

Collective Action Model: Facing Temporary Loss Income while the Rubber Replanting Program

by Ardi Novra

Submission date: 19-Jun-2023 03:01PM (UTC+0700)

Submission ID: 2118904454

File name: Novra_2020.pdf (908.69K)

Word count: 6985

Character count: 36082

PAPER • OPEN ACCESS

5
Collective Action Model: Facing Temporary Loss
Income while the Rubber Replanting Program

27
To cite this article: Ardi Novra and Suparjo 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **518** 012059

21
View the [article online](#) for updates and enhancements.

You may also like

- 20 - [Characteristics of Oil Palm Stem Mulch as](#)
- 20 - [Conditioner at Oil Palm](#)
- 20 - [Alfarisi, T Mandang and A Sutejo](#)
- 23 - [The role of model simulation for replanting](#)
- 31 - [tities: A review](#)
- 22 - [Nurhayati Sembiring, Humala Lodewij](#)
- 22 - [Napitupulu, Melita Tryana Sembiring et al.](#)
- [Market-oriented solutions for groundwater](#)
- [commons through collective-action](#)
- [Jonah J Allen and Steven M Smith](#)

The advertisement features a dark blue background. On the left, a hand is shown reaching out to touch a glowing globe. The globe is surrounded by a network of white icons representing people, connected by lines, symbolizing a global network or community. In the center, the ECS logo is displayed. To the right of the logo, the text 'Connect with decision-makers at ECS' is written in a bold, yellow font. Below this, in a smaller white font, it says 'Accelerate sales with ECS exhibits, sponsorships, and advertising!'. At the bottom right, a yellow play button icon is followed by the text 'Learn more and engage at the 244th ECS Meeting!' in a yellow font.

ECS

Connect with decision-makers at ECS

Accelerate sales with ECS exhibits, sponsorships, and advertising!

▶ Learn more and engage at the 244th ECS Meeting!

26

Collective Action Model: Facing Temporary Loss Income while the Rubber Replanting Program

Ardi Novra¹ and Suparjo²

¹Faculty of Animal Sciences and CoE Land Reclamation Technology, Jambi University, Jambi, Indonesia.

² Faculty of Animal Science, Jambi University, Jambi, Indonesia.

E-mail: ardinovra@unja.ac.id

Abstract. The research objective was to design a collective action model in the context of household independence in overcoming the temporary loss income (TLI) period during the rubber replanting process. The research partner was the Sumber Rezeki Farmer Group (SRFG) in Mestong District, Jambi, Indonesia. The results showed that collective action in integrated waste processing to produce TCI and BA+ can work well but not followed by inter-cropping cultivation implementation. The BA+ prototype technology with capacity 1,100 liters/period more advantages over conventional methods because it only takes 18 days with clearer and loss of pungent odor. The substitution power of food crops was only 49,27% from potential temporary loss income with the highest in food-corn which's 55.83%. Conversely, the food crops productivity implemented was not targeted as achieved by planting demonstration plot scale. The main inhibiting factor the water availability which is highly dependent on the season, and animal wild pest attacks such as monkeys and wild boar. Based on the results it can be concluded that the collective action model had not been effective at the implementation stage so that further research is needed to address the water management and wild animal pests control problems.

3 Introduction

The Master-plan for Acceleration and Expansion of Indonesia's Economic Development (abbreviated MP3EI) is an ambitious plan by the Indonesian government to accelerate the realization of becoming a developed country of which the fruits and prosperity will be enjoyed equally among the people. An important part of the MP3EI is the development of economic corridors in Indonesia based on the potentials and advantages inherent to each region throughout the country [1]. By taking into consideration these potentials and strategic roles of Sumatra Island economic corridors have been identified for production and processing center of natural resources and the nation's energy reserves.

Indonesia's rubber plantations are mainly dominated by small hold farmers which make up for 86 percent of the 3.5 million hectares of land under cultivation, with the remainder split more or less equally between private companies and state plantations. The majority of production at approximately 90 percent is exported with the remainder used in the domestic automotive sector and other manufacturing industries [2]. While having the largest area of rubber plantations in the world, low productivity has marred the sector and held it back from achieving the top spot as a global producer and exporter.

According to the Rubber Association of Indonesia (GAPKINDO), plantations in Indonesia produce an average of 880 - 1,000 kg/hectare, compared with up to 1,500 kg for Malaysia and Thailand. With most plantations being on the family held, small hold plots that lack the capacity for investment to replace older trees, the average age of the trees remains high and therefore less productive. Low-quality seedlings are also in use at an estimated 40% of all small hold rubber plantations resulting in



⁹ Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

lower quality rubber that is sold at a lower price. Moving up to higher value rubber will increase returns and allow small hold farmers to reinvest in new technology to increase output for the future as global demand continues unabated.

The Indonesian government are planning to launch a rubber replanting program with the pilot project covering up to 6,000 hectares of land in Sumatra and aims to replant 700,000 hectares of rubber farms by 2025 [3]. This program aim to strengthen the economic foundation of the region in order to withstand the economic crisis. For rubber replanting program sustainability, the local government had facilitated rubber development program through giving rubber planting material assistance to rubber nursery and rubber farming, as well as training for technical officer and rubber farmers [4]. Some of us forget that during the replanting process, rubber household will lose revenue from rejuvenated plant land. They typically natural rubber which grows in tropical regions reach 20-30 meter in height on rubber plantations and are able to produce commercial quantities of latex at about 7 years of age, depending on climate and location [5].

