

SFRN 2019

PROCEEDING

Security in
food,
renewable
resources,
and
natural
medicines



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**3rd INTERNATIONAL CONFER-
ENCE ON SECURITY IN FOOD,
RENEWABLE RESOURCES, AND
NATURAL MEDICINES 2019
(SFRN 2019)**

Convention Hall Politeknik Pertanian Negeri Payakumbuh
INDONESIA



hosted by,
Politeknik Pertanian
Negeri Payakumbuh



co-Hosted by,
Universitas Andalas
(UNAND)

QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF SUSTAINABLE DE- VELOPMENTS GOALS (SDGS)

September 25-26, 2019



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Welcome Message
**Executive Chairman of The 3rd International Conference on Security in Food,
Renewable resources, and Natural Medicines (SFRN) 2019**



Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikum wr.wb

On behalf of the SFRN 2019 organizing committee, I am really honoured and delighted to welcome all of you to the 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the State Polytechnic of Agriculture Payakumbuh, West Sumatra Indonesia

Our technical program is rich and varied with 8 keynote speeches and 4 invited talks and more than 170 technical papers split between 8 parallel oral sessions and 1 poster sessions. The speakers and participants came from 8 different countries, consist of Academicians, Scientists, Researchers, Practitioners, Professionals, and Government Officials in multidiscipline branch of knowledge, who gathered here today to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and HealthCare Free for All, in particular for those who in needs. As the chairman of conference 2019 SFRN, I know that the success of the conference depends ultimately on the how many people who have worked in planning and organizing both the technical program and supporting social arrangements. This year, the conference is jointly organized by the Payakumbuh State Agricultural Polytechnic and Andalas University. We also thank to the steering committee for their wise and brilliant advice on organizing the technical program; and also to the the Program Committee, both from the Payakumbuh State Agricultural Polytechnic and Andalas University , for their thorough and timely reviewing of the papers and to the Director of Payakumbuh State Agricultural Polytechnic and the rector of Andalas University, and the Head of the Institute for Research and Community Service of Andalas University, and Payakumbuh State Agricultural Polytechnic. Our recognition should go to the Organizing Committee members who have all worked really hard for the details of the important aspects of the conference programs and social activities, and then we extend our gratitude to our students who bore the arduous burden for preparing this event.

We hope this event is also a good step in gaining strengthened cooperation between our universities as we know that the State Agricultural Polytechnic of Payakumbuh is part of the Andalas University previously, of course the psychological relationship between the State Agricultural Polytechnic and the Andalas University is really close.

Finally on behalf of the committee, we apologize profusely for all the shortcomings and everything that is not properly in organizing this event and hopefully AES-Network contributes significantly to the research and technology for the good of humanity.

Thank you

Fithra Herdian, S.TP, MP

**Message from Afro-Eurasia Scientific (AES) Network
3rd International Conference on Security in Food, Renewable resources, and
Natural Medicines (SFRN) 2019**



Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

On behalf of the AES Network, I am honored and delighted to welcome you to the 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the Agricultural State Poly Technique of Payakumbuh, Indonesia. I believe we have chosen a venue that guarantees a successful technical conference amid the culture, delicacy and scenery of Payakumbuh, the city of "Rendang".

The AES-Network aims to Promote Livelihood Through Food Security, Promote Future Smart and Green Mobility by Using Renewable Energy, Promote Prosperity by Equally Managing and Distributing the Sustainable Resources and Promoting Enjoyable Long-Life by using Natural Medicines With Free Health Care For All. The AES-Network was established in 2018 and already have memberships from 12 countries. Our members consist of Academicians, Scientists, Researchers, practitioners, professionals, and government officials from multidiscipline branch of knowledge, who gathered and contributed their expertise to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In particular, the network aims to alleviate the condition of those who in dire needs. In the future, we also expect to provide technical demonstrations, and numerous opportunities for informal networking for Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In this opportunity, we invited you to become our members and join our efforts for a better life to all of mankind.

As a team, we acknowledge the existence of mutual interest among university and college educators, researchers, activists, business sector, entrepreneurs, policy

makers, and all society members. We must promote the need to strengthen cooperation for establishing Security in Food, Renewable Resources, and Natural Medicines in Africa, Europe, and Asia.

The AES-Network believe, a firm foundation for mutual collaboration with the spirit of equality and partnership and thereby contribute towards sustainable development in these three regions.

Therefore, through networking, friendships, and joint efforts, the capacity of our network can be enhanced to address major challenges in securing the Food, Renewable Resources, and Natural Medicines in Africa, Europa, and Asia. Our Network goals are to increase the awareness of educators, researchers, scientific community, business sector, entrepreneurs, and policy makers in Africa, Europa, and Asia, that the future of a better world, lies within their responsibilities, and to improve the networking, mobility and mutual collaboration of scientific community, business sector, entrepreneurs, and policy makers in Africa, Europe, and Asia to energize the delivery of Sustainable Development Goals.

Finally, I hope that, by registering our network, you will be provided a common platform and support the exchange of knowledge, while at the same time, we offer constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrived at the best solutions to our terminal goal, Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care based on scientific evidence in Africa, Europa, and Asian region.

Thank You for Joining us!

