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Processing rubber latex (*Hevea brasiliensis*) in agroforestry in Menggala Mas Village, Tulang Bawang Tengah District, Tulang Bawang Barat Regency

Yanne Permata Sari[1], Indra Gumay Febryano[*1,2,3], Susni Herwanti[1], Afif Bintoro[1]
[1]*Department of Forestry, Faculty of Agriculture, University of Lampung, Bandar Lampung 35145, Indonesia*
[2]*Graduate Program of Forestry, Faculty of Agriculture, University of Lampung, Bandar Lampung 35145, Indonesia*
[3]*Graduate Program of Environmental Science, Postgraduate, University of Lampung, Bandar Lampung 35145, Indonesia*
[*]Corresponding Author: indra.gumay@fp.unila.ac.id

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ABSTRACT
Local knowledge of rubber latex processing is important for village communities that depend on rubber plants for their livelihood. This research aims to determine the processing of rubber latex in agroforestry carried out by the community in Menggala Mas Village, Lampung Province, Indonesia. This research approach is qualitative. Data was obtained by observation, in-depth interviews, and documentation studies. Then, the data was processed by making data transcripts, coding, categorizing, drawing temporary conclusions, triangulating, and drawing conclusions so that the results obtained could be analyzed to determine the data processing. Local communities carry out rubber in agroforestry. The research results showed that three applications of agroforestry planting patterns were found, namely alley cropping (alley pattern), Trees along border (fence pattern), and random mixture (random pattern). The dominant combination in alley cropping is rubber-pulai, and rubber-mentru-afrika wood. The dominant combinations in Trees along the border are rubber-acacia, rubber-jackfruit-cempedak, rubber-petai-teak. The dominant combinations in the random mixture are rubber-jengkol, rubber-petai-jengkol-acacia, rubber-jackfruit-cempedak, rubber-pulai-noni-jengkol, rubber-banana-gadung-sungkai. The rubber latex processing process in agroforestry is carried out traditionally, starting from the tapping process, sap acidification, sap harvesting (napeu), sap separation, and sales and harvesting of agroforestry crops. The community's local knowledge has been passed down from their parents to reduce the costs of processing rubber latex from expensive materials so that the community can gain more profits. This has been proven if local communities can manage their land well, which can become a long-term source of livelihood. The government needs to assist with strategies for processing rubber latex as well as managing rubber agroforestry land to increase farmers' knowledge and harvest yields.
Keyword: Agroforestry, Latex, Local Knowledge, Rubber

1. Introduction

Agroforestry is a planting system on a plot of land managed by the community by planting types of plants that can produce crops, including rubber plants. Rubber agroforestry, or what is usually called a mixed rubber plantation, is a form of traditional agroforestry whose management has been carried out for generations and is planted with forestry plants, agricultural plants, and livestock plants simultaneously on one land [1]. Various forms of rubber-based agroforestry have been practiced in Indonesia. The first type is the rubber forest system, where rubber trees are planted in secondary forests while retaining some natural trees and plants. This has mostly been practiced in Indonesia and several small areas in other South and Southeast Asian countries. The second type is modern rubber agroforestry, often known as intercropping, namely planting trees or other plants with rubber trees (especially clonal rubber seeds) [20]. All commodities grown by the community are an effort and strategy to fulfill life's needs to maintain food security in their

families [2]. One of the areas that traditionally implements agroforestry is Menggala Mas Village. The people of Menggala Mas Village consider omou a place for activities and a source of food and economic income. Omou is a land management system practiced by farmers and developed in the community according to local wisdom, so its structure and constituent components are very diverse. The practice of local knowledge in an area positively impacts the community in meeting their daily needs. According to [3], people will use their resources to meet their family's needs to survive. Communities will access the capital assets they own to obtain sustainable livelihood strategies using local wisdom values [1].

