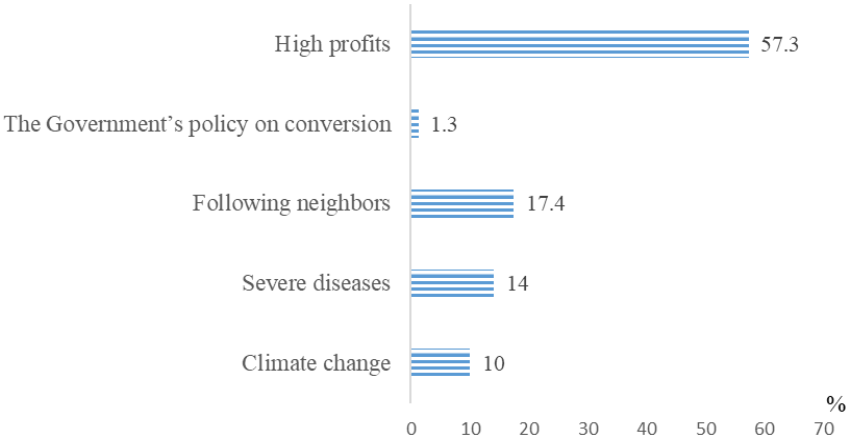

Fig. 3. Reasons for farming method transformation

Source: Survey on 180 farmers in Hau Giang province

3.1.6 Factors help enhance the outcomes of crop composition conversion on rice-land

As Fig. 4, according to the farmers, quality of crop varieties was the most important factor in the conversion of crop composition, this helps enhance the outcomes of the conversion, accounted for 27.7% as the highest ratio. The second important factor was applying new technologies in production, accounted for 24.3%. Besides, in order to enhance the conversion outcomes, according to the farmers, the type of crops selected should be suitable to each cropping in a year and also should be suitable to the natural conditions of the area, especially water resource, accounted for 19.9%. About supply chain, farmers didn't have adequate awareness. In the research, only 13% of farmers understood the important of the linkage with the market for their products.

Research found out that, lack of knowledge about supply chain, farmers couldn't build up connection with trading companies then they couldn't understand the market's needs. As the result, their output products' price was unstable. Another consequence that keep happening year is that when the crop yield is high, price would go down dramatically and vice versa. Research found out that, the farmers suggested that the Government have to play their parts in connecting farmers and the market. And farmers should only concentrate on producing high quality products.

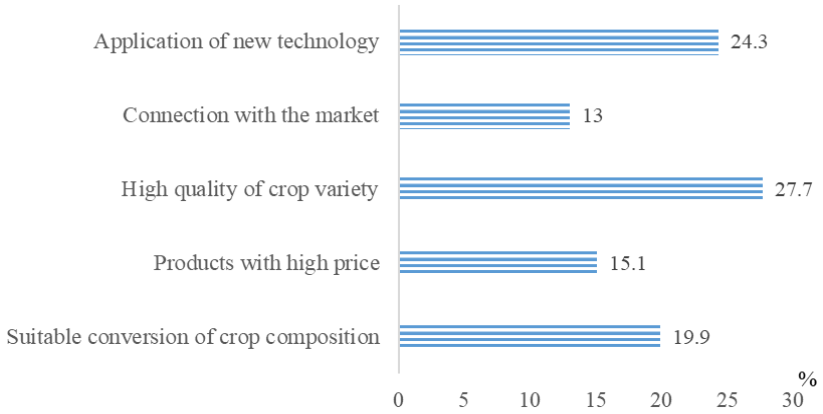

Fig. 4. Factors that help enhance the outcomes of crop conversion on rice-land

Source: Survey on 180 farmers in Hau Giang province

3.2 Factors affecting the conversion into crop conversion between rice and other crops

The research uses Binary Logistic Regression to analyze the impact of Xi to probability of I when X occurred. Binary Logistics Regression is one of the methods often used in models that have dependent binary variables by David R. Cox. In Logistics Regression model, outcomes are analyzed by binary variables while independent variables are analyzed by continuous variables, binary variables or categorical variables, inverse of probability distribution function or linear association of explanatory variable.