President

Assoc. Prof. Dr. Eng. Muhammad Makky

Welcome Message
Head of Institute for Research and Community Service
Universitas Andalas



Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

It is with great pleasure that I welcome the participants of the SFRN 2019 in Payakumbuh, the city of “Rendang”, the prime of Indonesian delicacy.

In this esteem event, we share the knowledges, and imparted it to the people. The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied to benefit humankind. It is hoped that this conference will become a platform to gather and disseminate the latest knowledge which can be adopted for securing the food, resources, and health for mankind, in Asian, European and African region.

Academics, Scientists, Researchers and practitioners from multidiscipline branch of knowledge who gathered here today will be able to share and discuss new findings and applications of innovations for ensuring food security, in particular for those who reside in developing countries. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to issues on environmental and sustainability. Therefore, we urge to all participants, to establish a scientific network that will voice the needs

Researchers in the multi sectoral aspects related to the benefit of mankind have been progressing worldwide. Food is a basic right, while energy drive the world. Human need a lot of resources so the civilization can be flourished. But human is not immune, and thus, ones need to take care of their health regularly. Modern Agri-food systems is the foundations of a decent life, a sound education and the achievement of

the Sustainable Development Goals. Over the past decade, we have witnessed a chain reaction that threatens the very foundations of life for millions of the world's people. Rising energy prices drove up the cost of food and ate away the savings that people otherwise would have spent on health care or education. Unsustainable plantation management induced forest fire and posed haze hazard to the whole Sumatra island and our neighboring countries.

The human cost of the food and energy crisis has been enormous. Millions of families have been pushed into poverty and hunger. Thousands more suffering from the collateral effects. Over the past year, food insecurity led to political unrest in some 30 countries. Yet because the underlying problems persist, we will continue to experience such crises, again and again -- unless we act now. That is why we are here today.

We must make significant changes to feed ourselves, and most especially, to safeguard the poorest and most vulnerable. We must ensure safety nets for those who cannot afford food, or energy, nor even a health service. We must transform agricultural development, markets and how resources is distributed. We must do so based on a thorough understanding of the issues. That is the only possible way we can meet the Goals of Sustainable Development.

Thank You,

Assoc. Prof. Dr.-Ing. Uyung Gatot S. Dinata,MT.

**Opening Ceremony
Rector of Andalas University**



Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

I welcome the opportunity to address you at this important event.

It gives me great pleasure in welcoming you to this 3rd Conference on "Security in Food, Renewable resources, and Natural Medicines (SFRN)" 2019. I am delighted that so many have accepted our invitation. I am particularly happy that we have in this room, dedicated individuals from so many stakeholder groups — including our most respected and distinguished guest “The ministry of Agriculture of the Republic of Indonesia”. We also welcome the mayor of Payakumbuh and the Regent of Lima Puluh Kota. We extend our welcome to the civil society, the private sector, international organizations; the science community; and others dedicated to help create an environment in which people can escape food insecurity. Imagine what we can do together if we make the security for all as an our top priority, and pull in the same direction. We can make a difference in the lives of millions.

Food is a basic right. Food security are the foundations of a decent life, a sound education and the achievement of the Sustainable Development Goals Access to medicines - a fundamental element of the right to health. Health is a fundamental human right, indispensable for the exercise of many other rights in particular the right to development, and necessary for living a life in dignity. Moreover, human rights principles and language are being used to support resource access claims as rights-based approaches empower individuals and groups to gain or maintain access to natural resources

Much progress has been made during the last decades but much more needs to be done. Millions of people are Insecure worldwide, meaning that they either starve or they do not know from where their next meal, health care or resources will come.

Much of the progress on security has occurred at the expense of our environment. With business as usual, we foresee that the production improvements during the next decade will be less than the last one, while the environmental degradation will continue, and health will deteriorate significantly. Without available resources to seek, mankind will become endanger species in a very short time.

Solutions to the security problems need to be designed and implemented within a new and rapidly changing environment. Globalization and sweeping technological changes offer new opportunities for solving these problems. A number driving forces or trends must be taken into account in developing appropriate action. Some of the action needed, such as appropriate technology for small farms, is not new but it must be cast in the new and changing global and national environment, taking into account new opportunities and risks. I hope that by providing a forum for knowledge exchange, this conference will help identify the action to be taken. Furthermore, this conference will help to provide constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrive at the best solutions.

In conclusion, even if those responsible give high priority to achieving sustainable security for all and back it up with action, the world may not achieve the goal by 2030. But we will be much closer than with business as usual. I urge all of us to provide the strongest support for this event, to enable securing the food for all in the closest time possible. It is my sincere optimism that through the accomplishment of the objectives of this event, we will come to an important step nearer to secure the food for all.

Finally, I would like to thank the organizing committee who have spent their utmost efforts to prepare and manage this event successfully. Let me conclude my remarks by wishing our guests happiness, good luck and great success in the conference.

May I announce now the opening of the “3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019” in Payakumbuh.

Thank you.

