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Profile of Farmers Based Feed Management and Animal Health of Bali Cattle in Agroecosystem Variation at Timor Island

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ABSTRACT

The research objective was to determine the profile of smallholder farms based on the aspects of feed management and animal health in different agro-ecosystems on Timor Island. The research was carried out for 6 months, from June to December 2018. The research location was determined by purposive sampling, namely (1) pasture agroecosystem in District of Belu, Malaka, and Timor Tengah Utara, (2) agricultural agroecosystem in Kupang Regency and Kupang City, (3) plantation agroecosystems in Kupang Regency, and (4) forest agroecosystems in District of Timor Tengah Selatan. The purposive stratified proportional sampling method was used to determine the number of samples according to the Slovin formula at an error probability of 0.05 (5%) so that the sampling of respondents was 436 people. Types of data used are primary and secondary data with data methods by observation, interviews (questionnaires), and documentation. Descriptive quantitative data analysis described in a narrative manner. The results showed that for the aspect of feed management, feed preservation was only done by some farmers, with the highest to lowest percentage of actors being plantation agroecosystems (12.8%), agriculture, (5.9%), pasture (1.6%) and forest (0%). Whereas in the aspect of livestock health, the highest to lowest vaccination implementers were carried out in agricultural agroecosystems (98.0%) followed by plantations (92.2%), pasture (66.9%) and forests (44.8%).

Keywords: Animal health, Feed management, Timor Island agroecosystem

Introduction

The central area of Bali cattle production in Nusa Tenggara Timur (NTT) Province is Timor Island with a percentage of 65.97% of the total cattle in NTT as many as 899,577 head (Disnak NTT, 2019), however, the topography of Timor Island which is generally dry land types is a limiting factor for livestock production, especially aspects of feed in terms of quality and quantity. Maintenance management that is still traditional also has implications for low livestock input. In fact, this is counterproductive to the enormous potential of the Timor Island agroecosystem, such as agricultural land, plantations, forests, and grazing areas that are large enough to ensure the availability of feed-in quantity and quality.

Varied agroecosystems greatly determine the productivity of Bali cattle if managed properly (Habaora, 2020). Efforts to increase cow productivity can be done by increasing the knowledge of farmers about feed management and livestock health. Riwukore and Habaora (2018) state that there is a very real relationship between feed management and livestock health on cattle production. So far, there is no information and data that can provide a clear picture of feed managerial and livestock health in Timor Island based on different agro-ecosystems. Therefore, the purpose of this study was to determine the managerial aspects of feed and livestock health on Timor Island based on agroecosystems.

Materials and Methods

This research was conducted on Timor Island, NTT Province, Indonesia from January to December 2018. Determination of the research location purposively representing pasture agroecosystems (Districts of Belu, Malacca, and North Central Timor). Kupang District and Kota Kupang are areas that represent agricultural agroecosystems and plantation agroecosystems.

Timor Tengah Selatan District represents forest agroecosystems. In this study, it was selected randomly using a sampling technique with a purposive stratified proportional sampling method (Sugiyono, 2017). Determine the number of samples, the Slovin formula (Riwukore and Habaora, 2019b) is used at an error probability of 0.05 (5%) so that the number of respondents in this study was 436 respondents. Based on this technique, the number of farmer respondents is 127 farmers in pasture agroecosystems, 102 farmers in agricultural agroecosystems, 102 farmers in plantation agroecosystems, and 105 farmers in forest agroecosystems. Respondents were interviewed using a prepared questionnaire list. Methods of data collection are carried out through observation, interviews, and documentation. Types of data are primary data and secondary data. Primary data collected, namely (1) respondent profile; (2) managerial feed; and (3) Livestock health. Secondary data were obtained from research reports and regional statistics. The research data were recorded and tabulated using the excel program, then analyzed descriptively according to Sugiyono (2017), which is a statistical tool used to provide an overview/information about the characteristics of the research variables.

Results and Discussion

Respondent profile

The age profile of farmers can be seen in Table 1. The age of Bali cattle farmers in each agroecosystem is generally still of productive age and can be a strong factor in developing a Bali cattle business. It is feared that the non-productive farmers will become an obstacle in the development of livestock. Maryam *et al.* (2016) stated that farmer productivity begins to decrease after 45 years of age, and becomes fanatical of tradition, apathetic to technological innovation, and difficult to be given the understanding to change the way they think, work, and live. Utami *et al.* (2016) and Riwukore and Habaora (2018) state that the productive age of farmers affects their curiosity about something, and their interest in adopting technology is getting higher.

The highest percentage of graduated education for farmers in each agroecosystem is presented in Table 2, where most farmers in the agroecosystems of pasture and plantation do not attend school, generally farmers in agricultural agroecosystems complete the highest education only junior high school, and most farmers in forest agroecosystems only complete education until elementary school. The results of this study indicate that the average education of farmers is still low, but this is considered to have no effect on livestock business development. Utami *et al.* (2016) and Maryam *et al.* (2016) stated that the level of farmer education does not affect that farmers will develop a business because the level of education from elementary school to junior high school is not a specification of animal science, except for farmers who learn specifically about these new innovations at school. However, one of the reasons for the slow development of livestock is the low level of education of farmers so that their ability to adopt technology and innovation is low. Hartini *et al.* (2013) and Sonbait *et al.* (2011) stated that a high level of education will be more receptive to the developments in its surroundings, and it will be difficult for low educated farmers. Thus, the educational factor is likely to become an inhibiting factor in the development of Bali cattle farming in each agroecosystem.

