
Farmer's perceptions of coffee by-products as Bali cattle feed in Catur Village-Bali

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Sanjaya, I. G. A. M. P., Sudita, I. D. N., Prakerti, N. L. A. D. and Santika, I. B. M, P. (2022). Farmer's perceptions of coffee by-products as Bali cattle feed in Catur Village-Bali. International Journal of Agricultural Technology 18(5):2229-2240.

Abstract The limitations of conventional feed sources can be overcome using feed ingredients based on plantation waste. The perception of most farmers (88.76%) on the use of coffee by-products as feed for Bali cattle is good. The youngest respondent was 26 years old, and the oldest was 68 years old. Most of respondents had elementary school education (57.14%), 40.48% of respondents had land to be used for coffee cultivation in the range of 0 – 0.5 Ha, raising Bali cattle in the range of 0-3 heads (78.57%), with 40 years of experience raising Bali cattle. Furthermore, age, formal education, the area of coffee area, the number of cattle, and experience in raising cattle have been shown to have a positive and significant effect ($P < 0.05$) simultaneously and partially on farmers' perceptions of the utilization of coffee by-products as Bali cattle feeds with an R Square (R^2) of 0.891. Age is the primary indicator that has the most significant influence on the coffee farmers' perception of using coffee by-products as Bali cattle feed. The coefficient of determination showed that the effect of the independent variable on the dependent variable simultaneously is 89.1%. While the remaining 10.9% is explained by other variables which are not included in the model. In conclusion, counseling on coffee by-products processing as Bali cattle feed has succeeded in changing perceptions, which will continue at each farmer's innovation adoption stage. The influence of individual characteristics cannot be ruled out in measuring coffee farmers' perceptions.

Keywords: Arabica Kintamani, Bali Cattle, Coffee By-product, Farmer's Perception, Feed

Introduction

Kintamani Arabica coffee is one of the leading agro-industrial commodities in Bali. Bangli is a district in Bali that has the highest Arabica coffee production. Kintamani is one of the sub-districts that has the highest planting area and production in the Bangli Regency. However, Arabica coffee production in this district has fluctuated from 2018 to 2020. Arabica coffee production in Bangli Regency in 2018 was recorded at 2.252 tons, decreased in 2019 to 2.247 tons, and increased again in 2020 to 2.249 tons (National

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Statistical Bureau, 2021). Kintamani Arabica coffee is developed by intercropping with fruits and livestock (Bali cattle) to increase farmers' income.

Intercropping systems between plants and livestock are generally widely practiced with plantation crops. Siswati (2021) revealed that plantation crops in an intercropping system are the main component, while grass and livestock grazing on them is the second component. Intercropping is a horizontally diversified part of an integrated farming system. An integrated farming system is a solution to the problem of limited agricultural areas and plantations in Bali. The purpose of an integrated farming system is to optimally utilize land functions (Fyka *et al.*, 2019). The effective use of agricultural areas and plantations will increase with the integration of livestock. Archer *et al.*, (2018) state that integrated farming often includes both crop and livestock enterprises. The approach to integrating livestock with food crops, plantations, and industrial forest plantations is feasible and should be developed technically, economically, and socially to increase the population of beef cattle with low production costs (Kusumo *et al.*, 2017).

Kintamani is the largest Arabica coffee-producing area in Bangli Regency, Bali Province. Coffee farmers in this district have integrated their coffee plants with Bali cattle. The majority of Arabica coffee plants in Kintamani are cultivated organically. Although they have implemented an integrated farming system between coffee plants and Bali cattle, the farmers have not applied the zero-waste concept to their farming. Institutionally, coffee farmers in Kintamani District are members of Subak Abian. Subak abian is a subak where most of its area is used for the cultivation of plantation crops such as coconut, coffee, and several other plants (Salamanca *et al.*, 2013). Subak Abian Wanasari Kenjung is one of several subak abian in Kintamani District. Subak Abian has received counseling on the process of processing coffee by-products into Bali cattle feed. Before a farmer adopts an innovation, he will go through a perception change stage. Farmers' perception of innovation is the result of the process of determining information and messages from the innovation. Perception is defined as the process of understanding or giving meaning to information derived from an existing external stimulus. External stimuli are generally obtained through sensing an event, object, or relationship between symptoms, which are then processed by the human brain (Sumanto, 2014).