Rector,
Prof. Tafdil Husni, SE, MBA, PhD

Welcome Message
Director of Politeknik Pertanian Negeri Payakumbuh



Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikumwr.wb

I congratulate to all participants on the invitation and participate at our beloved campus Payakumbuh State Agricultural Polytechnic. I feel really honoured to welcome all of you at our event, the 3rd International Conference on Security in Food, Renewable Resources, and Natural Medicines (SFRN) 2019 at the Payakumbuh State Agricultural Polytechnic, Indonesia.

Food security is a very important aspect in a country's sovereignty. Food also determines the future direction of a nation. Many social and political fluctuation can also occur if food security is disrupted. Food availability that is smaller than its needs can create economic instability. This critical food condition can even endanger economic and national stability. In the current situation, there are many challenges in exteriorize food security, such as climate change, population, limited natural resources and other challenges both locally, regionally and globally.

Renewable resources are also our starting point to start sustainable development. Research on renewable resources is also very important as the solution in meeting the principles of sustainable development. As we know that Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability is the foundation for today's leading global framework for international cooperation - the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)

The discovery of treatment based on local culture also contributes greatly to the good of humanity. Unfortunately, there are still many treatments that have not been carried out by scientific research. So, through this conference we hope it can be a trigger to increase in traditional plant-based treatments that not go through complex

chemical processes, so that the effectiveness of the pillars can be further suppressed and also contribute to the community's economy.

Finally, I would like to express my gratitude to all people who involved in organizing this event and to all of stakeholders who have helped to make this event go on successfully. Please accept my apologize for any shortage, Assalamu'alaikumwr.wb.

Thank you

Ir. Elvin Hasman, MP

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Revival of Shifting Cultivation Pattern in Subdistrict of Mapattunggul Selatan, Pasaman Regency, West Sumatera, Indonesia

Juli Yusran^{*1)}, Yonariza¹⁾, Elfindri¹⁾, Mahdi¹⁾, Rikardo Silaban²⁾

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Abstract. Shifting cultivation is a transitional culture of food fulfillment from before relying only on flora and fauna that grows and develops naturally to the pattern of cultivation of food crops. This new method is a response to the increasingly limited food resources provided by tropical forests, as a logical consequence of human growth that is moving faster than food growth. Shifting cultivation pattern has long been practiced in tropical countries and has been widely studied by academics. Previous research generally concluded that shifting cultivation will end in a permanent farming pattern. But in recent years, there has been a revival of the trend of shifting cultivation in Silayang Village, Mapattunggul Selatan District, Pasaman Regency, West Sumatra Province, Indonesia. This research will examine what causes farm households to the practice of shifting cultivation patterns. Data collection uses observation, key informant interviews, and household surveys. The results showed that the revival of shifting cultivation in Silayang Village in recent years was caused by the decline in global rubber prices, maintaining food security and efforts to increase household income. It leads to negative impacts on biodiversity and can result in natural disasters as people converted forests to agricultural land. A strategy is needed to reduce the effects of environmental damage, by creating alternative food sources, employment in addition to farming, environmental education with a cultural acculturation strategy, minimizing opportunities for farming to take place through price protection and pattern control shifting cultivation, especially on mountainside or hilly areas and spring springs by the government and local community leaders.

Keywords: Shifting cultivation, farm household, cultural acculturation, rice, rubber

INTRODUCTION

Shifting cultivation is a transition to the fulfillment of food from before relying only on what is naturally available in the tropics. Shifting cultivation, also commonly referred to as farms, is a farming system, usually using communal land in the tropics, and has been culturally the basis of land use, livelihoods and cultural traditions in highlands for centuries (Merts et al., 2009, Vliet et al., 2012, Dressler et al., 2015, Mukul, 2016). Shifting cultivation is a food production system that is commonly found in Asia and Africa to the present (van Vliet *et al.*, 2012; Wangpakapattawong *et al.*, 2010). But in the last few decades, the direction of shifting agricultural patterns of changing fields. The multidimensional transformation process of the cultivation system of shifting cultivation to sedentary farming patterns was triggered,

among other, by population growth, changes in market demand, and its main public policies since the 1970s (Merts et al., 2009; Mulyoutami; 2010, Padoch, 2010; Vongvisouk, 2014). Shifting pattern of shifting cultivation in various dimensions is also caused by environmental conditions and community welfare, which affect tenure systems and access to land (Contreras-Hermosilla dan Fay, 2006; Fay dan Michon, 2005).

Shifting cultivation undergoes an intensification process, for example, by planting permanent commercial crops on a shifting field location (Raintree & Warner, 1986). Teegalapalli and Datta (2016), claim that shifting cultivation is no longer relevant, in terms of population and growth. In Laos, changing cultivation activities are rapidly transforming into more permanent and market-oriented crops by replacing rice with rubber and corn in the North of Laos and sugarcane in the South of Laos (Mertz, 2014). Similar to the transformation of shifting cultivation in Sri Langka, the pattern of shifting farming also shifted towards permanent agriculture, by growing commercial crops (Banham, Fuller: 2012). Although what is the government's push for the transformation of shifting cultivation to permanent and market-oriented agriculture diverts deforestation from shifting farmers to stable and market-oriented plantations (Banham, Fuller: 2012).

