Optimizing Integrated Agribusiness of Beef Cattle Farm through Various Plantation Pattern Models on the Irrigated Land

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Abstract— The objective of this research was to analyze profit and loss from the integration of beef cattle and crop planting work at field-rice land. Each location sample is taken with Purposive Sampling. Umbulsari District in Jember Regency has extensive field-rice land managed with technical irrigation system: Crop Pattern/CP1 (Rice-Rice), Crop Pattern/CP2 (Rice-Corn), and Crop Pattern/CP3 (Rice-Soybean). The sample includes 32 breeder-farmers. Data analysis including analysis on cost and on income, and analysis of Linear Programming. The conclusions were obtained: the income from CP1 was IDR 12,944,460 and the income of beef cattle was IDR 4,315,000. The income from CP2 was IDR 14,175,050 and the income of beef cattle has attained for IDR 4,656,000. The income from CP3 was IDR 13,919,000 and the income of beef cattle has given income of IDR 4,141,500. The highest income was obtained from CP2rice-corn farming, the contribution of CP1 and beef cattle to the total income was 33.33%. CP2 contributed of 33.84% to total farming income. Moreover, CP3 contributed to total farming income by 29.755%. The selected crop pattern was rice-corn farming, its integration with beef cattle has achieved increasing of maximum income of IDR 2,434,000. This favorable yield was obtained with some resources such as 1.01 hectare, seedling priced at IDR 54,993, 143 kg Urea, 564 kg SP3 Fertilizer, 1,110 kg organic fertilizer, off-family workers at 259 labor works, beef cattle ownership at 2.00 animal unit, 12,775 kg animal feed, and on-family workers at 350 labor works.

Keywords—integrated beef cattle, plantation pattern, irrigation

I. INTRODUCTION

The concept of irrigation ricefield development was based on the four main points, they were diversification, intensification, extensification, and rehabilitation. The four points were conducted in integrated, harmonious, and based on the condition of climate, agroecosystem, and social which keep on in accordance by noticing the environmental sustainability. One of the ways to increase farmers' income is implementing the integrated agriculture system by combining crops of agribusiness and the beef cattle breeding business. The integrated agriculture system is defined as the combination of all agriculture components into an integrated agribusiness system. This is an eco-friendly economy system and the optimization of all resources obtained. The purpose of this system application is to minimize the input from outside (low input) that the negative impact maximumly will be avoided and sustainable [1].

Integration between crops and cattle has been depicted on the societies' agriculture pattern since a long time ago and become the part of farmers' agriculture cultivation. In the conventional agribusiness system, cattle are the supporting unit which is considered as a saving [2]. Distortion on the conventional system mostly happen since the population increased, the farming field gets narrow, and the business culture increased.

Integration between crops and beef cattle breeding is basically the combination of two commodities which can be developed simultaneously in the same region where they need each other. Plants will produce agriculture waste that can be used to feed the cattle. While the beef cattle can produce potential manure as the fertilizer for plants and repairing the soil physical nature.

By fulfilling one of the input medium especially food for the beef cattle and organic fertilizer for crops, it is expected that both of them will decrease the production cost and increase the crop and cattle production. Finally, this will increase the farmers' income and prosperity, and support the food and meat self-sufficiency in Indonesia.

The research was conducted in Jember Regency intentionally by considering that the region was one of the technical irrigation fields with a quite spacious area and it had a potential in beef cattle development. Besides, the local societies were used to raise the beef cattle and work on a rice field.

II. RESEARCH METHODS

The sample taken was farmers who had a beef cattle business and it has been raised for at least 1 (one) year, and the farmers have experienced in raising cattle for minimum 3 (three) years. Besides raising the cattle, the farmers should have a crops agribusiness that was cultivated in paddy fields. That requirement was needed to ease the data collection and the farmers may apply several models of cropping pattern.

The linear programming implementation framework for agribusiness and the beef cattle business were listed in Table I.

Num	Activity	Crop Agribusiness and Beef Cattle			Available Resources
		X1	X2	X3	b1
1	Rice-Rice Field	1	0	0	≤ b1
2	Rice-Corn Field	0	1	0	≤ b2
3	Rice-Soybean Field	0	0	1	≤ b3
4	Rice-Rice Seeds	1	0	0	≤ b4
5	Rice-Corn Seeds	0	1	0	≤ b5
6	Rice-Soybean Seeds	0	0	1	≤ b6
7	Urea Fertilizer	1	1	1	≤ b7
8	SP-36 Fertilizer	1	1	1	≤ b8
9	Rice-Rice Org. Fertilizer	1	0	0	≤ b9
10	Rice-Corn Org. Fertilizer	0	1	0	≤ b10
11	Rice-Soybean Org. Fertilizer	0	0	1	≤ b11
12	Out of family workers	1	1	1	≤ b12
13	Rice-Rice Cattle owner	1	0	0	≥ b13
14	Rice-Corn cattle owner	0	1	0	≥ b14
15	Rice-Soybean Cattle owner	0	0	1	≥ b15
16	Rice-Rice Animal Feed	1	0	0	≥ b16
17	Rice-Corn Animal Feed	0	1	0	≥ b17
18	Rice-Soybean Animal Feed	0	0	1	≥ b18
19	Family Workers	1	1	1	≥ b19