Extension workers play an important role in increasing the adoption of technology and farmers' perception along with the increase in feed availability, such as the utilization of rice and corn straws (Baba *et al.*, 2019). A variety of agricultural and farmer characteristics are also linked to intention (Daxini, 2018). Maswadi *et al.* (2018) stated that the five characteristics of the farmers,

namely age, education, land area, number of family dependents and farming experience, had a positive influence on farmers' perceptions; this indicates that farmers' characteristics are very important on the farmers' decision to adopt cocoa bean fermentation technology. Coffee farmers' perceptions of Subak Abian Wanasari Kenjung in processing coffee by-products have never been analyzed after they have implemented the use of coffee by-products as Bali cattle feed and attended the counseling. Therefore, the objective of this study was to determine the perception level of coffee farmers and the influence of individual characteristics on their perceptions of the utilization of coffee by-products as Bali cattle feed.

Materials and methods

Population and sample

This research was conducted from September to October 2021 at Subak Abian Wanasari Kenjung, Catur Village, Kintamani District, Bangli Regency, Bali Province. The selection of research locations was carried out by purposive sampling, namely the selection of locations based on certain considerations. Several things to consider include: 1) all coffee plants owned by members of the Subak Abian Wanasari Kenjung are organically grown; 2) all group members raise Bali cattle; and 3) all members have implemented the use of coffee by-products as Bali cattle feed for more than one year and have received counseling and training on processing coffee by-products as feed for Bali cattle for better quality than before from the Matching Fund team from Warmadewa University.

Respondents in this study were all coffee farmers who are members of Subak Abian Wanasari Kenjung. The census method is used in sampling, considering the number of respondents who are not too many, namely 42 people, and to get more accurate research results. The census is one way of taking respondents in the generalization area, which consists of objects or subjects that have certain qualities and characteristics determined by researchers to be studied, and then conclusions are drawn (Sugiyono, 2018). Data collection consists of primary and secondary data. Primary data was obtained through direct observation of coffee farmers who are members of Subak Abian Wanasari Kenjung who raise Bali cattle. This study was designed as survey research, therefore data collection used a questionnaire with structured questions developed by the enumerators. While secondary data is obtained from related agencies and other supporting publications that exist herewith.

Statistical analysis

The data in this research was analyzed both descriptively and qualitatively to determine respondents' perceptions of coffee by-products to be used as Bali cattle feed. The variables observed included: age (X_1 year), formal education (X_2 year), area of coffee areal (X_3 Ha), number of cattle (X_4 head), and raising cattle experience (X_5 year). Meanwhile (Y), farmers' perceptions of using coffee byproducts as Bali cattle feed are classified using the following criteria (Table 1).

Table 1. Categories of farmers perception of coffee by-products as bali cattle feed

No	Farmers Perception Category	Score Achievement
1	Good	2.34 – 3.00
2	Moderate	1.67 – 2.33
3	Poor	1.00 – 1.66

The total variable score is obtained based on the score achieved by respondents using class intervals, namely dividing the difference between the highest and lowest scores by the number of categories (Sudjana, 2016) with the following formula (1):

$$\text{Class Interval (CI)} = \frac{\text{Range}}{\text{Number of classes}} \quad (1)$$

Where range is the highest – lowest value and the number of classes is the specified category.

To analyze the influence of age, formal education, wide of coffee areal, number of cattle, and raising cattle experience on farmers' perceptions of the utilization of coffee by-product as Bali cattle feed used multiple linear regression analysis (Sugiyono, 2018) with the following models (2):

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \quad (2)$$

Where Y was farmers' perceptions of the utilization of coffee by-product as Bali cattle feed; α was constant; $\beta_1 - \beta_5$ was regression coefficient; X_1 was age; X_2 was formal education; X_3 was wide of coffee areal; X_4 was a number of cattle; X_5 was raising cattle experience; e was a standard error.