Conversion of shifting cultivation to the permanent farming system is needed because changing cultivation patterns are seen to be very wasteful of resources (Lal, 2015). Shifting cultivation also has at least three potential environmental damages. Firstly, it may trigger soil erosion on steep slopes. Secondly, it contributes to greenhouse gas emissions through biomass burning from conventional slash and burns techniques. Thirdly, it reduces biodiversity through land degradation and by leaving grassland (*Imperata cylindrica*) as the climax vegetation. (Mahdi dan Yonariza, 2017).

In another perspective, Mahdi and Yonariza (2017), explained that agricultural transformation is not a linear process, but rather a cycle because markets drive the conversion. Then patterns of sedentary agriculture are possible to return to shifting cultivation, primarily if the market can not provide food security. According to Cramb (1989) and Dove (1983), economic reasons for maintaining shifting cultivation patterns are tangible results and more available employment opportunities. According to Merzt et al. (2008), shifting cultivation must be accepted as a rational land-use system.

In their article, Mahdi and Yonariza (2017) explained falling rubber prices triggered the revival of shifting fields in Mapattungul Selatan subdistrict. The world rubber price declined from \$275 US cents in 2011 to just \$0.55 US in 2016 per kg. Meanwhile, the rice price was stable at IDR 15.000 (\$1.5 US) per kg. It means that farmers' incomes declined sharply and would be a shock to the livelihood security of those who had converted their land from a shifting cultivation system to rubber production.

This research continues the research conducted by Mahdi and Yonariza (2017), which confirms the decision of farmer households to return to the practice of shifting cultivation patterns due to market influences, namely the dramatic decline in rubber

prices. This research explores other possible causes, in addition to market influences, and the possibility of resolution through means other than price insurance schemes, if the price of rubber is lower than IDR 8000., as their research estimates.

MATERIAL AND METHOD

This type of research is a qualitative and quantitative descriptive study. This research will collect data and information to get a systematic and accurate picture of the facts or characteristics of the respondent. This type of research is qualitative and quantitative descriptive research. This research will collect data and information to get a systematic and accurate picture of the facts or characteristics of the respondents. The data collected is then compiled, analyzed, and explained so that it will get a picture of the state of rubber farming households (permanent agriculture), but then switches to the pattern of shifting cultivation. The researchers conducted the study in Silayang Village, Mapattunggul Selatan District, Pasaman Regency, West Sumatra, Indonesia. The researchers chose this location because previous reviews mentioned that this area had shifted to permanent farming patterns. It changed to rubber crops. Research activities carried out for three months, starting in June – August 2019.

This research sampling includes area samples and respondent samples. The examples are the households that change to rubber farming that turned to shift cultivation by purposive sampling. The method used is nonprobability sampling, due to the researchers did not know the number of each population. The respondents were 60 households. The determination of the sample area is carried out by purposive sampling aiming to determine the village where the majority of farmers take over farming from rubber plantation to shifting cultivation patterns. Of the 15 communities were selected according to the characteristics of the study. They were Mentundak Village, Padang Village, and Baru Village. The selection was because those villages had the highest number of farmers who converted from rubber plantations to shifting cultivation patterns in Silayang Village.

Determination of taking the 60 households as respondents was based on the opinion of Bailay (1999), who states on the idea of (Bailay, 1999) which says that the minimum sample size using statistical data analysis is 30 respondents where the population is spread normally. The data used in this study include primary data and secondary data. Primary data obtained from observations and direct interviews with respondents through the questionnaire, while secondary data is data sourced from government institutions, literature, and publication of research results relating to research, including production and other data.

Data analysis uses quantitative methods with a logistic regression model to see the factors that influence the transfer of farming to shifting cultivation patterns. The logistic model is a non-linear regression model that produces an equation where the dependent variable is categorical. The most basic categories of the model provide binary values such as numbers 0 and 1. The resulting numbers represent a specific category obtained from the calculation of the probability of occurrence of that category. The multiple logistic regression model is as follows:

$$1n \frac{P_i}{1-P_i} = \alpha + \beta X \text{ (Gujarati, 1991)}$$

Explanation:

P_i = Probability of farmer decisions

α = constant

β = Parameter sought

X_i = Variables that affect

The binary decision model is as follows:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$$

Explanation :

Y_i = farmer decision variable to switch over farming, where= 1, if farmers switch farming and $Y_i= 0$ if farmers do not switch farming

α = Constant

X_1 = land area (ha)

X_2 = the outpouring of farmer's work on other work

X_3 = rubber price

X_4 = shifting cultivation income

β_1 - β_5 = coefficient regression

e = random error

To examine the role of explanatory variables (X) in the model parameter (β) test is performed. The researchers conducted simultaneous testing using the Likelihood Ratio (LR). The test used to determine the level of influence of all independent variables together on the dependent. The hypothesis is as follows:

H_0 : $\beta_1 = \beta_2 = \dots = \beta_5 = 0$, if there is no influence of the independent variable on the decision over farming.

H_a : at least one $\beta_i \neq 0$, if there is an influence of the independent variables on the farming transfer decision.

LR compared to the *Chi-Square* table (X^2). If the LR count > *Chi-Square* table means H_0 rejected. It shows that the independent variables together have a significant effect on the dependent variable.

