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OPTIMIZING RESOURCES IN THE INTERCROPPING FARMING SYSTEM IN TABANAN REGENCY, BALI PROVINCE

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ABSTRACT

Land as a location for farming is the main asset managed by farmers. Land area is directly proportional to farm production. the wider the land managed, the higher the production produced. In the intercropping farming system, it shows that the land is used for the production of several commodities such as cocoa, coconut, bananas and cattle, if the commodities cultivated do not experience significant disturbances. The aim of the research is to analyze the gross income of smallholder plantation farming in Angkah Village, to analyze the allocation of agricultural resources with a cacao-coconut-banana crop intercropping system and cattle in Angkah Village. The research was conducted in Angkah Village, Selemadeg Barat District, Tabanan Regency, on an intercropping farming system. Research on optimizing resource allocation uses a linear programming approach, which is a formal mathematical technique that selects combinations and activity levels, of all feasible activities to achieve the objective function without neglecting the availability of resources, and other specified constraints. The gross income earned by farmers in Angkah Village is an average of Rp. 45,728,824 per year. This income is obtained from the intercropping system of cocoa, coconut, bananas and cattle. Farming is carried out on an average land area of 0.53 ha for cocoa. 0.071 ha for coconut land, 0.061 for banana land and 0.014 ha for cattle. The optimal income is 69,800,035. The amount of agricultural resource allocation with an intercropping system of cacao-coconut-banana crops and cattle in Angkah Village is 1,042 HOK. Changes in commodity prices cause changes in commodity income in the intercropping system in Angkah Village.

Keywords: *cocoa, linier programming*

BACKGROUND

Land is the main asset for farmers. Land owned by farmers or land leased by farmers is an asset in farming production. The area of land is directly proportional to the production of farming, the wider the land that is managed, the higher the production produced, if the commodities planted are not subject to major disturbances.

The area of plantation land in the province of Bali is 563,666 ha. The total land used for cocoa plantations is 122,127 ha in Bali. The 22,631 ha of land is in Tabanan district as the third largest land after Buleleng 31,323 ha and Karangasem regency 30,650 (BPS Bali 2017). The plantation land is planted with cacao, coconut, coffee, bananas and other crops. The land is also used for cattle production by farmers. The combination is carried out by farmers based on the needs of each farmer.

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In general, the combination is carried out on the basis of the assumption that the commodity is considered profitable by farmers.

The combination of plants in one field with several plants is an intercropping system. Planting several crops with the intercropping method is a system used by farmers to obtain several crops in one field. Intercropping allows farmers to obtain diverse yields and provides a source of income at different times, the application of intercropping cropping patterns is an opportunity for cocoa development by utilizing plants that have economic value. Hariati (2013), the clove crop intercropping pattern contributed the most to revenue. The reasons for farmers seeking intercropping cocoa cropping patterns in smallholder plantations include the hereditary system, high profits, increased yields, and low risk of failure.

Setiado et al. (2018) said that most of the cocoa production is carried out by intercropping is the smallholder plantation business, which is carried out based on the needs of farmers with consideration of increasing yields and reducing the risk of failure in the cocoa commodity. In line with Okpratiwi (2020), most of the income for cocoa farmers is obtained from on-farm cocoa farming and intercropping as well as cattle farming, which is the main income for farmers in Sungai Langka Village. Cocoa on-farm income contributes around 86.61% of farmer household income. The cacao intercropping system guarantees success in unfavorable climates. Cacao intercropping plants are plants that have economic value. Even though cocoa production in the study area is declining, farmers still get results from cocoa intercropping (Syarifudin, 2019).

