



THE REALITY OF THE DEVELOPMENT OF THE AVOCADO AND COFFEE TREES INTERCROP MODEL IN BAO LAM DISTRICT, LAM DONG PROVINCE

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ABSTRACT

According to study about the reality of the development of the avocado and coffee trees intercrop model in Bao Lam district, Lam Dong province, we propose some solutions to develop the intercropping avocado with coffee firmly in this region. The results show that the area of intercrop avocado with coffee in Bao Lam district tends to increase over the years. This model has positively impacted on the economy, society and environment of the region.

Keywords: Bao Lam district, intercropp, reality, economic, social, environmental effects.

TÓM TẮT

Thực trạng phát triển mô hình trồng xen canh cây bơ với cây cà phê ở huyện Bảo Lâm, tỉnh Lâm Đồng

Với việc nghiên cứu thực trạng phát triển mô hình trồng xen canh cây bơ với cây cà phê ở huyện Bảo Lâm, tỉnh Lâm Đồng trên cơ sở đó đề xuất một số giải pháp để phát triển mô hình trồng xen canh cây bơ với cây cà phê trong vùng theo hướng bền vững. Kết quả nghiên cứu cho thấy diện tích đất trồng xen canh cây bơ với cây cà phê tại huyện Bảo Lâm có xu hướng tăng dần qua các năm. Hoạt động của mô hình trên đã tác động tích cực về các mặt kinh tế, xã hội, môi trường trên địa bàn nghiên cứu.

Từ khóa: huyện Bảo Lâm, trồng xen canh, thực trạng, hiệu quả kinh tế, xã hội, môi trường.

1. Set the problem

Along with the advances in agriculture, people in the whole country are aware of and learn more varieties of plants and animals in production. Thanks to intercrop avocado with coffee, many households in Bao Lam district escaped from poverty to become rich. Mr. Nguyen Van Trong, Bao Lam district, is a typical one. He is not only good at planting avocado but also one of the pioneers in seedling the new generation of high yielding and quality avocados. Besides, thank to natural advantages of soil, cool weather all year round avocado in Lam Dong province in general and Bao Lam district in particular grow strongly with high productivity, good quality, fat butter, smooth and sticky. To make the model of intercropping avocado with coffee trees develop sustainably, in fact over 300 ha of avocado have been planted in Bao Lam district, some of which have just planted and most of them have been harvested. They are intercropped in tea and coffee areas, resulting in

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high income. For sustainable development, there should be scientific and technical consultancy from the local departments, agriculture and rural development department and people who work in scientific research.

2. Research methods

Collect available data from relevant agencies such as the Department of Natural Resources and Environment, Agriculture and Rural Development, Agriculture of Bao Lam district. Conduct random sampling of 100 households in Loc Thang town, Loc Thanh, Loc Quang, Loc Duc, Loc Phu, Loc Lam, Loc Bac commune to collect information related to the development of the intercropping model of avocado and coffee in the areas of perennial industrial trees in the region, main crops, costs, profits, markets of products, people's perceptions about developing this model, the factors have influence on the production of the households. To assess the economic efficiency of the models, researcher based on a number of indicators such as revenue, cost and profitability. In detail interviews with officers in wards and communes, farmers who directly worked in the intercropping model, it showed the development as well as the future direction of this model. From above we can make suitable recommendations, assessments and proposals for the objectives of the research.

3. Research results and discussion

3.1. Features of natural conditions and the use of intercropping models of fruit trees with long-term industrial crops in Bao Lam district, Lam Dong province

With an area of 146,342.89ha, Bao Lam is one of the largest districts in the province (19% of Lam Dong's natural area). Bao Lam borders three sides of Bao Loc city: North, East and West. Therefore, the perimeter of Bao Lam is very long. Bao Lam also borders with other provinces like Dak Nong to the north, Binh Thuan to the south, Di Linh district to the east, to the west with Bao Loc city, Cat Tien, Da Te and Da Huoi. In this position, Bao Lam has good conditions for exchanging with regions in and outside the province. The topography of Bao Lam is relatively flat. The average altitude is 900m. Although there are not many high mountains, this area is the source of many large streams and the source of La Nga River. Annual rainfall in the district is very large, average 2000 - 2500mm. Abundant water reserves (8-10 billion m³ / year), this is suitable for living, agriculture and industry even in the dry season. In dry season, due to high humidity and having rain almost every month, therefore, the crops, especially the long-term industrial crops grow well with high yield. In the process of diversifying the country's agriculture, the productivity and yield of industrial crops have increased considerably in recent years, especially in perennial industrial crops in the midland, mountainous and highland areas including Bao Lam district. With above situation, there are guidelines and policies of the Party and the State, Bao Lam Committee develop a large perennial industrial crops with 58,159.43ha (39.74% of the total natural area of the district). From such a large area, farmers feel secure in agricultural production and stabilize living condition.