The population in this research were the farmers who applied several cropping pattern models in one year as in the following: Cropping pattern 1: Rice-Rice and the beef cattle business; Cropping pattern 2: Rice-Corn and the beef cattle business; Cropping pattern 3: Rice-Soybean and the beef cattle business. The analysis performed in this research includes Cost and Income Analysis and Linear Programming Analysis.

III. RESULTS AND DISCUSSION

A. *The analysis of Crop Agribusiness and Beef Cattle business*

The analysis of Cost Components, Income, and Revenue, the R/C value with Various Cropping Pattern in One Year (Rupiah) were listed in the following Table II.

Num	Description	Cropping Pattern		
		Pattern 1	Pattern 1	Pattern 1
1	Cost of Farming			
	Fixed Cost			
	a. Land Tax	125.076	128.956	124.800
	b. Irrigation	574.616	564.445	574.500
	c. Land Lease	5.17.000	4.968.889	5.150.000
	d. Tools depreciation	770.000	670.556	771.000
	SUBTOTAL	6.642.692	6.332.846	6.620.300
	Variable Cost			
	a. Seeds	1.136.154	1.272.222	1.136.000
	b. Pesticides	4.071.538	3.876.667	4.275.000
	c. Fertilizers	4.376.923	4.294.444	4.485.000
	d. Workers	6.076.923	5.855.556	6.030.000
	e. Tractor Rental	2.346.153	2.455.556	2.340.000
	SUBTOTAL	18.007.691	17.754.444	18.266.000
	TOTAL COST OF FARMING	**24.650.383**	**24.650.383**	**24.886.300**
2	Cost of Beef Business			
	Fixed Cost			
	a. Cattle Depreciation	283.077	268.889	285.000
	b. Cage Depreciation	65.769	66.667	66.500
	c. Tools Depreciation	53.077	52.778	55.000
	SUB TOTAL	401.923	388.334	406.500
	Variable Cost			
	a. Feeding Cows	7.200.000	7.011.111	7.220.000
	b. Animal Feed Forage	1.138.462	1.144.444	1.160.000
	c. Concentrate	1.617.308	1.611.111	1.610.000
	d. Drugs	221.154	216.667	230.000
	SUBTOTAL	10.176.924	9.983.333	10.167.000
	TOTAL COST OF BEEF CATTLE	**10.578.847**	**10.371.667**	**10.220.000**
3	Agribusiness Revenue	38.592.500	38.596.500	38.569.500
4	Beef Cattle Revenue	14.829.231	15.015.556	14.881.500
5	Total Revenue	53.421.731	53.612.056	53.451.000
6	Agribusiness Income	13.942.117	14.509.210	13.683.200
7	Beef Cattle Income	4.250.384	4.643.889	4.255.00
8	Total Income	18.192.501	19.153.099	17.938.200
9	Agribusiness R/C	1,57	1.60	1,55
10	Beef Cattle business R/C	1,46	1.50	1,46
11	Total Business R/C	1,51	1.55	1,50

From the analysis results, the cost of Cropping Pattern 3 Rice-soybean + beef cattle business required the highest cost rather than the other cropping pattern, this was due to the land processing, land lease, and the inorganic fertilizer required an extremely high cost [3]. The results of this research showed the crop agribusiness and the beef cattle revenue with various cropping patterns in one year per hectare per livestock unit. Then it showed that the revenue of crop agribusiness with the Rice-Corn pattern and the beef

cattle business was the highest. This was presumed as the effect of cattle enlargement, manure result, forage waste, and workers result.

The research result showed that the income of cropping pattern 1 was Rp. 13.942.117,- and the beef cattle business was Rp. 4.250.384,- that the total was Rp. 18.192.501,-. While the income of cropping pattern 2 per hectare was Rp. 14.509.210,- and the beef cattle business per livestock unit was Rp. 4.643.889,- that the total was Rp. 19.153.099,-. Then the income of cropping pattern 3per hectare was Rp. 13.683.200,- and the beef cattle business per livestock unit was Rp. 4.255.000,- that the total was Rp. 17.938.200,-.

The data above showed that the highest income was from the cropping pattern 2 with the beef cattle business. The contribution of the cropping pattern 1 and the beef cattle business on the agribusiness income was 30,46%, the cropping pattern 2 plus the beef cattle business was 32,01%, while the cropping pattern 3 and the beef cattle business was 31,09%. Beef cattle contribution on the total crop agribusiness was 28,28% the research result in Batumerta Region, North Sumatra [4] and [5].

