

# The Comparison of Household Economic Level (M.YAMIN)

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**Submission date:** 04-Mar-2025 10:24AM (UTC+0700)

**Submission ID:** 2603717232

**File name:** The\_Comparison\_of\_Household\_Economic\_Level.pdf (254.9K)

**Word count:** 6571

**Character count:** 37031

# The Comparison of Household Economic Level from Conventional to Organic Rubber Farming farming to support Sustainable Development in Agriculture

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**Abstract.** Organic farming is one alternative method to increase productivity and farmers' income and improve soil ecology. The objectives of this research were to compare the time allocation of rubber farmers, the level of production, and the farmers' income, and also to analyze the changes in the household expenditure of conventional to organic rubber farming. The research was conducted in Musi Banyuasin District, South Sumatra Province. The samples were the farmers who changed the technology from conventional to organic farming. The Samples were selected by simple random sampling. This research shows a significant difference between the use of organic fertilizer and chemical fertilizer in rubber farming regarding time allocation, production level, household income, and expenditure. The level of time allocation revealed that organic farming was longer than conventional farming. The production level and income of organic farming were higher than those of conventional farming. The household expenditure on organic and conventional farming was at the same level.

Keywords: rubber, conventional, organic, livelihood, cultivation.

## 1 Introduction

There are several environmental issues due to the quick spread of rubber plantations in Asian nations. As a result, projects for the ecological restoration of rubber plantations are being implemented by local governments [1]. The conversion of natural forests to rubber plantations and the ongoing growth of these plantations could have various detrimental environmental effects. Rubber monoculture is linked to much lesser biodiversity pollution from pesticides, chemical fertilizers, herbicides and higher greenhouse gas emissions when compared to natural tropical forests. Current planting practices also affect the physicochemical characteristics of soil, including high loss of water, elevated soil erosion, low water infiltration, soil crusting, decreased soil nutrition, and environmental

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deterioration [2]. Deforestation and biodiversity loss are two sustainability issues affecting the development of natural rubber. There are no reliable measurement metrics to evaluate the development of sustainable natural rubber [3]. Therefore, rubber cultivation should be improved by switching to an organic manner [4].

The low level of rubber productivity in Musi Banyuasin, one of the regencies in Indonesia, is caused by conventional farming. Public rubber plantations there is characterized by bad management, including the selection of good seeds, maintenance, postharvest handling, limited lands and capital owned, and lack of human resources [5]. These factors become the reason for the low income of rubber farmers [6]. Rubber farming in Musi Banyuasin is traditionally maintained using chemical fertilizers and pesticides. The capital constraints cause conventional management to be inadequate since the farmers need to cultivate them as directed or with fertilizers [7]. This is the ultimate aspect of the low rubber productivity in this region. In addition, the character of conventional technology is synonymous with using chemicals in farming activities that cause environmental pollution [8]. The high concentration of chemical use destroys the soil structure and the microbes [9]. Agricultural systems-based materials with high input of energy (fossil materials), such as chemical fertilizers and pesticides, can damage the properties of the soil and ultimately reduce the productivity of the land in the future [10]. An organic farming system is needed because it avoids and mostly does not use artificial inputs (such as fertilizers, herbicides, hormones, feed additives, etc.). By reducing variable costs on rubber plantations such as fertilizers and pesticides, it will increase farmers' income. Crop rotation, crop residues, animal manure, off-farm organic waste, addition of mineral-grade rock, and a biological nutrient mobilization system are all necessary for organic farming to ensure the best possible crop protection. Soil, ecology, and sustainable human health are all benefits of organic farming. Instead - instead of using inputs with negative impacts, it relies on biological processes, biodiversity and cycles adapted to local conditions. Organic farming combines science, creativity and tradition to benefit the environment as a whole, foster equitable relationships and improve the quality of life of everyone person.