In this model, the Logistic equation has dependent variables on the left that have two outputs: 0 (if farmers convert their crop conversion) and 1 (if farmers don't). On the right, there are 5 groups of variables including individual characteristics, farming household's characteristics and Government's and Local authorities' policies about crop composition conversion, connection between producers and the market and factors of climate, land and water environment.

The equation is as following:

$$\text{Log}_e\, P(Y=1)/P(Y=0) = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 + a_8X_8 + a_9X_9 + a_{10}X_{10} + a_{11}X_{11} + a_{12}X_{12} + a_{13}X_{13} + a_{14}X_{14} + a_{15}X_{15}$$

Each variable indicates whether or not the farmers convert their crop composition in the regression model. The model has 5 groups of variables: (1) personal information of farmers (age and education background), (2) characteristics of farming households (labor force, farm size, financial resources), (3) government's and local authorities' policies on the conversion of crop composition (role of agricultural incentive activities, impacts of training activities on conversion, impacts of policies for capital support), (4) connection with the market and products sale and (5) group of varieties including climate, land and water (internal irritation system, characteristics of land and water and impacts of climate on production).

Table 1. Description of variables in the model

Group of variables	Variable	Meaning/Unit	Expected value
Characteristics of farmers	X_1	Age (Year)	-
	X_2	Education background (Grade)	+/-

Characteristics of farming households	X_3	Labor force (Number)	+
	X_4	Farm size (Hectare)	+/-
	X_5	Financial resources (Yes/No)	+/-
Government's policies	X_6	Role of agricultural incentive activities (Yes/No)	+
	X_7	Impacts of training activities on conversion (Yes/No)	+
	X_8	Support from the Government and local authorities (Yes/No)	+
Market connection	X_9	Impacts from the market (Scale from 1-5)	+
	X_{10}	Connection with the market (Scale from 1-5)	+
Climate, land and water	X_{11}	Internal irritation system for the conversion (Scale from 1-5)	+/-
	X_{12}	Irritation water management (Scale from 1-5)	+
	X_{13}	Land condition (Yes/No)	+
	X_{14}	Water suitable for crop (Scale from 1-5)	+
	X_{15}	Impacts from climate (Scale from 1-5)	+/-

SPSS was used to analyse the collected data, results shown in Table 2

Table 2. Results by Binary Logistic Regression model

Factors	**B index**	**S.E.**	**Wald**	**Sig.**	**Exp**
X_1 Age	-0,026	0,023	1,217	0,270	0,975
X_2 Education background	0,051	0,081	0,395	0,529	1,052
X_3 Labor force	0,296	0,285	1,084	0,298	1,345
X_4 Farm size	-0,386	0,353	1,197	0,274	0,680
X_5 Financial resources	5,414	1,472	13,522	0,000	224,516
X_6 Role of agricultural incentive activities	-0,124	0,318	0,152	0,697	0,883
X_7 Impacts of training activities on conversion	1,254	0,316	15,773	0,000	0,285
X_8 Support from the Government and local authorities	1,995	0,475	17,608	0,000	7,354
X_9 Impacts from the market	-0,335	0,333	1,012	0,315	0,715
X_{10} Connection with the market	0,494	0,304	2,639	0,104	1,638
X_{11} Internal irritation system	-1,052	0,455	5,349	0,021	0,349
X_{12} Irritation water management	0,215	0,476	0,204	0,651	1,240
X_{13} Land	23,438	8,903E3	0,000	0,998	1,511E10
X_{14} Water quality	2,264	0,597	14,410	0,000	9,626
X_{15} Impacts of climate	0,886	0,555	2,546	0,111	2,426
Constant	**-35,135**	**8,903E3**	**0,000**	**0,997**	**0,000**

Source: Survey on 180 farmers in Hau Giang province

Table 2 shows that, the independent variables X_5; X_7; X_8; X_{11}; X_{14} have statistical meanings while X_1, X_2, X_3, X_4, X_6, X_9, X_{10}, X_{12}, X_{13}, X_{15} have no statistical meaning in the model.

