

# INTERCROPPING MODELS FOR SMALLHOLDER COFFEE FARMERS IN TANGGAMUS REGENCY, LAMPUNG PROVINCE

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## INTRODUCTION

### 1.1. Background

Coffee plays an important role in regional economy. In West Lampung regency for instance, coffee is base sector as advancing commodity and having competitiveness with contributing to Growth Regional Domestic Product (GRDP) and absorbing the labor as well as sharing additional local income from processed coffee of about IDR 2,91 trillion annually (Marlina, 2014). Hence, coffee would potentially spur regional economic growth including household income.

Tanggamus regency is the second largest producing area of Robusta coffee in Lampung province, after West Lampung regency. In 2015, the performance of Robusta coffee in this regency is as follows: (1) 43,276 hectares (area); (2) 29,641 tons (production); (3) 817 kilograms per hectare (productivity); and (4) 42,847 households (number of farmers). Some farmers in this regency cultivate coffee through polyculture pattern with timber trees, estate crops such as paper and candlenut, fruits i.e., avocado, orange, and banana (Aminah and Munandar, 2013).

### 1.2. Objectives

The objective of this activity is generally to select the appropriate coffee intercropping model-based intercropping practices implemented in the respected location. The specific objectives are as follows:

1. Formulating the recommendation as the result of analysis that clearly states the advantages and disadvantages of the different crop alternatives.
2. Calculating the profitability of the selected crops in intercropped fields.

## II. METHODOLOGY

### 2.1. Method

The interview was carried out to gather primary data related to: (1) agronomic and environmental aspects (production as well as soil and water conservations); and (2) socioeconomic aspects (farm cost, income, and profitability). Farm cost particularly consists of seed, fertilizer, pesticide, labor, and equipment. Meanwhile, income and profitability are related to the existing yield and price in the area.

The collected primary and secondary data were analyzed descriptively. It covers agronomic and environmental as well as socioeconomic aspects. The analysis is as follows:

- 1) Identifying characteristics of crop type, cropping pattern, and management practices.
- 2) Implementing partial economic analysis namely profitability analysis (Gittinger, 1982) through simply financial gained particularly the difference between the amounts earned and spent in purchasing, operating, or producing coffee as a main crop and other related intercrops. Spending for inputs consists of seeds, fertilizers, pesticides, labors, machinery rental, value depreciation of equipment and other facilities, taxes, and other relevant expenses. Earning in farming is the value of yields of all crops, which are valued with the prevailing prices of each product. The analysis of the data gathered using the following formulas:

$$TR (R) = PQ \times Q \quad \dots\dots\dots (1)$$

$$TC (C) = FC + VC \quad \dots\dots\dots (2)$$

Where: TR = Total Revenue; PQ = Price of Yield; Q = Quantity of Yield; TC = Total Cost;

FC = Fixed Cost; VC = Variable Cost.

Results from the formula (1) and (2) is utilized to calculate revenue to cost ratio:

$$R/C = PQ \times Q / (FC + VC) \dots\dots\dots (3)$$

Based on the formulas (1) and (2) the profit is determined using the following formula:

$$\text{Profit} = TR - TC \dots\dots\dots (4)$$

Overall, the ratio between benefit and cost (B/C ratio) is calculated in line with monetary terms relative to its costs expressed in discounted present values.

- 3) Employing some assumptions. **First**, an intercropping farm consists of coffee as a main crop as well as pepper, avocado, banana, and chili as selected intercrops. **Second**, coffee, pepper, avocado, and banana are analyzed within a 20-year productive period. **Third**, cultivation technique entails planting space, fertilizing, pest and disease control, pruning, and other related production unit activities. **Fourth**, number of yields is assumed as follows:
  - a. Coffee is harvested in the third year after planting and the number of yields increases by 30 percent up to the age of 20 years and it decreases subsequently.
  - b. Pepper is harvested in the second year after planting and the number of yields increases by 30 percent up to the age of 20 years and it would decrease subsequently.
  - c. Avocado is harvested in the fourth year after planting and remains it up to the age of 20 years.
  - d. Bananas are harvested in the second year after planting and remain it up to the age of 20 years.
  - e. Chili is harvested at two-month after planting in which it can be frequently harvested twice a week up to the age of 120 days.
  - f. Input and output prices are constant and valid at the time of data analysis (2018). There is no difference in daily labor wages between men and women for all farm activity units.

