FARMER GROUPS' SUSTAINABLE AGRICULTURE PERCEPTION IN VIETNAM UPLANDS: THE CASE STUDY OF TWO BANANA FARMER GROUPS IN QUANG TRI PROVINCE

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Abstract: This study aimed to measure the sustainable agriculture perception of poor and better-off banana farmers and its determinants in the Vietnam uplands based on a case study of banana's farmer in Quang Tri Province. The stratified sample technique was used to randomly select 300 respondents from Dakrong and Huong Hoa districts. The primary data were collected using a structured questionnaire with the Cronbach's alpha coefficient of 0.87. The study revealed that the poor banana farmers' perception towards sustainable agriculture in Vietnam uplands was significantly lower than that of better-off farmers. Both poor and better-off banana farmers had highly positive perception towards sustainable agriculture regarding the protection of agricultural resources and the negative effects of agrochemicals on human health; by contrast, both of them had a low perception of the problems related to the production profits in sustainable agriculture, use of crop residues, and application of modern agriculture technologies. Both farmer groups also had the positive perception of sustainable agriculture concerning the problems related to negative effects of agrochemicals on the environment, input application, crop rotation, product consumption, roles of farmer groups and credit and extension policies. The study ascertained that both farmer groups' sustainable agriculture perception was positively affected by agricultural programs on TV, education level and agricultural newspapers and books. Besides, the study found that extension courses had a negative influence on the poor banana farmers' sustainable agriculture perception.

Keywords: banana farmers, perception, upland, sustainable agriculture

1   Introduction

The sustainable agriculture is defined as "farming that makes the best use of natural goods and services while not damaging the environment. It minimizes the use of non renewable inputs (pesticides and fertilizers) that damage the environment or harm the health of farmers and consumers. In addition, it makes better use of the knowledge and skills of farmers" [12]. Assessing the farming sustainability needs to be based on the dimensions of economics, society and the environment [25, 27, 28]. The environmental dimension refers to the management of natural resources as well as issues related to the protection of landscapes, habitats, biodiversity, and drinking water and air quality. The dimension of economics refers to the efficient resources

use, the competitiveness and the ability of the economic area and its contributions to the strengths of rural areas. The important elements of this dimension involve the structure of efficient agriculture, proper technologies and income sources diversification for farming producers [17]. The social dimension is estimated to be based on the issues related to labour opportunities and access to resources and services of farming producers in comparison with other economic organizations in rural regions as well as equal opportunities and society´s ethical concerns regarding methods of agricultural production [17].

The uplands of Vietnam have a natural land area of 24.7 million ha, accounting for three-quarters of the nation's total natural land area [10]. In general, the upland lands are marginal so they are unfavourable for agricultural production. Most gentle slopes of less than 15º (accounting for 21.9 %) are used for agricultural and forestry production [11]. The uplands account for around 30 % of the nation's population. Most of the population in these regions belongs to ethnic minorities. The Vietnam uplands have the highest rate of the population living under the poverty line in the nation, and the main income comes from the agriculture activities [8, 3]. In general, the yield of crops especially cassava, hill rice, soybean and maize in the uplands is low [9, 19]. The main reason is that the farming land has seriously been degraded because most farmers in the uplands have still applied many unsustainable farming practices (such as tillage, monocultures, burning of crop residues and poor fertility management) while they cultivate crops on sloping soils [18, 19, 22]. Several efforts have been made to improve farmers' adoption of sustainable farming practices as well as limit soil degradation. Despite promising results, very few of these practices have been adopted by farmers, and thus the soil degradation process has an increasing trend in the uplands [10]. Hence, there is an urgent need to find key factors that influence farmers' adoption of sustainable farming practices. Besides, there is a difference of this adoption between the poor farmer group and better-off farmer group in the uplands, and it depends on the socio-economic characteristics. Hence, finding out the root factors that result in the low adoption of sustainable farming practices in different farmer groups is vital to the extension institutions in Vietnamese uplands.

