Research Article
Farmers' Sustainable Agriculture Perception in the Vietnam Uplands: the Case of Banana Farmers in Quang Tri Province

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Abstract: Upland farmers in Vietnam are associated with the lowest income and face serious issues of natural resources degradation and environmental pollution because of poor agricultural practices. To persuade the upland farmers to adopt sustainable practices, it is vital first to assess their perception of sustainable agriculture. This study aimed to measure banana farmers' perception towards sustainable agriculture and its determinants in the Vietnam uplands based on a case study in Quang Tri province. Stratified sample technique was used to randomly select 300 respondents from 2 upland districts of Quang Tri. The primary data were gathered by using a structured questionnaire with Cronbach's alpha coefficient of 0.84. The results showed that the majority (84.7%) of the farmers had low to mode rate perceptions of sustainable agriculture. Farmers had positive perceptions towards sustainable agriculture in issues related to protection of agricultural resources, negative effects of agrochemicals on human health and the environment, input application, crop rotation, product consumption and roles of farmer groups; whereas, they had moderate perceptions about issues related to production profits, plant residue use and modern technology application. In addition, the study revealed that agricultural programs on TV, education, ethnic group, economic status and credit use were the factors that affected farmers' sustainable agriculture perceptions.

Keywords: Perception, sustainable agriculture, upland farmers

INTRODUCTION

Concern about the negative impacts of modern agriculture on human health, the natural environment and resources has prompted development and diffusion of an alternative called sustainable agriculture. Sustainable agriculture is the approach that not only makes better use of natural goods and services for human needs without damaging the environment, but also minimizes the use of external inputs. Besides, it enables farmers to more effectively use their knowledge and skills (Duesterhaus, 1990; Shiri *et al.*, 2012). Sustainable agriculture is considered to be based on dimensions of economics, society and environment (Von Wirén-Lehr, 2001; Zhen *et al.*, 2005). Hence, sustainability of the farming production system is achieved if it is economically viable, socially acceptable and environmentally sounds (Shiri *et al.*, 2012).

However, to convince farmers to adopt sustainable agricultural technologies promoted by governmental institutions, they first need to believe that these technologies are vital, provide safety for the rural environment and create stable and long-term income (Tatlıdil *et al.*, 2009). Moreover, the perceived importance of agricultural sustainability differs from

farmer to farmer and it is influenced by their socio-economic characteristics and information-seeking behavior. Hence, measuring farmers' perceptions about sustainable agriculture and studying the factors influencing those perceptions is crucial to design extension programs for sustainable agriculture development (Tatlıdil *et al.*, 2009).

There have been different indicators designed to investigate farmers' perception in early studies about agricultural sustainability. Taylor *et al.* (1993) developed a set of farm-level sustainable agricultural indicators to measure Malaysian farms namely aspects related to pest control, soil fertility management and soil erosion control. Drost *et al.* (1998) estimating agricultural sustainability of vegetable growers, compiled the farming index with practices related to integrated pest management, nutrient management and field operations. Bagheri *et al.* (2008) developed different sustainable indicators regarding timely input uses and mode of cultivation to assess perceptions of farmers in Iran. Besides, Bagheri *et al.* (2008) and Tatlıdil *et al.* (2009) further constructed sustainable agricultural indicators related to commodity marketing, healthy animals, farm management and agricultural energy sources. Bagheri (2010) and Eric *et al.* (2013) developed a set of different sustainable index items

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related to conservation of the natural environment, farming management, profits, cultivation modes and problems of human and animal health to measure farmers' sustainable agricultural perception. Although previous studies have compiled many different indicators of farmers' sustainable agriculture perception, these indicators have focused on mostly sustainable concepts and practices of input uses, farming management, problems related to the environment and natural resources management. However, to measure farmers' perceptions towards sustainable agriculture in general, it is vital to develop more indicators related to sustainable consumption, production cooperatives and agricultural extension policies and to take into consideration some social issues surrounding sustainable agriculture. Hence, the present study was conducted to bridge this gap.

