

Coffee Produced by Households and Sustainable Development in Western Highlands

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Western Highlands are the biggest supplier of coffee in Vietnam, beside many other industrial crops. Results of the coffee crop and coffee yield affect greatly the economic growth of this zone. This paper presents efficiency of coffee production in Western Highlands and factors affecting the efficiency, and suggests some measures to ensure the sustainable development for the whole zone.

1. Problem

Western Highlands comprise five provinces: Đắk Lắk, Đắk Nông, Lâm Đồng, Gia Lai, and Kon Tum, and a population of five million (2007). With a total area of 600,000 hectare of basaltic soil, they constitute the Vietnam's biggest coffee zone. Any fluctuation in coffee production and price will affect seriously the economic development of the zone because coffee accounts for 30% of the gross products and 80% of export value of the zone (Bùi Quang Bình, 2007).

Many studies have affirmed that it's necessary to improve the efficiency and develop in a sustainable manner the coffee production, and suggested various measures. In her study "On Development Prospects of Organic Coffee in Western Highland," Tôn Nữ Tuấn Nam argues that current farming techniques affect unfavorably the efficiency and sug-

gests applying eco-friendly and qualified techniques. Nguyễn An Phong (2006) maintains that the production of coffee is limited to a reasonable size in districts where natural conditions are favorable instead of expanding it at any price. Lack of sustainability of the coffee production, presented by Bùi Quang Bình in his study "Sustainable development for coffee production in western Highlands," comes from unruly expansion of coffee area and obsolete farming techniques; and he also suggests measures to deal with the situation.

Coffee, as a perennial crop, requires high managerial skills and modern farming techniques. Trịnh Minh Đức, in his study "Impact of technologies on development of coffee production," presents technical solutions applicable to the coffee production in Western Highlands. With international integration and open economy, the efficiency of coffee production can be improved if consistent solutions to coffee production and trade are carried out. Phan Quốc Sùng (2007) deals with this aspect in his study "Ten measures to ensure a sustainable development for coffee production in Đắk Lắk during the international integration."

Improving the efficiency and encouraging the sustainable production of coffee can allow the sustainable development in Western Highlands. At

present, coffee is produced at a household scale in Western Highlands, therefore, enhancing the efficiency of coffee production at household scale is important to the sustainable development in Western Highlands.

2. Solving the problem

a. Methodology:

The efficiency of coffee production at household scale is based on some combination of factor inputs that aims at (1) increasing the coffee yield from a unit of area; or (2) increasing the added value (VA) from a unit of area.



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In the first approach, the aim can be achieved by estimating effects of each factor in order to work out a perfect combination of these factor inputs. In the second approach, efforts are made to cut intermediary cost (IC) and increase the VA. In current condition in Vietnam, the second approach is meaningful in increasing the income of agricultural laborer and requires solutions to changes in prices.

In the first approach, many methods of assessing the efficiency of production of farm products have been introduced. A.B. Deolalikar (1981) uses the production function to analyze relations between productivity and size of a farm. Johan Van Zyl, Bill R, Miller, and Andrew N, Parker (1996) uses the Cobb-Douglas production function to analyze effects of factors on the income.

In Vietnam, the production function is also used by many studies on the agricultural production. Lê Quang Cảnh (2003) uses this function to assess effects of the factors on income of farms. Đinh Phi Hổ (2003) uses it to estimate effects of such factor inputs as capital and labor on income of rice planters in An Giang.

In my research, I use the linear production function to assess the efficiency based on effects of input factors in which Y is the coffee yield per hectare, Xi is investment in i, and coefficient $\hat{\alpha}_i$ shows the effect of input factors. This method allows me to assess effects of the input factors on the yield thereby finding ways of using effectively these factors.

The second approach is also followed by many studies, such as the "Research on competitiveness of production of raw materials for animal feed (corn and soybean) in Vietnam" conducted by the IEA-MISPA in 2004. Estimation of the efficiency of production of corn and soybean is based on data about productivity, gross output (GO), IC, VA, and working days for a hectare. This estimation allows calculation of such ratios as GO/IC, VA/IC, GO/working day, and VA/working day.