Results

Individual characteristics

Based on the results of data analysis on the individual characteristics of coffee farmers members of Subak Abian Wanasari Kenjung, which consist of age (X1 year), formal education (X2 year), area of coffee areal (X3 Ha), number of cattle (X4 head), and raising cattle experience (X5 year) the following results were obtained:

Table 2. Distribution of Respondents Based on Individual Characteristics

No	Individual Characteristics	Classification	Number of Respondents	Percentage of Respondents (%)
1	Age	0 – 15 Year	0	0
		16 – 30 Year	3	7.14
		31 – 45 Year	19	45.24
		46 – 60 Year	12	28.57
		61 – 75 Year	8	19.05
Total			42	100
2	Formal Education	Elementary School	24	57.14
		Junior High School	8	19.05
		Senior High School	9	21.43
		Diploma	0	0
		Under Graduate	1	2.38
Total			42	100
3	Wide of Coffee Areal	0 – 0,5 Ha	17	40.48
		> 0,5 – 1 Ha	11	26.19
		> 1 – 1,5 Ha	5	11.90
		>1,5 – 2 Ha	6	14.29
		> 2 Ha	3	7.14
Total			42	100
4	Number of Cattle	0 – 3 Head	33	78.57
		> 4 – 6 Head	9	21.43
		> 7 – 9 Head	0	0
		> 10 – 12 Head	0	0
		> 12 Head	0	0
Total			42	100
5	Raising Cattle Experience	0 – 10 Year	0	0
		> 10-20 Year	6	14.29
		> 20-30 Year	12	28.57
		> 30-40 Year	9	21.43
		> 40 Year	15	35.71
Total			42	100

Source: Field survey, 2021

Respondents in the age range of 31-45 years were 45.24%. The age of the youngest respondent was 26 years and the oldest was 68 years old. It can be seen that most of the respondents (80.95%) were in the productive age range. Most of the coffee farmers who were members of Subak Abian Wanasari

Kenjung had elementary school education (57.14%). Respondents with junior high school education were 19.05% and 21.43% high school educated. Meanwhile, only 2.38% had a bachelor's degree and no one had a Diploma. This indicates that the education level of most coffee farmers is still very low. In terms of wide of coffee areas, most of the respondents (40.48%) had land to be used for coffee cultivation in the range of 0 – 0.5 Ha. This number showed that some coffee farmers who were members of Subak Abian Wanasari Kenjung are smallholder coffee farmers. As for a number of cattle, most of the respondents (78.57%) raise Bali cattle in the range of 0-3 heads. This number showed that most of the farmers were smallholder farmers with a small number of cattle. The survey data showed that as many as 19 farmer members of Subak Abian Wanasari Kenjung own 2 Bali cattle. Furthermore, most respondents (35.71%) had more than 40 years of experience raising Bali cattle. A total of 28.57% of respondents had experienced in raising Bali cattle more than 20-30 years, 21.43% over than 30-40 years, and only 14.29% of respondents in the range of more than 10-20 years. These results indicated that all members of Subak Abian Wanasari Kenjung had sufficient experience in raising Bali cattle.

Farmers' perception

Based on the five indicators that made up the variable perception of coffee farmers, information is obtained that most farmers (98.57%) had a good mindset and 95.71% of farmers had a good perception of the concept of integrated agriculture (plant-livestock). As many as 98.10% of farmers had a good perception of the innovation of processing coffee by-products as cattle feed, this would be able to increase their income. These three perception indicators get a very high percentage because coffee farmers' members of Subak Abian Wanasari Kenjung have used coffee by-products as Bali cattle feed but without the proper fermentation process. Furthermore, the high percentage of farmers' assessment of the integrated farming concept is because, in coffee farming, they have long applied this concept where the coffee product produced is organic coffee.

In terms of ease of manufacture and application, 78.10% of farmers had good perceptions. It is believed this innovation can be easily carried out and applied to Bali cattle that are reared. Meanwhile, 19.52% had a moderate perception, and only 2.38% of farmers had a bad perception of this feed innovation. This is a common thing in an innovation introduced to farmers'. Furthermore, in terms of farmer trust, most coffee farmers (73.33%) had a high level of trust. Only 26.67% of farmers with a moderate level of trust in the processing of coffee by-products would positively impact their farming because

farmers have felt the positive effects of processing coffee by-products as fertilizer and Bali cattle feed; more details can be seen in Table 3.