Specifically, according to Table 1. Planning of perennial industrial trees area in Bao Lam district, Lam Dong province in 2016. Bao Lam consists of 13 communes and a town. Area of perennial crops compared with Agriculture area (according to administrative units) is that perennial land of Loc An , Loc Duc , Tan Lac , Loc Ngai Commune accounts for over 90%. Loc An 99.85%, Loc Duc 99.18%, Tan Lac 98.84%, Loc Ngai 91.6%, These communes have high rate due to appropriate terrain, long-term territorial settlement, large populations. In addition, people have technical skills in farming, convenient transportation and policies encouraging the development of perennial industrial crops of local government. In Loc Bac and Loc Lam Commune, land area for perennial crops is the lowest 14.2% and 6.5% because their main areas are forest, transportation is not convenient, Policies of protecting forest.

Table 1. Planning of area for perennial industrial tree planting in Bao Lam district, Lam Dong province in 2016

TT	Chi tiêu sử dụng đất (Land use criteria)	Tổng diện tích (Total area)	Diện tích phân theo đơn vị hành chính (Area by administrative unit)													
			Thị trấn Loc Thắng (Loc Thang town)	Xã Loc Bao (Loc Bao commune)	Xã Loc Bắc (Loc Bac commune)	Xã Loc Lâm (Loc Lam commune)	Xã Loc Phú (Loc phu commune)	Xã Loc Quảng (Loc Quang commune)	Xã Loc Ngai (Loc ngai commune)	Xã Loc Đức (Loc Duc commune)	Xã Loc Tân (Loc Tan commune)	Xã Loc An (Loc An commune)	Xã Loc Thành (Loc Thanh commune)	Xã Loc Nam (Loc Nam commune)	Xã B' l' i (B'la commune)	Xã Tân Lạc (Tan Lac commune)
	Tổng diện tích tự nhiên (Total natural area)	146.342,89	8.026,88	24.639,03	26.504,19	13.543,09	12.565,74	2.827,70	9.848,94	3.849,01	13.705,35	4.848,90	8.184,65	7.006,90	8.078,52	2.713,99
1	Đất nông nghiệp (Agricultural land)	137.055,62	6.626,38	23.832,08	25.596,31	12.469,87	11.665,68	2.656,30	8.654,52	3.557,94	12.955,64	4.467,35	7.645,06	6.513,53	7.876,95	2.538,01
1.1	Đất trồng lúa (Land for growing rice)	5,20		1,41	3,79											
	Trong đó: Đất chuyên trồng lúa nước (Of which: Land specializing in wet rice cultivation)	3,79			3,79											
1.2	Đất trồng cây hằng năm khác (Other perennial crops)	222,22	13,05		2,42	2,61	15,11		87,61	1,78	19,61	0,41	50,61	11,63	3,47	13,91
1.3	Đất trồng cây lâu năm (Land for perennial crops)	58.159,43	5.490,04	3.340,32	3.623,89	813,68	4.646,46	2.514,74	7.928,12	3.529,04	5.262,76	4.460,99	6.167,66	5.443,36	2.429,66	2.508,71
1.4	Đất nuôi trồng thủy sản (Aquaculture land)	185,06	20,94	4,46	0,70	0,29		22,02	48,91	27,12	5,02	5,95	19,72	5,39	9,15	15,39
1.5	Đất nông nghiệp khác (Other agricultural land)	28,74				10,60		18,14								
2	Đất phi nông nghiệp (Non-agricultural land)	8.790,39	1.380,17	671,97	788,14	1.030,67	862,27	170,27	1.146,16	291,07	713,41	381,55	526,45	493,37	158,97	175,90
3	Đất chưa sử dụng (Unused land)	496,90	20,33	134,98	119,74	42,55	37,79	1,13	48,26		36,30		13,14		42,60	0,08

"Quote: DIVISION OF LAND AREA IN THE 2016. Attach: Decision No. 798 / QĐ-UBND dated 12 April 2016 of Lam Dong People's Committee"