The agricultural sector plays an important role in Vietnam's national economy, accounting for 22% of the total Gross Domestic Product, 25% of total export value and the livelihood of two-thirds of the population (Bertelsmann Stiftung, 2014). During the last two decades, Vietnam's agricultural sector has achieved impressive achievements in rapid growth of yield and production, due partly to the fact that Vietnam has adopted modern technologies (Ian *et al.*, 2010). However, according to Doanh and Tuan (2007) these achievements have only helped Vietnam to overcome food security problems on a national level but not at a household level, particularly in the uplands. Besides, agricultural production in Vietnam has been faced with serious problems of natural resource degradation and environmental pollution because of poor practices adoption (Yen *et al.*, 2013).

The Vietnam uplands occupy three-quarters of natural inland territory and it constitutes 30% of the country's population with a majority belonging to the ethnic minorities. The uplands of Vietnam is associated with the lowest income and highest rate of poverty (Bertelsmann Stiftung, 2014). The livelihoods of the uplands population mainly depend on agricultural production activities (An, 2006). Cassava, bananas, coffee, beans and upland rice are the major crops in the uplands. However, upland people still use many unsustainable cultivation techniques and bad habits such as monocultures, burning of crop residue, poor fertility management, tillage, etc., which results in low yields, increasing insect pests and diseases on crops, natural resources degradation and environmental pollution in the uplands of Vietnam (Espaldon *et al.*, 2003; Valentin *et al.*, 2008; Schmitter *et al.*, 2010). In addition, the poor linkage between production and consumption results in low and fluctuating product prices. Hence, it is vital to improve production and consumption practices towards sustainable agriculture to address the above mentioned problems in the uplands of Vietnam. To support the agricultural sector of Vietnam in designing extension projects on sustainable agriculture, it is useful to conduct studies on upland farmers' perception and factors that influence their perception towards sustainable agriculture. However, studies related to this field have been lacking in the Vietnam uplands. For this reason, the present study was conducted on upland banana farmers with following specific objectives:

- To describe banana farmers' socio-economic characteristics and information-seeking behavior
- To measure banana farmers' sustainable agricultural perception
- To determine the selected socio-economic characteristics and information-seeking behavior that influence banana farmers' sustainable agricultural perception

MATERIALS AND METHODS

Research site and data: Quang Tri province is located in the North of Central Vietnam. Quang Tri has five upland districts that make up 67% of the natural land area (317,965 ha) in the province and have typical features of tropical-monsoon climate. The climate is hot and humid all year round with the average temperature of 22°C and the average rainfall of 2,262 mm/year. Bananas, coffee and cassava are staple crops in the uplands of Quang Tri. Most of the banana production areas (90.5%) in Quang Tri are distributed in the uplands with a total of 2,814 ha. Dakrong and Huong Hoa upland districts located in West of Quang Tri province have four ethnic groups, namely Kinh, Pa Co, Van Kieu and Ban Hy and population of 37,190 and 78,854 people, respectively (QTSO, 2012).

A cross sectional survey research method was used in this study during the period of January-August, 2014 in the uplands of Quang Tri Province, Vietnam. The target population of the study consisted of all banana farming households in two upland districts of Quang Tri province, namely Dakrong and Huong Hoa. The stratified random sampling technique was used to select 300 respondents in the research area. The instrument of the study was a structured questionnaire pretested and revised as appropriate to establish its reliability. Questionnaire reliability was estimated by calculating Cronbach's alpha coefficient, which was 0.84 for the scales of perception.

The structured questionnaire consisted of two sections. The first section comprised information on socio-economic characteristics and information-seeking behavior of farmers. The second section was a list of 27 statements (indicators) designed to assess the farmers' sustainable agricultural perception. These were compiled after taking reference to studies conducted by Tatlıdil *et al.* (2009), Bagheri (2010), Sadati *et al.* (2010), Eric *et al.* (2013), Ghosh and Hasan (2013) and Shiri *et al.* (2013).