The high number of old plants is caused by the farmers' unpreparedness to take part in rejuvenation because it will cut off their income as long as the plants produce again, which is 5 years [6]. There are several important things in the framework of a smallholder of rubber replanting, namely: a) the government buys rubber tree trees that are cut down, b) the government provides rubber seeds, and c) subsidized fertilizers and inter-cropping seeds to farmers [7]. The farmers' decision to rejuvenate rubber in the economic aspect is related to fulfilling household needs and when rejuvenating it will lose from rubber farming which runs from the start of replanting to can be tapped [8]. The reluctance of farmers to undertake to replant one of which is the fear of losing a source of household income even if only temporary and this is actual conditions facing households due to declining latex yield and has implications for household income [9].

Utilizing the space between replanting young rubber plants by planting food crops is one option in overcoming temporary loss income known as inter-cropping. It's possible to utilize the land cleared from old rubber plantation for replacement with rubber, maize, and cassava; the land can also support inter-cropping systems of rubber with maize and cassava [10]. Inter-cropping is the simultaneous cultivation of two or more species on the same field, during a growing season, in order to produce a greater yield, making use of resources that would otherwise not be utilized by a single crop [11]. Inter-cropping being a unique property of tropical and sub-tropical areas is becoming popular day by day among small farmers as it offers the possibility of yield advantage relative to sole cropping through yield stability and improved yield [12]. Grain leguminous-cereal mixed inter-crops are better at exploiting natural resources as compared to the sole crops of different plant species [13].

Some rubber farmer households also have a side business as beef cattle farmers, including the SRFG. Both solid and potential cattle waste is used as the main raw material for the development of solid and liquid organic fertilizers. Organic fertilizers, which mainly come from agricultural waste residues such as cow manure and spent mushroom compost or municipal solid waste compost (MSWC), are often identified as suitable local organic fertilizers [14]. Among different organic sources, cow urine is a unique product of dairy which has huge property such as manure, antimicrobial agent, disinfectant. It contains 95% water, 2.5% urea, and the remaining 2.5% contains mineral salts, hormones, and enzymes [15]. In organic farming, cow urine is used for the number preparation of growth promoter and bio-pesticides, which are effective in improving soil fertility, and management a large number of pests and diseases in the varied group. The compost and bio-urine are then used to substitute of commercial fertilizers to encourage the independence of replanting households for inter-cropping systems.

The low scale of people's livestock business causes waste management to be integrated through collective action to be more efficient and effective. Collective action, in turn, results in greater well-being for rural villagers and successful poverty alleviation as a positive effect of leadership, trust, and collective action [16]. Based on the description above, the research was carried out with the title of the

collective action model for smallholder independence toward temporary loss income on the rubber replanting program.

2. Materials and Methods

The research activity was carried out for 3 years from 2015 - 2017 with the research location in Mestong District, Muaro Jambi Regency, Jambi Province. This field experiment research using a Participatory Research Action (PRA) approach with partners was the Sumber Rezeki Farmer Group (abbreviated SRFG) who's the group actor in the integration of plantation and cattle raising farming. The SRFG was established in 2003 with the initial membership of 10 people with a joint venture in broiler chicken. The business of this group cannot survive after suffering losses due to price fluctuations and bird flu outbreaks. The SRFG assets in the form of ex-cage land with an area of 4,000 meters are currently used as rubber plantation gardens. In 2006 and 2008 received the assistance of superior rubber seedlings on the Jambi Province replanting program. Another assistance that was in 2007 received assistance 60 cattle from Jambi Province Nursery Program and in 2010 assistance for the construction of forage gardens and a well unit through the Livestock and Fisheries Service of Muaro Jambi Regency. The SRFG is active in holding monthly meetings (every 10th) which become experience sharing media, arrange work plans and receive direction from relevant institutions. This SRFG is part of a farmer group association "GAPOKTAN Bangun Sari" which the member six farmer groups and 14 active members.

The group is working well, the leader is a key player in collective action with the ability to lead, and mobilize the organization, leaders need to have experience, professional and good reputation, and actively participate enthusiastically to promote collective action [17]. The collective action is "a group of people to take the action for the common interests" and the connotation of collective action includes two important key elements for the "group characteristics" and "external environment" [18].

The scope of activities in the research is divided into three stages, namely a) collective action in the development of integrated group waste processing centers, b) the stage of using compost and bio-urine on the intercropping demonstration plots within 4 commodities were rice, corn, soybean and sorghum, and c) the stage of inter-cropping implementation in the replanting area of SRFG members based on the collective decision using technical and economic considerations. Primary data collection in field experiments uses a field practice approach in both demonstration plot and household scale, laboratory analysis, household surveys in three centers of smallholder rubber production, limited group discussions, and stock taking studies. Evaluation and analysis of the activities on the collective action model use completely randomized design, simultaneous equation models, and benefit-cost ratio analysis.

3. Results and Discussion

3.1. Collective Action Model and Institutional Rule of Law

The characteristics of the branch of farming that is sought, the construction of a collective action model uses the sustainable integrated farming system (SIFAS) approach. The SIFAS contains four basic characteristics, namely a) Integration System Components are branches of farming that exist must interact with each other and work together to form a single unit so that the system can run, b) Boundary System Integration is a region that limits between a system with another system or with its external environment or shows the scope of the system, c) Environment System Integration is an environment outside the system boundaries that has the potential to affect the operation of the integration system such as institutions, government policies, and market conditions, and d) Interface System Integration is a connecting media between sub-systems, namely technology that allows resources to flow from one branch of the farm to another farm branch [19]. The resources flow cycle on the SIFAS approach can be briefly seen in Figure 1.