Tabanan Regency as one of the regions in Bali combines various plants in one land. The land in Tabanan Regency is planted with cocoa, coffee, cloves and coconut. The area of land planted with cocoa in Tabanan Regency reached 4,533.31 ha, of which 15,081.33 ha were planted with deep coconut, 685.38 ha of early maturing coconut and 8.20 ha of hybrid coconut (BPS Bali, 2017). The combination carried out by farmers is cacao, coconut, banana and cattle. Tabanan Regency is one of the farming-based villages, which combines cocoa-banana-coconut plantation crops on farming land. The purpose of combination development is to increase land productivity through an intercropping system. To improve the welfare of farmers and encourage the improvement of the rural economy. Hariyati (2013), shows that the application of intercropping cropping patterns is an opportunity for cocoa development by utilizing plants that have economic value. Sofian et al. (2015), if cocoa production decreases, farmers still get income from cocoa intercropping. Rahmawati (2020) also make a note that cocoa plants are able to bear fruit throughout the year and can be used as a source of daily income for the community.

One of the cocoa development centers in Tabanan Regency is Angkah Village. Agribusiness commodities aim to increase competitiveness, yield quality and marketing. Angkah Village was designated as a Self-help Agricultural and Rural Training Center, or P4S, namely a training institution with agricultural and rural apprenticeship methods. The purpose of establishing P4S is to accelerate access and application of information technology through the learning process of farmers and their families according to real conditions in the field.

To increase the income of farmers in Angkah Village, Selemadeg Barat District, Tabanan Regency, they are faced with limited land, capital, labor and others. Farmers' land ownership is an average of 0.53 ha. Ownership of the land has not been fully able to improve the welfare of farming families. Besides that, farmers have not been able to detail farming needs, other necessities of life with certainty and even definite benefits obtained in intercropping farming. In an effort to increase

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the income of farmers who are faced with limited resources, it is necessary to do research on optimizing intercropping farming of plantation land in Angkah Village through a linear programming approach.

Based on the description above, a problem arises whether the intercropping farming system in Angkah Village can fulfill the aspects of economic feasibility and optimize land in an effort to earn income. The aims of the study were (1) to analyze the income of intercropping farming on smallholder plantations in Angkah Village, (2) to analyze the allocation of agricultural resources using the intercropping system of cacao-coconut-banana and cattle in Angkah Village, and (3) knowing whether the intercropping system is efficient in using inputs to produce outputs. The research results are expected to be useful, for farmers to be able to utilize the available resources in limited quantities to maximize income through intercropping cropping patterns. For policy makers whether the intercropping system is prospective enough to increase income. Is the intercropping system efficient in land use?. The novelty in this research is the cocoa-banana and cattle intercropping system is economically feasible and shows the optimal allocation of land resources to generate maximum income.

RESEARCH METHODS

Research Location

The research was carried out in Angkah Village, Selemadeg Barat sub-district, Tabanan Regency from June to September 2022. The location was chosen, namely Angkah Village, which is a training center for agriculture and rural areas for cocoa commodities. Cacao is cultivated using the shoot grafting method for production and post-harvest processing of cacao by fermentation. Cacao production with cacao-banana-coconut intercropping farming system and cattle.

Data Collection

The research was conducted using a survey method with a structured questionnaire. The total population of cocoa farmers in Angkah Village is 48 people. The entire population is used as a research sample so that the total sample is 48 people. The types of data collected in this study are quantitative data and qualitative data. Quantitative data include: (1) The area of smallholder plantation land, both the area of land owned by farmers and the area of land used as a place for farming, (2) Type and quantity of production facilities used and production (output) of each production activity, (3) The price of each means of production and product prices, (4) The labor required for crop production activities per hectare, the labor required for each livestock production activity and the distribution of working days for each production activity, and (5) The amount of costs incurred by farmers consists of the cost of renting labor outside the family, the cost of production facilities and other costs for farming (variable costs) expressed in rupiah per hectare.

Qualitative data include: village map data, cropping pattern systems, and post-harvest activities in Angkah Village. Source of data obtained from primary data and secondary data. Primary data includes the number of farmers, the area of farming land, the number of cocoa plants, the number of coconut plants, the number of banana plants and the number of cattle in Angkah Village. Secondary data, namely data obtained from BPS data for the province of Bali, includes the amount of land in Bali, cocoa production in Bali and the area of cocoa production in Bali.