The study of Tatlıdil et al. 2009 ascertained whether farmers only ascertained whether farmers only choose practices of sustainable agriculture fostered by governmental institutions when they first think that these practices are necessary and can be applied in their own socioeconomic conditions. Furthermore, the importance of sustainability perception differs from a farmer to another, and this perception is influenced by the socio-economic characteristics and behaviour of information-seeking [20]. Therefore, investigating perceptions of farmers and revealing the factors influencing the farmers' perceptions towards sustainable agriculture is vital. They will help to design feasible extension programs to improve adoption of sustainable farming practices in the Vietnam's uplands. As for our best knowledge, only Nguyen et al. [23] investigated these problems in general. There is still a great shortage of information regarding Vietnam's uplands. For this reason, the present study was conducted on the poor banana

farmer group and better-off banana farmer group in two upland districts in Quang Tri province with following specific objectives.

(1) To describe the socio-economic characteristics and information-seeking behaviour;

(2) To assess the sustainable agriculture perception;

(3) To identify the selected socio-economic characteristics and information-seeking behaviour that influence the sustainable agriculture perception.

2   Materials and methods

2.1   Research site

This study selected two upland districts of Quang Tri Province as a representative location to collect the data because the conditions of climate, edaphology and economics in these regions are very similar to those of the uplands of other provinces in Vietnam. Quang Tri is one of the five provinces that have the biggest banana farmland area in Central Vietnam [16]. Quang Tri, located in the Central North, has five upland districts, making up 67 % of the total natural land area (317,965 ha) of the province (Figure 1). The staple crops in the uplands of Quang Tri include bananas, coffees, and cassavas. The banana farming-land areas in Quang Tri are distributed mainly in the uplands with a total area of 2,895 ha (accounting for 90.7 % of the total banana farming land areas in Quang Tri Province).
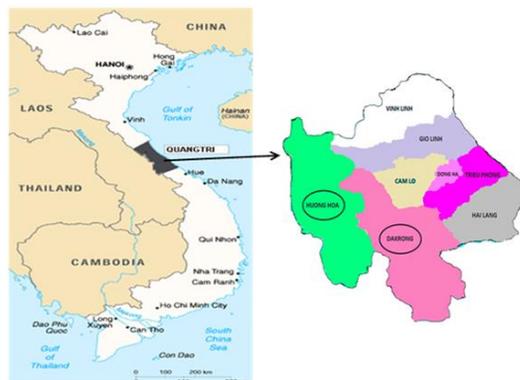

Figure 1. Map of the study site

2.2   Data collection and analysis

The cross-sectional survey research method was used in this study from January to August, 2014 in the uplands of Quang Tri Province, Vietnam. Dakrong and Huong Hoa districts with a major banana production scale were chosen for the data collection. The Yamane's

formula was used to identify the sample size [26]. According to this formula, 300 samples were chosen (with the sampling error = 5.5 %);

The study instrument used for the data collection was a structured questionnaire pretested and revised as appropriate to establish its reliability. This reliability was estimated by calculating the Cronbach's alpha coefficient, which was 0.87 for the scales of perception.

Table 1. Description of variables used in the regression model

Name of variables	Variable description and unit of measurement
1. Dependent variable	
INDEX	The farmers' sustainable agriculture perception (min. = 76, max. = 129)
2. Independent variables	
Socio-economic characteristics	
Age	Age of farmers (years)
Education level	Number of years in schools (years)
Household size	Number of members in households (persons)
Ethnic group	Ethnic group (Kinh = 1; otherwise = 0)
Farm experience	Number of farming years (years)
Farm size	Farm size (ha)
Credit use	Credit use for inputs (credit use = 1; otherwise = 0)
Information-seeking behaviour	
Extension courses	Participation in extension courses (times/year)
Agricultural programs on TV	Watching agricultural programs on TV (times/month)
Agricultural programs on the radio	Listening to agricultural programs on the radio (times/month)
Agricultural newspapers and books	Reading agricultural newspapers and books (times/year)

