

NEW DEVELOPMENT IN DAK LAK PROVINCE (VIETNAM) TO IMPROVE SUSTAINABLE AGRICULTURE

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ABSTRACT

The perennial crops are known as a capital importance in Vietnam's Central Highlands in general and Dak Lak in particular. They are to improve income, abolishing starvation and reducing poverty, in which coffee, pepper and rubber are driving force crops. The cultivation areas, productivity and export have been increasing gradually from 1986 till now. In the recently, population explosion problem due to spontaneous migration from delta and other regions has been created a pressure for agricultural production. Additionally, production of agriculture in general and perennial crops cultivation in particular, households have been facing with many risks as climate change, unstable market and disease. Therefore, in order to reduce damage, in practiced production, farmer often carries out many effective solutions. One of all is perennial intercropping system.

The study is about economic performance of coffee and pepper intercropping (CPI) in Quang Hiep commune, CuMgar district, Dak Lak province. A household survey of 50 of CPI farmers and key informants interviews were conducted in 2015 by using method of descriptive and cooperative statistics. The research findings indicated that CPI brought economic performance to farming household. Particularly, although the investment cost spent 165.7 million VND per hectare and the annual cost occupied 60.5 million VND, the gross product reached 358.4 million VND. After deducting for intermediate cost, the farmer received over 304.4 million VND of family net income (FNI). Furthermore, this system is highly cost-effective investment because the ratio cost of gross product and value added are 10 % and 13 %, respectively. The income per family labor is 0.9 million VND. Key recommendations and new study approach were proposed for sustainable development.

Key words: perennial crop, intercropping, economic performance, Dak Lak

INTRODUCTION

Before liberation, French colonial recognized Central Highlands (Tay Nguyen) was not only important location but also had costly resource of land (basalt soil). Yet, the perennial crops were grown in there very early. Although, the output wasn't high, Tay Nguyen coffee beans were in many countries in the world and many connoisseurs have really admired the quality and its taste.

In the 1920's, suitable coffee growing areas were discovered in the Central Highlands. The acreage increased until 1945 to approximately 10,000 ha, mainly in Dak Lak province (Dave D'haeze et al., 2005). Between 1931 and 1959, total area of coffee Dak Lak increased from 2.130 ha to 5.200 ha with 49 plantations and farms, most of all are French's (cited in Minh, 2011).

After South Vietnam is completely liberated, the perennial crops developed quickly in Dak Lak province. They are strength of central Highland in general and Dak Lak province in particular because of appropriate soil and weather suitability. From 1975 to 1977, the principal perennial crops included coffee and rubber with the area to follow 16.056 ha in 1975 and 9.688 ha in 1977 (Dak Lak People's Committee, 1985).

Concerning the coffee, it is favorable drink in the world. Therefore, Dak Lak province has early attention to developing industry with opening in series of coffee farms as Thang Loi, Ea Ho, Phuoc An, Duc Lap directly managed by Agricultural Nation Company (Minh, 2011). In 1975, coffee was grown 11.563 ha, the yield was 1.5 ton/ha and output reached 8.802 tones. During period from 1981 to 1985, the coffee area increased from 13.766 to 21.829 ha (Dak Lak Statistics Office, 1986).

Beside coffee, rubber is used in many important industry sectors. It was also cultivated in Central Highlands in 1923 and developed significantly during 1960-1962. As a result, rubber production has been expanding about area and improving about productivity in Dak Lak. From 1975 to 1977, production of rubber downed up from 4.478 ha to 2.821 ha. However, between 1981 and 1985, the area rose significantly, reached 10.896 ha in 1985 (Dak Lak Statistics Office, 1986).

About pepper, a new variety is pepper which has begun to develop in central Highlands after 1975 with small area but developed quickly. From 1981 to 1985, Dak Lak grew pepper for spice in domestic and international. In 1981 rose 11 ha, in 1984 reached 77 ha and in 1985 occupied 79 ha with productivity are 5 tones, 41 tones and 48 tones, respectively), (Dak Lak Statistics Office, 1986).

In the renovation years, under influence of appropriate economic policies, Dak Lak transformed cultivable structure, livestock in direction to be suitable for land. As a result, agricultural production developed both quality and quantity to follow commodity economy. The farmer who grows coffee in Central Highlands has the saying: "Coffee is the tree for rich people" (Ba, 2007). Thanks to the new economic policies of Party and State, the province invested the new planting and expanded intensive farming to gradually form the major coffee growing areas concentrated in Buon Ma Thuot city, CuMgar, EaH'leo, Krong Nang, etc.