### III. FINDINGS

#### 3.2. Calculation of Intercropped Farm Profitability

The intercropped farm profitability is calculated based on crops exists in intercropped coffee farm, namely: (1) coffee as a main crop; (2) pepper and chili as intercropped plants; (3) avocado and banana as border plants; and (4) *lamtoroas* shading plant (tree pillar for pepper plant). It encompasses each crop and cumulative crops-based intercropped calculation toward farm input-output analysis.

##### 3.2.1. Coffee

The profitability of the main coffee crop is calculated within 12 years production period, namely from the first year up to the twelfth year. It would be harvested in the third year with negative profit. The positive profit would be started at the third harvesting period annually and the seventh harvesting period cumulatively. Both profits tend to increase within consecutive harvesting periods. The highest annual profitability would be obtained at the eleventh harvesting period, while the largest cumulative profitability would be gained at twelfth harvesting period.

It is calculated that the profitability of coffee at 10-12 year after planting is about IDR 18,300 per plant per year, on average. Cumulatively, the average profitability is almost four-times that of annual profitability.

##### 3.2.2. Pepper

Pepper can be harvested at three-year after planting with minor production and negative profit. The annual and cumulative profit would be started at the fourth and the sixth harvesting period, respectively (Table 6). As intercropped plants, the cumulative profitability of pepper is about 50.35

percent of cumulative profitability of coffee. The average profitability of pepper at 10-12 year after planting is IDR 29,510 per plant per year.

### **3.2.3. Chili**

The profitability of intercropped chili is calculated in one year basis comprising production unit activity from land preparation up to harvest. This intercropped plant can be harvested 10 times within one year planting period. Table 7 summarizes that the profitability of intercropped chili is quite minor, because its number (910 plants/0.5 ha) is much lower than that of monoculture chili (9,000 plants/0.5 ha). It derives from calculations of input cost (pre-harvest and harvest) and output (yield) value. The extent of cumulative profitability is about 43.30 percent of output value.

### **3.2.4. Avocado**

The summary and detail profitability of avocado border plant is shown in Table 8. Avocado can be categorized as a promising plant with high profitability. This border plant is initially harvested three years after planting with annual profitability of about IDR 7,074,500 per 0.5 hectare. The highest profitability is at the tenth-year harvest, namely IDR 16,654,500 per 0.5 hectare. The average profitability at the third year and the tenth-year harvests is about IDR 147,385 per plant per year and IDR 346,968 per plant per year, respectively.

### **3.2.5. Banana**

Even though bananas are commonly planted in coffee farms, the profitability of this border plant is quite low. The annual profitability of banana at the first and the twelfth harvests is respectively about IDR 1,077,000 per 0.5 hectare per year and IDR 1,517,000 per 0.5 hectare per year (Table 9). Nevertheless, the annual profitability of this border plant is IDR 22,437 per clump per year (first year harvest) and IDR 31,604 per clump per year (twelfth harvest).

### **3.2.6. *Lamtoro***

*Lamtoro* is not only used for shading plant of coffee but also utilized as tree pillar for pepper. Therefore, this crop must be maintained to keep growing coffee and pepper optimally productive. The annual cost for this shading plant is initially high in the first-year planting period. It mostly covers land preparation, planting, fertilizing, replanting, weeding, pruning, and controlling pests and disease. Subsequently, the annual cost from the second year up to the twelfth-year planting periods tends to decrease. It is because the cost simply includes weeding and pruning with minor fertilizing as well as controlling pests and disease.

Overall, the ratio between benefit and cost (B/C ratio) is calculated in line with monetary terms relative to its costs expressed in discounted present values. Table 11 summarized that the ratio between benefit and cost of intercropped coffee-pepper-chili with avocado border plant and *lamtoro* shading plant (B/C=2.27) is aggregately higher than that of intercropped coffee-pepper-chili with banana avocado border plant and *lamtoro* shading plant (B/C=1.38). The average benefit of coffee with avocado border plant is IDR 5,721,630 per year (IDR 476,802/month). Meanwhile, the average benefit of coffee with banana border plant is IDR 2,028,319 per year (IDR 169,027 /month). This indicates that avocado border plants are much more profitable than banana border plants in intercropping coffee farms.