The means and standard deviations were employed to depict the socio-economic characteristics and information-seeking behaviour of poor and better-off banana farmers. To identify poor and better-off banana farmers' perception towards sustainable agriculture, they were asked to indicate the extent of their agreement on each of sustainable indicators using a Likert-type five-point continuum scale of Entirely agree, Agree, Moderate agree, Disagree and Entirely disagree with assigning a weight of 5, 4, 3, 2 and 1 for positive statements, respectively, and vice versa for negative statements. The mean for all indicators was categorized as follows: 1.00–1.49 = Entirely disagree (ED), 1.50–2.49 = Disagree (DI), 2.50–3.49 = Moderate agree (MA), 3.50–4.49 = Agree (AG), and 4.50–5.00 = Entirely agree (EA) [16]. The possible value for general perception in this scale was taken any value between 27 and 135. The study used the stepwise regression analysis to determine the factors influencing poor and better-off banana farmers' perception towards sustainable agriculture. The dependent variable was calculated by adding up the banana farmers' responses to the 27-item and 5-point Likert-type scale, which was used to measure the farmers' sustainable agriculture perception and it was treated as a continuous variable. The independent variables of the model are described in Table 1.

3   Results and discussion

3.1   Socio-economic characteristics and information seeking behaviour of two banana farmer groups

Table 2 indicates that age, household size, and farm experience of two banana farmer groups were quite equivalent (40.0 years, 5.56 persons and 8.70 years for poor banana farmers, and 42.37 years, 5.16 persons and 8.47 years for better-off banana farmers). In general, the education level of the farmers was relatively low; while the average number of years in schools of the better-off banana farmers was nearly 2 times as high as the other farmer group. In the poor banana farmer group, the Kinh, a common ethnic group in Vietnam, only accounted for 5 %; this means that 95 % comprises other minority ethnic groups including Pa Co, Van Kieu and Ban Hy. By contrast, in the better-off banana farmer group, the Kinh ethnic farmers accounted for 34 %, and other minority ethnic groups made up 66 %. The farm size of the poor banana farmer group was 1.15 ha; this data was around two times as small as that of the better-off banana farmer group. The rate of the poor banana farmer group and the better-off banana farmer group using credit for inputs was 7 % and 28 %, respectively.

Table 2. Socio-economic characteristics and information-seeking behaviour of two banana farmer groups

Items	Poor banana farmers (*n* = 170)		Better-off banana farmers (*n* = 130)	
	Mean	SD	Mean	SD
1. Socio-economic characteristics				
Age (years)	40.0	13.06	42.37	13.18
Education (years)	3.46	3.89	6.18	4.11
Household size (person)	5.56	1.70	5.16	1.45
Ethnic group (Kinh = 1; otherwise = 0)	0.05	0.21	0.34	0.48
Farming experience (years)	8.70	6.98	8.47	5.58
Farm size (ha)	1.15	1.46	2.32	2.65
Credit use (credit use = 1; otherwise = 0)	0.07	0.26	0.28	0.45
2. Information-seeking behaviour				
Extension courses (times/year)	0.75	1.13	0.74	0.99
Agricultural programs on TV (times/month)	2.37	3.40	4.78	5.01
Agricultural programs on the radio (times/month)	0.20	1.00	0.32	1.55
Agricultural newspaper and books (times/year)	1.18	3.35	2.18	5.30

Generally, the access of the two banana farmer groups to agricultural information from mass media, namely TV, radio, extension courses, newspapers and books was very limited. This could result in their low perception of sustainable agriculture. On average, the poor banana farmer and better-off banana farmer groups participated in extension courses about 0.8

times/year. One month, the poor banana farmers watched agricultural programs on TV 2.3 times; this figure was around two times as low as that of the better-off banana group. Both banana farmer groups listened to agricultural programs on the radio about 0.3 times a month. The poor banana farmer group read agricultural newspapers and books around 1.18 times/year, while the other farmer group do 2.18 times/year.

3.2 Sustainable agricultural perception of two banana farmer groups

Table 3 represents the two banana farmer groups' perception of the selected indicators of sustainable agriculture. For the better-off banana farmer group, 2 statements were placed in the EA category, 20 statements in the AG category and 7 statements in the MA category; no statements were rated in the ED and DI categories. By contrast, for the poor banana farmer group, 17 statements were placed in the AG category and 10 statements in the MA category; no statements were rated in the categories of EA, ED and DI. The analysis of independent sample t-tests revealed a significant difference among the selected statements about sustainable agriculture practices and concepts in the poor and better-off banana farmer groups ($p < 0.05$). Based on the comparison of each of the displayed statements, the study concluded that the perception of the better-off banana farmers for each statement was significantly higher than that of the poor ones.