Table 1: Description of variables used in the regression model

Name of variables	Variable description and unit of measurement
1. Dependent variable	
Index	Sustainable agriculture index (min. = 76, max. = 129)
2. Independent variables	
2.1 Socio-economic characteristics	
Age	Age of farmers (years)
Education	Number of years in school (years)
Household size	Number of members in households (persons)
Economic status	Economic status (above poverty line = 1; 0 otherwise)
Ethnic group	Ethnic group (Kinh = 1; 0 otherwise)
Farm experience	Number of years in farm experience (years)
Farm size	Farm size (ha)
Credit use	Credit use for inputs (credit use = 1; 0 otherwise)
2.2 Information-seeking behavior	
Extension courses	Participation in extension courses (times/year)
Agricultural programs on TV	Watching agricultural programs on TV (times/month)
Agricultural programs on radio	Listening to agricultural programs on radio (times/month)
Agricultural newspaper and books	Reading agricultural newspapers and books (times/year)

Table 2: Grouping banana farmers' sustainable agricultural perception

Perception levels	Frequency	(%)	Cumulative (%)
Very low (A)	-	-	-
Low (B)	56	18.7	18.7
Moderate (C)	198	66.0	84.7
High (D)	42	14.0	98.3
Very high (E)	4	1.3	100.0
Total	300	100	

Data analysis: The means and standard deviations were employed to depict the farmers' socio-economic characteristics and information-seeking behavior. To determine sustainable agricultural perception, the respondents were asked to indicate the extent of their agreement on each indicator 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). The possible value for general perception in this scale was taken any value between 27 and 135. The sustainable agricultural perception level of respondents was grouped using the interval standard deviation from mean: A = Very low: A≤Mean - 2 S.D., B = Low: Mean - 2 S.D.<B≤Mean - S.D., C = Moderate: Mean - S.D.<C≤Mean + S.D., D = High: Mean + S.D.<D≤Mean + 2 S.D., E = Very high: Mean + 2 S.D.<E. The study used stepwise regression analysis to determine the selected factors influencing the farmers' sustainable agricultural perception. The variables were entered in the regression model as described in Table 1.

RESULTS AND DISCUSSION

Banana farmers' socio-economic characteristics and information seeking behavior:
Socio-economic characteristics: Seventy percent (n = 210) of the respondents were male; their age ranged from 18 to 72 and the mean age was 41 years.

Respondents' education was low; on average, number of years in school of the respondents was 4.3 years. Their farm experience years were fair, ranged from 1 to 30 and the mean was 8.6 years. The mean household size was 5.4 members. The percentage of respondents belonging to households having economic status under the poverty line was high at 57% (n = 161). Twenty percent (n = 60) of the respondents were Kinh ethnic group, a common ethnic group in Vietnam, while 80% (n = 240) were other ethnic minority groups namely Pa Co and Van Kieu. Sixty percent (n = 48) of the respondents used credit for inputs; and mean farm size was 1.3 ha. No respondents participated in farm groups.

Information-seeking behavior: Except for access to agricultural programs on TV, respondents' access to agricultural information from other media namely radio, extension, newspapers and books was limited. Some of the respondents, 35% (n = 105), said they watched agricultural programs on TV for at least three times a month; and on average, they watched these programs 3.3 times a month, whereas only 3% (n = 9) of the respondents listened to agricultural programs on radio at least three times a month and the mean was 0.3 times a month; 9% (n = 27) read agricultural newspapers and book sat least twice in the past year and the mean was 0.8 times a year; and 25% (n = 75) participated in extension courses at least twice and on average they took part in these courses 0.7 times in the past year.

Banana farmers' sustainable agricultural perception: As shown in Table 2, 1.3% of the respondents (n = 4) had very high perception towards sustainable agriculture; whereas 18.7% of the