According to the 10 decree program (10/CT) of Vietnamese government about greening the barren land in 1990 as well as implementing policy of Vietnamese Prime Minister in 1992- 2011 period about development 100.000 ha rubber in Centre Highlands, the rubber area went up significantly, with around

31.200 tones in 2011(DARD, 2012). In 2010 - 2015, the rubber area increased to 38.000 ha, 20 companies and organizations were set up in the whole province (Dak Lak People's Committee, 2016).

By 2004, the total pepper area contributed to over 17.980 ha. Dak Lak exporting pepper has been ranked the second in country (Dak Lak People's committee, 2014)

Concerning the population, between 1986 and 1995, Dak Lak resettled 311,764 planned migrants. Spontaneous immigration compounded the flow, with approximately 350,000 arriving during the same interval. By 1997, the province's population was close to 1.5 million people. Indigenous minorities such as the Ede and the Mnong, who had made up 48 percent of Dak Lak's population in 1975, now only comprised 20 percent of the population. Ethnic Kinh comprised about 70 percent, with miscellaneous others, including ethnic minorities from the Northern Highlands, making up the remaining 10 percent (cited in Xuan, 1998). Between 1976 and 2004, the immigrants who are ethnic minority reached 17.328 families and 91.749 people including Tay, Nung, Thai, Dao, Hmong, Muong, etc increased significantly due to the price of perennial crops increasing quickly, especially coffee and pepper (DARD, 2012). Between 2005 and 2013, the immigrants of Dak Lak occupied 1.503 households and 7.578 people (Dak Lak People's Committee, 2015). In 2014, Dak Lak had over 1.8 billion inhabitants, 47 ethnic groups, 1.1 billion Kinh and 300 thousand people of Ê ĐÊ minority group to provide with over 66.1 % agricultural workers.

The result of spontaneous immigration is lack of resources and land for agricultural production. For instance, the finding survey in 1996 revealed that the planned and spontaneous immigrants occupied an average of 1.26 hectares of land per household. At that rate, provincial authorities said, the new immigrants could have destroyed as much as 100,000 hectares of forest for agricultural clearing during the prior twenty years. Land conflicts were inevitable, particularly since most immigrants to the province have settled in upland rural areas where the indigenous ethnic minorities have traditionally lived (cited in Xuan, 1998).

Regarding the production result, the gross value of agriculture sector in 2014 reached 38.897 billion VND in current price, contributed to 42.1 % in economic development of Dak Lak. Coffee dominates the main part of agricultural value with the largest area as well as export product in the country. The export productivity in 2014 reached 22.7 thousand, accounting for 480.9 million USD (Dak Lak Statistics Office, 2015). About one quarter population depends on coffee production. In 2014, Dak Lak had around 293 thousand hectares of perennial crop, of which coffee dominates about 204 thousand hectares (70%) and the productivity reached 444 tones (Dak Lak Statistics Office, 2014). The pepper and rubber areas rose steadily, dominated 30.000 tons rubber and 21.000 tons pepper (DARD, 2012). Clearly, perennial crop has been becoming driving force of farm households in Dak Lak. Although the livings of farmer depended on totally perennial crops production and living standard of population has been gradually improved, the dramatically increase and lack of planning

(Hoa, 2010) of coffee as well as other perennial crops led to the growing significantly productivity but low quality and economic efficiency. The production has been facing with a lot of risks and economic efficiency of limitation due to subjective and objective reasons. Therefore, workshop “Coffee sector development to adapt climate change and international integration” shows solution to intercrop other tree in coffee garden to improve income per unit area and ecological environment protection (DARD, 2014). Furthermore, the international competitiveness is restriction. This is led to decrease groundwater, destruction of forest, environmental pollution and socioeconomic insecurity. The coffee price went down or the fluctuation of pepper and rubber price led to farmer to be extremely worried and withdraw in their production. The “cut – plant” situation happened in the recent years. Many farmers became the poor and debt. This is extensive effect on socioeconomic living and security. Clearly, mono-cropping systems lacked sustainability and without protecting environment (cited in Trinh, 2014). Traditional farming of coffee and pepper has now been expanded from mono-system (separating coffee and pepper) to intercropping system, where coffee and pepper are intercropped. Initially, this system is considered to have highly economic potential. The study indicated that the economic efficiency of CPI is higher twice than pure coffee system was analyzed by Trinh, 2014.