Table 3. Sustainable agriculture perception of two banana farmer groups

Sustainable agricultural practices and concepts	Poor farmers		Better-off farmers		Sig.
	Mean	Catogory	Mean	Catogory	
1. The indiscriminate uses of agrochemicals are harmful for human health	4.39	AG	4.62	EA	0.01
2. Natural resources must be protected for next generations	4.48	AG	4.61	EA	0.05
3. Effective input uses maintain crop productivity in the long run	3.91	AG	4.36	AG	0.00
4. Varieties have the major effect on crop yield and product quality	4.00	AG	4.22	AG	0.02
5. Selling products for enterprises by contracts maintains the stability of product prices and farming income	3.78	AG	4.19	AG	0.00
6. Designing labels for products is one of value-added techniques	3.45	MA	4.15	AG	0.00
7. Application of organic fertilizers and mulches can increase soil fertility and maintain soil humidity	3.83	AG	4.06	AG	0.02
8. Sustainable agriculture obtains increasing profits and reduces production risks in the long run	3.72	AG	4.05	AG	0.00
9. Participating in farmer groups can improve farmers' knowledge and experience	3.79	AG	4.05	AG	0.02
10. Support of policies as credits and extension improves production efficiency	3.79	AG	4.05	AG	0.02
11. Minimum tillage can reduce erosion and soil degradation	3.66	AG	4.03	AG	0.00
12. Utilization of animal fertilizers can increase income	3.73	AG	4.02	AG	0.01

Sustainable agricultural practices and concepts	Poor farmers		Better-off farmers		Sig.
	Mean	Catogory	Mean	Catogory	
13. Environmental pollution can be caused by agrochemicals	3.62	AG	4.02	AG	0.00
14. Good soil preparation and sowing limit weeds and get high yields	3.57	AG	3.97	AG	0.00
15. Sustainable agriculture prevents polluting and destroying of natural resources	3.61	AG	3.95	AG	0.00
16. Crop rotation improves soil fertility and reduces soil erosion	3.63	AG	3.95	AG	0.00
17. Crop rotation and diversification can reduce pests and diseases	3.60	AG	3.91	AG	0.01
18. Cover crop cultivation improves soil fertility and reduces erosion	3.71	AG	3.88	AG	0.04
19. Sustainable agriculture can address poverty problem	3.46	MA	3.85	AG	0.00
20. Farmer's income will increase due to crop rotation	3.46	MA	3.82	AG	0.00
21. Indigenous knowledge application is fit for sustainable agriculture	3.30	MA	3.82	AG	0.00
22. Integrated pest management practices reduce needs for pesticides	3.24	MA	3.78	AG	0.00
23. Biological control is the best way to control and reduce damage of farm pests and weeds	3.15	MA	3.44	MA	0.01
24. Soil tests should be conducted before applying fertilizers	3.07	MA	3.38	MA	0.01
25. Not burning crop residues after harvesting or before starting the new crop is necessary	2.82	MA	3.26	MA	0.00
26. Only using modern technologies, agriculture can be developed (n^*)	2.92	MA	3.24	MA	0.01
27. Farmers' main objective must maximise profit (n^*)	2.52	MA	3.08	MA	0.00

(n^*): Negative statement

The data in Table 4 show that the statement related to unexpected impacts of indiscriminate uses on the human health had the highest score in the better-off farmer group and the second highest score in the poor farmers group. This shows that both better-off and poor farmers had a highly positive perception of unexpected impacts of uncontrolled agrochemical use on human health. This finding is similar to the results of Bagheri et al. [6], and Eric et al. [14]. The study also pointed out that these farmer groups had a highly positive perception of the protection of natural resources for future generations. This means that both farmer groups were very interested in the protection of natural resources for their future generations. This finding is supported by Agahi et al. [1] and Eric et al. [14].