Farm household is also a problem in changing the organic rubber cultivation technology and significantly contributes to the present study [11]. The implementation of organic farming is important for realizing SDGs goal number 2, which is to achieve food security with sustainable agriculture. This goal must also be applied by rubber farmers engaged in the plantation sector as the second largest contributor to foreign exchange in Indonesia. Each farmer household can run three roles simultaneously: labor providers, manufacturers, and consumers [13]. Decision outpouring household labor time, both agricultural and non-farm, will affect the production process [14]. Farmers, over the role of producer and consumer of a farm household, are assumed rational, maximizing satisfaction. Farmers, as producers, will produce more relatively expensive goods and fewer relatively cheap goods. Farmers, as consumers, will consume more goods that are relatively inexpensive and consume less valuable goods. Farmers as providers of labor factor are related to income [15]. If the main job does not meet all the household's needs, then the rational farmer households will seek alternatives outside their primary job. One interesting problem about the farm household is the complex interaction between production and consumption decision-making [16]. It shows that in an economic context, the goal is to achieve the satisfaction of households / maximum use of its available resources. Diversified economic activities in farming households can be studied consistently, assuming that the activity is based on utility maximization [16]. In other words, the behavior of farmer households can be divided into three main groups; as a manufacturer, a source of labor, and consumers of food and non-food [17].

Seeing this problem, the researcher is interested in researching the economic behavior of household rubber farmers in response to technological change in the organic cultivation of conventional rubber in Musi Banyuasin. Based on the descriptions above, the research objectives are to compare the working hours of rubber farmers engaged in conventional and organic rubber farming, the level of income generated by each type of farming, and changes in household consumption habits among farmers who use organic rubber cultivation techniques.

## **2 Methods**

### **2.1 The innovations of organic rubber farming**

After the conversion of a forest to a rubber plantation, the soil was severely damaged. Long-term rubber farming is also bad for the soil and has a worse effect than rubber stand age on the physicochemical characteristics of the soil and carbon dynamics. The 0–10 cm soil layer's quality was inferior at the third rotation, 50 years after the beginning of rubber farming [18]. However, using cover crops, mulching, composting, integrated pest management, agroforestry or polyculture, and many other practices can help rubber plantations' ecological function to some level [19]. Overall, organic farming increased biodiversity by 23% at the cost of a corresponding production decrease. Gaining biodiversity is inversely connected with plant and microbial production decline. Biodiversity and output trade-offs vary under different contexts of organic farming [20].

The principle of organic farming that is environmentally friendly does not pollute and damage the environment. In organic farming, compost and manure can replace chemical fertilizers to enrich the soil. Moreover, it can also use a plant belonging to the family Leguminosae eg, legumes, root nodules that can tie up nitrogen from the air and turn it into nitrogen that plants can absorb [2]. Meanwhile, the pesticides used in organic farming to combat pests and diseases is an organic pesticides. Some plants that can be used as organic pesticide is neem, tobacco, noni, mahogany, papaya, and others. These organic pesticides are harmless and easy to find, do not pollute the air, and do not poison the consumers because they can be unraveled and easy to obtain or plant in the garden.

Organic fertilizer results from decomposing organic materials broken down (dismantled) by microbes. The outcome of this could provide some nutrients that plants need for growth and development [21]. Organic fertilizers are essential as a buffer to the physical, chemical, and biological soil to improve fertilizer efficiency and land productivity. Manure and compost's effect on improving soil fertility and increasing crop yields has long been known. Manure can improve soil properties because it contains high levels of organic C, N, P, and K. It has a high value of cation exchange capacity (CEC) [22]. Therefore, it provides in-depth information on the various microorganisms that may influence soil health in promoting plant growth and serves as potential bioremediation of polluted soil. It also provides information on using rhizobacteria, which promotes plant growth in sustainable agriculture and the environment. Finally, it provides in-depth information on other helpful microorganisms that may increase agricultural production [23].

### **2.2 Household economic activities**

The definition of a household is a group of people living in part or all of the physical building and usually staying and eating from one kitchen. While farm household is a

household that is at least one member of the household do farming or gardening, woody plant plants, raises fish in ponds, hunts or captures wildlife, commercializes livestock/poultry, or attempts agricultural services with the aim of part or all of the results are to be sold or obtain income/profit on its rehearsal based on Census of Agriculture 2013.