In researching the sustainable development of coffee production in Western Highland, Bùi Quang Bình (2007) also takes the approach to the VA for estimation of the efficiency of coffee production. In this research, I also use results of these studies to analyze the efficiency of coffee production at household scale in Western Highland.

b. Data:

A survey of 230 coffee-producing households in Western Highland to collect data needed for estimating the efficiency of coffee production and analyzing factors affecting the efficiency has been

Table 1: Efficiency of coffee production by surveyed households (per hectare)

Indicator	Unit	Min	Max	Average
Coffee yield	Tonne/ha	1.00	4.0	2.097
GO/ ha	VND million	10.52	70.3	36.7
IC/ ha	VND million	0.23	20.3	10.7
VA /ha	VND million			26.0
Labor/ha	Working day	0	300	164
IC /tonne of coffee	VND million	1.54	9.5	5.15
VA /tonne of coffee	VND million	3.81	18.8	12.1
rarsid6904163 GO /IC	Time			3.43
VA/IC	Time			2.43
Labor cost /ha	VND million	0.07	10.05	5.4
GO /labor	VND1,000	110	1,536	255.7
VA /a laborer	VND1,000	-132	725	108.4
Profit/ha	VND million	-1.66	30.34	16.9

Source: Calculations based on collected data

carried out within this research project. The data is presented in the following section.

The Table 1 shows that the average yield of coffee gained by surveyed households is 2.097 tonnes while the national average is nearly 2 tonnes. The highest yield among them is 4.0 tonnes, which means that potentials for a higher yield are great. The average profit from a hectare is nearly VND17 million.



Photo by Huynh Tho

Table 2: Comparison of the efficiency of coffee production among groups of households (per hectare)

Indicator	Unit	Size of farming land	Comparison (time)					
		1	2	3	4	1/2	2/3	3/4
Coffee yield	Tonne/ha	2.2	2.01	2.19	1.5			
GO/ ha	VND million	37.87	34.07	38.28	26.56	1.11	0.89	1.44
IC/ ha	VND million	10.78	10.87	10.54	9.4	0.99	1.03	1.59
VA /ha	VND million	27.09	23.1	27.74	17.16	1.17	0.83	1.61
arLabor/ha	Working day	185.9	148.4	127.7	87			
GO /IC	Time	3.51	3.13	3.63	2.82			
VA/IC	Time	2.51	2.12	2.63	1.82			
GO /labor	VND1,000	231	265	305	696			
VA /laborer	VND1,000i	99.3	106.7	139.7	309.1			

Source: Calculations based on collected data

Note: Farming area of the Group 1 varies from 1,500m² to 10,000 m², Group 2: > 10,000 – 20,000 m², Group 3: > 20,000 – 30,000 m², and Group 4: > 30,000 m².

Regarding the average GO per hectare, it is only VND36 million. It is lower than the target of VND50 million set by local agricultural authorities. However, the successful household can earn up to VND70 million. The low GO comes from a low yield while the price of coffee bean at late 2006 and early 2007 accepted by surveyed households was VND17,180 per kilo.

The IC was VND10.7 million on average, equaling some 30% of the GO, that is, the GO/IC ratio was 3.43 proving that households ran their business strictly. Some households, however, suffered this cost as twice as much others. This means that agricultural extension must be carried out better to transfer techniques and managerial skills to coffee planters. The low IC allows a high VA, which reached VND26 million per hectare. The VA/IC ratio was relatively high, at 2.43.

The productivity of labor in coffee production is high in comparison with other agricultural activities. The GO per laborer was VND255,000 and the VA per laborer was VND108,000. In other words, the VA per laborer per year was VND17 million (if the laborer works 164 days a year). This level is higher than the national average of personal income (US\$630 in 2005) and the present productivity of labor of VND6 million in the agricultural sector.

Data in the Table 2 show that there is no difference in yield between Groups 1 and 3, but their yield is higher than the one achieved by Groups 2 and 4. Their efficiency, therefore, is different: the VA earned by Groups 1 and 3 is over VND27 million, higher than the average of 26 million, while the other two groups earn from VND17 to 23 million. It is because they make the less successful

groups make a lower GO per hectare but their IC is all the same. It's worth noting that, however, households with more than four hectares of farming land usually have a poorer efficiency and yield but they enjoy better GO and VA per laborer.

Generally, analyses of results and efficiency of coffee production by surveyed households show that: (1) Their average yield is higher than the provincial average according to General Statistic Office in 2005, and there is a clear difference between the highest, the average and the lowest yield levels; (2) There is a difference in the efficiency between groups of households: the bigger the size of farming land, the higher the GO and VA per laborer; (3) The IC is the same regardless of the size of farming area.

3. Factors affecting the efficiency of coffee production at household scale

The above section proves that there is a difference in results and efficiency of coffee production due to different farming conditions and skills of farmers. This difference in yield and efficiency reveals great potentials for intensive development of coffee production. The use of input factors determines results and efficiency of coffee production. The Table 3 presents relations between the coffee yield and quantity fertilizer used.