RESULTS

Respondent Characteristics

Respondent characteristics are characteristics possessed by research respondents. Based on information obtained through observation and interviews with respondents, these characteristics include age, level of education, number of family dependents, and farming experience. Isdijoso et al. (1990) state that aspects of age, educational background, number of dependents, and farming experience affect farmers' skills in managing their farming. The age of farmers is very influential in their ability. Generally, farmers who are younger and physically fit will have more ability to work compared to older farmers. Based on the result of research, data

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obtained by rubber farmers, and shifting cultivation respondents by age in Silayang village are presented in the table below:

Table 1. Age of Respondent Farmers in Kampung Mentundak

No	Age (Years)	Number of Respondents	Percentage (%)
1	> 39	9	45
2	40-51	6	30
3	51-62	5	25
Total		20	100

Source: Primary Data (processed), 2019

Tabel 2. Age of Respondent Farmers in Kampung Padang

No	Ages (Years)	Number of Respondents	Proportion (%)
1	> 39	7	45
2	40-51	9	30
3	51-62	4	25
		20	100

Source: Primary Data (processed), 2019

Tabel 3. Age of Respondent Farmers in Kampung Baru

No	Ages (Years)	Number of Respondents	Proportion (%)
1	> 39	8	45
2	40-51	6	30
3	51-62	6	25
		20	100

Source: Primary Data (processed), 2019

Young farmers usually have high morale, are easy to accept innovations, and are brave enough to take risks. Old farmers are less enthusiasm for work but have more experience, which resulted in more careful farm management decision making. Suratiah (2006) argues that a person's age can determine that the person's performance. The heavier the physical work and the increasing age will also decrease the ability to work. The data in the table shows that the majority of respondents' age of rubber farmers and shifting cultivation farmers are at a productive period. It depicts an indication of the existence of a productive workforce in managing ist business, thus providing opportunities for increased productivity.

Level of education

Education is quite influential in the type of activities carried out. Knowledge will affect one's level of thinking. High and low levels of education will affect the ability of the respondent to run a business. It will affect the quality of farmers' farming. Higher education will make it easier for farmers to adopt new technologies that will affect the ability of farmers to run their businesses. It will affect the quality of their farming. The higher the farmer's education, the more comfortable they adopt new technologies that will impact his agriculture work. In the fulfillment of food other family needs. Research data obtained in the field shows the level of education

of respondents in Silayang Village between education not graduating from Elementary School to Strata 1 (S1). The highest level of education is 28 respondents were Junior High School or 46,67%, around 36,37% were High School, the remaining 16.98 % did not complete primary education, graduated from Elementary school, D2 and S1 graduation.

Number of Family Dependent

The number of family dependents is also one factor that can affect farming. The more the number of dependents on the family, the more costs will be borne by farmers to meet all the needs of their family life. Also, the number of family dependents contributes significantly to the availability of labor, but on the other hand, it leads to higher economic burdens in the family. The number of dependents of farm families, especially those in productive age, is a source of labor in helping farming works. The number of dependents of the majority of farmer respondents in Silayang Village is 4-6 people, 39 households, or 65 %. The rest are respondents with a family dependency of 1 to 3 people, 17 people, or 28 percent. The remaining four households or 7 percent have other dependents.

Experience of Farming

Experience is one way of ownership of knowledge experienced by someone in an unspecified period. Experience can develop one's competence, and improve farming is closely related to the level of expertise and age of farmers. Respondents in this study have 3 to 15 years of farming experience (37%), and experience farming from 16-30 years as many as 34 people or 57 percent. It shows that the majority of farmer respondents in Silayang village have experience in cultivating their businesses. Farmers with a sufficient level of expertise generally will have more skills in managing the factors of production and applying them and, according to recommendations, to increase production and income optimally. The data also gives an indication and income optimally. The information also indicates that based on the experience of farmers, farming is expected to run well.

The Condition of Rubber Farming in Silayang Village

Land Area. Land as a growing medium is one of the factors that influence farming. In general, the greater the area of farmland, the higher the products produced. The area of land cultivated by respondents for rubber farming in Silayang Village ranges between 0.5-3 hectares. Around 58% of respondent's land area is 0.5-1 hectares. It was a total of 35 people. The remaining 20 people (33 percent) have a land area of 1.1-2 hectares, and five households or 8 percent have a land area of 2.1-3 hectares. As for the average land area of rubber plantation respondents in Silayang Village in 2019 was 1.15 percent. The average land area of the respondent farming household is 1.3 hectares with details of working on land under 1 hectare totaling 18 households (30%), 1-2 ha totaling 40 households or 67 percent, and the remaining two families have an area of shifting land above 2 hectares per season. Most of the shifting land originates from the opening of new territory, then it is turned into changing property and part of it is from rubber plantations.

The outpouring of farmer-labor on non-farm Work. Labor that is used by farm households mostly comes from their own families. A small number of respondent households also have other jobs, such as trading, voluntarily, or contract work in the district office, guardian village office, and teachers. Other work besides farming will affect the working hours of farming because part of their time has been taken up in the work activities they are involved in.