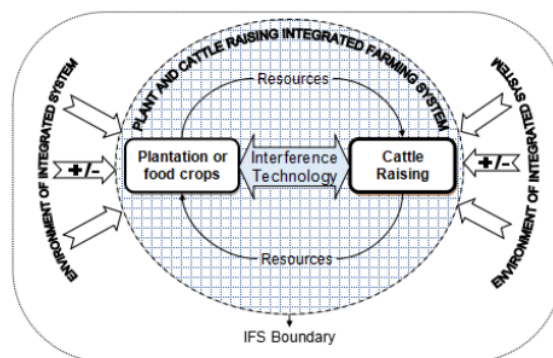


Figure 1. Resources Flow Cycle on the SIFAS Approach

The resource flow cycle above shows that both solid and liquid cattle farm waste is used for the production of organic fertilizer. Urine liquid waste is used for bio-urine production, while solid waste in the form of feces and feed residue is used for raw material for compost production. The two types of organic fertilizer are then used as a substitute for commercial fertilizers in inter-cropping cultivation. When harvesting inter-cropping plants, a by-product will be produced in the form of crop residues. The rest of this plant can be used as a source of cattle feed and/or ingredients for the compost production. Specifically, the SIFAS approach includes three business activities, namely cattle raising, waste processing technology, and intercropping. Collective action for first and second activities can be combined in one model and for the third one will have its own model but both complement each other. As a boundary in the implementation of the collective action model, not all activities are carried out together but there are activities carried out in a personal and collective manner, such as Figure 2.

Briefly, it can be explained that collective action was carried out starting from raising cattle in the SRFG collective animal house, processing waste in the IWP unit, intercropping mechanism, and marketing of products. Sources of raw materials for IWP units both member and SRFG collective cattle raising, but do not rule out the possibility of the surrounding cattle farmers. For this reason, every animal house, both personal and collective, must be equipped with a place for storing liquid waste and drying solid waste. The pricing of each type of waste was IDR 300/kg for solid waste and IDR 1,000/litre of liquid waste which can be paid in cash or calculated as a farmer supplier deposits. Related to the utilization of waste processing results as an example for TCI products can be sold or used for intercropping programs. If sold, then net revenue (IDR 340/kg) was the margin between product price (IDR 1.100/kg) and cost (IDR 760/kg) multiplied by quantity. Net revenue was then distributed for payment of suppliers' raw materials, cost of IWP production and SRFG cash deposits. Specifically, the mechanism for sharing profit in the SRFG intercropping program under the replanting rubber stand can be illustrated in Figure 3.

This share profit mechanism was the result of an agreement taken through internal discussions between the SRFG management and members. SRFG collectively provided all intercropping inputs including organic and commercial fertilizers, seeds, pesticides and herbicides except land and labor for pest maintenance and control. The funding source was the result of the commercialization of organic fertilizers produced by the IWP unit which will be calculated as production costs. During the cultivation process, the collective use of labor is carried out when large needs such as land preparation, initial fertilization, planting, and harvesting. Conversely, for activities requiring little energy such as plant safety from pests and diseases and other threats using available family labor.

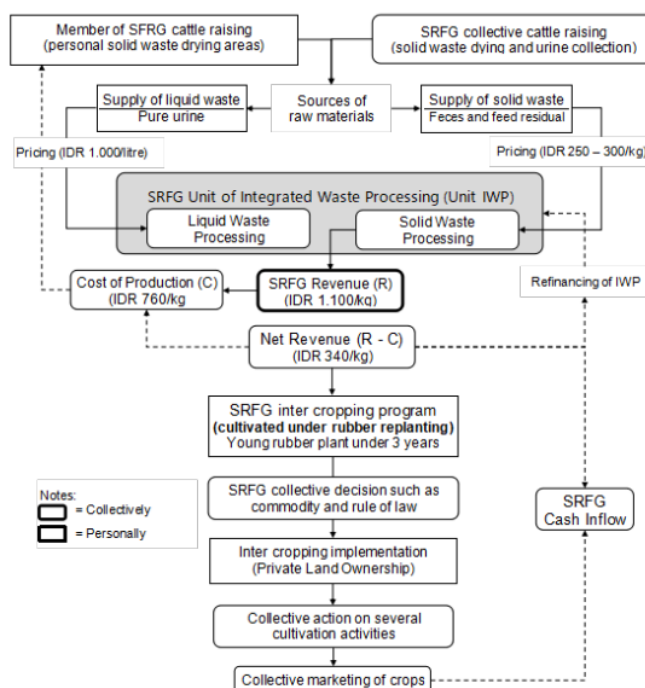


Figure 2. The Boundary of the Collection Action on the SIFAS Approach

The profit sharing system between landowners and SRFG was 60:40 after deducting the product portion used for breeding the seeds (5% of production volume) and total production costs. Net revenue received by landowners was expected to be a substitute for temporary loss income during the replanting process, while those received by SRFG are used for expansion of intercropping programs. Another value expected from the program was to encourage households to more intensively maintain replanting rubber plants and obtain crop residues for cattle feed reserves. How much part of the results obtained by each party will be discussed in the implementation of inter-cropping both the demonstration plot and the implementation on a household scale.

3.2. Waste Processing Technology as an Interface Media

The previous discussion implicitly explained the components and boundaries of the collective action model using the SIFAS approach. Farming branches as a component of the integration system were connected by a media called technology. At least there are 3 technologies that become the connecting media in the model, namely the composting and bio-urine technology, and the intercropping technology. Called Trichocompost In-situ (abbreviated TCI) cause it is an organic material in the form of a mixture of cattle raising waste and residues of crops who are composted using Trichoderma as a biological agent [20]. Trichoderma species are commonly used as an effective biological agent to control phytopathogens especially the soil-borne fungi while some isolates are able to ameliorate plant growth [21].