All R/C ratio value gained positive number which means that farmers still obtaine profit in a small number. According to [6] the result showed that the income of beef cattle in Lempang village, Tanete Riaja Subdistrict, Barru regency with an average income per year obtained by the farmers who had 8 cattle was Rp. 21.901.667,- with R/C 2,9, 7 cattle was Rp. 20.420.417,- with R/C 3,1, 5 cattle was Rp. 12.079.444,- with R/C 2,3, 4 cattle was Rp. 9.356.500,- with R/C 2,0, 3 cattle was Rp. 7.232.917,- with R/C 1,8, 2 cattle was Rp. 5.201.146,- with R/C 1,8, and 1 cattle was Rp. 2.507.500 with R/C 1,8.

B. Implementing the Crop Agribusiness and Beef Cattle Business Optimization

The analysis result came to the finishing stage on the three cropping patterns activities that were listed on Table II. In Table II, the selected agribusiness activity of rice-corn agribusiness which had activity value of 1,017 and additional income contribution of Rp. 2.434.000,- while the rice-soybean agribusiness which had activity value of 0,230 and income contribution of Rp. 612.000,-.

TABLE III.   OPTIMIZED CROP AND BEEF CATTLE

Number	Activities	Activity Value	Income Contribution
1	Rice-Rice with beef cattle	0	0
2	Rie-Com with beef cattle	1,017	2.434.000
3	Rice-Soybean with beef cattle	0,234	612.000

The rice-rice agribusiness activity was not selected since the final computation result showed that the activity value of the agribusiness was 0 that the income contribution was also 0. From the analysis on table 2, the result obtained was that the optimal pattern of the selected agribusiness was the one with the highest income contribution, which in this case was the rice-corn cropping pattern with the beef cattle business

Implementing the crop agribusiness and the beef cattle business optimization in this research generally included 3 main components, they are resources hurdle speed, activity vector columns, and functional purpose row. the selected agribusiness activity of rice-corn agribusiness which had activity value of 1,017 and additional income contribution of Rp. 2.434.000,- while the rice-soybean agribusiness which had activity value of 0,230 and income contribution of Rp. 612.000,-.

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The resulting analysis of linear programming for the rice-corn agribusiness activity with beef cattle business was listed on Table III.

TABLE IV.   OPTIMIZED CROP AND BEEF CATTLE PATTERN

Number	Optimal Activities	Activity Unit	Activity Level
1	Area width on the Rice-Corn Cropping Pattern	Hectare	1.01
2	Plant Seeds Value	Rupiah	54,933
3	Urea Fertilizer	Kg	143
4	SP-36 Fertilizer	Kg	564
5	Organic Fertilizer	Kg	1,110
6	Out-of-Family workers	day work	259
7	Beef Cattle Ownership	Cattle unit	2.00
8	Animal Feed	day work	12,775
9	Family Worker	Kg	350
10	Maximal Income	Rupiah	2,434

The final analysis result with linear programming, the selected cropping pattern was the rice-corn agribusiness and the beef cattle business with maximum income increasing of Rp. 2.434.000,-. To earn those number, several resources needed were 1,01 hectare of field, the plant seeds value of Rp. 54.993,-, 143 Kg urea fertilizer, 564 Kg SP-36 Fertilizer, 1.110 Kg organic fertilizer, 259-day work out-of-family workers, 2 beef cattle, 12.775 Kg Animal feed, and 350 family workers

IV. CONCLUSION

Based on the research and discussion above, it could be concluded that the research result showed that the income of cropping pattern 1 was Rp. 13.942.117,- and the beef cattle business was Rp. 4.250.384,- that the total was Rp. 18.192.501,-. While the income of cropping pattern 2 per hectare was Rp. 14.509.210,- and the beef cattle business per livestock unit was Rp. 4.643.889,- that the total was Rp. 19.153.099,-. Then the income of cropping pattern 3per

hectare was Rp. 13.683.200,- and the beef cattle business per livestock unit was Rp. 4.255.000,- that the total was Rp. 17.938.200,-. The data above showed that the highest income was from the cropping pattern 2 with the beef cattle business.

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The selected cropping pattern was the rice-corn agribusiness and the beef cattle business with maximum income increasing of Rp. 2.434.000,-. To earn those number, several resources needed were 1,01 hectare of field, the plant seeds value of Rp. 54.993,-, 143 Kg Urea fertilizer, 564 Kg SP-36 Fertilizer, 1.110 Kg Organic fertilizer, 259 HOK out-of-family workers, 2 beef cattles, 12.775 Kg Animal feed, and 350 HOK family workers.

Based on the existing five sustainability dimensions, the integrated agribusiness of beef cattle and crops in the research area had a sustainability index of 42,40. This index showed that the agribusiness was not quite sustainable. Dimension with the worst sustainability index and need more attention were technology and infrastructure, and law and institutional dimensions.

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