Local knowledge is the most essential cultural component, including rubber agroforestry management. Local wisdom is a habit carried out by a group of people from generation to generation, which until now has still been maintained by the people in certain areas and taught through non-formal institutions/not trained formally [4]. Local wisdom is present in knowledge, belief, understanding or insight, customs or ethics that guide human behavior in ecological communities and is lived, practiced, taught, and passed down from generation to generation [5]. In managing agroforestry, farmers have their methods which are influenced by culture and local wisdom inherited from their parents [6].

Local people depend on rubber plantations for their livelihoods, and around 80% of the community's living needs are met by rubber plantations. The community combines rubber with other types of plants in rubber agroforestry land so that almost all their living needs are obtained from rubber agroforestry: money, fruit, firewood, wood for building, medicinal plants, and secondary crops. Community interaction with rubber agroforestry is relatively high. This can be seen from the many farmers' activities on the plantation. Community interaction with rubber agroforestry can also be seen from the meaning of rubber plantations for the community. For them, rubber plantations are an important economic resource. A superior mixed rubber plantation will be more profitable in harvesting than the previous seasonal one, which can be harvested daily for a year due to the variety of plants that will support the family's economic security [7]. In rubber agroforestry management, not only do men play a role, but women also have quite an important role. Women especially play an important role in collecting fruit, firewood, and rubber harvests. Therefore, this research aims to determine the processing of rubber latex in agroforestry.

2. Method

This research was conducted from March to October 2023 in Menggala Mas Village, Tulang Bawang Tengah District, West Tulang Bawang Regency, Lampung Province, Indonesia (Figure 1). The key informants selected using purposive sampling were the village head (1 person), agricultural instructor (1 person), and rubber agroforestry farmers (6 person). The criteria are set using the following considerations: indigenous Menggala Mas Village communities who know rubber agroforestry, as well as communities who have experience developing and managing rubber latex. The raw data obtained is then collected in documents, and the results are recorded as data, then processed without researcher intervention [8] and analyzed qualitatively. Data was obtained through observation, in-depth interviews, and documentation studies. In-depth interview data on planting patterns, farmer motivation, and ways of managing rubber latex were then analyzed by making data transcripts, coding, data categorization, temporary conclusions, triangulation, and conclusions so that the results obtained could be analyzed to determine processing. Local communities carry out rubber latex in agroforestry.