Table 4. Other Types of Work Besides Respondent Rubber Gardening

Sample Area	Other Types of Work				Total
	Small Traders	Honorary		Tutors	
		Sub-district office	Village Office		
Mentundak Village	2	0	1	1	5
Padang Village	1	0	1	1	3
Baru Village	2	1	0	0	2
Total	5	1	2	2	10

Source: Survey, 2019

From the above table, the total research respondents are 60 households. Ten families (16.7%) having other types of work, besides rubber farming and shifting cultivation, with details of 4 farmer households trading, one civil servant (civil servants), and honorary/ contracts in the sub-district office one household, two households in the village office, and two honorary contract in the Elementary School (SD) as teachers.

Farmer Household Farming Production. The production of rubber farming by respondents in Silayang Village in 2019 is quite varied, due to the wide variety of farms owned by farmers. On average, the rubber production of each farm household is 2,875,000 kg/ 1.15/ month. At present, the land area and rubber production are declining, so farmers are planting lemongrass in their former shifting fields. Fertilizing, pesticides, and herbicides may not be used in the process of rubber cultivation in Silayang. While the average production of respondent shifting cultivation farmers in Silayang in 2019 was 3.5 tons dry rice grain/ 1.3 ha/ year or if it was converted into rice to around 2,135 kg/ 1.3 ha/ rice. Similar to the rubber plantations, the pattern of shifting cultivation households of farmers has not used fertilization or pesticides and herbicides in the cultivation of agricultural crops.

Analysis of Farmer's Income. Farm income is the difference between farm receipts and farm costs. Farming costs are costs incurred by farmers for the ongoing process of agricultural production. The amount of income that will be obtained from an activity depends on several factors that influence it, such as land area, level of production, price, use of factors of production, and the efficiency of the use of labor. Cost and productivity are sources of uncertainty factors. If prices and production change, the income received by farmers also changes (Soekartawi, 1993). The average salary of rubber farming households with an average production of 253 kg with current price conditions of IDR 6500 per kg, then the gross income of rubber farming households is 253 kg x IDR 6500 per kg, then the total income of rubber

farming households is $253 \text{ kg} \times \text{IDR } 6500 \times 12 = 19.974.000$ per year, equivalent to Rp 1.664.500 per month while the average net income of farmers households from rubber products is $\text{IDR } 1.664.500 - \text{IDR } 1.383.600 = \text{IDR } 280.900$ per month. The average gross receipts of the respondent's shifting cultivation farms in Silayang is $2.135 \text{ kg} \times \text{IDR } 10.000 = \text{IDR } 21,350,000$ per year or 1,779,1667 per month. The net income of Silayang farmer households is equal to $\text{IDR } 1,779,1667 - \text{the price of the dry rice grain } 7000 = \text{IDR } 22,400,000$ per year or around 1,867,000 hectares per month. While the income of the shifting farmer's household after the wage is issued is $\text{IDR } 1,867,000 - 1,260,000 = 607,000$ per 1,3 hectare per month. Economically, the level of income can be directly affected by selling prices and the use of factors of production.

Analysis of Factors Affecting the Choice of Farmers to Take Over Farming. Logistic regression will form a predictor or response variable ($\log(p/(1-p))$), which is a linear combination of the independent variables. The value of this predictor variable is then transformed into a probability with a logistic function. This analysis is used to determine the effect of the independent variable (farmer's decision), where the Y variable is the dummy decision of the dependent farmer is 0 if the farmer does not switch from the rubber plantation and one of the farmers moves to the pattern of shifting cultivation. The variable factors that influence farmers' decisions. Coefficient estimation of significant independent variables, there are 2 out of 4 predicted variables, meaning that there are two independent variables on the decision of farmers to switch to shifting cultivation patterns. Two of the independent variables that influence farming choices are rubber prices and farm household income. Then there are two categories of variables that do not affect the decision of farming; they are the area of land area and the outpouring of domestic workers towards other jobs besides agriculture.

The coefficient of production costs is 8.68 means that an increase of 8,68 percent in production costs has the potential to influence farmers' decisions to switch commodities by 8,68 percent. T-test value of 2.153678 or with a p-value of 0.0367 with an error rate (alpha 5%), then H_0 is rejected because the p-value (0.0367) is smaller than the error rate (alpha 5%). So it can be concluded that the price of rubber is likely to influence the decision of farmers to switch rubber plantation commodities to shifting cultivation. If the amount of rubber is not comparable to the value of the amount of 1 kg of cost, then the possibility of farmers switching to shifting cultivation patterns is getting stronger.

Logistic regression analysis results produce adjusted R-Squared value = 0.6421, indicating that the variant of farmers' choice in switching commodities and fixed (Y) can explain simultaneously by land area (x_1), production costs (x_3) and income (x_4) of 63.10 %, while the rest amounted 36,90% is explained by other factors not included in the model. **The** F-statistic test is to test the effect of independent variables on the overall independent variables. From the F-statistically significant test results of 21.33231 with an error rate (alpha 5%), then H_0 is accepted because the F-test value $>$ alpha 5%. **The** T-statistic test is used to test the effect of independent variables. The results of the t statistic test can be concluded that only the

rubber price variable (x_3) and income (x_4) can influence the decision of farmers to switch to shifting farming patterns.

