Integrated farming system of Arabica coffee in Karo District, North Sumatera

S N Lubis*, D A N Hida and L Fauzia

Department of Agricultural Social Economic and Agribusiness, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia.

E-mail: *satianegara06@gmail.com

Abstract. The development of Arabica coffee through the Integrated Farming System in Karo District is relatively potential. The supportive topography and the habits of farmers in this region to plant coffee become the main reasons for integrating coffee farming with goat farming. This study aims to analyse the contribution of goat farming to household income in the integrated farming system of Arabica coffee and goat farming in Karo District. It used a quantitative analysis method. The result showed that goat farming has a relatively higher contribution to household income by 50.23%. It indicates that goat farming provides a great contribution to the farmer’s income.

1. Introduction

Coffee is a plantation commodity which ranks the fourth largest foreign exchange contribution after palm oil, rubber, and cocoa. The average export volume of Indonesian coffee is approximately 350 thousand tons per year consisting of Robusta coffee (85%) and Arabica coffee (15%). This country has exported the coffee to more than 50 countries in which its main targets are the USA, Japan, Germany, Italy, and the UK [1].

Karo District has been cultivating Arabica coffee for years as it is rich in natural resources and has supportive topography. PT Sumatra Specialty Coffee (PT SSC) has a quite large business scale in this district and it has a social program to improve the welfare of Arabica coffee farmers around the company through promoting a partnership of integrated farming systems by integrating the coffee farming and goat farming.

PT Sumatra Specialty Coffee (PT SSC) provides socialization and guidance to Arabica coffee farmers in this region to implement an integrated farming system of Arabica coffee farming and goat farming. It aims to increase the welfare and economic condition of the household of the coffee farmers in the surrounding company.

Integrated Farming System is the integration of all agricultural components into one agricultural system. This system promotes an economic improvement based on environmentally-friendly technology and the optimization of all energy sources produced. The crop-livestock integration system (SITT) in the agricultural business is a comprehensive agricultural science and engineering. Basically, the integration system follows the principles of integrated farming science. Agricultural science is a biological production process that utilizes limited natural resources, human resources, capital, and management [2].
[3] stated that based on the results of previous studies, the development of goats or sheep using an integrated system on plantation areas (oil palm, coffee, cocoa, and coconut) has high potential. The cover crop on the plantation areas can be utilized to feed the livestock without disturbing the main crop.

The integration of Arabica coffee farming and goat farming is a feasible effort for the local farmers in this district. Even, the issue of land degradation can be solved by the presence of livestock which regularly produces organic fertilizers, both solid and liquid. The use of goat manure as fertilizer for Arabica coffee plants is highly recommended and profitable as it increases land productivity and agricultural production. The use of manure for fertilizer needs to be re-promoted. Therefore, agricultural development programs that integrate livestock and plants (crop-livestock) has to be intensified.

However, coffee trees require shade plants that play an important role in a sustainable coffee production system [4]. The shade plants control the microclimate to optimally grow the coffee trees. The presence of shade plants affects the light intensity received by the coffee trees. Besides requiring loose soil and nutrient, coffee trees also require slightly Acid soil with pH 5-6.5 for Arabica coffee and pH 4.5-6.5 for Robusta coffee. If the pH does not the requirement, the coffee trees will still grow but unable to absorb more nutrients so the farmer needs to apply limestone to the trees. On the other hand, coffee trees are not suitable in alkaline soil (pH > 6.5), thus the application of limestone should consider the appropriate amount.

The integrated farming system of Arabica coffee, Lamtoro, goat farming, and bees has been implemented by Starbucks Farmer Support Centre (FSC). FSC is a division of the Starbucks Company that has launched its C.A.F.E. Program (Coffee and Farmer Equity). This program promotes coffee and farmer equity and provides farmers free access to the latest findings of Starbucks agronomists including new disease-resistant coffee varieties and advanced soil management techniques. Further, this program works directly with the farmers in the field and supports cooperatives and suppliers. Starbucks has opened its first “Farmer Support Centre” in San José, Costa Rica in 2004 and it currently operates nine farmer support centres and one satellite agronomy office in coffee-producing countries around the world [5].