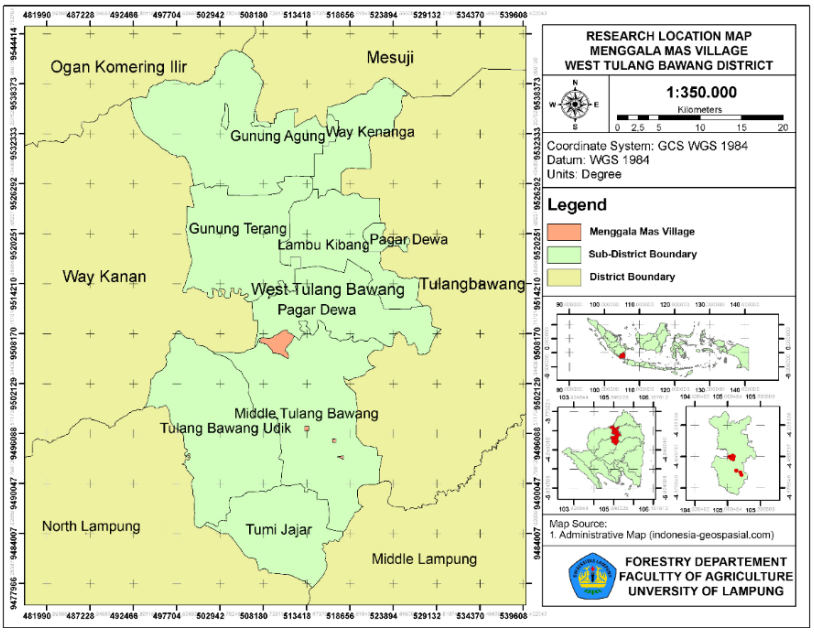

Figure 1. Map of research location

3. Result and Discussion

3.1. Overview of research locations

Menggala Mas Village is one of the villages in West Tulang Bawang Regency. Topographically, West Tulang Bawang Regency is a lowland region with a tropical climate, with alternating rainy and dry seasons throughout the year. The average temperature is 25°C - 31°C, annual rainfall is 57-299 mm, and the average humidity is 85.2%. The West Tulang Bawang Regency area is lowland with a height of 39 meters above sea level. This height is suitable for growing rubber plants [9]. Menggala Mas Village has an area of 1,592 ha, of which around 863 ha includes productive land.

Geographically, the territorial boundaries of Menggala Mas Village are as follows:

1. To the north, it borders Pagar Dewa Village, Pagar Dewa District
2. To the east, it borders Penumangan Village, Tulang Bawang Tengah District
3. To the south, it borders Bandar Dewa Village, Tulang Bawang Tengah District
4. To the west, it borders Pagar Iman Village, Negeri Besar District

Menggala Mas Village has a population of 1,460, consisting of 742 men and 718 women. The number of people of productive age is 672 people, while the population in the poor category is 601 people. This village is fairly good regarding its agricultural potential, especially rubber and cassava commodities. Around 80% of the population makes a living as rubber farmers; the rest work as traders, breeders, fishermen, agency employees, etc. The residents of this village mostly come from the Lampung Pepadun tribe [10]. Communities develop their gardens according to land conditions and their ability to manage the land. This ability comes from the local knowledge they have. Communities that have relatively limited land tend to develop agroforestry systems. Management with this system is considered more profitable because, apart from meeting daily needs, it can also harvest crop commodities simultaneously. The components that make gardens owned by the community are very diverse, including types of trees, medicinal plants, shrubs, undergrowth, and annual plants.

3.2. Rubber agroforestry

Agroforestry is an intensive land management system that combines forestry plants and agricultural plants to obtain maximum results from forest management activities without ignoring aspects of land conservation and the practical cultivation of local communities. According to [11], agroforestry is a form of multi-crop land use consisting of a mixture of trees, bushes, and annual crops, often accompanied by livestock on one plot of land. Agroforestry is carried out by implementing mixed farming, one of which is implementing rubber agroforestry. The rubber agroforestry system is an agroforestry model on rubber land that aims to increase plant productivity, including rubber itself as the main product and also by-products such as fruit, wood, rattan, etc., with an intensification system and for the benefit of rubber sustainability [12]. Rubber is a commodity that occupies a very important position in non-oil and gas foreign exchange, supports the development of the Indonesian economy, and has excellent and promising development prospects [13].

Therefore, efforts to increase the productivity of rubber farming businesses continue to be made in its cultivation. Rubber is usually used as a raw material in factory industries, such as for making tires, balls, rubber shoes, gloves, swimsuits, rubber bands, and toys [14]. A sustainable agricultural system is an important part of a sustainable agroforestry system characterized by a planting pattern [15].

Before implementing an agroforestry system, it is necessary to know that there is a suitable and appropriate planting pattern. The agroforestry planting pattern is a type of management with excellent prospects and is very promising for farmers to achieve their goals [16]. The characteristics of agroforestry planting patterns depend on the land owner and the characteristics of the land. The final goal to be achieved is prioritizing production so that people create different planting patterns from one land to another [17]. There are four agroforestry planting patterns: trees along the border, random mixture, alley cropping, and alternate rows [18]. Based on the planting pattern, three agroforestry planting patterns are applied by the community on their rubber agroforestry land: alley cropping, trees along the border, and random mixture.