DISCUSSIONS

1. *Land Area*

The land is one of the most essential factors of production in farming. The land area of farmer households varies from under one hectare up to 3 hectares. The average area of rubber farming land of respondent farmer households in Silayang was 1.15 hectares, while the average area of shifting cultivation reached 1,3 hectares. So the average area of shifting cultivation land is 0.15 ha wider than the area of the respondent farmer's household plantation. Now, as a farmer's household business to increase income, they decided to plant other commercial crops that lower production costs and risks, namely Serai Wangi (citronella grass) community. Now, as a farmer's household business to increase income, they decided to plant other commercial crops that lower production costs and risks, namely Serai Wangi (citronella grass) community.

2. *Out of Respondents for Other Work apart from farming*

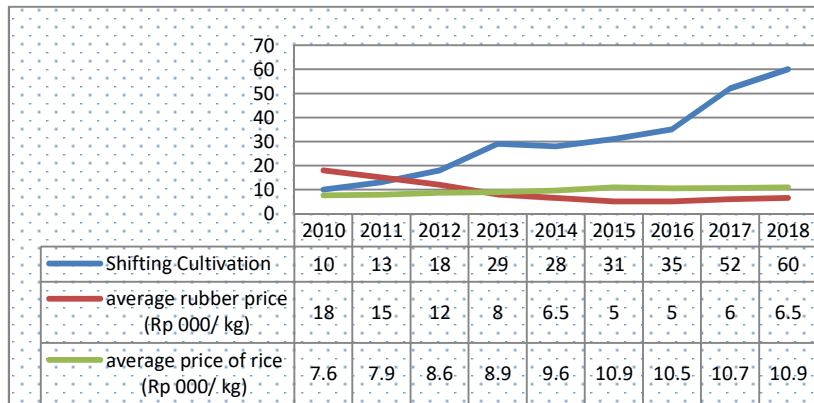
The use of labor that is used in farm households in Silayang is labor in the family. Employment in the house is a household resource that can be used and regulated its use by the head of the family. While workers outside the family workers who come from outside family members who are commonly called farm laborers. According to Damayanti (2012), the use of labor is a form of utilization of human resources aimed at maximizing satisfaction. The amount of time usage is limited to 24 hours a day, and with this limited amount, farmers will use it for farming and other work they do. A variable outpouring of labor for work other than agriculture harms the choice of farming over rubber farming (permanent) of respondents with a value of -0.0042, meaning that the outpouring of labor of respondents to other work besides agriculture does not affect the opportunities to switch to the pattern of shifting fields. Due to the labor that is used in farming, in general, is the existing labor in farm households. So that they are more focused on their work routines, and lack of time to open new land to be used as swidden fields. There is no difference in the expected sign of the coefficient (expected sign) on the opportunity for no transfer of farming, because no matter how high the outpouring of labor for agriculture, farm households continue to rely on employment in the family, so that when the outpouring of labor farmers work to other types of work, causing them to lack time to transfer farming to shifting cultivation.

3. *Rubber Price*

The variable price of rubber and other occupations is significant with a coefficient of 8.36, meaning that the price of rubber is at the farm level and other jobs owned by the respondent's household have the opportunity to influence the decision of the farmer's family to switch to the pattern of shifting cultivation. The odds ratio for commodity transfer opportunity to rubber prices is 8.68, indicating that

the chances of rubber farmers becoming a pattern of shifting cultivation because the difference in price between 1 kg of rubber and the price of 1 kg of rice is 8.68 times affected. The higher the price difference of rubber with rice raised by respondent farmers, the higher the chance of switching to farming in a shifting cultivation pattern.

Table 5. Comparison of Number of Moving Farmers, Average Price, and Rice



Source: Informant, 2019 (data processed)

Table 5 explains that the price of rubber experienced a downward trend, the price of rice and shifting cultivators in the 2010-2018 period consistently increased. The most significant increase in the number of shifting cultivators occurred in 2013, namely the 3rd year of falling rubber prices, and in 2017, coinciding with farmers starting to change from planting old crops after harvesting to paddy fields, to the Serai Wangi plant in Nagari Silayang. Farmers grow Serai Wangi on shifting fields after the harvest. The effect of rubber prices on the shifting of farmers to the practice of changing cultivation patterns in Nagari Silayang reinforces Mahdi and Yonariza's research (2017) which states that a decrease in rubber prices causes the revival of shifting cultivation patterns in Nagari Silayang

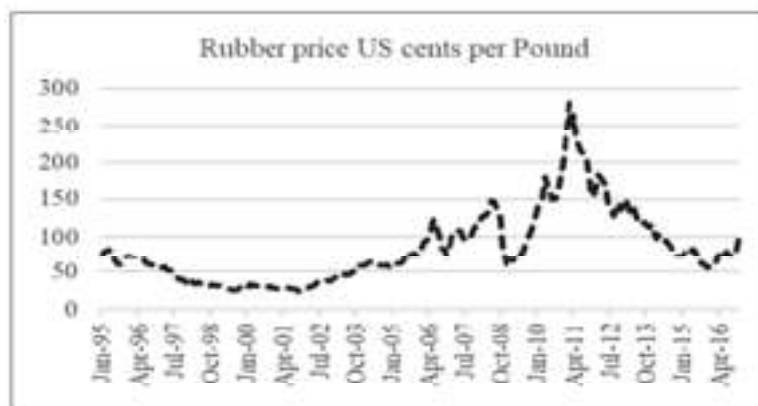


Fig. 1. Global trend of monthly rubber price 1995-2016.
 Source: Singapore Commodity Exchange (SICOM)
<http://www.indexmundi.com/commodities/?commodity=rubber&months=300> access 27 Feb 2016