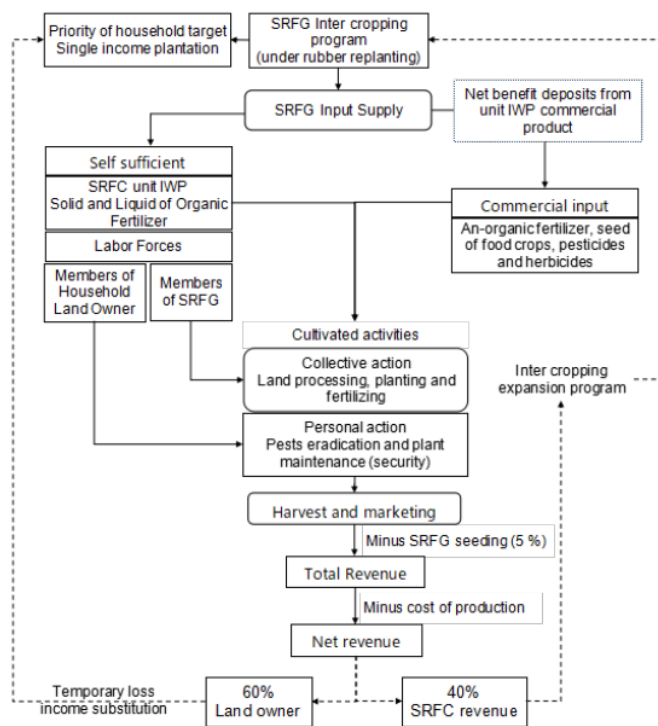


Figure 3. The SRFG share profit mechanism on the SIFAS Approach

The process of the TCI production can be grouped into 3 (three) stages, namely raw material preparation (collecting and drying), composting and post-composing (harvest and packaging). The second stages are composing begins with the preparation of the main raw material consisting of solid waste which has undergone a drying process and in-situ plant waste (leaves and legumes). After that, the top of the waste arrangement is spread rock phosphate evenly and doused with Trichoderma. Reversal is done every 2 days during the composting process, which is 1 week or 3 times during the composting process. Composing lasts for 1 week and after the composting process is sieved before packaging, the results of laboratory analysis the average nutrient content in each level of the combination of solid waste and plant residuals can be seen in Table 1.

The analysis results indicated that the effect of increasing the composition of the plant residual is not significant for the content of C elements but affects the content of P and N. The addition of plant residual composition to the level of 30% significantly encourages a decrease in the nutrient content of P and N, so the recommended level of use is 25%. Composition treatment is only significant for the color change of the organic fertilizer produced, where the higher the residual components of the plant, the brighter the color of the TCI. The limited watering treatment using pure urine during the composting process does not cause a significant difference in the nutrient content with watered with ordinary water. The addition of raw urine during the fermentation process is limited in order to avoid fermentation failure due to too wet waste. This indicates that the use of urine in cultivation should be done directly and ineffectively mixed on the TCI production.

Table 1. Analysis Results in Effect of Raw Material Composition of TCI Ingredient of C, P, and K

No	Nutrient	SW and PR Composition	Watering treatment		Average
			Water	Urine	
1	C	80 : 20	20.950	19.887	20.418 ^a
		75 – 25	17.337	18.893	18.115 ^a
		70 – 30	12.333	11.637	11.985 ^a
		Average	16.783 ^a	16.806 ^a	
2	P	80 : 20	0.375	0.313	0.344 ^a
		75 – 25	0.331	0.467	0.399 ^a
		70 – 30	0.250	0.153	0.202 ^b
		Average	0.319 ^a	0.311 ^a	
4	N	80 : 20	1.718	1.853	1.786 ^a
		75 – 25	1.979	2.067	2.023 ^a
		70 – 30	1.036	0.967	1.001 ^b
		Average	1.578 ^a	1.629 ^a	

Notes: Different letters show significant at the level of confidence 90% (Prob. <0,1)

SW = solid waste and PR = plant residual

Sources: Analyzed by ANOVA Completely Randomized Design

⁴All organic matter was made up of substantial amounts of carbon (C) combined with lesser amounts of nitrogen (N). The balance of these two elements in an organism is called the carbon-to-nitrogen ratio (CN ratio). For best performance, the compost pile, or more to the point the composting microorganisms, require the correct proportion of carbon for energy and nitrogen for protein production. The average CN ratio of TCI is 12,198 and is still in the range of the CN ratio of organic materials that can be absorbed by plants which range from 12-15 and temperatures close to ⁴ambient temperature. If the CN ratio is too high (excess carbon) decomposition slows down and if too low (excess nitrogen) you will end up with a stinky pile.

The use of urine directly in plants cultivation is also ineffective so that treatment is needed and one of them is through the development of bio-urine plus. Bio-urine plus is a liquid organic fertilizer that has been added by several bio-pharmacy plants so that it also has the ability to prevent plant diseases. To accelerate the pace of production and labor efficiency, a model of a liquid waste treatment plant is developed with an aeration system approach as shown in Figure 4.

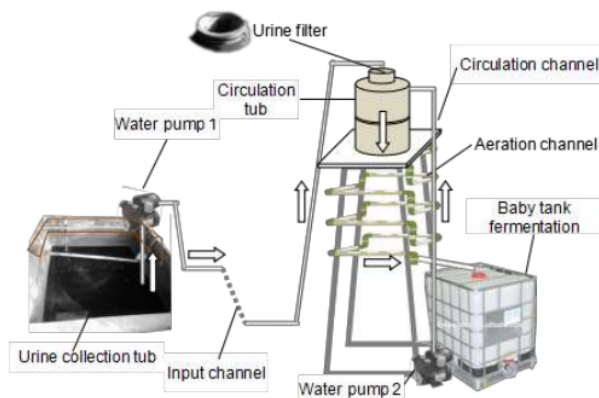


Figure 4. Bio-urine A Plus Processing Installation

16

Aeration is the process of increasing the oxygen saturation of the water, as a result, which produces active sludge that can be used as fertilizers, so the liquid fertilizer produced is called bio-urine A plus (abbreviated BA+). Briefly, the BA+ production process starts from filling fermented baby tanks from pure urine into a special liquid waste collection tank in cattle housing using the first water pump. The production capacity for each treatment process is in accordance with the volume of the baby tank used which is around 1,100 liters. After the baby tank is full, the input channel is closed and opens the aeration channel. The aeration process consists of two types, namely type of flowing water and waterfall stairs. The process of pure urine aeration with the help of a second water pump is carried out for 3 days with a frequency of 2 times a day for approximately 15 - 20 minutes [22].