In Quang Hiep commune, coffee and pepper intercropping (CPI) is reported to play a pivotal role to improve socio – economic status in the commune (cited from commune leaders). However, the expanding of the system is generally spontaneous where farmers almost work by their own experiences in intercropping coffee and pepper. As a results, the coffee - pepper production are faced with risks as high investment cost, disease, etc. This study is designed to evaluate the current economic efficiency of CPI in Quang Hiep commune, to provide information for agricultural managements, extension centers as well as local authority so that they can orient and develop sustainability this intercropping system in the future.

METHODOLOGY

In the frame of the research, the different activities such as observing and discussing with key informants (extension worker, elderly people, chief and head); open – ended interviews and other participatory activities. The secondary data was gathered from official sources. The primary data was selected from household surveys with 50 CPI farms in Quang Hiep commune to focus on CPI production activities in the most recent season (2014 – 2015) by random sampling method. The investigation collected information such as investment cost, annual cost, yield and output. Cost – efficiency analysis and comparative statistics were employed to analyze data with following indicators: Gross output; investment cost; annual cost; mixed income; family labor income as defined by EC, 1989.

RESULTS AND DISCUSSION

The situation of coffee and pepper in Quang Hiep commune

Intercropping is a multiple cropping practice involving growing two or more crops in proximity. Growing two or more crops at the same time on a single field is an ancient practice still used in much of the developing world.

In Quang Hiep commune, the pepper was grown in coffee garden in 1990s and developed quickly. In 2014, the area coffee and pepper estimated 2,540 hectares, of which intercropping area occupied about 20% of total coffee and pepper in the commune. Total output production of coffee has decreasing trend due to be unstable of weather while pepper has increased quickly, from 742 tons to about 1400 tons during 2012-2014.

Table 1: The coffee and pepper production in Quang Hiep commune

Indicators	2012	2013	2014	Comparison (%)	
				2013/2012	2014/2013
1.Total coffee and pepper area	2,259.5	2,340.5	2,540	103	108
<i>Of which, intercropping area</i>	225	335.5	450	149	134
2. Total production (ton)					
<i>Coffee</i>	5,490	6,985	6,680	127	96
<i>Pepper</i>	742	994	1,423	134	143

Sources: Statistics from Quang Hiep commune (2015)

The economic performance of CPI in Quang Hiep commune

General information the intercropping system

There are generally two method of intercropping coffee and pepper is now practiced in Quang Hiep commune, which are group and intersection methods. Intersection method is method that producer plants 2 – 3 coffee rows to intercrop one pepper row (the pepper crop is cultivated intersection point of coffee holes), where in the group method, many small sub- areas of coffee and pepper are designed in the garden. Among interviewed households, farmers tend to choose more on intersection method than group method, corresponding 60% (Table 2).

Table 2: Characteristics of CPI garden in farm households

Items	Value	Proportion (%)
Method of intercropping		
Group	20	40
Intersection	30	60
Density (tree/ha)		
Coffee	960	-
Pepper	690	-

The average experience (years)		
Under 5 years	12	24
5-15 years	26	52
Over 15 years	12	24
Garden old age		
Under 3 years	12	24
Over 3years	38	76

Source: Household survey 2015

It was observed that cropping density reached at 960 coffee trees/ha and about 700 pepper crops/ha (Table 2). To compare with standard technique, households tend to grow higher density (cited from commune extension worker). Over half of households have experience from 5-15 years in production coffee and pepper. This is an advantage for others to want to practice and expand this rotation in sharing experience. In additional, survey finding shows that most the intercrop garden with age is over 3 years, account for 76%.

The investment cost of coffee and pepper intercropping systems

CPI is cropping system requires a high quantity of inputs which are spent previous and back processing cultivation directly such as hole, water irrigation, materials (nursery, pillar, hire labor, fertilizer), occupy 165.7 million VND (table 3). For instance, the land preparation and land preparation dominated high cost in CPI production, account for 58.3 million VND. This is because they are almost used from well instead of reservoirs and digging the hole my contract (about 5000vnd/hole). Notably, there are some households own from two to three wells because their gardens are located in different places or previous well did not provide sufficient water. With farming (under 1 ha), the holder often gets difficulties in irrigation and the cost spends for digging wells is high. For example, in the severe drought that has lasted for many months, all reservoirs like lake, stream are dry to the bottom, all the wells of 30-40 meter deep also don't have water while she/he doesn't has money to dig deeper wells. Besides, the material costs are highest proportion about 98.1 million VND (59 %) in the total of investment cost. The pillar dominated over a half cost (83.3 million VND or 50 %) in total of material cost. According to worker extension, households used fry tree instead of fresh tree and concrete pole because it is quick and easy in production. However, the cost of a fry tree for pepper crop to sprawls on is from 100.000VND to 120.000VND, not including material and transportation. This not only cause to be difficult in initial capital but also cutting forest situation is happen. Especially, household practiced high density, the high density they grow more capital they spend. Therefore, in the future, the local government well as worker extension should have training programs about CPI production technique for farmer.