The statements regarding the crop residue use, modern agricultural technologies and production profits were rated with the lowest scores in both banana farmer groups (under 2.82 mean scores for the poor banana farmers and under 3.24 mean scores for the better-off banana farmers). This shows that the perception of both farmer groups related to these problems was very low. Regarding the farmers' perception of the use of crop residues, its low perception can be due to the local customs. Burning all crop residues after harvesting or before beginning the

new season is the farming habit of upland farmers. This habit has existed for many centuries in the uplands of Vietnam. Upland farmers believe that crop residue burning eliminates insect pests and pathogens in their fields. However, the habit has promoted the process of increasing decline in crop yields and soil deterioration in the upland areas of Vietnam [13, 24]. Bot and Benites (2005) believed that crop residue burning causes severe consequences in the long run because it results in the loss of soil nutrients, decline in organic matter and yields, and death of beneficial microorganisms in the soils [7]. The data also pointed out that both farmer groups did not have favourable perceptions of the application of modern agriculture technologies. Alonge and Martin (2005) confirmed that although conventional agriculture has gained impressive achievements in improving the productivity and production, it has also obtained the cost of massive damage to the natural resources in the recent decades [2]. Regarding the profit-related problem, both farmer groups had the lowest level of perception. The economic aspect is one of the three dimensions used to assess farming sustainability. This means that the maximum of profits in farming production is not allowed, but a farming system having low profits cannot achieve the sustainability [5]. Therefore, banana farmer groups in the selected study site had a low perception of viable profits of sustainable agriculture. This seems to be a real problem in the uplands of Vietnam. These findings are in line with those of Tatlidil et al. [20] and Agahi et al. [1].

3.3   Factors influencing two banana farmer groups' perception of sustainable agriculture

Factors influencing poor banana farmers' perception of sustainable agriculture

Table 4 represents the influence of the selected variables on the perception of poor banana farmers towards sustainable agriculture. There were 11 independent variables of the model (Table 1), out of which only 4 had a significant influence on poor banana farmers' perception of sustainable agriculture ($p < 0.05$).

The first variable of the regression model was "Agricultural programs on TV". Considered alone, this variable explained 28.1 % of the variance in the farmers' sustainable agriculture perception. The second variable of the model was "Education level" and explained 8.7 % of the variance. Two additional variables explained additional 4.2 % of the variance, namely "Agricultural newspaper and books" and "Extension courses". These four variables together explained 41 % of the variance in the farmers' sustainable agriculture perception among the poor farmers in the selected region.

Table 4. Multiple regression analysis for determinants of poor banana farmers'
sustainable agriculture perception

Variables	R^2 Cumulative	R^2 Change	F Change	P Change	Beta (β)
Agricultural programs on TV	0.281	0.281	65.708	0.000	0.320
Education level	0.368	0.087	48.720	0.000	0.302
Agricultural newspapers and books	0.394	0.025	35.916	0.002	0.218
Extension courses	0.410	0.017	28.723	0.031	-0.137

"Agricultural programs on TV" had the greatest influence on poor farmers' sustainable agriculture perception. The β value associated with this factor was 0.320 ($p < 0.05$). This means that for every standard deviation change in watching "Agricultural programs on TV", the perception towards sustainable agriculture will increase by 0.320 standard deviations. In under-developed countries, the success of agricultural development programs mainly depends on the nature and extent of mass media use in the mobilization of people for development. The policy-makers in these countries realise that the development of agriculture could be promoted quickly with the effective application of mass media [15]. Ariyo et al. revealed that mass media such as TV is considered as an effective means to improve farmers' scientific knowledge of agriculture [4].

"Education level" had the second important influence on poor farmers' sustainable agriculture perception. The β value associated with the level of education was 0.302 ($p < 0.05$). This implies that for every standard deviation change in years of education, the perception of poor farmers toward sustainable agriculture will increase by 0.302 standard deviations. Indeed, in Vietnam, the educational level of upland farmers is still low [21, 23]; hence, improving the level of education is vital to enhance their perception of sustainable agriculture.

The next factor affecting poor farmers' sustainable agriculture perception was "Agricultural newspapers and books". The β value associated with this factor was 0.218 ($p < 0.05$). This implies that for every standard deviation change in reading agricultural newspapers and books, the perception of poor farmers toward sustainable agriculture will increase by 0.218 standard deviations. The study of Ariyo et al. also found that printed materials such as books and newspapers had a positive influence on agricultural technologies among farmers in Kaduna North local government area of Kaduna State, Nigeria although the access to these printed materials was limited [4].