Starting fermentation process on the last day of aeration, pure urine is added with an EM-4 and brown sugar solution, as well as a mixture of biopharma plants (Zingiber officinale, Curcuma xanthorrhiza, Kaempferia galangal L, Ginger, and Tumeric) wrapped in gauze. Leave the fermentation process in an-aerobic condition for 3 days and then do the stirring process. During the fermentation process around 12 days stirring was carried out 3 times, namely the 3rd, 6th, and 9th day in the same way as the aeration process but only once every stirring with about 15 minutes. The results showed that through this aeration method besides the production capacity of BA+ more (1,100 liters/period) and faster (15 days) than the conventional method (21 days) also produced BA+ with lighter colors and pungent odors disappearing.

The last interface technology is the use of TCI and BA+ in intercropping cultivation with 4 (four) food crops commodities namely corn, sorghum, rice, and soybean. The demonstration plot was conducted on 3 years old replanting rubber land with a total area of 2 ha (0.5 ha for each food commodity). The same fertilizer treatment for all food commodities is using TCI 5 tons/ha and for planting still using commercial fertilizers (Urea, KCl, TSP, and Dolomite). The BA+ treatment is only applied to corn and sorghum plants by giving mixed water with a ratio of 1: 10 after the plants are 2 weeks old for 2 months with a frequency of two weeks. The average productivity level and the results of the analysis of benefit costs for each food crop are presented in Table 2.

Table 2. Food Crops Productivity and Estimation of Revenues, Costs and Net Revenues of Cultivation under Rubber Replanting

No	Food Crops	Productivity (ton/Ha)	Revenue (IDR/Ha)	Total Cost (IDR/Ha)	Net Revenue (IDR/Ha)
1	Soybean	2.04	5,530,000	2,720,850	2,809,150
2	Upland Rice	3.03	5,522,000	2,487,050	3,034,950
3	Corn	2.83	5,947,200	2,740,310	3,206,890
4	Sorghum	2.62	5,440,000	2,661,650	2,778,350

Sources: Data processing, 2017.

Food crop productivity at demonstration plots is lower than some of the results of intercropping research such as 2.12 tons/ha [23] for soybeans and 3.80 tons/ha [24] for upland rice, 4.246 ton/ha [25] for corn, and 2.69 ton/ha [26]. The productivity ratio of all four food crops so far with the results of previous studies shows that only the productivity of sorghum food crops is the closest. Observations during the maintenance period of food crops showed that the BA+ treatment had a positive influence on the growth of corn and sorghum plants. The average height of sorghum plants watered by BA + reached 277.5 cm, much higher than without watering which was only 185.0 cm and the same thing for corn plants reached 213.8 cm compared to without watering ie 171.3 cm (see Figure 5).

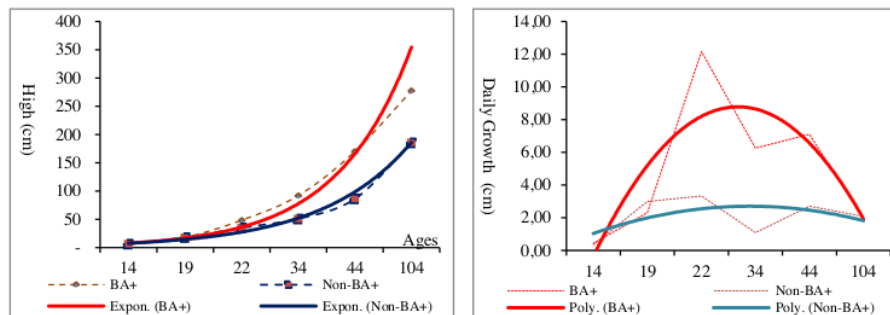


Figure 5a. Growth Pattern of Sorghum

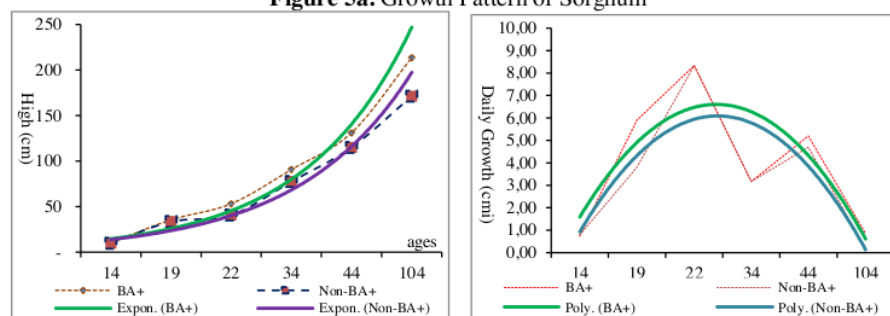


Figure 5b. Growth Pattern of Corn

Figure 5. Graphically, the impact of BA+ watering on food crops growth pattern

The maximum growth rate of the BA+ watered treatment more rapid (<34 days) compared to sorghum were not watered, but in general growth in the same period remained higher. This indicates that the acceleration of the growth rate of plant height can take place consistent with their BA+ watering treatment. Statistically, the plant height achieved at harvest between sorghum and maize differed significantly with differences reaching around 53.45 cm. Food crops that were given a BA+ treatment produced significantly different harvest heights of around 69.07 cm compared to without watering. Every centimeter increase in plant height significantly increases the harvest weight of 4.31 grams. The higher the height of the plant at harvest, the smaller the ratio of hump weight to the stem, which means that the increase in plant height has more influence on the weight of the stem than the weight of the cob, and the same thing happened to the weight of the crop although not significant.