Table 3: Banana farmers' sustainable agricultural perception

Rank	Sustainable agricultural practices and concepts	Mean	S.D.	Category
1	Natural resources must be protected for next generations	4.63	0.58	EA
2	The indiscriminate uses of agrochemicals are harmful for human health	4.57	0.67	EA
3	Effective input uses maintain crop productivity in the long run	4.11	0.87	AG
4	Varieties have the major effect on crop yield and product quality	4.10	0.85	AG
5	Selling products for enterprises by contracts maintains the stability of product prices and farming income	3.96	0.82	AG
6	Application of organic fertilizers and mulches can increase soil fertility and maintain soil humidity	3.93	0.84	AG
7	Participating in farmer groups can improve farmers' knowledge and experience	3.90	0.96	AG
8	Support of policies as credits and extension improves production efficiency	3.90	0.93	AG
9	Sustainable agriculture obtains increasing profits and reduces production risks in the long run	3.86	0.89	AG
10	Utilization of animal fertilizers can increase banana production	3.86	0.99	AG
11	Minimum tillage can reduce erosion and soil degradation	3.82	0.95	AG
12	Environmental pollution can be caused by agrochemicals	3.79	1.07	AG
13	Cover crop cultivation improves soil fertility and reduces erosion	3.78	0.87	AG
14	Crop rotation improves soil fertility and reduces soil erosion	3.77	0.91	AG
15	Sustainable agriculture prevents the polluting and destroying of natural resources	3.76	1.01	AG
16	Designing labels for products is one of value added techniques	3.75	1.01	AG
17	Good soil preparation and sowing limits weeds and gets high yields	3.74	1.01	AG
18	Crop rotation and diversification can reduce pests and diseases	3.73	0.99	AG
19	Farmer's income will increase due to crop rotation	3.62	1.10	AG
20	Indigenous knowledge application is fit for sustainable agriculture	3.53	1.00	AG
21	Integrated pest management practices reduce the need for pesticides	3.47	1.04	MA
22	Sustainable agriculture can address poverty problems	3.34	0.90	MA
23	Biological control is the best way to control and reduce damage of farm pests and weeds	3.28	0.95	MA
24	Soil tests should be conducted before applying fertilizers	3.20	1.01	MA
25	Only using modern technologies, agriculture can be developed (n*)	3.06	1.01	MA
26	Not burning plant residues after harvest	3.01	1.27	MA
27	Farmers' main objective must be maximized profit (n*)	2.76	1.05	MA

(n*): Negative statement

respondents (n = 56) had low perception, 66.0% of the respondents (n = 198) had moderate perception and 14.0% of the respondents (n = 42) had high perception towards sustainable agriculture. Therefore, it can be stated that the majority (84.7%) of the respondents did not have favorable perception towards sustainable agriculture.

Table 3 presents the respondents' sustainable agricultural perception of each of the selected indicators. It was observed that 2 statements were placed in the Entirely Agree (EA) category, 18 statements in the Agree (AG) category and 7 statements in the Moderately Agree (MA) category. No statements were rated in the categories of Entirely Disagree (ED) and Disagree (DI).

In terms of EA category, the study pointed out that farmers had a highly positive perception of protecting natural resources for their future generations. This result is supported by Rahman (2003), Agahi *et al.* (2011) and Eric *et al.* (2013). Besides, upland farmers also stated their serious concern about issues of uncontrolled agrochemical uses affecting human health. This finding tallies with that of Bagheri *et al.* (2008) and Sadati *et al.* (2010). Environmental exposure of humans to agrochemicals may lead to instant death or chronic health effects. Diseases like cancer, lung damage and infant methemoglobinemia are linked to exposure to agrochemicals like pesticides and overuse of fertilizers (Weisenburger, 1993). Therefore, enhanced efforts are needed to control or eliminate human exposures wherever possible.

Regarding the AG category, it was shown that farmers had a positive perception about using inputs such as fertilizer, pesticides and plant varieties effectively to maintain crop productivity in the long run, improve product quality and soil fertility and manage insect pests and diseases. In fact, most upland farmers in Vietnam have to cultivate crops on sloping soils that are not favorable for farming (Doanh and Tuan, 2007). Fortunately, the study showed that farmers perceived well about the benefits of good agricultural practices like crop rotation, crop diversification, cover crops and minimum tillage. According to experts, these practices are considered as an effective solution to improve soil fertility (Rusinamhodzi *et al.*, 2012), reduce soil erosion (Giller *et al.*, 1994) control development of weeds, pest and diseases and reduce yield loss (Trenbath, 1993). Besides, respondents were positively aware of the adverse impacts of applying agrochemicals on the natural environment. This finding is consistent with that of Bagheri (2010). Respondents also perceived that production towards sustainable agriculture can tackle problems of environmental pollution and resources degradation, increase profits and reduce production risks in the long run.