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Data Analysis

Methods of data analysis using Linear Programming analysis. Optimization of resource allocation using a linear programming approach is a formal mathematical technique that selects combinations and activity levels, of all feasible activities, to achieve the objective function without neglecting the availability of resources, and other specified constraints (Barlow et al., 1977). Linear programming is a computer-based procedure that can direct the selection of activity combinations to achieve the objective function with existing constraints (Dengen et al., 2019). The specifications for the linear program are:

1. Objective function: to maximize the income of intercropping farming, cocoa, coconut, banana and cattle rearing.
2. Obstacles faced: land area, input stock, output stock, maximum hired labor, cash in, cash out.
3. To maximize farm income through the implementation of various farming activities including crop production (plantation) and cattle in one year, input purchases, labor rental, output sales, allocation and transfers.

Mathematically, based on Cohen and Cyert (1976), the problem of linear programming is stated as follows.

1. Objective Fungtion Z : $C1X1 + C2X2 + \cdots CnXn$
2. Contraint Fungtion : $a11X1 + a12X2 + \cdots a1nXnb1$
   : $a21X1 + a22X2 + \cdots . a2nXnE2$
   : $amX1 + am2X2 + \cdots . + amnXnEQ4$
3. Assumption : X1,X2, . . . Xn > 0

Or in compact form as follows:

1. Maximum output : $z = \sum_{j=1}^{n} c_j x_j$
2. With contrains : $\sum_{j=1}^{n} a_{ij} x_j \{\leq = \geq\} b_i$; i = 1, 2, …, m
3. Assumptions : $x_j \geq 0$; j = 1, 2, …, n

Information:

Z : Objective function value
C : Cost coefficient
X : Production activities, hiring labor, raising cattle
Aij : Output and input coefficients
Bi : Available resources

Optimization analysis of constraints on farming systems on dry land with the Linnier Programming approach, using BLPX 88 software (Eastern Software Product, Inc. 1984). Analysis using the Simplex Method is one of the Linear Programming aims to maximize profit in the form of a linear function (Sriwidadi & Agustina, 2013).

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Farming Activity

Linear programming is a way to solve allocation problems limited resources among activities that compete in the best way (Sukanteri et al., 2019). Farming activities in this model can be classified into three activities, namely crop and livestock production, hiring labor, and raising cattle. All activities and coefficients can be explained as follows:

1. Plant Production. Positive values in the land availability column and row indicate a reduction in the land available for crop production. Positive one in the crop production column and land availability row indicates a reduction of one hectare of land to produce 1 hectare of cocoa, coconut, banana and cattle. The positive coefficient on the labor availability line indicates the proportion of labor HOK required to produce one hectare of crops and/or one cow.
2. Renting Labor. Hiring workers Negative one (-1) in the labor supply line indicates the additional labor needed in one HOK indicates that each activity of hiring one HOK will add one HOK to the labor stock.
3. Raising Cattle. The positive coefficient on the cattle production column and the land availability row indicates a reduction in the amount of land required to raise one cow.

Farming Constraints

All types of constraints along with relationships and right hand side values (RHS). In detail, each obstacle is explained as follows:

1. Land area: measured in hectares. Land for crop production on average is 0.53 ha, indicating that the constraint relationship with land is less than or equal to the RHS value, meaning that the land used for production indicates that the land used in production can be smaller than the available land.
2. Planted area: area of land used to produce crops (cocoa, coconut, banana). The amount of available land indicates the value of RHS per planting season. Its value indicates that it can be less than the available land.
3. Availability of labor: measured by working days (HOK) for adult male workers. Unlike the female workforce, which is calculated at 0.8 HOK from the value of the wages earned. Labor is calculated based on real labor requirements which show a smaller or equal relationship with the RHS, meaning that the labor used is not more than the availability of family labor or hired labor.
4. Cattle stock: calculated from changes in cattle stock. the average number of cattle owned by farmers is 3 cows.