The households use large quantities of inorganic fertilizer. When the quantity increases, the yield increases at different levels. They all use the all-nutrient (or NPK) fertilizer and it accounts for the best part of the total quantity. The organic fertilizer is also used at different levels: coffee yield achieved by households that use no organic fertilizer is lower than 1.25 tonnes per hectare. Households that gain

Table 3: Coffee yield and quantity of fertilizer used per hectare by surveyed households

Yield	Fertilizer			
	Inorganic fertilizer (kg/ha)	Organic fertilizer (m3/ha)		
		NPK	Urea	Phosphate
From 1 to 1.25 tonne/ha	577.09	99.77	81.7	0
From 1.26 to 1.5 tonnes/ha	551.39	131.51	108.15	2.16
From 1.52 to 2 tonnes/ha	431.17	162.44	169.03	2.58
From 2.08 to 2.138 tonnes/ha	524.25	114.82	147.66	5.05
From 2.2 – 3.0 tonnes/ha	612.03	196.45	105.64	8.69
Above 3.0 tonnes/ha	750.97	196.45	105.64	8.71

Source: Calculations based on collected data

from 1.52 to 2.0 tonnes per hectare use 2.58 m3 of organic fertilizer per hectare while the ones gaining from 2.08 to 2.138 tonnes per hectare use over 5.05 m3 /ha, as twice as many the other group uses. This fact shows that the organic fertilizer affects increases in the coffee yield better than the inorganic one.

To assess the effects of input factors on the coffee yield, this research uses the OLS regression to estimate coefficients in the production function model of relations between yield per hectare, or between coffee yield and input factors use for a hectare of coffee. Tests show that the model is based on the most reliable data as shown in the Table 4.

Result show that such input factors as manure; urea, NPK and phosphate fertilizers; and labor affect favorably the coffee yield at different levels. The strongest is from labor, followed by manure and other organic fertilizers. The effect of chemical fertilizer is not as strong as expected. So coffee planters had better make the best use of local labor and manure from animal husbandry business, and limit the use of chemical fertilizers. This practice can enhance quickly the efficiency of coffee production and make their development sustainable.

The coffee production requires some technical knowledge and managerial skills, therefore the educational level of the head of the household will determine their ability to absorb such knowledge. My research, therefore, pays certain attention to the effect of the education of the head of the household. And as expected, planters with better education always gain higher yield levels. Effects of other factors always have positive values when the planter

Table 4: Data processing results

Independent variable	Original model	Extended model
Nitrogenous fertilizer	0.513 (0.120)***	0.463 (0.116)***
NPK and DAP	0.335 (0.0529)***	0.325 (0.051)***
Phosphate (P2 O5)	0.343 (0.082)***	0.351 (0.079)***
Manure	1.791 (0.354)***	1.274 (0.366)***
Labor	2.546 (0.621)***	2.65 (0.61)***
Irrigation		225.55 (69.6)***
y-intercept	994.81 (123.5)***	796.5 (136.9)***
Cases observed	216	216
F (5, 210)	25.51	21.76
Prob > F	0.00	0.00
R-squared	0.3779	0.4227
Adj R-squared	0.3631	0.4033
Root MSE	464.73	449.81
Chi-2 of Breusch-Pagan / Cook-Weisberg test	1.96	5.92

Source: Calculations based on collected data

Note:***, **, * mean levels of significance of 1%,5%,and 10% respectively. Numbers in bracket are standard deviation.

has a better education. Thus, the education, or human resource, is an important factor whose effect is greater than any other input factors ever examined.

Results in the Table 4 also show that planters who can control inrrigation always achieve higher yields, and better irrigation can help enhance favorable effects of other factors.

From the above analyses, we can draw the following conclusions of the effects of input factors on the efficiency of coffee production. Firstly, the chemical fertilizer produces no big effect on the efficiency and its effect may be limited by overuse. Secondly, labor and manure have strong effects on the yield. And thirdly, control of irrigation system is a decisive factor to the efficiency of coffee production.

4. Some suggestions

To develop the coffee production in a sustainable manner in the coming years thereby supporting the economic sustainable development, the following measures can be taken:

- Maintaining the scope of coffee production at a reasonable level based on a good planning and strict control over implementation of the plan in order to increase the farming area of each planter instead of increasing the total coffee area.

- Encouraging intensive farming with a view to enhance the coffee yield in a sustainable manner.

- Developing the coffee production by using more labor and manure and using the chemical fertilizer reasonably.

- Improving farming techniques and managerial skills of coffee planters by supplying training courses and beefing up the agricultural extension programs.

- Upgrading and building irrigation systems in order to ensure the supply of water to coffee plantations and diversify technical and crop protection services. ■

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