The study showed that respondents were well aware about the importance of selling their products by using contracts. In fact, linkage between farmers and enterprises in farm production through contracts is a common trend in agricultural production that can help farmers to gain more profits through value adding and

Table 4: Results of multiple regression analysis

Var.	Predictor variables	B	Beta	t	p
	Constant	92.300	-	97.333	0.000
X_1	Agricultural programs on TV	0.863	0.307	5.639	0.000
X_2	Education	0.863	0.281	5.500	0.000
X_3	Ethnic group	5.608	0.172	3.255	0.001
X_4	Economic status	3.297	0.132	2.578	0.010
X_5	Credit use	-2.509	-0.101	-2.082	0.038

F = 37.256; Sig. = 0.01; R = 0.623; R^2 adj = 0.377

reduced price fluctuation (Weatherspoon *et al*., 2001; Tuan, 2012). Realizing the importance of this problem, the Vietnamese government issued a decision to promote agricultural contracts between farmers and processors/traders (Decision 80/2002/QDTTg) in 2002. Besides, most respondents agreed with the statement that establishment of a product label was an important technique to add to the product value and improve public awareness about the products. Moreover, it was ascertained that the respondents had positive perceptions concerning the roles of farmer groups. Barham and Chitemi (2009) stated that farmer groups are considered as an effective factor to improve farm livelihood. They play a vital role in improving members' knowledge and experience to gain access to production resources, increasing negotiating capacity as well as establishing product labels (Bosc *et al*., 2002).

Indigenous knowledge used popularly by farmer's plays a role in managing and protecting sustainable natural resources in the Vietnamese uplands (Trung *et al*., 2007). However, farmers' perception on application of indigenous knowledge for sustainable agriculture had the lowest mean score in the AG category. This showed that the farmers still had doubts about the feasibility of applying native knowledge to develop sustainable agricultural production in the uplands of Vietnam.

In regard to the MA category, results revealed that respondents had limited knowledge on the management of pests and diseases. These findings are supported by Eric *et al*. (2013). Besides, the study revealed that farmers did not have favorable perceptions about the application of modern agriculture technologies. Alonge and Martin (1995) stated that high productivity of modern agriculture had been achieved at the cost of massive damage to the nature resources in the last five decades. In addition, according to Tatlıdil *et al*. (2009), many farmers trust that they can use proper fertilizers in their farm because they know the kind of fertilizers their soils need; therefore, they do not take soil tests into consideration before they apply fertilizers. Hence, it can explain why respondents had a low favorable perception of the practice of having a soil test before applying fertilizers.

Respondents' awareness of the disadvantages of plant residue burning was low. This can be a realistic depiction of the situation in the Vietnamese uplands, because burning all plant residues after harvesting or before beginning the new crop is the cultivation habit

formed by the upland people in the old days. Upland farmers burn crop residues to get rid of insect pests and pathogens in the fields. However, this habit has promoted a quickening process of decline in crop productivity and soil erosion and degradation in the Vietnam uplands (Dung *et al*., 2008). According to Bot and Benites (2005) burning plant residues results in severe long-term consequences because it causes the death of many beneficial soil microorganisms, loss of nutrients, decline in organic matter, decline in yields and increasing soil erosion.

Finally, the study showed that respondents had the lowest level of perception regarding profit-related problems. As discussed above, economic viability is one of three dimensions of agricultural sustainability. This means that the maximum of profits in agricultural production is not permitted, but a farming system with low profits cannot be sustainable (Bagheri, 2010). Therefore, the respondents had moderate perception about viable profits from sustainable agriculture seem to be an indication of a realistic problem in the Vietnam uplands. These findings are consistent with that of Tatlıdil *et al*. (2009) and Agahi *et al*. (2011). Moreover, in the aspect of society, sustainable agriculture production has to eliminate poverty problems. However, the study showed that farmers in the study area still had doubts about the feasibility of sustainable agriculture in getting rid of poverty. The uplands have the highest rate of poverty in Vietnam. If upland farmers perceive that shifting their production towards sustainable agriculture technologies can eliminate the poverty problem, they will be willing to adopt these technologies.