The last factor that attached to poor farmers' sustainable agriculture perception was extension courses. The *β* value associated with "Extension courses" was –0.137 ($p < 0.05$). This implies that for every standard deviation change in "Extension courses", the perception of poor farmers toward sustainable agriculture will reduce by 0.137 standard deviations. The finding

showed that extension training program in the research site had a negative influence on poor farmers' sustainable agriculture perception. This implies that the extension training program could be focused on conventional agriculture technologies to improve income for upland poor farmers while ignoring sustainable agriculture ones. The finding of this study was a contrast to that of Bagheri et al. who carried out the study on wet-rice farmers in Mazandaran province of Iran. Bagheri et al. showed that the farmers' sustainable agriculture perception was significantly associated with agriculture extension courses [6].

Factors influencing better-off banana farmers' perception of sustainable agriculture

Table 5 represents the influence of the selected variables on perceptions of better-off banana farmers toward sustainable agriculture. There were 11 independent variables of the model (Table 1), out of which only 3 had a significant influence on better-off banana farmers' sustainable agriculture perception ($p < 0.05$).

Table 5. Multiple regression analysis for determinants of better-off banana farmers' sustainable agricultural perception

Variables	R^2 Cumulative	R^2 Change	F Change	P Change	Beta (β)
Agricultural programs on TV	0.293	0.293	53.117	0.000	0.324
Education level	0.377	0.084	38.440	0.001	0.281
Agricultural newspaper and books	0.412	0.035	29.391	0.007	0.208

"Agricultural programs on TV" came first in the regression model. Considered alone, this variable explained 29.3 % of the variance in the farmers' sustainable agriculture perception. "Education level" was the second and explained 8.4 % of the variance. The last was "Agricultural newspaper and books" and explained 3.5 % of the variance. These three variables together explained 41.2 % of the variance in the farmers' sustainable agriculture perception among the better-off farmers in the selected study site.

The data in Table 5 also show that "Agricultural programs on TV" with $\beta = 0.324$ ($p < 0.05$) influenced the better-off farmers' sustainable agriculture perception the most. This means that for every standard deviation change in agricultural programs on TV, the sustainable agriculture perception will increase by 0.324 standard deviations.

"Education level" and "Agricultural newspaper and books" had the β values of 0.281 and 0.208 ($p < 0.05$), respectively. These two variables were the second and third factors of the regression model, and they contributed significantly to predict the better-off farmers' sustainable agriculture perception. For every standard deviation increase in "Education level" and "Agricultural newspaper and books", better-off farmers' perception toward sustainable agriculture increases by 0.281 and 0.208 standard deviations, respectively.

4   Conclusions and recommendations

The research results showed that poor banana farmers' perception towards sustainable agriculture in the uplands of Vietnam was significantly lower than that of the better-off ones.

The study ascertained that both poor and better-off banana farmers had a highly positive perception of the problems regarding protection of agricultural resources for future generations and negative effects of agrochemicals on human health. By contrast, both had a low perception of practices related to viable profits, use of crop residues, and application of modern agriculture technologies. The study also revealed that both farmer groups had a positive perception regarding problems such as support of credit and extension policies; the role of farmer groups; proper application of inputs (such as fertilizers, pesticides, and varieties); application of cover crops, crop rotation, and crop diversification; adverse impacts of applying agrochemicals on the natural environment; the role of sustainable agriculture in tackling problems of environmental pollution and resources degradation, increasing profits and reducing production risks in the long run; and the importance of selling products for enterprises by contracts and establishment of product labels in sustainable agriculture.

The study found that except "Extension courses" that had a negative influence on poor banana farmers' sustainable agriculture perception, "Agricultural programs on TV", "Education level", and "Agricultural newspapers and books" had a positive influence on banana farmers' sustainable agriculture perception in both poor and better-off farmer groups. "Agricultural programs on TV" had the most significant influence on the sustainable agriculture perception of both banana farmer groups.

This study suggested that it is essential to enhance farmers' sustainable agriculture perception, especially poor farmers in the uplands of Vietnam toward economic benefits and feasible practices of sustainable agriculture. Specific programs on sustainable agriculture should be broadcasted more on TV to improve farmer's perception in Vietnam's uplands. Extension programs in the study region should change the approach towards sustainable agriculture to improve poor farmers' sustainable agriculture perception.

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