Gross Margin Analysis

Gross Margin is a comparison of operating profit that occurs after the selling price is deducted from the cost of purchase (Jumaidi et al., 2018). Gross Margin (GM) or economic profit, namely the average amount of income minus the average amount of all costs incurred on a certain land area (per hectare) in a certain period of time (per year). Basically, this economic profit is agricultural income (production x price) minus costs (Saputro & Helbawanti, 2020). Testing the efficiency of the intercropping pattern on the use of costs uses the R/C ratio analysis, with the formula (Hariyati, 2013). R/C Ratio = TR/TC, where TR is the total income of intercropping farming, and TC = total cost of intercropping farming. Criteria:

1. R/C > 1, efficient and profitable farming

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2. R/C = 1, farming does not experience losses and has not yet made a profit
3. R/C < 1, farming is inefficient and suffers losses

RESULT AND DISCUSSION

Income of Cocoa Farming with Intercropping System

The intercropping farming system is one of the cropping patterns chosen by the farmers in Angkah Village for cocoa production as well as for the production of economically valuable crops. intercropping system chosen by cocoa-banana-coconut farmers and cattle. The production of crops and livestock for cattle is carried out in one area with the aim of obtaining yields for different crops other than the cocoa harvest. The combination cropping pattern chosen by farmers in Jembrana is the majority of the cacao-coconut-banana-coffee and clove pattern done to generate income and has been done for generations (Hariyati, 2013).

Based on the results of the study, it was shown that the cocoa farming income received by farmers was Rp. 22,0840,755, the gross income for coconut farming was Rp. 3,403,694, the banana farming income was Rp. 1,953,125, and the cattle farming income was Rp. 17,531,250. The income earned by the farmers in Angkah Village from all commodities is Rp. 45,728,824. The income of smallholder plantation farmers in Angkah Village can be seen in Table 1.

Table 1. The Average Gross Margin of Each Intercropping Farming System in Angkah Village Per Year

No	Type of farming	Land Area (Ha)	Revenue (Rp)	Farm Cost (Rp)	Farm Income (Rp)
1.	Cocoa	0.53	27,141,315	4,300,560	22,840,755
2.	Coconut	0.07	4,653,994	1,250,300	3,403,694
3.	Banana	0.06	2,183,125	230,000	1,953,125
4.	Catle	0.01	20,981,250	3,450,000	17,531,250
	Total		**54,959,684**	**9,230,860**	**45,728,824**

Source: Processed from Primary Data, 2022

Research shows that smallholder cocoa provides a large enough income for farmers in one harvest period on an average land area of 0.53 ha. The results showed a higher number compared to cocoa research in Jembrana. Cocoa farming income with an intercropping system in Jembrana provides income of Rp. 12,766,644.64 per ha (Hariyati, 2013). The difference in income is due to the cost of cocoa farming which is produced in Angkah Village, requiring only rented labor costs at harvest time.

Based on the results of the study, it was shown that the farming system of intercropping cocoa, coconut and banana and cattle carried out by farmers in Angkah Village for ± 1 year earned an average income of cattle farming of Rp. 17,531,250 with an average maintenance of three cows. The average revenue is Rp. 20,981,250 and the average cost is Rp. 3,450,000. The results of this study are different from the farmers' income obtained from cattle in Penebel, an average of Rp. 11,650,000 per head for raising cattle for two years (Hendrawati, 2018). The income of Bali cattle in North Buton is Rp.

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5,212,000 (Sani et al, 2021). Revenue from cattle farming shows quite high yields due to the sale of cattle that are more than one year old and bulls.

In line with research conducted at the Catur farmer group, it was shown that cattle sold were more than one year old, thus providing greater income compared to calves that were still under one year old (Darmawi, 2011). Cattle raised on plantations usually have more activity and look cleaner so that the performance of the cows is greater. Cattle that are raised by being released into the wild in plantation areas provide better weight of cattle compared to cattle that are kept in stables continuously (Anindyasari et al., 2015).

