

Contribution of coffee farming and goat livestock based integration in Karo regency, north Sumatra province

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Abstract. This research evaluated the contribution of coffee farming and goat farming to farm income. It was conducted in Karo Regency, North Sumatra Province, where the Starbucks Farmer Support Center (SFSC) supported the area, which empowered farmers to develop an integrated farming system for coffee and goat farming. The sample size was determined using the census method, a sampling technique based on the Population size. The data analysis was performed descriptively, analyzing the income from coffee farming and goat farming and the contributions of each business to farmer income. The results indicated that the average income from coffee farming after integration was Rp 14,262,639.20, while goat farming generated an income of Rp 4,063,601.19. The efficiency of coffee farming was reflected in the R/C value of 4.92, compared to goat farming, which had an R/C value of 1.72. Coffee farming contributed 77.83% to farm income, whereas goat farming contributed 22.17%. Based on these findings, it was recommended that farmers increase the number of goats they raised to enhance both income and efficiency.

1. Introduction

Karo Regency is one of the areas in North Sumatra that produces Arabica coffee. Nevertheless, there are several problems currently faced by people's coffee plantations in Karo Regency, namely, decreasing land area and coffee production. Karo Regency experienced a decrease in coffee land area of 5.5% in 2020, and production decreased by 44.9%. Furthermore, there was a decrease in the land area in 2021 of 2.05%. The decline in coffee productivity in this area also occurred in 2019 by 4.71% and in 2020 by 41.71%. The decrease in production shows the need to increase coffee plant production. One effort that can be made is through the development of integrated farming. The development of land area and coffee plant production in Karo Regency can be seen in Table 1.

Table 1. Development of Land Area and Coffee Production in Karo Regency 2016 - 2022.

Year	Area (ha)	+/- (%)	Production (tons)	+/- (%)	Productivity (tons/ha)	+/- (%)
2016	7,741.00	0.00	7,486.00	0.00	0.97	0.00
2017	8,378.00	8.23	8,777.00	17.25	1.05	8.33
2018	9,180.00	9.57	13,280.00	51.30	1.45	38.09
2019	9,750.00	6.21	13,440.00	1.20	1.38	-4.71
2020	9,210.00	-5.54	7,400.00	-44.94	0.80	-41.71
2021	9,021.00	-2.05	7,411.00	0.15	0.82	2.25
2022	9,171.00	1.66	8,336.19	12.48	0.91	10.64

Another problem experienced by the agricultural sector is the decreasing productivity of land due to soil erosion and loss of nutrients from the soil, increasing costs, and dependence on external inputs [1]. The development of sustainable plantation commodities combined with integrated livestock management is one of the concepts implemented by farmers to increase production by combining agricultural components, namely coffee plants and goats. The crop-livestock integration system is an efficient integrated farming business and has become part of the farming culture of farmers in Indonesia. One way to optimize coffee farming is through prospective innovation, namely the coffee integration model with goat farming. This farming pattern must be continuously developed and fostered properly to increase farmers' income. The integrated farming system can be created by utilizing plant waste as animal feed, animal manure, and non-feed plant waste into compost. The benefits of compost are to improve the soil's physical, chemical, and biological properties, while goat grazing is directed to eat wild plants or weeds [2].

[3] stated that the direct benefits obtained by farmers from integrating plants with livestock are green fodder and plant waste that can be used to increase the need for cattle feed. At the same time, cattle manure can be used as manure to increase plant fertility. The synergy between coffee plants and goats in an integrated farming system can provide organic fertilizer and animal feed opportunities. According to [4], integrating coffee plants with livestock can increase the efficiency of farming and the productivity of coffee plants and farmers' income sustainably per unit of time and land area. Integrated farming aims to minimize input from outside the farm so that it has an impact on increasing farmers' income. In line with [5], integrating goat farming with coffee plantations is a sustainable system that can increase farmers' income. [6] stated that the average income of farmers participating in the integration per planting season was higher than that of non-participating farmers.

[7] stated that the Integrated Farming System (IFS) for crops and livestock is an agricultural system with a close relationship between the crop and livestock components in a farming business in a region. The aim of implementing an integrated farming system is to reduce input costs and to be able to continue sustainably [8]. [9] stated that there are several advantages of an integrated farming system, namely that external input is not needed because of the utilization of waste in a system built using local resources. Integrated farming systems (IWS) have advantages in both ecological and economic aspects, namely being more adaptive to changes in habitat, more stable, environmentally friendly farming, energy efficient, high biodiversity, more diversified business, higher product diversification, healthier products, better sustainability of farming, better and sustainable labour absorption [8]. [10] stated that the integrated agricultural system (IAS) based on local potential will be able to support the sustainability of sustainable agricultural development. [11] stated that an integrated farming system combines all agricultural components in an integrated agricultural business system.