Factors influencing banana farmers 'sustainable agricultural perception: Table 4 presents the influence of the selected variables on the perception toward sustainable agriculture. There were 12 independent variables entered in the model, out of which only 5 variables had a significant influence on farmers' sustainable agricultural perception. The R^2 value of 0.377 with F value of 37.256 indicated the power of the model for prediction, its significance at 0.01 level of probability and revealed that 37.7% of variance in the perception could be explained by these five variables.

According to Table 4, the following linear regression equation can be used to estimate farmer's perception towards selected sustainable agricultural technologies:

$$Y = 92.300 + 0.863 (X1) + 0.863 (X2) + 5.608 (X3) + 3.297 (X4) - 2.509 (X5) + e$$

The variable that had the most important influence on farmers' sustainable agricultural perceptions was "agricultural programs on TV" with the $\beta = 0.307$ ($p < 0.01$). This means for every standard deviation change in agricultural programs on TV the sustainable agricultural perception will increase by 0.307 standard deviation. Agricultural development towards sustainability has been considered as a strategy to solve poverty, food security, environmental pollution and resources degradation in Vietnam. Hence, in order to promote adoption and diffusion of sustainable agricultural technologies, special telecasts towards sustainable agriculture are broadcasted to Vietnamese farmer's every day. Ariyo *et al.* (2013) stated that mass media, especially TV, is assessed as an effective means to create awareness of new agricultural technologies among farmers. Spread of agricultural technologies to the farmers by TV is considered a faster rate than through personal contacts (Table 4).

The value $\beta = 0.281$ ($p < 0.01$) associated with education implies that for every standard deviation change in years of education, the sustainable agricultural perception will increase by 0.281 standard deviations. This finding is supported by Boz and Akbay (2005), Bagheri *et al.* (2008) and Tatlıdil *et al.* (2009). Besides, economic status and ethic group were the third and fourth factors influencing significantly farmers' sustainable agricultural perception with $\beta = 0.172$ ($p < 0.01$) and $\beta = 0.132$ ($p < 0.05$), respectively. For every standard deviation change in ''economic status'' and ''ethnic group'' sustainable agricultural perception of farmers increases by 0.172 and 0.132 standard deviation, respectively. Finally, β of credit use was -0.101. The findings revealed that one standard deviation increase in credit use decreases the sustainable agricultural perception by 0.101 standard deviations (Table 4).

CONCLUSION AND RECOMMENDATIONS

The research results showed there is cause for concern about banana farmers' perception towards sustainable agriculture in the uplands of Vietnam, as pointed out that a majority (84.7%) of the respondents' perceptions about sustainable agriculture were rated as low and moderate.

Besides, the study revealed respondents were highly interested in protecting agricultural resources for future generations, concerned about negative effects of agrochemicals on human and animal health, as well as they had highly positive perceptions about proper application of inputs (such as fertilizers, pesticides and varieties), application of cover crops, crop rotation and crop diversification. They were also aware about the adverse impacts of applying agrochemicals on the natural environment; the roles of sustainable agriculture in tackling problems of environmental pollution and resources degradation, increasing profits and reducing production risks in the long run; as well as the importance of selling products for enterprises by contracts and establishment of a product label. Conversely, respondents had only moderate perceptions regarding practices related to viable profits, burning of plant residues, application of soil tests before applying fertilizers, the role of sustainable agriculture in addressing poverty and the application of modern agricultural technologies.

In addition, the result of the regression analysis revealed that 5 variables that influenced farmers' sustainable agricultural perception were agricultural programs on TV, education, ethnic group, economic status and credit use. These variables explained 37.7% of the variation of farmers' sustainable agricultural perception in the selected research area. The variable of agricultural programs on TV had the most significant influence on farmers' perception towards sustainable agriculture.

The study recommends that efforts to enhance farmers' perceptions towards sustainable agriculture in the uplands of Vietnam should focus on improvement of their awareness of economic benefits and feasible practices of sustainable agriculture. Moreover, special programs on sustainable agricultural production should be broadcast more on TV to improve farmer's perception in the Vietnam uplands.

The study measured perceptions of the sample farmers towards sustainable agriculture. However, it could not predict whether farmers will readily adopt sustainable agricultural technologies themselves. Hence, further research should be conducted to find out if they are likely to do so and to determine the characteristics of farmers that promote or hinder the adoption of sustainable agricultural practices in the Vietnam uplands.

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