Theoretically, the household can be regarded as an economic unit whose behavior can be learned. The household is viewed as an economic unit that has a number of objectives to be fulfilled by utilizing a number of available resources [24]. Analogous to the household company (firm) in economic theory is an economic organization that aims to maximize profits by using several resources that are owned by the company [25]. Their goals to be achieved and the number of available resources, the rational behavior of the company's organization can be studied. Similarly, the domestic unit can be studied if the household as a single economic unit has the objective to be achieved and there are several resources, which is undoubtedly limited, which can be used for such purposes [26]. The household objective is to maximize the utility function by utilizing several household resources. Households, therefore, must be assumed to be an economic unit that has a specific utility function. If so, rational behavior is behavior towards a point of equilibrium to the maximum utility [27].

The economic behavior of farmer households is basically rational behavior in allocating domestic resources to produce goods and services and in using goods and services to meet the household's needs [28]. The rational behavior of households in allocating resources can be grouped into a production decision, while rational behavior in the use of goods and services to meet the household's needs can be grouped into consumption decisions. In addition, the farm households also act as labor providers for the farming they earn [29].

The behavior of peasant households is shown by various economic activities, namely the allocation of labor, production, and consumption. The behavior of economic activities farmer households, based on the primary objective, is to maximize the satisfaction of farm households. In the allocation of labor, peasant households with a position as a source of labor that aims for a wage use the workforce at their disposal for farming activities to reduce the cost of production. In production activities, farm households as producers who have the authority to determine the products they produce. In other words, farming households have power tips to determine the type of commodity they would try, considering the available resources. The behavior of the consumption side is that domestic farmers try to act as consumers. To maximize satisfaction and the constraints of the budget line, another feature of the farmer's household consumption is the majority of the products consumed by the farmers' households.

The economic behavior of the peasant communities in the system of the rural economy is characterized by social networks that are less supportive, weak capacity in mobilizing the cooperation network with the modern institutional, increasing its internal capacity to compete in the economic field, and facing pressure from outside.

### 3 Research method

This research was conducted in three villages in Musi Banyuasin, South Sumatra province: Langkap Village, Lais, and North Lais. The choice of location is intentionally (purposive) because this location is an area with most of the livelihood of rubber farming. The study was conducted in 2021. The survey method is the research methodology employed in this study. Proportionate Stratified Random sample is the sample technique applied in this study to the peasant population in the organic rubber growing program group of Langkap Village,

Lais, and North Lais. There are 30 farmers in each village, and ten of them served as the sample for each community.

The calculation of working hours by International Labour Office of peasant households from rubber farming was done by using mathematical calculations as follows:

$$JK \text{ total} = JO \times HK \times JK \quad (1)$$

$$HOK = \frac{Jk \text{ Total}}{JKS}$$

(2)

Notes :

HOK = Working Hours of Farmers

JO = Number of Farmers

HK = Working Days

JK = Working Hours

JKS = Standard Working Hours

Standard working hours in the above calculation use the provisions of Manpower and Transmigration (2021), equal to 7 hours. Then the calculation of the household income of farmers in rubber farming was performed by using a mathematical calculation as follows:

$$\text{Revenue: } PNT = Y_i \times P_{y_i}$$

(3)

Notes :

PNT = Total revenue (Rp/ha/year)

Y = Production for each farming (kg/year)

P<sub>y</sub> = Selling price (Rp/kg)

$$\text{Total income : } \pi = PNT - BT \quad (4)$$

Notes :

$\pi$  = Income (Rp/ha/year)

P<sub>n</sub> = Total income (Rp/ha/year)

BT = Total cost (Rp/ha/year)

Total household expenditures:

$$Pg.tot = K_{pg} + K_{npg} \quad (5)$$

$$Tb = \sum Pd - Pg.tot$$

(6)

Notes:

PG.tot= Total expenditure (Rp/year)

K.pg = Food consumption (Rp/year)

K.npg = Non-food consumption (Rp/year)

Tb = Saving (Rp/year)

Meanwhile, tabulation and explanation descriptively are carried out to see if there is any difference in working hours, income, and expenses of conventional and organic household farmers.