Table 3. Coffee farmers' perceptions in utilizing coffee by-product as Bali Cattle Feed

No	Statement	Good (%)	Moderate (%)	Bad (%)
1	Mindset	98.57	1.43	0
2	Integrated Farming Concept	95.71	4.29	0
3	Increase in Farmer's Income	98.10	1.90	0
4	Ease of Creation and Application	78.10	19.52	2.38
5	Trust	73.33	26.67	0

Source: Field survey, 2021

Effect of independent variables on dependent variables

Data processing results using software SPSS version 25.0 for windows are presented in Table 4. Results of the multiple linear regression equation were as follows: $Y = -2.175 + 0.010 X_1 + 0.558 X_2 + 0.222 X_3 + 0.162 X_4 + 0.455 X_5 + e$. Base on multiple linear regression equation, the regression coefficient value of the age (X_1) was 0.010, formal education (X_2) was 0.558, wide of coffee areal (X_3) was 0.222, a number of cattle (X_4) was 0.162, and raising cattle experience (X_5) was 0.455. These five indicators had a positive correlation with farmers' perceptions. It showed that for every increase in the age indicator (X_1), formal education (X_2), wide of coffee areal (X_3), number of cattle (X_4), raising cattle experience (X_5) increased in farmers' perception in the utilization of coffee by-product as Bali cattle feed (Y) with the assumption that the other independent variables were constant.

Effect test results of simultaneous independent variables on dependent variables

The results showed that the influence of the independent variables on the individual characteristics of farmers with five indicators such as age (X_1), formal education (X_2), wide of coffee areal (X_3), number of cattle (X_4), raising cattle experience (X_5) on the dependent variable, namely the perception of farmers in the utilization of coffee by-product as Bali cattle feed (Y) had an R Square (R^2) of 0.891 (Table 4). The coefficient of determination showed that the effect of the independent variable on the dependent variable simultaneously is 89.1%. While the remaining 10.9% is explained by other variables which is not included in the model. It is supported by the results of the significance test which showed that the sig value of the five indicators was in the range of 0.001-

0.020 where the value was smaller than 0.05 ($P < 0.05$). These results showed that X_1 , X_2 , X_3 , X_4 , and X_5 simultaneously affected the Y variable.

Table 4. Multiple linear regression analysis Results of the effect of independent variables on dependent variables

Independent Variable	Dependent Variable	Coefficients Regression (B)	t	Sig.	Explanation
(Constant)	Farmers' perception of		-3.119	0.004	
Age (X1)	the utilization	0,411	3.958	0.000	**
Formal Education (X2)	of coffee by-	0,232	2.428	0.020	*
Wide of Coffee Areal (X3)	products as	0,185	2.648	0.012	*
Number of Cattle (X4)	Bali cattle feed	0,183	3.194	0.003	*
Raising Cattle Experience (X5)	(Y)	0,232	3.446	0.001	*
Multiple R	= 0.944				
R Square	= 0.891				
Adj. R2	= 0.876				
F count	= 58.991				
Sig.	= 0.000				
α	= 0.05				

Source: Primary Data (Processed), 2021.

Explanations: **: significant at $P < 0.01$, *: significant at $P < 0.05$

Partial effect test result of independent variable on dependent variables

The results of the partial effect test (T-Test) is presented in Table 4 which showed that the individual characteristics variables consisting of five indicators (X_1 , X_2 , X_3 , X_4 , and X_5) had a significant simultaneous effect on the dependent variable, namely farmers' perceptions of the utilization of coffee by-product as Bali cattle feed (Y) (sig value < 0.05).

Discussion

The variable perception of coffee farmers in the utilization of coffee by-products as Bali cattle feed consists of five indicators. Most of the coffee farmers had a good mindset towards the utilization of coffee by-products as Bali cattle feed to realize organic coffee farming with a zero-waste concept. Kretschmer *et al.* (2021) stated that organic mindsets are generally constrained by convergent narratives of enlightened self-interest that display clear conformity to the principles of sustainable development. Farmers' perceptions on the integrated farming concept, especially the integration of coffee plants with Bali cattle were good. The majority of coffee farmers understood the

benefits of integrating coffee plants with Balinese cattle that are raised. Coffee farmers understood that the integration of coffee plant-Bali cattle would be supported the development of regional potential by optimizing land productivity and local resources. Kathleen (2011) stated that integrated farming between crops and cattle was useful for improving soil quality, increasing yields, producing diverse food, and improving land-use efficiency. The development of livestock using an integrated pattern on plantation lands such as oil palm, coffee, cocoa, and coconut had good prospects (Kusumatuti and Sembiring, 2016).