Figure 1. The Fluctuation of Rubber Prices in 1995 to 2016 (Yonariza, 2017)

Figure 1, shows that the sharp decline in rubber prices that has taken place since October 2011 triggers farmers' concerns about food security, thus, opening up old forests to plant rice fields. Global rubber prices fell from 275 US \$ cents in 2011 to 55 US \$ cents in 2016 per kg. While the price of rice tends to rise slightly with an average of Rp. 15,000 (USD 1.5) per kg. In their article, Mahdi and Yonariza (2017) confirmed from respondents, the price of rubber at the farm level dropped dramatically from Rp 18,000 - 20,000 in 2011 to Rp 5,000 per kg since 2014 and rose to 6,500 in 2018. While the information that has been confirmed to farm households by Mahdi and Yonariza (2017), the people of Nagari Silayang will stop shifting cultivation if the price of rubber is above Rp 8000 / kg (US \$ 0.62). Household farmers believe that with rubber prices above Rp 8000 / kg, it is sufficient to meet food and cash needs for other purposes.

4. Revenue

Income is an essential economic variable as a determinant for the fulfillment of one's life needs, including for a farmer. Farmer households will continue to carry out an activity if the activity is deemed able to provide an appropriate income (Azmi, 2008). This research confirms the level of income earned by farmers is one of the main factors for the choice of rubber farmers' decision to switch to shifting cultivation. A significant income variable with a coefficient of 1.15 means that the income obtained by farmer households has the opportunity to influence the decision of farmers to switch to shifting cultivation patterns. Each additional respondent's household income of one million rupiahs will increase the probability of respondent farmers to switch by 11.5 percent. The low income and agricultural production results are based on the existing conditions the average gross income in the rubber plantation sector in Nagari Silayang with an average area of 1.15 ha/farmer's household for Rp 6,500 / kg, after the production costs were only incurred Rp387,550 / month. While the net income of the shifting farm households, after the production costs were Rp. 720,200 / month. Besides that, besides rice, the pattern of shifting fields also produces vegetables, chilies, tomatoes, cucumbers, tubers, and so on. Although the yield pattern of shifting cultivation is not too large, but by shifting cultivation, farmers feel more secure in the availability of food. The practice of shifting cultivation patterns in Nagari Silayang is also culturally a way to gain access to communal land and the transition media to commercial crops, which are believed to be able to increase household income. From the information obtained from respondents, the rubber trees they currently have, in general, started with the opening of shifting fields. After their rubber trees are large and deemed sufficient to meet household needs, including food, they stop shifting cultivation activities and focus on managing plantations. But when the price of rubber plummeted and lasted long enough, they returned in droves to open up old forests to be used as swidden fields. Before 2017, to anticipate the price of rubber, they planted various types of old plants such as cinnamon, mangosteen, nutmeg, areca nut, and so on in swidden fields. But since 2017 until now, in general, they have planted Serai Wangi to supplement household income. Lemongrass was chosen because the cost of

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production is still affordable; the technology for maintaining and refining essential oils is not difficult. Besides, the price of Lemongrass at the farm level is still promising (between Rp. 180,000 - Rp. 210,000), the transportation costs are also not expensive when compared to rubber. The transfer of rubber to the pattern of shifting cultivation has an impact on various aspects, especially on the environment, because old forest supplies are running out.

Moreover, timber substitutes planted by seasonal plants such as Serai Wangi, which can not absorb water and withstand maximum soil erosion. If the transfer of rubber to the shifting cultivation pattern is out of control, it is very possible to cause natural disasters, which ultimately harm all residents in Nagari Silayang, such as massive flooding and causing considerable losses that occurred in the Nagari Muara Sungai Lolo on 2016 ago. nagari Sungai Lolo is Nagari one sub-district and borders directly with Nagari Silayang.

CONCLUSIONS

Based on the results of research and discussion, it can be concluded that the difference price of rubber influences the opportunities for rubber farmers to switch farming to the pattern of shifting cultivation in Nagari Silayang. The converted price to rice prices of farmer households with a coefficient value of 8.68 and income shifting cultivation patterns with a value of 0.59. Meanwhile, the area of land and labor poured into work other than farming does not affect the farmer's household's decision to switch to shifting cultivation

RECOMMENDATIONS

It is necessary to create alternative food sources, so that farm households do not only rely on shifting fields to meet food needs. Then, it is required to increase the number of jobs other than cultivating farmers to be used as a source of growing farmer's household income. Besides, local government support is needed to provide environmental education with a cultural acculturation approach and provide stimulants to farm households in rubber farming or more environmentally friendly agricultural commodities such as cinnamon, nutmeg, mangosteen, and productive tree crops. Finally, minimize the chances of farm transfer through price protection in the form of subsidies for agricultural commodity prices and control of shifting cultivation patterns, especially on mountainside or hilly areas and springs, by governments and local community leaders.

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