Table 3. The impact of food crop cultivation on the performance of replanting rubber plants

No	Variable	Unit	Performance	
			Non-IC	IC
1	Stem circumference			
a.	Initial observation	cm	4.68	5.05
b.	Final observation	cm	6.53	7.41
2	Changes (105 days)	cm	1.85	2.36
4	Daily changes	cm/day	0.02	0.02
5	Growth (105 days)	%	0.42	0.46
6	Daily growth	%/day	0.38	0.44

Notes: IC = Inter-cropping

Statistically, the daily growth of rubber plant stem circumference in the intercropping area (0.45%) was significantly higher than the rubber plant on the same area (0.38%). This is in line with the research results show that sorghum as a intercropping has a positive effect on the growth of clone rubber plants IRR 118 [26]. Planting short-lived plants between long-lived plants aims to suppress weed growth by covering the area that is usually overgrown with weeds. This is one of the advantages of food crop cultivation after replanting rubber, in addition to several other advantages, namely 1) intercropping can function as a cover crop, so that it serves to conserve rubber land, 2) efficiency of farming costs and labor, because of maintenance farming costs rubber plants can be done together with maintenance of intercropping, 3) increasing farmers' income and 4) farmers can provide their family's food needs independently, so they can save food needs in the area.

Based on the net revenue of each food crop and the collectively agreed profit sharing system (60:40), substitution can be obtained for each commodity. Survey of rubber smallholder who is decreasing productivity shows that the average land ownership area reaches 2.60 ha/household, and the average potential loss of monthly income if rubber rejuvenation is reached IDR 1.85 million/ household or IDR 770.713/Ha. Using the assumption that in one-year consists of 2 planting seasons, the substitution power for each panga commodity is presented in Table 4. In general, the substitution power of food crops to TLS is still not full, which is an average of 49.07% with the highest ability in corn food crops (55.83%). The low substitution power was caused by a maximum of two planting seasons in one year. The condition of the land which was in a moderate and quite undulating land, the availability of water is very dependent on the season. Other factors were related to the level of soil fertility that begins to decline so that the productivity of food crops was also not optimal. The highest substitution of corn food crops was one of the basic considerations for SRFG members in implementing intercropping under the immature plant of rubber replanting.

Table 4. Substitution power of intercropping for potential lost income under rubber replanting

No	Food crops	Land owner revenue (IDR)		Substitution power (%)
		Yearly	Monthly	
1	Soybean	4,686,000	390,500	50.67
2	Upland rice	3,729,360	310,780	40.32
3	Corn	5,163,288	430,274	55.83
4	Sorghum	4,649,040	387,420	50.27
	Average	4,556,922	379,744	49.27

Sources: Data processing, 2017.

3.3. The Household Inter-cropping Implementation and Performances

The selection of commodities for intercropping implementation was determined through the SRFG members' collective decisions. The choice of corn besides due to consideration of substitution power was also related to the low risk of production and marketing. Even soybean and upland rice had no problems in marketing but were susceptible to pests and wild birds. On the other hand, sorghum even though they were able to achieve optimal production conditions but were still not well known so that the results are difficult to sell. Individuals of society naturally tend to choose joint actions when there were similarities in terms of goals to be achieved and when they feel there are uncertainty and the risks faced when moving alone [27]. The implementation of corn cultivation under the replanting rubber stand was carried out on land belonging to 6 members of SRFG with a total area of 8.5 hectares, which can be grouped on 4 as shown in Table 5.

Table 5. The grouping of replanting rubber land used for the implementation of corn cultivation as intercropping area

No	Group of Age	Cultivation are		Owner
		Ha	%	
1	Control (1 - 1,5 years)	2,0	23,53	1
2	< 1 year	2,0	23,53	3
3	1 - 1,5 years	2,0	23,53	1
4	> 1,5 years	2,5	29,41	1
Sum		8,5	100,00	6

Sources: Land area inter cropping implementation, 2016

The control group was cultivating corn on the land belonging to the SRFG leader and functioning as a demonstration plot for other households. The others location (non-control) land replanting belonging to group members with the following characteristics: a) separate from settlements, b) surrounded by old rubber plants (local community calls it rubber forest) that are still bushy and c) scattered in several locations around the village area (not in one stretch). The first stage of planting (June 2016) in control land failed due to drought factors, so replanting (September 2016) was carried out simultaneously with the land of other group members. Achievement of the level of corn production for each planting group is presented in Table 6. The attack of wild animal pests (monkeys and wild boar) occurs in all corn plantations and there is even one plot of land that is not left and does not reach the age of harvest. Initial anticipation has been made by installing a fence of plastic mulch around the corn planting area plot. On land provided by special security personnel, some can still be saved, including in the demonstration plot area. Of the 8.5 ha replanting rubber land with an area of planting corn food 70% (5.95 ha) leaving only about 35% (2 ha) that can be harvested. Based on the average yield of corn produced (687,23 kg) and the area of corp planting (1,49 ha) obtained actual productivity of 490,54 kg/ha, but if calculating only the harvested area, the potential productivity was obtained 856,38 kg/ha. The highest productivity in control land (1,92 ton/Ha) was still far below the expected productivity of corn food crops, which is 2.83 tons/Ha.