Optimal Resource Allocation Intercropping Farming

Efforts to maximize profits or objective functions in cocoa, coconut, banana and cattle intercropping farming in Angkah Village experience constraints or limited resources.

Constraints

Limited resources include: land area, labor availability constraints, number of cows kept (Teguh Ujianto & Maringka, 2018). The obstacles can be explained below:

1. Arable land area. The arable land area is the area of land used for intercropping farming production activities. The results showed that the average area of arable land in Angkah Village was 0.53 Ha and was used for intercropping farming activities for all commodities owned. The area of land used in farming activities is based on the characteristics of land use in an effort to maximize farmer income (Maulida & Munir, 2022). Research shows that the land in Angkah Village shows that the land is mostly used for cocoa farming, which is considered to provide the maximum income.
2. Availability of labor in the household. The number of workers in the household in question is productive workers aged between 15-65 years. varying ages as a source of labor evenly throughout the year (Maulida & Munir, 2022). The results showed that the number of productive workers involved in the production of each farming household in the village of Angkah in units of work 8 hours per day. The number of workers available per day is 48 HOK. Labor is calculated for 25 working days in one month. To meet the demand for labor during the cocoa harvest season, farmers hire labor sourced from outside the family only in certain months.

Activities

Farming activities on an average of 0.53 ha of land in Angkah Village show the various activities carried out on that land. The results showed that the intercropping system included cacao, coconut, banana and cattle. The intercropping system is a farming system that provides the best alternative in the production process to increase farming profits through various farming activities. (Howara, 2011) shows that farming activities combine crop and livestock maintenance or are known as plant-livestock integration systems. The choice of various activities is sought in order to optimize the use of various available resources owned by farmers. There are various activities carried out by farmers, including:

1. Cocoa farming. Farming activities, namely cocoa cultivated by farmers in Angkah Village. Farming activity is notated by PKO1. Farming income obtained from cocoa farming is Rp. 12,105,600 in one harvest period on an average land area of 0.53 ha for cocoa production. Income is obtained based on revenue minus farming expenses in one cocoa harvest period. On one ha of land, an income of Rp. 22,840,755 is obtained. The results of the study (Nauly et al., 2014) show

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that cocoa income is linearly related to the area of land used for production. the larger the area of land planted with cocoa, the greater the income earned,

2. Coconut farming. Coconut farming is carried out throughout the year, farmers in Angkah Village cultivate coconuts with a harvest duration of every 6 months. Coconut is denoted by PK1. The average income received by farmers is Rp. 3,404,694 per ha. Coconut is the main crop planted on the sidelines of cocoa as a shade tree and farmers' income. Farmers are able to earn income outside of cocoa harvest from the number of coconuts produced. The need for labor both from within the family and outside the family in coconut farming is 18.45 HOK.
3. Banana farming. Banana production on farmer's land is one of the intercropping plants planted by farmers as a source of income. Banana production is denoted by PP1. Bananas are managed throughout the year but banana harvests are not the same as cocoa and coconut. Currently cultivated bananas have yielded Rp. 1,953,125 in accumulated harvests for six months. Banana plants as intercropping plants are planted only on the outskirts of the farmer's land. This is to make it easier for farmers to harvest bananas and make it easier for farmers to transport bananas. Harvesting bananas outside the cocoa plants will make harvesting easier because banana trees that have been harvested will rot, and minimize bacterial or fungal attacks that can affect cocoa plants.
4. Cattle farming. Farmers in Angkah Village carry out cattle farming activities in addition to producing cocoa, coconut and banana crops. Cattle farming activities are carried out throughout the year. The activity of raising cattle is denoted by PSAPI. The average livestock cultivated by farmers is 3 cows. Cattle farming activity provides farmers income of Rp. 17,531,250.