In implementing an integrated farming system through the group, short-term costs refer to fixed costs and variable costs. Fixed costs (FC) are costs that are relatively fixed amount of cost need to be incurred regardless of the total amount of production. Variable costs (VC) are costs influenced by the size of the produced products, for example, costs for labour [6]. Meanwhile, in this case, farmers' income is the difference between revenue and production costs.

This research aims to analyse the integrated farming system of Arabica coffee farming and goat farming, analyse the household income from the integrated farming system of Arabica coffee farming business and goat farming, and analyse the contribution of goat farming business to the household income of Arabica coffee farmers in Karo District.

2. Materials and methods
The research was conducted in Karo District, North Sumatra. The selection of the research location was done purposively with several considerations. First, Karo District is one of the largest Arabica coffee producers in North Sumatra. Second, Karo District is one of the districts that have implemented an Integrated Farming System of Arabica coffee.

The sample was selected using the snowball sampling technique in which the sample was obtained by selecting one respondent and then asked the respondent to appoint another respondent and so on.

This research used both primary and secondary data. The primary data were obtained through interviews, observations, and discussions with farmers who implemented the integrated farming system of Arabica coffee farming and goat farming in Karo District. The data were collected using a questionnaire. The secondary data were obtained from related agencies, such as the Statistics Indonesia (BPS Karo), the District Agriculture Office, literature, and suitable internet sources.

The collected data were then analysed using the quantitative analysis formula proposed by [7]:

\[ \text{Something} \]
\[ Y = \frac{A_i}{B_i} \times 100\% \]  

Where \( Y \) = Proportion of income/contribution of income; \( A \) = Income of goat farming; \( B \) = Total household income; and \( i = 1, 2, 3, \ldots, n \).

3. Results and discussion

The household income obtained from the integration of coffee farming and goat farming is presented in Table 1 and Table 2 below.

| Sample No. | Land Size (Ha) | Production (Kg) | Sales price (IDR) | Revenue (IDR) | Costs (IDR) | Income (IDR) |
|------------|---------------|----------------|------------------|--------------|-------------|--------------|
| 1          | 0.6           | 720            | 28,000           | 20,160,000   | 5,371,600   | 14,788,400   |
| 2          | 0.4           | 400            | 27,000           | 10,800,000   | 4,643,600   | 6,156,400    |
| 3          | 1             | 1,000          | 36,000           | 36,000,000   | 7,093,000   | 28,907,000   |
| 4          | 0.5           | 600            | 29,000           | 17,400,000   | 5,224,600   | 12,175,400   |
| 5          | 2             | 3,000          | 28,000           | 84,000,000   | 57,856,200  | 26,143,800   |
| 6          | 0.4           | 320            | 28,000           | 8,960,000    | 3,563,600   | 5,396,400    |
| 7          | 0.5           | 550            | 28,000           | 15,400,000   | 4,870,600   | 10,529,400   |
| 8          | 1             | 800            | 27,000           | 21,600,000   | 8,650,500   | 12,949,500   |
| 9          | 0.8           | 1,200          | 27,000           | 32,400,000   | 8,875,000   | 23,525,000   |
| 10         | 0.4           | 500            | 29,000           | 14,500,000   | 4,615,600   | 9,884,400    |
| 11         | 1             | 800            | 30,000           | 24,000,000   | 8,322,500   | 15,677,500   |
| 12         | 0.5           | 600            | 28,000           | 16,800,000   | 5,356,600   | 11,443,400   |
| 13         | 0.4           | 600            | 28,000           | 16,800,000   | 5,006,100   | 11,793,900   |
| 14         | 0.4           | 600            | 28,000           | 16,800,000   | 4,218,600   | 12,581,400   |
| 15         | 0.5           | 750            | 27,000           | 20,250,000   | 5,325,600   | 14,924,400   |
| 16         | 1             | 1,000          | 28,000           | 28,000,000   | 8,209,000   | 19,791,000   |
| 17         | 0.5           | 450            | 28,000           | 12,600,000   | 4,323,600   | 8,276,400    |
| 18         | 1             | 800            | 28,000           | 22,400,000   | 8,737,500   | 13,662,500   |
| 19         | 0.5           | 450            | 28,000           | 12,600,000   | 4,796,100   | 7,803,900    |
| 20         | 0.4           | 400            | 28,000           | 11,200,000   | 3,998,600   | 7,201,400    |