3.2.1. Alley cropping

The alley planting pattern combines forestry plants and agricultural plants. Alley cropping is a planting system where annual plants are planted in an aisle between two rows of hedges, usually in the form of trees or shrubs [15]. The pattern on which rubber plants are planted resembles rows of aisles. Plants in the aisle include afrika wood (*Maesopsis eminii*), pulai (*Alstonia scholaris*), and mentru (*Schima wallichii*). The dominant plant combinations include rubber-pulai, rubber-mentru- afrika wood planted in the middle of rows of rubber trees. This plant can complement the rubber plant as an alley plant, which, according to farmers, has benefits for extracting its wood.

3.2.2. Trees along border

This agroforestry planting pattern is a pattern for arranging plant space, which is arranged like a fence. Forestry plants are planted as a fence, where the tree components are arranged at the edge of the land, and rubber plants, as the main plants, are located in the middle [16]. The community combines various MPTS and forestry plants such as acacia (*Acacia auriculiformis*), teak (*Tectona grandis*), kapok randu (*Ceiba pentandra*), petai (*Parkia speciosa*), jackfruit (*Artocarpus heterophyllus*), cempedak (*Artocarpus integer*), mango (*Mangifera indica*), lamtoro (*Leucaena leucocephala*), guava (*Psidium guajava*) and noni (Morinda citrifolia). The dominant plant combinations in this planting pattern are the combination of rubber-acacia, rubber-jackfruit-cempedak, rubber-petai-teak. People deliberately plant these plants to mark the boundaries of gardens or fences so that other people don't take the rubber sap. According to the farmers, they choose plants that can provide many benefits in choosing the type of hedge plant. The majority are more dominant in planting MPTS types for their fruit and trees for their wood.

3.2.3. Random mixture

The random pattern is the pattern most widely applied by farmers because this pattern can be said to be simple and does not have a systematic distribution model. A random mixture is a random agroforestry planting pattern between forestry plants, agricultural plants, herbs and shrubs that grow unevenly distributed on the same land [18]. The filler plants are very diverse, such as acacia (*Acacia mangium*), gaharu (*Aquilaria malaccensis*), medang (*Phoebe hunanensis*), pelangas (*Aporosa aurita*), pulai (*Alstonia scholaris*), sungkai (*Peronema canescens* Jack), jengkol (*Pithecellobium lobatum*), petai (*Parkia speciosa*), cashew (*Anacardium occidentale*), durian (*Durio zibethinus* Murr), kopi (*Coffea sp.*), kakao (*Theobroma cacao*), banana (*Musa paradisiaca*), takokak (*Solanum torvum*), ketepeng cina (*Senna alata*), gadung (*Dioscorea hispida*), lengkuas hutan (*Alpinia malaccensis*), turmeric (*Curcuma longa*), kumis kucing (*Orthosiphon aristatus*), java chili (*Piper retrofractum*), grass jelly (*Cyclea barbata*), lemongrass (*Cymbopogon citratus*) and others. The dominant plant combinations applied include rubber-jengkol, rubber-petai-jengkol-acacia, rubber-jackfruit-cempedak, rubber-pulai-noni-jengkol, rubber-banana-gadung-sungkai. Farmers deliberately plant these plants, and some of them grow naturally. The types of plants that are widely planted are jengkol, petai and banana. This is because many people in this village are from the Lampung tribe and like to eat fresh vegetables.

3.3. Processing of rubber latex by the community

The processing of rubber sap is quite simple and uses traditional methods from local knowledge that they have, starting with rubber tapping. Rubber tapping is the first link in the rubber production process. Tapping is carried out in production plantations by slashing or slicing the bark using specific methods or techniques to obtain sap or latex. Rubber tapping uses a unique knife tool for rubber tapping. Tapping is done at 3 am or 4 am so that the latex in the vascular cells can quickly come out because the higher the temperature, the faster the latex will be released. Usually, the tapping limit is until 6 am. Apart from that, farmers believe that if

they tap at dawn, the sap will come out more quickly, and the process of taking the sap and getting sustenance will be faster. Tapping is carried out from the top left to the bottom right, with the angle of the tapping slice affecting production. The best tilt angle ranges from 30-40 degrees to a flat plane for the lower tapping plane and 45 degrees for the upper tapping plane. The angle of inclination of the tapping also influences the flow of latex towards the tapping bowl. Place the bowl on the rubber tree trunk at a good distance of 10 cm from the tapping to the bowl [19].