Construction of the Linear Programming Model in the Intercropping Agricultural System

Based on the description above, a Linear Programming construction model can be made including resource constraints, farming activities, and resource availability, in the form of a matrix as shown in Table 2.

Table 2. Optimal Solutions in the Farming System of Intercropping

NA2:N21			X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	REL	RHS
NO	ITEM	UNIT	PKO1	PK1	PP1	PSAPI	STK03	STK04	STK05	STK08	STK09	STK12		
R1	EGM	Rp000	22,840,755	3,403,694	1,953,125	17,531,250	-50	-50	-50	-50	-50	-50		
R2	LAHAN	Ha	1	1	1	0.005							≤	4.7
R3	MLPKO1	Ha	1										≤	4.7
R4	MLPK1	Ha		1									≤	4.7
R5	MLP1	Ha			1								≤	2.1
R6	MLPSAPI	Ha				1							≤	5
R7	TKT01	HOK	11.8			3.75	-1						≤	48
R8	TKT02	HOK	10	0,92		7.5							≤	48
R9	TKT03	HOK	12.3	6.45		7.5							≤	48
R10	TKT04	HOK	11.52		24.1	9.375		-1					≤	48
R11	TKT05	HOK	8.3			7.5							≤	48
R12	TKT06	HOK				7.5							≤	48
R13	TKT07	HOK				7.5			-1				≤	48
R14	TKT08	HOK	49.8			7.5				-1			≤	48
R15	TKT09	HOK	15.1			7.5					-1		≤	48
R16	TKT10	HOK	5.84			4.125					-1		≤	48
R17	TKT11	HOK	14.4		23	7.5						-1	≤	48
R18	TKT12	HOK		69.3		7.5						-1	≤	48
R19	MTKS01	HOK											≤	23.4
R20	MTKS02	HOK		12									≤	34.4
R21	MTKS03	HOK	30.01				1						≤	35
R22	MTKS04	HOK	22					1					≤	60
R23	MTKS05	HOK	12						1				≤	27.2
R24	MTKS06	HOK											≤	35.6
R25	MTKS07	HOK											≤	35.6
R26	MTKS08	HOK	13.45								1		≤	50
R27	MTKS09	HOK	24.12									1	≤	55.01
R28	MTKS010	HOK											≤	55.01
R29	MTKS011	HOK											≤	55.01

The results of the analysis obtained income in optimal conditions of Rp. 45,728,824 from all farming activities carried out by farmers with an intercropping system in Angkah Village in one

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production period. Farming activities can be seen in Table 1 showing the activities in the dry land farming system are all profitable. Some of the activities of hiring labor carried out by farmers to cover the need for labor in March, April, May, August and September turned out to be unprofitable. This means that in these months there is no need to hire workers. Hiring workers for that month will increase costs, it's best to take advantage of the existing workforce. Hiring labor causes a decrease in farmers' profits.

The results of the analysis show that the conditions have not been optimal in utilizing the land. In this condition farmers should use 0.52 ha of land from the available 0.53 ha of land so that the remaining 0.0010 ha of land can be used for other more profitable farming. In coconut farming, farmers use 0.071 ha of land. In this condition farmers should use 0.0764 ha of land so that there is 0.00036 ha of remaining land that can be used for other farming. Banana farming uses 0.061 ha of land and cattle uses 0.014 ha of land which should only be used 0.013 ha of available land.

The use of available household labor is 48 HOK per month. Which is used as in January, February, March, April. May and August, September, October and November. According to Budiasa et al., 2012, hiring workers in October shows that the supply of forage for Bali cattle fodder in the rainy season is sufficiently available from grass production, banana stem waste, and cocoa shell waste). Farmers are allowed to hire labor because the availability of labor is exhausted so that labor needs can be obtained from hiring labor. But for the months of June, July and December farmers should not hire labor because the labor from within the family is still sufficient. The need for labor can be seen in Table 3.