Table 3: The investment cost of coffee and pepper intercropping farming in the first year*Unit: Million/ha*

Indicators	Value	Proportion (%)
1. Land preparation	58.3	35
2. Hired labor	8.2	5
3. Material costs	98.1	59
<i>Nursery</i>	6.3	4
<i>Pillar</i>	83.3	50
<i>Fertilizer</i>	8.5	5
4. Others	1.1	1
Total investment cost	165.7	100

*Source: Calculated from survey 2015****The annual costs of CPI systems***

This cost is accounted for business period of intercropping, after trees are over three years old. On average, the Intermediate cost of CPI is 36.5 million VND (about 70%). Base on result of investigation, farming's household provided chemical and organic fertilizer from 4-5 times including 2 times in dry season and 3 times in rainy season. This cost occupied 14.8 million VND. Whereas, insecticide only was supported when cropping system gets diseases, especially *Pseudococcus* spp; *Colletotrichum* spp in coffee and *Sdently* dead; yellow leaf in pepper. In some recent years, thanks to training of local authority as well agriculture cadres, farmers were recommended to care farming without too many inorganic fertilizers. Instead, organic fertilizer like: straw, coffee peeling, manure cow. Additionally, in term of many activities in taking care period as digging furrow –drains to fertilizer; spraying and trimming the creepers; pruning and forming bud, water irrigation; hand –picking, the high labor cost is inevitable. It dominated 15.6 million VND (Table 4) with inside and outside local region. This helps holder to salvage good condition of market and weather as well as protect their products form thief. However, in this period, it is not only scarce labor but also increasing price. Although coffee hand – picking is from September to December and pepper harvesting is from February to April, family labor could not afford hand picking for their garden. Meanwhile, interest rate is cost which is should take account, corresponding 14.7 million VND with interest rate 10%/month. To thanks to policy of Vietnam government to encourage agricultural development. In current years, farm holder is easy to borrow capital from banks like: Dong A, Agrbank, etc. Finding shows that 100 percent of farmer borrows money from banks to invest their farming.

Table 4: The annual costs of CPI in Quang Hiep commune (per hectare/year basis, million VND)

Indicators	Value	Proportion (%)
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I. IC	36.5	68
1. Fertilizer	14.8	28
2. Pesticide	10.6	1
3. Fuel expenses	4.4	8
4. season workers	15.6	2
4. Others	1.2	29
II. Interest payment	14.7	27
III. Depreciation	2.2	5
Total annual cost	53.9	100

Source: Calculated from survey 2015.

The economic performance of CPI system

The following is the statistical table for economic outcomes of CPI production. CPI is characterized that in the first year, the growers have to be invested more finance. After years, the holders just spend little for annual care taking cost. From fourth year, the plants can give high output and stability for farmers.

The finding reveals that the gross product and added-value are quite high (358.4 million VND and 321.8 million VND, respectively) due to at the favorable price of pepper (180.000 VND/kg). The CPI production is a highly cost-effective investment because the ratio of cost to gross production and value added are thus extremely low, about 10 % and 11.3 %, respectively. CPI production is thus of great importance for the household economy in this production system. That the reason why most coffee farmers focus on pepper area development in the recent years and Dak Lak province identifies that coffee tree is a force driver in development of agriculture. However, households should note that this system is also strongly affected by the price in the domestic and international market. Thus, the expanding area should follow advices of agricultural expert and local authority.

Table 5: The economic efficiency of coffee and pepper by production system during business period (per hectare/year, million VND)

Indicators	Unit	Value
Gross Product (GP)	Million dong	358.4
Intermediate cost (IC)	Million dong	36.5
Value added (VA)	Million dong	321.8
Family Net Income (FNI)	Million dong	304.4
IC/GP	Percentage	10
IC/VA	Percentage	11.3

Family labour	Day	230
FNI/active family labour	Million dong/day	0.9

Source: Calculated from survey 2015

Moreover, the result shows that CPI production is attracting more employees because they receive high income per day with 0.9 million VND. This explains why Dak Lak province has high migration situation to compare with other regions, especially ethnic minorities in North and Middle Vietnam.

Factors affecting economic performance of coffee and pepper production

Infrastructure, crop disease, input and output prices, and weather are those considered to be the most common factors that negatively affect the production, as reported by all farmers (Figure 1). From data analysis, it is also found that production scale, age of trees also influences economic performance of the CPIC.