## 4 Results and discussion

Overall, the age group of farmers who are still doing a lot of conventional and organic rubber farming is in the age group from 36 to 45 years old. Most are physically productive farmers who can still work and generate economic household activities. The level of education also has an effect on farmers in carrying out their farming. Higher education can assist farmers in deciding if they farmer is confronted by various obstacles associated with farming activities [30]. Generally, the formal education level pursued by conventional and organic rubber farming farmers is still relatively low [31]. Farmers' education is diverse, from not completing primary school, elementary school, and junior high school to university. However, most of them had elementary education. The number of household members can show the number of people who live together in the household. Member household consisting of a husband, wife, children, and other relatives such as parents, nieces, or grandchildren. The number of household members looks quite varied, for instance, two people in one household and the most that amounted to 6 people in one household. The primary factors that improved household income were the age of the family head, formal education, amount of land owned, and revenue from rubber [32].

**Table 1.** Sample Profile of Household Farmers

No	Household Profile	Mean	Percentage (%)
1.	Age:		
	25-35	6	20,00
	36-45	10	33,00
	46-55	6	20,00
	56-65	8	27,00
2.	Education level:	3	10,00
	Not finished with elementary education	13	44,00
	Elementary education	6	20,00
	Junior high school	7	23,00
	Senior high school	1	3,00
	Bachelor degree		
3.	Family members:	2	6,66
	1-2	10	33,34
	3-4	16	53,34
	5-6	2	6,66
	7-8		
4.	Land area (ha)	1-2,61	100,00

Source: Processed primary data

The land area is cultivated by growers ranging from 1 ha to 4 ha. Most of the farmers have land with an area of 2.61 hectare (ha). With enough land, it is expected that farmers are capable of producing large products so as to provide higher income for farmers. However, it also must be balanced with their capital condition. Comparatively speaking, the economic scale based on the land area was the best asset in input farming. Working hours are the amount of time spent by household members on productive activities in rubber farming. Labor used in conventional rubber and organic farming consists of labor in the family. Table 2. shows the outpouring of labor time in conventional and organic rubber farming.

Before adopting organic farming techniques, farmers cultivated rubber simply because of limited knowledge and capital [33]. Increased acceptance of organic rubber cultivation was positively correlated with farmers' involvement in acquiring agricultural knowledge through training, extension contact, educational level, and membership in farm groups [34]. When planting, they did not use spacing so that the rubber trees scattered irregularly.



Usually, farmers use fertilizers with inorganic fertilizers with much lower doses than recommended. The condition of rubber plantations needed to be cleaner as there were weeds in the form of grass and other herbaceous plants. Tapping frequency does not comply with the rules, once in two days.

Organic rubber cultivation techniques use enough material available around the settlement of farmers and do not cost money to get it. Local manufacture of microorganisms (MOL) farmers use raw materials such as bamboo shoots, banana weevil, maja fruit, vegetables, and fruits that have been damaged as helpers in the form of coconut water, rice water, and brown sugar. In addition, the material is easily obtained. Also, the manufacturing process is simple and can be done by the farmers.

**Table 2.** Sample Time Allocation of Conventional and Organic Rubber Farming

No	Activities	Conventional		Organic	
		Working day/year	%	working day/year	%
1.	Fertilization	12,77	5,43	64,33	22,08
2.	Weeding	37,03	15,76	48,91	16,79
3.	Spraying	3,01	1,28	0	0
4.	Tapping	171,43	72,96	163,66	56,18
5.	Slab Making	10,74	4,57	14,4	4,94
Total		234,98	100,00	291,3	100,00