3.2. The development of model of intercropping avocado with coffee trees in Bao Lam district, Lam Dong province.

3.2.1. Reality of using land in Bao Lam district, Lam Dong province

Table 2. Reality of using land in Bao Lam District, Lam Dong Province in 2016

Targets	Area (ha)	Structure (%)
Total of natural area	146.342,89	100,00
Area of agricultural cultivation in the whole district	137.055,62	93,65
Area of perennial industrial crops	58.159,43	39,74
Tea	13.187,50	9,00
Coffee	26.692,20	18,20
Mulberry	200,00	0,13
Fruit	800,00	0,45
Non-agricultural land	8.790,39	6,00
Unused land	496,90	0,40

"Quote: DIVISION OF LAND AREA IN THE 2016. Attach: Decision No. 798 / QD-UBND dated 12 April 2016 of Lam Dong People's Committee"

The area that can be used in agricultural production is high. It covers 137,055.62ha (93.65%), and now 58,159.43 ha have been planted perennial plants (39.74%). Specifically, the area of major perennial crops of Bao Lam is as follows:

The tea plantation area is 13,187.5ha (9.0%), over 12,457.3 ha have harvested. Bao Lam is the largest tea material in the province with annual output of tea buds reached over 98,500 tons. People in the district are actively applying new technical advances in tea cultivation, introducing new varieties and using cutting techniques to improve productivity and product quality.

Area of coffee covers about 26.692,2 ha (18.2%), harvested area is 25,395.2ha. At present, they are implementing grafting low-quality coffee gardens with the first generation to improve productivity.

Due to the silkworm mulberry sector is in difficulty, the area of mulberry is 781 ha (0.13%). There are only about 200ha at present.

The district also planted over 800ha of fruit trees accounted for 0.45%, mainly intercropped in coffee and tea gardens. Most of them are durian, avocado, mangosteen, and jackfruit and they give large profit.

3.2.2. Applying the model of intercropping avocado with coffee in Bao Lam district, Lam Dong province.

In order to improve the economic value of households through local agricultural commodities, which are the strengths of the region, some farmers in the region have applied the model of intercropping avocado with coffee and initially achieved high economic efficiency. With over 800ha (0.45% of the total natural area of the region), mainly intercropped in coffee and tea gardens. According to information provided by the People's Committee of Bao Lam, the area of fruit trees intercropped with the long-term industrial crops of the district is as follows:

Avocado intercropped with coffee: 327.6 ha, mainly grown in Loc Thang and Loc Duc commune.

Durian intercropped with coffee: 434.1 ha, planted mainly in Loc Ngai and Loc Phu commune.

Mangovesteen planted with coffee: 159.9 ha, planted mainly in Loc Bac and Loc Phu commune.

Jackfruit intercropping with coffee: 56.3 ha, planted mainly in Loc Tan, Loc Quang commune.

At present, the area of intercropping with fruit trees, especially avocado and coffee is larger and larger with average annual rate is over 100 ha.

Table 3. Area of some models of intercropping of fruit trees with coffee trees in Bao Lam district, Lam Dong province in 2016

TT	Type	Area (ha)
1	Avocado intercropped with coffee	327,6
2	Durian intercropped with coffee	434,1
3	Mangovesteen intercropped with coffee	159,9
4	Jackfruit planted with coffee	56,3

(Source: People's Committee of Bao Lam district, Lam Dong province)

3.2.3. Economic, social and environmental effects of the model of intercropping avocado with coffee in Bao Lam district, Lam Dong province.

Based on the price survey of some agricultural products in the area and the survey through interviews with the households, we can show the economic efficiency of some models of intercropping fruit trees with coffee in Bao Lam district, Lam Dong province.

Table 4. Prices of some agricultural products in Bao Lam district, Lam Dong province in 2016

TT	Product	Price of agricultural products on the market (VND/kg)
1	Coffee (dry)	35.000 - 43.000
2	Fresh tea	8.000 - 12.000
3	Butter (fresh)	45.000 – 65.000
4	Mangosteen (fresh)	30.000 – 55.000
5	Jackfruit	23.000 - 35.000
6	Durian (fresh)	10.000 - 30.000

(Source: Bao Lam district market report, Lam Dong province)

Table 5. Economic efficiency of some models of intercropping fruit trees with coffee in Bao Lam district, Lam Dong province in 2016