The positive impact of implementing this system is more dominant than the negative impact regarding economic, social, and environmental aspects. The development of sustainable plantation commodities combined with livestock management, with the Coffee Plant Integration with Livestock (goats) program aims to utilize waste generated from coffee farming in the form of pruning shade trees, coffee fruit harvest waste (cherry) can be used as animal feed, through the process of shredding and flouring (greens and concentrate). On the other hand, livestock waste/dung (goats), managed through the collection and separation of solid and liquid waste, can be used as fertilizer for coffee plants. [12] explains that the benefits of crop and livestock integration are increasing business diversification, utilization of livestock manure, increasing the added value of crops or their by-products, and maintaining the sustainability and function of the ecosystem.

[13] said that goat farming has a high economic value with a vast open market share. Goats can be taken not only for their meat but also for milk, skin, and even their manure, which can be used for plant fertilizer [14]. The contribution level to income from goat farming businesses in rural areas still varies, depending on business motivation (maintenance management), the availability of family labor, and the scale of maintenance at the farmer level, especially the number of mothers kept [15]. Based on the description above, it is necessary to analyze income and efficiency in the integrated farming of coffee plants and goats so that the contribution of this

income to the income of the integrated farming business can be known. For this reason, this study aimed to determine the contribution of coffee and goat farming income to farmer income.

2. Method

This research was conducted in Karo Regency, North Sumatra Province, where the area was supported by the Starbucks Farmer Support Center (SFSC), which empowered farmers to carry out integrated coffee and goat farming. The census method was used to determine the sample size, employing a sample selection technique based on the Population. The census method was chosen because the number of respondents supported by Starbucks was limited to 51 families from two sub-districts: Simpang Empat Sub-district and Tiga Panah Sub-district.

The data analysis method was carried out descriptively, analyzing the income from coffee farming and goat farming and then assessing the contribution of each business to the income of integrated farming operations. Coffee farming income was calculated using the formula: $I = TR - TC$, where I represent income (Rp), TR denotes total revenue (Rp), and TC indicates total cost (Rp). The R/C ratio approach assessed coffee farming efficiency, which compared total revenue and costs. The contribution of coffee farming was calculated with the formula: $A = B/C \times 100\%$, where A represents the coffee farming contribution, B denotes coffee farming income, and C indicates total integrated farming income. Starbucks's integration pattern, which was applied to farmers in the research area, was an intensive integration system. The goats were kept in pens without release on coffee farming land. The feed used for the goats was sourced from the coffee plantation area owned by the farmers, and lamtoro plants were intentionally planted to provide shade for the coffee plants.

3. Results and Discussion

3.1 Arabica coffee farming business analysis

Production costs in managing Arabica coffee farming include variable costs and fixed costs. Variable costs include fertilizer and labor costs, while fixed costs are equipment depreciation costs. The advantage of farmers who implement an integrated system of Arabica coffee plants and goats is that they can reduce the cost of purchasing fertilizer by utilizing goat waste to become fertilizer. The production costs of Arabica coffee farming before and after integration can be seen in Table 2.

Table 2. Average Production Costs and Income of Arabica Coffee Farming (Rp/Year)

No	Description	Production Cost After Integration (Rp)	Production Cost Before Integration (Rp)
1	Variable Costs		
	-Cost of Inorganic Fertilizer + Goat Manure	1,189,411	4,950,125
	-Labor costs	1,976,331	1,976,331
2	Fixed Costs		
	-Depreciation Cost	452,950	452,950
	Total Production Cost	3,630,456	7,391,170
3	Coffee price (Rp)	13,000	13,000
	Coffee Production (Kg)	1,407.95	1,407.95
	Receipts (Rp)	17,893,095.24	17,893,095.24
	Income (Rp)	14,262,639.20	10,501,924.92
	Efficiency	4.92	2.42

Based on Table 2, the average annual production cost in integrated coffee farming includes the cost of inorganic fertilizer, labor, and depreciation, which is Rp3,630,456. The total production cost before integration was Rp7,391,170. If the coffee farming business is integrated with goat farming, it will reduce the cost of purchasing manure by Rp3,760,714.