Source: Processed primary data

In Table 2, there are differences between the conventional and organic farming activities where there was activity on conventional farming herbicide spraying, whereas, in organic farming, it did not exist. Besides a striking difference in fertilization activity, the organic one had more work time due to the allocation of time to make fertilizer MOL coupled with fertilization activity. Of all the rubber farming activity, the allocation of time working on organic farming is more than the conventional one, which is 56.32 labor days/year. Materials processed rubber produced by farmers in the study area is thick slabs with an average thickness of 35 cm and different dry rubber content. The freezing process of the slab used a coagulant in the form of vinegar because the vinegar is easy to get, quick to clump, and relatively cheap. The heavy slab was produced by farmers of about 50 to 100 kg in one chunk slab. Farmers undertake the processing of latex in the garden. After that, the production of the slab was taken to the farmhouse for a week to be sold later on. Some farmers even put the slab in the area and immediately sold it to mediators who came to the village of their area. Transaction costs and socioeconomic factors influenced the decision of which selling slab to use [35]. Natural rubber's declining price hurts the productivity, life, and lifestyle of farmers' households and rubber output. Farmers were hesitant to maintain their plantings regularly, resulting in fewer days for tapping [36]. It was discovered that there are two primary sorts of strategies: (i) reversible modifications at the level of activity system variables, and (ii) mobilization of available production factors in an activity that



permits. Although reversible, this kind of adaptation demonstrated long- and medium-term motivation. They were redirecting the production components already engaged at the rubber crop's systemic level [37].

**Table 3.** Production, Revenue, Cost, and Income of Conventional and Organic Rubber Farming

No	Component	Conventional		Organic	
		(cultivated/year)	(ha/year)	(cultivated/year)	(ha/year)
1	Production (Kg)	5.640	2.146	6.028	2.300
2	Selling price (Rp/kg)	8.000	8.000	8.000	8.000
3	Revenue (Rp)	45.120.000	17.168.581	48.229.333	18.402.256
4	Total production cost (Rp)	1.510.931	610.935	446.898	174.480
	Income (Rp)	43.609.068	16.557.646	47.782.434	18.227.765

Source: Processed primary data

From Table 3, it can also be seen that the organic rubber farm productivity is higher than that of conventional rubber farming. This difference is due to organic rubber farming using organic fertilizers such as MOL. MOL could increase the availability of nutrients and soil microbial survival and improve the soil's physical structure. Organic materials provide a complete nutrient, both macro and micronutrients. Moreover, organic materials provide the materials needed for soil microbes to maintain the viability of soil microbes that are beneficial to plant rubber, one of which is microbial decomposing organic matter. Thus the production of organic rubber increased compared to conventional rubber farming using chemical-based fertilizers. Then using organic fertilizers stems become tender when tapped, and the color of their leaves is green. The release of large amounts of chemical fertilizer and pesticides in rubber plantations decreased soil fertility and threatened the safety of the surrounding environment [38]. In organic rubber farming, fertilizer cost is small since it is made with materials already available in the environment so that farmers do not have to buy them. Pesticides in organic farming theory are not used anymore. Overall organic rubber farming costs are lower than conventional farming; consequently, organic rubber income is higher than conventional rubber income [39].

The selling price of rubber from organic farming is no different from conventional rubber, so the revenue is higher in organic farming than in conventional farming just because of the difference in production rates. Farmers' age and availability of extension services reduce their likelihood of selling. However, contractor payment delays, latex weigh-in delays, and difficulties acquiring a truck to carry latex to a sale point are positively connected with selling behavior [40]. Moreover, organic rubber production costs are lower than conventional. Therefore, the organic rubber farm income becomes significantly higher, Rp.1.670.119 / year or 10.09%. The overall revenue of rubber farmers remains low because, at the time of conducting this research, the rubber prices went further down, Rp8,000 / kg, whereas it is usually priced at 12,000 - 15,000 / kg. According to [41], lower-income households tend to use more chemicals on plantations, putting more stress on the ecosystem. Using a combination of on-and off-farm income, rubber tapper households employed a varied livelihood strategy [42]. For locals, rubber still serves as their primary source of income. However, as rubber prices have fallen, both men and women have grown more concerned about their livelihood strategies and have been forced to look for alternative sources of income, such as planting more varied cash crops and looking for work as

off-farm laborers [43]. Rubber households employed a varied livelihood strategy using a combination of on- and off-farm income [42].