The community says that tapping on productive rubber is 7-10 years old with a tapping line of 15 cm, 10-15 years old with a tapping line of 30 cm, and more than 15 years old, the tapping line is usually 50 cm. Still, there are also tapping lines of up to 1m if the trunk diameter is very large. The initial tapping is called plate A. This tapping is where the rubber tree bark is tapped for the first time. The following tapping is plate B. This tapping is tapping on the tree bark on the opposite side. This is done if the tapping path on plate A has run out. The tapping path near the base of the stem is called the bottom plate. This bottom plate is carried out when the tapping paths for plates A and B have run out. Usually, this bottom plate has the most sap production. The following tapping path is the top plate or poke plate. This happens because the plate underneath has not recovered. Usually, with this poke plate, farmers use a tapping knife modified with wood or bamboo to reach higher levels of the bark. Plates A and B can be tapped again when the bark has recovered. Farmers say that the cambium on rubber stems can still produce latex after several years, provided the tapping is correct and does not touch the stem bone. If the tapping is wrong, such as too deep, it can hit the stem bone. This can cause damage to the tree, such as bumps in the tapping path, resulting in no longer producing sap.

Based on local knowledge, the community believes privately owned rubber land can last longer (around 35-40 years) than company-owned land. This is because company-owned rubber land is tapped by people who can change at any time, so the tapping techniques used are also different, which can cause the rubber trees to be damaged more quickly. Rubber trees begin to produce sap after five years of age, while trees that are 35 years old need to be cut down and replaced with new ones [20]. The rubber tapping process is shown in Figure 2.

Figure 2. Rubber tapping process

Acidification of rubber sap is carried out to speed up the process of freezing the rubber in the bowl and increasing the volume of the sap so that it increases further. Usually, farmers use natural acids such as acid made from noni fruit juice. Noni (*Morinda citrifolia* L.) is a plant that is also planted in rubber agroforestry land. To be used as a freezer, ripe noni rubber is pounded or kneaded to extract the juice, then homogenized with water. Apart from noni fruit, acidification also usually uses alum stones. It is believed that alum stone has the substance to make the color of the sap clear and to freeze the sap more quickly. Just like noni, alum stone is also homogenized with water so that it dissolves. People also usually use rubber freezers in stores, but the prices are expensive. Therefore, people often use natural rubber latex freezers, which are cheap and easy to obtain. After the rubber latex freezing liquid is homogeneous, put it into a bottle with a hole in the lid and immediately pour it into the bowl containing the latex. Noni and alum are part of the local knowledge possessed by the Menggala Mas community in rubber development, learned from previous generations. The rubber latex acidification process can be seen in Figure 3.

Figure 3. Sap acidification process

After being frozen, the community carried out wiretapping the next day. This time, the purpose of tapping was to collect liquid sap. This was intended to increase sap yield because if you tapped just once, you would get very little sap. Then harvesting is carried out 3-4 hours after completion of tapping. The sap from the tapping is then harvested or what people usually call "Napeu." Napeu is the climax process of rubber latex processing. Napeu is done by preparing a small bucket filled with water as a container to hold the sap. Napeu starts from the first tree tapped by taking sap from 1-2 rows of rubber trees. Farmers take the sap one by one in a bowl, which will later be collected in a larger drum. However, frozen sap and liquid sap must be separated before being put into a large drum. Separation is also used to check the cleanliness of the sap from leaves, grass, or other debris. The napeu process until the sap is ready for sale can be seen in Figure 4.