**TOTAL**

15,540 27,379 442,670,000 169,058,500 273,611,500

**AVERAGE VALUE PER FARMER**

777 27,301 22,133,500 8,452,925 13,680,575

**AVERAGE VALUE PER HA**

1,126.09 1,983.98 32,077,536.23 12,250,615.94 19,826,920.29

Source: Results of research 2020.

Table 1 show that average production of 1,126 kg per hectare, farmer profits IDR 19,826,920. Based on these results of revenue. So, the Arabica coffee farming in Karo district is very profitable.

The total household income of farmers who implement the integrated farming system of Arabica coffee and goat farming is the sum of the income from the Arabica coffee farming and the income from the goat farming business.
Table 2. Income of integrated farming system of goat farming in Karo District, 2020.

| Sample No. | Number of goat (goats) | Additional value (IDR) | Sales (IDR) | Total revenue (IDR) | Total cost (IDR) | Income (IDR) |
|------------|------------------------|------------------------|-------------|---------------------|----------------|--------------|
| 1          | 17                     | 4,200,000              | 12,000,000  | 16,200,000          | 2,120,667       | 14,079,333   |
| 2          | 12                     | 4,800,000              | 10,000,000  | 14,800,000          | 1,942,781       | 12,857,219   |
| 3          | 7                      | 1,800,000              | 6,000,000   | 7,800,000           | 1,034,000       | 6,766,000    |
| 4          | 20                     | 6,400,000              | 15,000,000  | 21,400,000          | 3,671,667       | 17,728,333   |
| 5          | 64                     | 19,600,000             | 104,000,000 | 123,600,000        | 39,961,400      | 83,638,600   |
| 6          | 8                      | 1,800,000              | 6,000,000   | 7,800,000           | 1,046,167       | 6,753,833    |
| 7          | 10                     | 2,400,000              | 8,000,000   | 10,400,000          | 1,117,867       | 9,282,133    |
| 8          | 6                      | 1,200,000              | 4,000,000   | 5,200,000           | 1,039,200       | 4,160,800    |
| 9          | 8                      | 2,400,000              | 6,000,000   | 8,400,000           | 1,033,000       | 7,367,000    |
| 10         | 11                     | 3,400,000              | 9,000,000   | 12,400,000          | 1,123,333       | 11,276,667   |
| 11         | 15                     | 3,600,000              | 13,000,000  | 16,600,000          | 1,360,333       | 15,239,667   |
| 12         | 10                     | 2,400,000              | 8,000,000   | 10,400,000          | 1,054,857       | 9,345,143    |
| 13         | 16                     | 4,800,000              | 13,200,000  | 18,000,000          | 1,210,190       | 16,789,810   |
| 14         | 8                      | 2,400,000              | 6,000,000   | 8,400,000           | 1,064,200       | 7,335,800    |
| 15         | 12                     | 3,600,000              | 10,000,000  | 13,600,000          | 1,080,190       | 12,519,810   |
| 16         | 10                     | 4,200,000              | 7,000,000   | 11,200,000          | 1,080,000       | 10,120,000   |
| 17         | 7                      | 1,800,000              | 5,000,000   | 6,800,000           | 1,099,000       | 5,701,000    |
| 18         | 8                      | 1,200,000              | 6,000,000   | 7,200,000           | 1,094,750       | 6,105,250    |
| 19         | 5                      | 1,200,000              | 4,000,000   | 5,200,000           | 1,077,000       | 4,123,000    |
| 20         | 12                     | 3,000,000              | 9,000,000   | 12,000,000          | 1,230,333       | 10,769,667   |

TOTAL 76,200,000 261,200,000 337,400,000 55,296,000 276,159,064

AVERAGE VALUE PER FARMER 7,257,143 13,060,000 16,870,000 276,159,064

AVERAGE VALUE PER GOAT 1,284,211 207,880 1,038,192

Source: Results of research 2020.