Besides, household expenditure analyzed in this study consisted of consumption of food, non-food consumption, and savings. Food consumption consists of all spending of farmers to meet the needs of families eating and drinking, including rice, fish, meat, chicken, vegetables, spices, fruit, sugar, gas, coffee, tea, and cigarettes. Based on the study's results, the most contributed food consumption was tobacco (cigarettes). It follows the facts on the ground because all the farmers sampled in the study area are active smokers.

**Table 4.** Total Expenditure of Household Farmers

No.	Kind of Expenditure	Conventional		Organic	
		Total (IDR/year)	Percentage (%)	Total (IDR/year)	Percentage (%)
1.	Food consumption	12.335.933	28,29	13.496.583	28,25
2.	Non-food consumption	22.755.100	52,22	22.849.600	47,82
3.	Savings	8.498.034	19,49	11.436.251	23,93
Total		43. 609.068	100,00	47.782.434	100,00

Source: Processed primary data

Non-food consumption expenditure is expenditure incurred by farmers for consumption other than food, such as clothing, personal care, communication, vehicle (motorcycle/car), petrol, education, health, and lighting. The results showed that the most prominent non-food consumption farmer is issued for the vehicle. Based on Table 4, the consumption expenditure of farmers is predominantly for non-food consumption. Results occurred because many farmers still have to repay two-wheeler loans each month. This research shows that the spending patterns of conventional rubber farmers to organic unchanged.

Household saving is an expenditure that farmers set aside for unexpected purposes. Farm household savings in research is the difference between total revenue and total expenditure of households because farmers typically do not have specific standards that must set the money aside each month for savings. Although some farmers earn high incomes, there must be more savings for the farmer households with some members and school-age children. With increasing farmers' income and savings switching to organic rubber, farming increases the quality of their food and non-food consumption. The household consumption expenditure of rubber farmers when doing rubber farming organically is greater than the farm household consumption patterns while still doing conventional rubber farming. According to the report, it is necessary to revitalize rubber-based organic cultivation options in order to reduce poverty. At the same time, the need for organic farming methods for rubber should be addressed by extended intervention with the appropriate institutional setup. The results of this study suggest that government organizations should continue to concentrate on current policies to implement organic rubber farming to increase the productivity and profitability of rubber lands. In order to encourage farmers to embrace the rubber organic farming method, attention must be paid to the agricultural support program We conclude that while this scenario clearly demonstrates the value of revenue diversification in lowering livelihood vulnerability, it also highlights the significant emphasis on organic rubber cultivation [44]. In the face of falling rubber

prices, smallholder rubber growers frequently relocate <sup>5</sup> family labor from farms to off-farm employment and diversify their sources of income. Notably, farmers who depend less on the rubber industry are more likely to diversify their sources of income. Smallholders are strengthened against potential dangers, and the income gap in rural areas is reduced thanks to the lowering price-induced diversification method [15]. According to studies by [1], the increase in output prior to changes in agricultural technique can be shown by the increase in production, which led to an increase in production from 2146.07 kilograms per hectare per year to 2300.28 kilograms per year, and reduction in the total cost of production, which was previously increased by advancements in farming technology between IDR 634,475 and IDR295,061 per hectare each year, therefore revenue generated rose by 9.51 percent. Furthermore, the highest costs are on conventional farming fertilizer costs. The same is true of research conducted by [2] Management of organic fertilizers and fertilizers inorganic through P4 treatment (12.5 tons/ha Compost and 75 kg / ha NPK + 75 kg/ha Urea) can increase production Manado Yellow corn seen in seed/cob weight components, shelled weight dry / cob, which is higher compared to chemical fertilizer treatment.

## 5 Conclusions

The allocation of working time of rubber farmers in response to technological change to organic cultivation of conventional rubber is higher than farmers who undertake conventional rubber farming. The productivity of organic rubber farming is higher than conventional rubber farming. This difference is due to organic rubber farming using organic fertilizer in MOL to increase production. The level of organic rubber farm income is greater than conventional rubber farming. Rubber farmers' household consumption pattern is relatively unchanged after they make organic rubber cultivation technology.

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