a. Rubber latex harvesting process (Napeu)

b. The process of separating frozen sap and liquid sap

c. Rubber latex products that are ready to be sold

Figure 4. The napeu process until the sap is ready to be sold

The frozen sap is placed first on the drum, while the liquid sap is left for several minutes to harden. Liquid sap can also be added with gadung tuber juice. Gadung tubers (*Dioscorea hispida*) are one of the agroforestry products that are also usually planted on rubber plantations. Like making rubber frosting from noni, gadung tubers can be grated or pounded until smooth and added with water to make gadung juice. Farmers use gadung tuber juice as a latex mixture during the napeu process, making the latex more supple and denser. The denser it is, the heavier the rubber volume will be and the more expensive the selling price of the rubber will be. After the liquid sap has hardened, it can be combined into large drums until the napeu (harvesting) process is complete. Usually, farmers get 1-2 large drums depending on the area of land and the amount of sap. Collecting latex to obtain high-quality rubber must also consider cleanliness [21]. Farmers who will sell rubber latex products to collectors can be seen in Figure 5.

Figure 5. Process of transporting rubber latex to collectors

After filling the large drum, the farmer will sell the rubber to collectors in or outside the village. The process of rubber sale products is carried out traditionally without being processed and sold directly to rubber collectors as second parties before being resold to rubber processing companies. Sales to rubber collectors are carried out at rubber stalls by weighing, checking, and paying. Farmers carry out the sales process twice a week, where the process of extracting rubber sap from the trees is carried out three days a week [22]. Rubber sales stalls to collectors can be seen in Figure 6.

Figure 6. Rubber pad

The price of rubber at collectors ranges from Rp 7,000 to 7,500/kg, but the price depends on the type of rubber. If the rubber is good, you can get Rp 7,500. If the rubber is bad or soft (not hard enough), you can only get Rp 7,000. Most rubber farmers say the biggest problem when working in a rubber plantation is the weather factor. Climate change is an erratic change in weather that farmers cannot predict and impacts the agricultural sector [23]. During the rainy season, tapping rubber is difficult because the rubber stems are wet, so if you tap, a lot of the sap spills out of the tapping route because it mixes with rainwater, so tapping is useless. However, during the dry season, the problem is that the sap yield could be higher due to a lack of water. During the rainy season, the average farmer's income from rubber increases, usually producing around 60 kg of rubber latex with a selling price range of Rp 7,000-7,500/kg, resulting in Rp 450,000 in one harvest. If the season is dry and the sap is difficult to get out, it usually only produces 30 kg or less for Rp 7,500/kg, so the farmer's income decreases by around Rp 225,000. For farmers, more is needed to meet family needs such as children's education costs, basic daily needs, or other needs such as buying goods. Farmers are looking for ways to obtain different products apart from rubber latex. The price of rubber changes every year, making farmers look for solutions to meet their needs. Unstable rubber prices will impact farmers' income [24]. A comparison of the list of rubber latex prices in Menggala Mas Village in the last five-year period is presented in Table 1.

Table 1. Comparison of rubber rubber prices

Rubber price fluctuations for the 2018-2022		Rubber rubber price list in Menggala Mas Village	
Year	Average rubber prices (Rp)	Year	Average rubber prices (Rp)
2019	8,000-7,500	2019	7,500-7,000
2020	7,500-3,500	2020	7,000-3,500
2021	10,000-9,000	2021	8,000-5,000
2022	12,700-9,000	2022	9,000-7,500
2023	8,000-7,000	2023	7,500-7,000

From the description above, it can be concluded that rubber price determination in Menggala Mas Village is based on the basic price set by the government or company. The profits obtained by intermediaries from buying rubber and then selling it back to the company need to be higher, namely, making a profit of around Rp 2,000/kg, adjusted for the quality of the rubber latex. Meanwhile, rubber farmers, with the proceeds from these sales, can still meet their daily needs even though they are still looking for other income as additional income to meet their needs.