3.2 Arabica coffee farming revenue, income, and efficiency

Based on Table 2, the average income from coffee farming is Rp17,893,095.24. The coffee production produced and sold in the form of cherries is Rp1,407.95 per year, with an average cherry selling price of Rp13,000. Thus, the income obtained after being integrated with goat farming is Rp14,262,639.20. The average income of farmers before integration was Rp10,501,924.92, so there was an increase of Rp3,760,714.29. The efficiency of coffee farming integrated with goat farming is also more significant than before integration. The higher the R/C value, the more efficient a farming business is or the more significant the profit from the farming business. The R/C in farming after integration is 4.92. This means the revenue will be Rp for every Rp1. 4.92 cost. Meanwhile, the R/C in coffee farming before integration is 2.42, which means that for every cost incurred of Rp1, the revenue will be Rp2.42. This shows that coffee and goat farming can benefit farmers because of the use of manure from goat waste.

3.3 Goat farming business analysis

The production costs for the goat farming business consist of the cost of goat kids, feed costs, labor costs, equipment depreciation costs, and drug costs. The average production costs for goat farming can be seen in Table 3.

Table 3. Average Cost of Goat Livestock Production

No	Information	After Integration	Before Integration
1	Feed Cost (Rp)	0.00	501,428.57
2	Labor Cost (Rp)	2,218,571.43	2,218,571.43
3	Cost of Medicines (Rp)	26,940.48	26,940.48
4	Goat Seed Cost (Rp)	2,672,321.43	2,672,321.43
5	Cage Depreciation Cost (Rp)	704,880.95	704,880.95
6	Equipment Depreciation Cost (Rp)	19,636.90	19,636.90
7	Total cost	5,642,351.19	6,143,779.76
8	Selling price of goat/head (Rp)	1,800,000	1,800,000
9	Number of Goats (tails)	5-6	5-6
10	Receipts (Rp)	9,705,952.38	9,705,952.38
11	Income (Rp)	4,063,601.19	3,562,172.62
12	Efficiency	1.72	1.58

Table 3 shows that the average cost of integrated goat farming per year includes feed, medicine, labor, cage, and equipment depreciation costs of Rp5,642,351.19. From these data, it can be seen that if the goat farming business is integrated with coffee, farmers will save feed costs of Rp501,428.57.

3.4 Goat farming business revenue, income, and efficiency

The data in Table 3 shows that the average income from goat farming is Rp9,705,952.38. Farmers have 5-6 goats, with an average selling price of Rp1,800,000 per head. Thus, the income obtained when integrated with coffee farming is Rp4,063,601.19. If integration is not carried out, the income obtained is Rp3,562,172.62, so an increase in income of Rp501,428.57. The efficiency of goat farming is enhanced when integrated with coffee farming compared to operations that do not employ such integration. The R/C in integrated goat farming is 1.72, which means that for every cost incurred of Rp1, the revenue will be Rp1.72. The R/C in goat farming without integration is 1.58, which means that for every cost incurred of Rp1, the revenue will be Rp1.58. This shows that the integration system is an integrated farming business that is quite efficient.

3.5 Contribution of coffee farming and goat farming to farm income

The coffee and goat integration system can increase farmers' income. Table 4 shows the contribution of coffee farming and goats.

Table 4. Contribution of Coffee Farming and Goat Farming Income to Farmer Income (Rp/year)

No	Types of Farming	Income (Rp)	Contribution (%)
1	Coffee	14,262,639.20	77.83%
2	Goat Farming	4,063,601.19	22.17%
	Amount	18,326,240.39	100%

Based on the research results in Table 4, coffee farming contributes 77.83% to farm income, while goat farming contributes 22.17%. According to [16], coffee contributes 82.82% to the farm income of coffee and goat integration, while goat farming contributes 17.18%.

4. Conclusion

The study results showed that the average income of coffee farming after integration was Rp14,262,639.20, while the income from goat farming was Rp4,063,601.19. The efficiency of coffee farming was indicated by an R/C value of 4.92, and goat farming had an R/C value of 1.72. The contribution of coffee farming to farm income in Karo Regency was 77.83%, whereas the contribution of goat farming was 22.17%. Based on the conclusions obtained, it can be suggested that if farmers increased the number of goats raised, it would increase income and efficiency.

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