Unit: thousand VND per household

Type (intercropped crops)	Revenue (sao/year)	Cost	Profit	The level of profitability
Avocado intercropped with coffee	195.661.000 /sao/year	30.361.000 /sao/year	165.300.000 /sao/year	High
Durian intercropped with coffee	92.180.000 /sao/year	31.132.000 /sao/year	61.048.000 /sao/year	Medium
Mangovesteen intercropped with coffee	96.742.000 /sao/year	30.771.000 /sao/year	65.971.000 /sao/year	Medium
Jackfruit planted with coffee	65.820.000 /sao/year	29.863.000 /sao/year	35.957.000 /sao/year	Low

(Source: Statistical interview with 100 households in Bao Lam commune, Lam Dong province)

Note: 1 sao equals 1.000m²



Picture 1. Intercropped avocado with coffee, Mr. Tran Ma Vien, group 19, Loc Thang town, Bao Lam district, Lam Dong province



Picture 2. Durian trees intercropped with coffee, Mr. Tran Ma Vien, group 19, Loc Thang town, Bao Lam district, Lam Dong province



Picture 3. *Mangosteen intercropped with coffee, Mr. Nguyen Van Thanh Village 10, Loc Ngai Commune, Bao Lam District, Lam Dong Province*

According to the results of Table 5 and the random sampling survey of 100 households in the area, it was found that if 1,000m² coffee garden are under good cultivation and with high-yield variety, this will produce a stable yield from 800kg to 1,100kg. The market price in 2016 was from 39,000 to 44,000/ kg, it brings profit more than 40 million dong/ 1,000m², excluding labour and fertilizer. The applications of intercropping with fruit trees with coffee such as avocado, durian, mangosteens bring high economic efficiency, but avocado produces the highest and the most stable due to the high market demand, high quality, less labour. Avocado tree is very suitable for the soil here.

The model of intercropping durian and mangosteen with coffee has higher profit than that of the monoculture of coffee trees. However, in stable level of profitability, it is valued average because the soil in some parts of the district is unsuitable; the durian's branches die as it is harvested. In 1,000 m², there are about 6 to 7 durian or mangosteen trees while we can plant 20 to 25 avocado trees. Moreover, mangosteen is usually rotten, bleeding, fruit worm, this results in lower quality and costs.

The model of intercropping of jackfruit trees with coffee is economically low due to the ecological characteristics of jackfruit trees are strong, so that when we intercrop with coffee trees they will absorb all nutrients of coffee. Besides, its leaf canopy is large that causes lack of light for coffee, soil becomes poor. Jackfruit is mainly grown as fence to cover or prevent wind for coffee.

Table 6. Socio-environmental effects of the avocado tree planted with coffee in Bao Lam district, Lam Dong province (n = 100)

Target	(%) Number of households agree
1. Society	
- Having stable living condition due to more works and income	100
- Increasing socialization	88
- Using free time of students and the old suitably	70
- Improving health, psychological stabilization as stable market.	100
- Opening knowledge, skills of agricultural production.	99
- Having more kinds of intercropping in farming, relax to improve physical and mental health.	90
2. Environment	
- Bettering soil, ground water.	100
- Making air fresher, creatures can develop	97

(Source: Statistical interview with 100 households in the communes of Bao Lam district, Lam Dong province)

With the economic value of the models intercropping fruit trees with coffee, especially with avocado, most households in Bao Lam district have not had the right investment. The scale is still small and spontaneous, production purposes of some households are mainly for economic development. People mainly learn from people who have experience in intercropping or follow to information on social networks, television. Farming techniques such as ways of caring and grafting are still confused, inadequate when apply. The information from extension agencies or training courses is limited.

4. Conclusion

The model of intercropping avocado trees with coffee has been expanded in size with area in Bao Lam. The area has good conditions for development. With favorable natural conditions like appropriate climate; cultivation area for perennial industrial crops is large, people have experience in agricultural cultivation, hard-working, creative. Therefore, that has brought economic, social and environmental effects. In order to bring about high economic, social and environmental effects from above intercrop in Bao Lam, Lam Dong province must have some following measures:

- Evaluating natural and socio-economic conditions in the area to develop intercropping models; re-planning the model of intercropping avocado with coffee for each specific area in the direction of supporting economic development in the same area of cultivation;

- Allocating production zoning to prioritize households who have cultivated long-term industrial crops and who wish to renovate their coffee gardens;
- Organizing and encouraging people to participate in training courses on crop cultivation techniques, crop care according to VietGap and GlobalGap standards, application of technologies to production;
- Adding the issue of rural agriculture into the socio-economic development orientation of the locality and having short-term and long-term investment programs to support farmers.

❖ **Conflict of Interest:** Author have no conflict of interest to declare.

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