On farmers' land, other plants such as wood, MPTS, fruit, medicinal plants, shrubs, and others have begun to grow, which can at least be used as additional income. The majority of the Menggala Mas people are from the Lampung tribe. This also triggers several motivations for choosing plant types. The species of woody plants that people often plant are acacia (*Acacia mangium*), afrika wood (*Maesopsis eminii*), pulai (*Alstonia scholaris*), teak (*Tectona grandis*), sungkai (*Peronema canescens* Jack), medang (*Phoebe hunanensis*) and mentru (*Schima wallichii*). Local ecological knowledge is closely related to decision-making in planting and maintaining trees [25]. People often use wood materials from the land to make traditional houses. Apart from being used for making houses, it is usually sold or used as firewood. The public can also sell rubber wood to make plywood boards.

Types of MPTS that are widely planted include jengkol (*Pithecellobium lobatum*), petai (*Parkia speciosa*), cempedak (*Artocarpus integer*), jackfruit (*Artocarpus heterophyllus*), mango (*Mangifera indica*), durian (*Durio zibethinus Murr*), cashew (*Anacardium occidentale*) usually only consumed by families, for example, gatherings to eat together "Nyeruwit," sent as family souvenirs and distributed to neighbors. In line with [26], agroforestry is a dynamic and ecologically based practice of planting trees on agricultural land alongside food crops. Apart from their ecological function, MPTS plants can also be a source of long-term income, considering that MPTS products can only be harvested once a year [27]. Several factors influence rubber latex productivity in Menggala Mas Village: weather factors (rainy and dry) and attacks by white root fungus and peel fungus. The most productive MPTS plants are cempedak and jengkol. These plants are usually only taken for personal food needs, sometimes sold. However, the profits from MPTS are low compared to those from rubber latex, which can be obtained twice a week. People who plant many crops have the hope of another source of income from multi-purpose tree species [28]. When primary crop production is no longer optimal, they can still earn income from intermediary crops (MPTS and food crops).

The types of medicinal plants are also quite diverse, such as ketepeng cina (*Senna alata*), java chili (*Piper retrofractum*), turmeric (*Curcuma longa*), lemongrass (*Cymbopogon citratus*), kumis kucing (*Orthosiphon aristatus*), grass jelly (*Cyclea barbata*), noni (*Morinda citrifolia* L.) and others that farmers usually use as traditional family medicine or as a spice. The agroforestry system provides benefits for farmers. They can obtain results from latex, wood, fruit, foodstuffs, traditional medicines, spices, and other products they can profit from. Community dependence on the surrounding forests is commonplace, especially for communities close to natural forests that manage local plants [29]. Apart from that, farmers concluded that the conditions on the rubber land were better after the rubber agroforestry planting pattern was implemented, which made their land more productive, better, shadier, and cooler. The soil quality was also better, so they could generate income throughout the year with the rubber agroforestry system. Harvesting activities of agroforestry products on rubber land can be seen in Figure 7.

Figure 7. Harvesting of agroforestry products

Not only in terms of forestry and agriculture, rubber agroforestry land is also able to become a place for livestock grazing during the day. This can be found in the research location. Undergrowth vegetation in shrubs increases during the rainy season, allowing people to graze their livestock wildly on rubber land. Many believe that agroforestry can maintain sustainable agricultural yields because it combines forestry plant species with crops or livestock systems [30]. The benefits of livestock farming in rubber fields can reduce weeds [31]. However, in this study, cattle grazing was scarce because herders only stopped by when going to the pasture. Cattle grazing in rubber agroforestry land can be seen in Figure 8.