Table 2 can be explained as following:

- Variable of farming household's financial resources (X_5) has impact on the decision of conversion into crop diversification. Results show that, crop composition conversion requires a specific amount of financial investment, especially for farming households who convert in a large area. Therefore, households who have adequate financial resources will find it easier to change to crop diversification. In the model, the variable has $\alpha<0.05$ ($\alpha=0.000$).

- Variable of impacts from training activities (X_7) has Sig. = 0.000 ($\alpha<0.05$) and B = 1.254. It means that for farmers who had chance to join training activities on conversion of crop composition are more likely to apply what they had learned in order to earn more income.

- Variable of support from the Government and local authorities (X_8) has có giá trị Sig. = 0.000 and B = -1.995, a direct proportion with the conversion of crop composition. This means if the farmers receive more support from the Government they are more likely to convert their crop composition, especially for financial as well as technical support for more effective conversion.

- Variable of internal irritation system (X_{11}) has Sig. = 0.021 ($\alpha<0,05$) and B = -1.052. There are two ways of explanation here: on one hand it create favorable conditions for conversion but on the other hand it can also act as a barrier. It means that in areas that have suitable canal system for irritation or suitable internal irritation system, rice is the main crop. On the other hand, in areas without enough water for irritation, especially in summer-autumn crop, conversion into other crops that requires less water is a good solution for farmers. In the model, B of variable X_{11} is negative (-), this means lack of irritation water is a factor that make farmers convert into other suitable crops, for more efficient use of their agricultural land.

- Variable of water quality (X_{14}) has Sig. = 0.000 ($\alpha<0,05$) and B = 2.264. This means that for areas with good and suitable irritation water and for other crops, the farmers will change agricultural land-use to other crops for higher income.

In the model, variables of characteristics of farmers including age and education background have no statistical meaning (Sig. are 0.270 and 0.529 respectively). For age variable, it is assumed that older farmers are less likely to change their crop composition. As for them, it's not easy to acquire new knowledge or adapt to changes. Besides, they already have rich experience in cultivating rice then they are not willing to change to other crops. However, within the scope of the research, in our opinion it's a macro issue and it depends on other objective factors as well on each farmer's determination.

Table 3. Quantitative results of the model

Observation		**Crop composition conversion on rice-land**		**Likelihood of the model (%)**
		Households converted their crop composition	Household didn't convert their crop composition	
Conversion	Households converted their crop composition	7	83	92,2
	Households didn't convert their crop composition	80	10	88,9
Binary logistic regression 2-log likelihood				**90,6**

By Binary Logistic Regression model, 2-log likelihood is 103.081 and Cox & Snell R Square is 0.557 while Nagelkerke R Square reaches 0.742. It means that about 74.2% factors of the model can be explained by the model and this is rather high value. Via Homer-Lemeshow test, Chi-square is 19.245 with Sig. = 0.014 (α<0.05). According to Table 3, the 2-log likelihood is rather high 90.6% it means that the use of binary logistic regression in the research is suitable.

4. CONCLUSION

According to the research, farming households who converted the crop composition own less land than those who still grow 3 crops of rice per year. Farming households who did crop rotation between rice and other crops think that the conversion can bring higher profits as compared to grow 3 crops of rice a year. Besides, right selection of crop variety and applying new technologies into agricultural production are two most effective ways suggested by the farmers.

Results by using Binary Logistic Regression show that the likelihood is 90.6%, in which variables including household's financial resources (X_5), impacts of training activities (X_7), support from the Government and Local authorities (X_8), internal irritation system (X_{11}) and irrigation water (X_{14}) have statistical meaning to the conversion of crop composition while other variables have no statistical meaning.

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