Table 3. Contribution of goat farming business income to household income of Arabica coffee farmers in Karo District, 2020.

| No. | Description | Total (IDR/year) | Contribution (%) |
|-----|-------------|------------------|-----------------|
| 1   | Income of Arabica coffee farming business | 13,680,575 | 49.77 |
| 2   | Income of goat farming business | 13,807,953 | 50.23 |
|     | Total of household income | 27,488,528 | 100 |

Source: Results of research 2020.

The average contribution of goat farming business income to household income in 20 samples reached 50.23%, and the average contribution of the Arabica coffee farming business was 49.77%. The contribution of goat farming business income to household income is higher than 50% meaning that the goat farming business income provides a major contribution to the household income of coffee farmers. Besides helping in providing natural fertilizer for Arabica coffee trees, the goat farming business also provides a relatively high contribution to the household income of the coffee farmers.
4. Conclusions
The integrated farming system of Arabica coffee and goat farming in Karo District is feasible to implement. The partnership between the breeders and Starbucks Farmer Support Centre (FSC) is essential to stimulate coffee farmers to continue developing the integrated farming system. The goat farming business income contributes 50.23% or higher than 50% to household income meaning that goat farming business makes a large contribution to the household income of the coffee farmers.

References
[1] AEKI (Asosiasi Eksportir Kopi Indonesia [Indonesian Coffee Exporters Association]) 2019 Ekspor Kopi [Coffee Exports] Available from: http://www.aeki-aice.org/coffee_export_regulations.html
[2] Kusnadi U 2008 Inovasi Teknologi Peternakan dalam Sistem Integrasi Tanaman-Ternak untuk Menunjang Swasembada Daging Sapi [Innovation in Livestock Technology for Animal Plant Integration System Supporting Beef Self-Supply] Pengembangan Inovasi Pertanian 13 p 193
[3] Kusumastuti T A and Sembiring S 2016 Sistem Pertanian Terpadu: Pengukuran Potensi Sumber Daya dan Ekonomi Pada Ruminansia Kecil [Integrated Agricultural System: Measurement of Resource and Economic Potentials in Small Ruminants] (Yogyakarta, Indonesia: Gadjah Mada University Press)
[4] Soedradjad R and Usmadi 2013 Peranan Tanaman Penaung dalam Memasok Nutrien Makro Sistem Agroforestry Berbasis Tanaman Kopi [The role of Shade Plant in Supplying Macro Nutrients to Coffee Plantation] Agritrop 11 2 pp 166-70
[5] Prihandono I and Relig F H 2019 International Certification as a Mechanism for Protecting the Human Rights of Indonesian Coffee Farmers Environ Policy Law 49 1 pp 49-54
[6] Dillon J L, Hardaker J B, Soekartawi and Soeharjo A 2011 Ilmu Usahatani dan Penelitian untuk Pengembangan Petani Kecil [Farming Science and Research for Smallholder Development] (Jakarta, Indonesia: Universitas Indonesia)
[7] Tan T C 1977 Soysauce Fermentation, Microbiology and Technical Development (Singapore: Singapore Institute of Standard Industrial Research)

Acknowledgements
The research was funded by Universitas Sumatera Utara through the Non PNBP Fund Fiscal Year 2020 based on the Implementation Contract Research Fiscal year 2020 between the Rector and the chairman of Universitas Sumatera Utara Research Institute Number: 450/UN5.2.3.1/PPM/SPP-TALENTA USU/2020 date April 22nd 2020.