Tabel 3. Programing Linear Code Meaning

Code	Meaning
PKO1	Cocoa Production in Period 1
PK1	Coconut Produktion in Period 1
PP1	Bananas Production in Period 1
PSAPI	Cows Production
MLPK1	Providing Land for Harvesting Cocoa Production in Period 1
MLP1	Providing Land for Harvesting Coconut Production in Period 1
MLPSAPI	Provide Cattle Production Land
TKT01	January Workforce
TKT02	February Workforce
TKT03	March Workforce
TKT04	April workfoce
TKT05	May Workfoce
TKT06	Juni Workforce
TKT07	Juli Workforce
TKT08	August Workforce
TKT09	September Workforce
TKT10	October Workforce
TKT11	November Workforce
TKT12	Desember Workforce
MTKS01	Hiring Labor in January
MTKS02	Hiring Labor in February

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MTKS03	Hiring Labor in March
MTKS04	Hiring Labor in April
MTKS05	Hiring Labor in May
MTKS06	Hiring Labor in Juny
MTKS07	Hiring Labor in July
MTKS08	Hiring Labor in August
MTKS09	Hiring Labor in September
MTKS010	Hiring Labor in October
MTKS011	Hiring Labor in November
MTKS012	Hiring Labor in Desember

Production Efficiency in the Intercropping System

The production efficiency of cocoa-coconut-banana intercropping farming and cattle livestock requires a cost of Rp. 9,230,860 in managing farming inputs while the revenue obtained is Rp. 54,959,684. The results showed that the R/C ratio of intercropping system farming was 5.95. The results of this study were higher than the R/C ratio of intercropping cocoa farming in Pesawaran Village of 5.18 (Gusti et al., 2013) indicating an efficient cocoa farming system in the use of inputs so as to provide income for farmers.

Prices of agricultural commodities in the market often change. Changes in prices and allocation of agricultural resources and farm income caused by changes in commodity prices. Cocoa commodity prices in the research locations fluctuate greatly. Changes in resource allocation can be seen from changes in the price of cocoa commodity inputs. If the price of cocoa increases to Rp. 3,000 per kg, the gross income earned by cocoa farmers will increase to Rp. 1,210,560 or 10% from Rp. 12,105,600 so that the gross income received by farmers will be Rp. 13,316,160 for each cocoa harvest period.

So is the price of cattle. Farmers receive an average cow price per head of Rp. 6,041,667. If the price of cattle increases from Rp. 6,041,667 by 7.5%, the income from cattle will be Rp. 6,500,000 per head. An increase in the price of cattle will increase the income received by farmers to Rp. 19,500,000 per year if farmers are able to produce an average of 3 cows per year. Cattle income is one of the reasons for increasing farmer income and is a saving for farmers (Sukanteri et al., 2019)

Cattle as a source of income for farmers apart from cocoa harvest. the number of cows kept by farmers is between 2 to 5 cows with an average number of cattle kept as many as 3 cows. If the number of cows kept by farmers is increased to an average of 5 cows, the income that farmers will receive will be Rp. 32,500,000 or an increase of 37.9%.

CONCLUSION AND SUGGESTION

Resource allocation in cocoa-coconut-banana intercropping farming and cattle farming shows efficiency in land use. The average income earned by farmers in the village of Angkah on the intercropping system is Rp. 45,728,824 per year. This income is obtained from the intercropping system of cocoa, coconut, banana and cattle crops on an average cocoa land of 0.53 ha. 0.071 ha of coconut, 0.061 bananas and 0.014 ha of cattle obtain optimal income of Rp. 69,800,035. the efficiency of using farm inputs of R/C of 5.95 indicates efficient intercropping farming, even though there are

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changes in commodity prices reaching 15%. Farmers should maintain a crop-cattle intercropping system if posible by increasing the number of cows so that land use is more optimal and utilizing waste as crop input so as to reduce input costs and then the R/C ratio can be increased by farmers.

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