Table 6. The grouping of replanting rubber land used for the implementation of corn cultivation as intercropping area

No	Grouped of age	Area			Yield (kg)	Productivity (kg/Ha)	
		Plantation (Ha)	Crop (Ha)	Harvest (%)		Actual	Potential
1	Control	2,00	1,40	50	1.345,00	960,71	1.921,43
2	< 1 year	2,00	1,40	10	4,32	3,09	30,86
3	1 - 1,5 years	2,00	1,40	70	1.390,00	992,86	1.418,37
4	> 1,5 years	2,50	1,75	10	9,60	5,49	54,86
Average		2,25	1,49	35	687,23	490,54	856,38

Sources: Land area inter cropping implementation, 2016

In general, the implementation of corn as a place between the rubber replanting can be said to fail to reach the target. The feasibility of expanding the implementation of other areas in the surrounding area was also still doubtful because based on the results of household surveys most of the smallholder rubber farming has almost the same characteristics. The survey data from three central areas of smallholder rubber plantations show that a) about 81.58% of smallholder rubber plantations are located on one stretch with varying age conditions of plants, b) the location of plantation land was around 67.79% far from settlements with a majority distance > 1 km, and c) approximately 98.00% of separate plantation land with settlements not specifically guarded by households.

Market factors and the risk of disease attacks that were considered in choosing food commodities, seasonal factors (availability of plant water sources) and the level of vulnerability to wild animal pests are external factors in the collective action model. Of course, commodity market price factors and the sustainability of the availability of raw materials for waste (the development of cattle population) and other sources of income (other business branches) were other external factors that influence the performance of the collective action model. This discussion complements the fourth characteristic of the SIFAS approach, namely the external environment of the IFS in addition to government policy and institutional factors.

4. Conclusion

Based on the results of research and discussion, some conclusions can be taken, namely a) the collective action in integrated waste processing to produce TCI and BA + can work well but not followed by inter cropping cultivation implementation, b) the TCI product with lighter colors (light brown) and shorter production time (15 days) and CN ratio 10,198 have met the requirements for use in food crop cultivation with a CN ratio range of 10 - 15, c) the prototype technology of BA+ with capacity 1,100 liters/period more advantages over conventional methods because it only takes 18 days with clearer colors and loss of pungent odor, d) the substitution power of food crops is only about 49.27% of the potential temporary loss income (IDR 1.85 million) with the highest in corn which is equal to 55.83%, e) the productivity of food crops under the replanting rubber stand implemented on a household scale is not as targeted as achieved by planting demonstration plot scale, and f) the main inhibiting factor is not in the aspect of farmers' technical capacity of cultivation but rather the factor of availability of water resources which is highly dependent on the season and pest attacks on wild animals such as monkeys and wild boar. So that we recommended to design further research is needed to address the problem of management of water availability and control of wild animal pests.

Acknowledgments

This research for this paper was financially supported by the Ministry of Research, Technology and the High Education Republic of Indonesia through MP3EI scheme 2015 - 2017 with contract number 11/UN21.17/PP/ 2017. In particular, thanks to SRFG for their cooperation and the rubber farmer's household for all information in the survey activities. Thanks also to the leaders of Jambi University and the Institute for Research and Community Service for their assignments, as well as support from the CoE Land Reclamation Technology.

References

- [1] Indonesia Investment 2011 Masterplan for Acceleration and Expansion of Indonesia's Economic Development
- [2] GGB (Global Business Guide) Indonesia, 2012. Overview of the rubber sector
- [3] RJA (Rubber Journal Asia) 2018 *SEA Rubber Producers to Gather and Discuss Falling Prices*, Asia's First's e-magazine for rubber industry
- [4] Syarifa LF, DS Agustina, A Alamsyah and IS Nugraha 2017 *Indonesian Journal of Natural Rubber Research* 35 (1) 71 - 82.
- [5] AZOM (AZO Material) 2016 Natural rubber/latex-production of natural rubber
- [6] Ferry Y 2014 *Rejuvenation of Cheap and Effective Smallholder Rubber Plantations* Science and Technology Column Indonesian News Online
- [7] Damardjati DS 2011 *Rejuvenation and Expansion of Rubber Plantations: Demands for The Rejuvenation of The Smallholder Rubber Plantation* Economic news: plantation business
- [8] Septianita 2009 *AgronomiS Journal*, 1 (1) 130-136.
- [9] Novra A, Sunarti, and Endriani 2013 *Bio-compos insitu application on the land rehabilitation to Soybean plant under rubber replanting* The partnership research report: CoE Land Reclamation Technology, Research, and Development Technology (Jakarta: Ministry of

- Research and Technology Republic of Indonesia)
- [10] Idoko SO, Ehigiator JO, Esekhide TU and Orimoloye JR 2012 *Journal of Agriculture and Biodiversity Research* 1 : 97-101.
 - [11] Dusa E, M and V Stan 2013 *European Scientific Journal* **21** 69-78.
 - [12] Moradi H, M Noori, M Fahramand, A Sobhkhizi, and K Rigi 2014 *Journal of Novel Applied Sciences* **3** 315-320.
 - [13] Nielsen H, MK Andersen, B Jørnsgaard, ES Jensen 2006 *Field Crops Research* **95** 256–267.
 - [14] Kochakinezhad H, G Peyvast, AK Kashi, JA Olfati and A Asadii 2012 *Journal of Organic Systems* 7 (2) 14 - 25.
 - [15] Pradhan SS, S Verma, S Kumari and Y Singh 2018 *International Journal of Chemical Studies (IJCS)* 6 (3) 298-301.
 - [16] Jones D, N Nekbakhtshoev and D Spechler 2016 *Society for International Development* **16** 1011-6370
 - [17] Lobo IDM, Velez M and S Puerto 2016 *International Journal of the Commons* 10(2) 982-1012.
 - [18] Meinen-Dick R, DM. Gregorio and N McCarthy 2004 *Agricultural Systems Journal* 82(3) 197-214
 - [19] Novra A and Adriani 2015. Master plan of integrated farming area development in Jambi Province, Report of Livestock and Animal Health Service, Jambi Province.
 - [20] Novra A, Suparjo, Endriani and A Meilin 2015 *Guide Book: Technology processing of trichocompost in-situ, MP3EI scheme output research* (Jambi: Jambi University research and community service institution)
 - [21] Talukdar P, MM Siddiq, MMI Masum, ABM Habibullah, and MKA Bhuiyan 2017 *International Journal of Environment, Agriculture and Biotechnology* 2(2) 0831-0839.
 - [22] Novra A, Suparjo, Endriani and A Meilin 2015 *Guide Book: Technology processing of trichocompost in-situ, MP3EI scheme output research* (Jambi: Jambi University research and community service institution)
 - [23] Sopandie D and Trikoesoemaningtyas 2011 *Food Crop Science and Technology Journal* 6(2) 168 - 182.
 - [24] Arifin Z and HM Toha 1996 *Agricultural Research Journal* 15(3) 174 - 180.
 - [25] Sahuri 2017 *Agrotechnology Journal* 8(1) 1-10.
 - [26] Sahuri 2017 *Journal of Agricultural Policy Analysis* 15(2) 113-126.
 - [27] Syamsuddin, Neldysavrino, H Komarudin, and Y Siagian 2007 Are community aspirations being accommodated in development plans? A lesson from collective action in Jambi Governance Brief No. 34. Bogor, Indonesia: CIFOR.