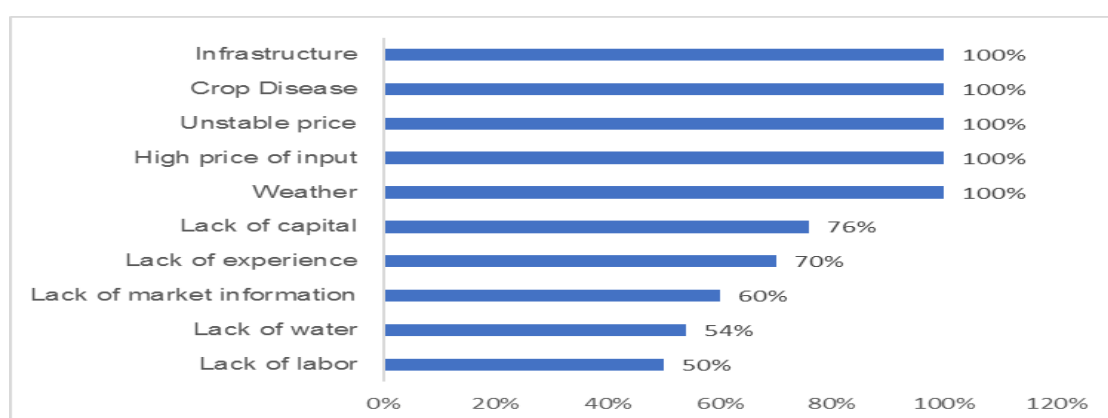


Figure. Constraints in coffee and pepper production, as perceived by farmers

Source: Data collected from survey (2015)

Infrastructure is reported as one of the most important factor affecting coffee and pepper production, especially roads to transport coffee, electricity and irrigation system. Water is reported by about 54% of farmers as one of the impediments to coffee and pepper yield in the commune, especially in dry season. Farmers have to use pumps to get water from wells, but in many cases three-phase electricity wire was not available, use of gasoline is also expensive.

Recommendations to improve economic performance of coffee and pepper intercropping in Quang Hiep Commune

Improving farmer's knowledge and technique on CPI production: Intercropping is new to farmers and most of them practiced based on their own knowledge. Therefore, they often lack of knowledge and skills in planting, caring, and harvest. Future training should focus on the construction period, harvesting period and harvesting method. Trainings also should focus more on female and ethnic farmers.

Increasing investment and encouraging use of quality nursery: Local authority should create good condition for farmers to approach and use new, quality nursery. Also, technical guidance on nursery selection for intercropping should be provided. For example, encouraging farmers use quality and

certified nursery. To replace timber pillar by fresh tree because the timber source is exhausted and expensive.

Infrastructure improvement and other supports from local government and line agencies:

Local authority might support farmers in finding water sources, or measures to save water for in dry season. Extension services should be more focus on the intercropping system. Local government could also be an intermediate in setting up linkage between farmers and buyers in order to reduce market risk for farmers. Coffee price and other input prices, and other market information should be inform widely.

Improve farmers' capability in production and negotiation with traders: Therefore, improving production capacity (land, capital) and negotiation capability for farmers in necessary. One possible solution is to set up a region for coffee and pepper intercropping (e.g. probably more than 20 ha) such that the volume is high enough to get better prices. In addition, local government can set up practiced policies in linkages between farmer and enterprises in production and consumption. Farmers might be organized in group to have better voice in negotiating output and input price, especially escape from the price squeeze of collector or trader.

CONCLUSION

The coffee and pepper has been practiced widely in Quang Hiep commune with rapid increase in terms of area, reaching 2.540 hectares in 2014, producing about 6.680 tons coffee and 1.423 tons pepper, in which CPI accounted for 17 %. CIP system has been becoming key cropping system for local economic development. The study shows that average of income returned to family labor is estimated at about 304.4 million VND/ha in the crop season 2014-2015. Cost and benefit analysis also revivals that investment on coffee and pepper intercropping system is economically feasible. However, the production system now faces other obstacles, such as lack of water resource, farmers' practical knowledge, crop disease and pests, changing weather, finance, market information. Therefore, several recommendations to improve economic performance of the coffee- pepper intercropping in Quang Hiep commune are proposed, namely improving farmer's knowledge and technique on intercropping of coffee and pepper, increasing investment and encouraging use of quality seed, infrastructure improvement and other supports from local government and line agencies, and improve farmers' capability in production and negotiation with traders. And there is a need to conduct a research on the effectiveness and economic performance of the system over longer span of time that is to examine that is there more economically efficient of CPI more than the mono – systems. It should be carefully studied in the future.

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