Figure 8. Cattle Grazing on rubber agroforestry land

The agro silvopasture system combines woody components (forestry) with agriculture (seasonal) and, at the same time, animal husbandry/animals in the same land management unit. The advantage of the agro silvopasture system is that apart from the efficiency of livestock land by planting between stands, it also provides input (fertilizer) from natural ingredients from animal waste components. Farmers can graze their livestock on rubber land to find sources of animal feed and reduce existing weeds. A reciprocal relationship will occur when livestock excrete manure, used as fertilizer for plants planted in the area. Animal waste as fertilizer can support the nutrients and nutrients that enter the roots of rubber plants, which will increase the productivity of rubber latex [32].

The rubber diseases most often encountered by farmers are sap death, bark death, root fungus, and termites. Dead sap is the condition of bark is in good condition, but the sap does not come out at all, while dead bark is a condition where the bark is damaged, but over time, it will be replaced with new bark so that the sap will produce again. Farmers do not know the correct medicine for gum disease and bark death. Usually, when rubber trees experience dead sap or bark for a long period, farmers do not take action to overcome this problem. The trees will be left to die or cut down and replaced with new plants [33]. In general, economic losses from damage caused by rubber plant diseases are greater than those caused by pests [34]. Vulnerable in June-August, rubber leaves usually experience leaf shedding or what local people generally call "Merang" to reduce evaporation during the dry season. During the rubber season, the stems still produce sap, but when the young leaves grow, the stems do not emit sap. At that time, farmers took other products apart from rubber latex from agroforestry plants. However, the tapping process takes little time, so farmers can continue tapping. For rubber plants to grow faster and become more mature, fertilization

must be done. The change from the rainy to the dry season is the most appropriate time to apply fertilizer in the form of NPK, Urea, SP36, and KCI fertilizers with a ratio and frequency appropriate to the age of the rubber tree [35].

Rubber agroforestry in Menggala Mas Village has been managed for a long time, so farmers have had a lot of work experience and risks while being rubber farmers. People with more farming experience earn higher incomes, so the longer the farmer's expertise is expected to be able to operate the farm well, which can increase the farmer's income [14]. Farmers said there were several unexpected experiences that farmers in this village often experience. For example, encountering wild animals such as snakes, monitor lizards, insects, wild boar, and other wild animals, sometimes the motorbike used for work experiences damage such as breaking down and burst tires, when working, hands get hit by rubber knives or eyes get splashed with sap, and experiences that are very out of control (unexpected) by farmers, namely that irresponsible people stole the rubber. There was even an incident where someone else's motorbike was stolen. From the experience and risks of being a rubber farmer, there is a reason why they persist until now in becoming mixed rubber farmers: they have no other job options. They can only become rubber farmers because, in their environment, most jobs are as rubber farmers. With their wealth of experience and local knowledge about rubber agroforestry development, they choose to remain as they are now, considering the profits obtained from mixed rubber plantations so that they will manage rubber plantations. Mix as best as possible with proper management to make it more profitable.

4. Conclusion

Three applications of rubber agroforestry planting patterns were found, namely alley cropping (alley pattern), trees along the border (fence pattern), and random mixture (random pattern). The dominant combination in alley cropping is rubber-pulai, rubber-mentru-afrika wood. The dominant combinations in trees along the border are rubber-acacia, rubber-jackfruit-cempedak, rubber-petai-teak. The dominant combinations in the random mixture are rubber-jengkol, rubber-petai-jengkol-acacia, rubber-jackfruit-cempedak, rubber-pulai-noni-jengkol, rubber-banana-gadung-sungkai. The rubber latex processing process in agroforestry is carried out using traditional methods, starting from the tapping process, sap acidification, sap harvesting (napeu), sap separation, sales and harvesting of agroforestry crops. Communities develop agroforestry land based on land conditions and the ability to manage the land. This ability is obtained from the local knowledge they have. The local government needs to provide support and assistance regarding strategies for processing rubber latex and managing rubber agroforestry land to increase farmers' knowledge and income.

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