Coffee farmers' perception of an increase in income in the utilization of coffee by-products as Bali cattle feed was good. Farmers had the perception that by processing coffee by-product as Bali cattle feed, they would be able to save time and transportation costs for procuring fodder forage. Saptana (2012) stated that combining several types of business commodities in a certain area is an opportunity that can increase farmers' income. Financially, in addition to farmers getting income from the coffee plantation sector, they also get income from the sale of cattle. In addition, the efficiency of farming is also obtained from this integration activity. Moreover, with the introduction of technology, coffee by-products can be processed as an alternative feed for Bali cattle.

Respondents had different perceptions about the ease of processing coffee by-products and its application as Bali cattle feed. Most of the farmers had a good perception of the ease of manufacture and application of Bali cattle feed based on coffee by-products. Liu and Qingxiong (2006) stated that perceived easily using that had a positive impact on respondents' behavioral intentions to use a system. Business scale, type of business, cost capability, human resource capacity, and affected the type of the used technology (Gumbira and Harizt, 2001). From the side coffee farmers' trusted in technological innovations for processing coffee by-products as Bali cattle feed is perceived in the moderate to good range. Rusdiana (2014) stated that people must believe that the innovation can meet a need that is truly felt by them. On the other side, Syatra *et al.* (2016) state that the success or failure of technology development is determined by whether or not farmers want to apply the recommended technology.

Analysis results of the effect of an independent variable on the dependent variable showed that the five indicators that made up the individual characteristics (X) both simultaneously and partially had a positive and significant effect on farmers' perceptions of the utilization of coffee by-products as Bali cattle feed (Y). Age is the primary indicator that has the most significant influence on the coffee farmers' perception of using coffee by-products as Bali cattle feed. Most of the respondents were in the productive age (15–64 years). Soekartawi (2005) states that farmers in the productive age

would be more optimal in managing their farming, so that it is possible to increase productivity and income. In general, education can be categorized into three-lane; namely: formal education, non-formal, and informal. The results showed that the majority of respondents were at a low level of formal education, namely only elementary school graduates. Maryam *et al.* (2016) stated that education is one of the factors that influenced business success where education affected the mindset, attitudes, and abilities of farming productivity. Viewed from the aspect of wide of coffee areal, it showed that all respondents were smallholder plantations. It is indicated by the small ownership of coffee plantations areal owned by farmers. This result is in line with Rukmana (2014) which stated that most of the coffee plantations owned by farmers were smallholder plantations, while a small portion was a government and private plantations. Manatar *et al.* (2017) mentioned that the production of food crops produced by farmers can be influenced by the size of the land and good agricultural cultivation practices. The coffee farmers who were the members of Subak Abian Wanasari Kenjung mostly own 2 Bali cattle. The low number of Bali cattle ownership was due to the limited working capital they have. Farmers with a small number of cattle tended to be more open to counseling about innovation because farmers had a high interest in developing their farming (Kurnia *et al.*, 2019).

In terms of experience, all respondents had a long experience in raising Bali cattle. The average had experienced between 10-40 years. Indraningsih (2011) stated that experience was one of the factors that influenced the formation of attitudes in addition to other factors such as other people who are considered important, mass media, educational institutions, and religious institutions, as well as emotional factors within the individual. Farming experience plays an important role in improving farmer behavior (Manyamsari and Mujiburrahmad, 2014). Makatita *et al.* (2014) stated that the longer a person's experience in raising livestock, the more knowledge they would gain so that they can determine their mindset in making decisions for managing their farming.

The perception of coffee farmers about processing coffee by-products as Bali cattle feed had been successfully changed through proper fermentation process counseling. Individual characteristics with their five indicators had a positive correlation with coffee farmers' perception measurement. Intensive assistance is needed to increase the adoption of innovation used of coffee by-products as Bali cattle feed widely and accelerate the application of the zero-waste agriculture concept on the integration of coffee plants with Bali cattle in Catur Village-Bali.

Acknowledgements

We as the research team through this opportunity would like to express our highest gratitude to the Director-General of Higher Education, Ministry of Education, Culture, Research, and Technology who has supported funding activities through the 2021 Matching Fund Grant, Warmadewa University, and The Foundation Welfare Korpri Bali Province, especially to the Rector of Warmadewa University, Chairman of The Foundation Welfare Korpri Bali Province.

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(Received: 5 January 2022, accepted: 30 July 2022)