Collective Action Model: Facing Temporary Loss Income while the Rubber Replanting Program

ORIGINALITY REPORT

20%
SIMILARITY INDEX

19%
INTERNET SOURCES

11%
PUBLICATIONS

10%
STUDENT PAPERS

PRIMARY SOURCES

1	www.gbgindonesia.com Internet Source	3%
2	repository.umi.ac.id Internet Source	3%
3	insis.vse.cz Internet Source	2%
4	slideplayer.com Internet Source	1%
5	www.ajol.info Internet Source	1%
6	www.chemijournal.com Internet Source	1%
7	tuyisengemoses.wordpress.com Internet Source	1%
8	pdfs.semanticscholar.org Internet Source	1%
9	cyberleninka.org Internet Source	1%

10	ejournal.puslitkaret.co.id Internet Source	1 %
11	jnasci.org Internet Source	1 %
12	Ardi Novra, Adriani, Ade Oktavia, Depison. "CHEAP SYARIAH QURBAN INVESTMENT (CSQI) PROGRAM: DETERMINING FACTORS OF POTENTIAL PARTICIPANTS DECISION MAKING", International Journal of Research - GRANTHAALAYAH, 2021 Publication	1 %
13	www.azom.com Internet Source	1 %
14	docplayer.net Internet Source	<1 %
15	www.latexindia.com Internet Source	<1 %
16	www.environmental-expert.com Internet Source	<1 %
17	www.slideshare.net Internet Source	<1 %
18	Defne Jones, Navruz Nekbakhtshoev, Dina Spechler. "Collective Action for Rural Village Development", Development, 2016 Publication	<1 %

- | | | |
|---|---|----------------|
| <div style="background-color: #8B4513; color: white; padding: 5px; display: inline-block;">19</div> | <p>Submitted to University of Lancaster</p> <p>Student Paper</p> | <p><1 %</p> |
| <hr/> | | |
| <div style="background-color: #0056b3; color: white; padding: 5px; display: inline-block;">20</div> | <p>Tania June, Ana Meijide, Christian Stiegler, Alan Purba Kusuma, Alexander Knohl. "The influence of surface roughness and turbulence on heat fluxes from an oil palm plantation in Jambi, Indonesia", IOP Conference Series: Earth and Environmental Science, 2018</p> <p>Publication</p> | <p><1 %</p> |
| <hr/> | | |
| <div style="background-color: #800080; color: white; padding: 5px; display: inline-block;">21</div> | <p>dosen.umsida.ac.id</p> <p>Internet Source</p> | <p><1 %</p> |
| <hr/> | | |
| <div style="background-color: #6b8e23; color: white; padding: 5px; display: inline-block;">22</div> | <p>Davide Piras, Hiranya V Peiris, Andrew Pontzen, Luisa Lucie-Smith, Ningyuan Guo, Brian Nord. "A robust estimator of mutual information for deep learning interpretability", Machine Learning: Science and Technology, 2023</p> <p>Publication</p> | <p><1 %</p> |
| <hr/> | | |
| <div style="background-color: #000080; color: white; padding: 5px; display: inline-block;">23</div> | <p>Nurhayati Sembiring, Humala Lodewijk Napitupulu, Meilita Tryana Sembiring, Aulia Ishak Sipahutar. "The role of model simulation for replanting activities: A review", IOP Conference Series: Materials Science and Engineering, 2021</p> <p>Publication</p> | <p><1 %</p> |
| <hr/> | | |
| <div style="background-color: #0056b3; color: white; padding: 5px; display: inline-block;">24</div> | <p>Submitted to Universitas Brawijaya</p> <p>Student Paper</p> | |

<1 %

25

Submitted to Universitas Jenderal Soedirman

Student Paper

<1 %

26

www.rsisinternational.org

Internet Source

<1 %

27

Yardha, L Izhar, Salwati. "Farming Support Systems for Smallholders Rubber Production in Jambi, Indonesia", IOP Conference Series: Earth and Environmental Science, 2022

Publication

<1 %

28

breathe.ersjournals.com

Internet Source

<1 %

29

www.ukessays.com

Internet Source

<1 %

30

pertambangan.fst.uinjkt.ac.id

Internet Source

<1 %

31

www.proceedings.com

Internet Source

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On

Collective Action Model: Facing Temporary Loss Income while the Rubber Replanting Program

GRADEMARK REPORT

FINAL GRADE

/1000

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14