The results showed that cattle ownership from farmers varied greatly between 13.2-15.8 heads per household (Table 3). This situation shows that the ownership of cattle in each agroecosystem is feasible to develop commercially. Utomo *et al.* (2012) stated that ownership of more than 13 head of cattle per household was economically feasible. Rouf and Munawaroh (2016) stated that the

Table 1. Age of farmers based on agroecosystem on Timor Island

Age of Farmers	Agroecosystems			
	Pasture	Agriculture	Plantation	Forest
	.... %			
15-30 years	5.5	8.8	4.9	7.6
31-45 years	62.2	49.0	67.7	66.7
46-50 years	11.0	23.5	14.7	11.4
>50 years	21.3	18.6	12.7	14.3
Total	100.0	100.0	100.0	100.0
Productive	88.2	86.3	92.2	84.8
Non-productive	11.8	13.7	7.8	15.2
Total	100.0	100.0	100.0	100.0
Average Age (years)	42.8	43.3	41.7	42.2

Table 2. Farmers' education level based on agroecosystem on Timor Island

Education Level	Agroecosystems			
	Pasture	Agriculture	Plantation	Forest
	......................................%..............................			
No School	37.0	9.8	41.2	26.7
Elementary School	32.3	14.7	33.3	33.3
Junior High School	22.0	44.1	12.8	22.9
Senior High School	5.5	23.5	11.8	14.3
Bachelor	3.2	7.8	1.0	2.9
Total	100.0	100.0	100.0	100.0

Table 3. Livestock ownership by agroecosystem on Timor Island

Cattle Ownership	Agroecosystems							
	Pasture		Agriculture		Plantation		Forest	
	Σ	%	Σ	%	Σ	%	Σ	%
Calves	2.1	15.3	2.5	15.6	2.4	15.4	2.2	16.2
Young	4.6	35.0	5.4	34.5	6.4	41.87	5.3	38.3
Mature	6.5	49.7	7.9	49.9	6.5	42.8	6.2	45.5
Total	13.2	100.0	15.8	100.0	15.3	100.0	13.7	100.0

number of ownership of cattle has a positive and significant effect on the income level of farmers. Habaora *et al.* (2019) stated that a small number of livestock will increase the fixed costs borne by farmers. Thus, increasing the number of livestock raised creates efficiency and seeks to increase the productivity of much livestock.

Bali cattle farmers in Timor Island based on their farming experience show that the average experience of maintenance Bali cattle in agroecosystems of pasture, agriculture, plantation, and the forest has been more than 10 years (Table 4). The situation of this research shows that Bali cattle farmers in Timor Island based on the agroecosystem have been cultivating livestock for a long time so that it can influence the increase in business success. Utami *et al.* (2016) stated that the long experience of raising cattle makes it easier for farmers to overcome the difficulties they experience and from this experience, it becomes knowledge to advance their business.

The highest value of raising Bali cattle based on motivation shows that farmers in pasture and agricultural agroecosystems raise livestock because of inheritance, then in plantation and forest agroecosystems because it is profitable (Table 5). The difference in motivation to cultivate cattle has an effect on the success of the livestock business because economic-oriented farmers will try to increase the productivity of cattle than socially-oriented farmers. Alam *et al.* (2014) stated that livestock business due to inheritance is a social motive, and profitable is an economic motive. Social motives are influenced by efforts to maintain social status and fill spare time, while economic

motives are influenced by the urge to have savings or increase existing savings because cattle can become family savings which can be sold at any time. Differences in motivation in the livestock business will affect the profile of feed management and livestock health.

Feed management

Feed management by breeders in each agroecosystem tends to be low (Table 6), where most farmers in each agroecosystem do not preserve feed for their livestock. The factors causing the low adoption of feed preservation technology are allegedly due to the low level of education and the influence of motivation on farmers. The results of this study indicate that the highest level of education completed by farmers is from not attending school until completing junior high school/equivalent. Most of the motivation of farmers in each agroecosystem tends to raise cattle due to inheritance factors (social motives). Strengthening the capacity of Bali cattle farmers needs to be done through extension as a strategy to broaden knowledge. Extensionists have an important role in developing livestock and increasing the adoption of livestock technology to farmers (Riwukore and Habaora, 2019b).

The need for livestock consumption per day is generally 10% of body weight. Farmers' perceptions of the consumption needs of cattle in various agroecosystems can be seen in Table 6. Most farmers in pasture agroecosystems stated that it was not enough, most farmers in agricultural, plantation, and forest agroecosystems stated that it was sufficient. Knowledge of feed needs is strongly

Table 4. Livestock experience based on agroecosystem on Timor Island

Livestock Experience	Agroecosystems			
	Pasture	Agriculture	Plantation	Forest
		...............%...............		
<5 years	6.3	15.7	8.8	14.3
5-10 years	40.2	29.4	41.2	48.6
>10 years	53.5	54.9	50.0	37.1
Total	100.0	100.0	100.0	100.0
Average Experience (years)	12.3	12.1	10.3	10.2

Table 5. The motivation for farming based on the agroecosystem on Timor Island

Motivation for farming	Agroecosystems			
	Pasture	Agriculture	Plantation	Forest
		...............%...............		
Profitable	66.9	75.5	90.2	96.2
Tradition	55.9	71.6	66.7	86.7
Livestock Culture	53.5	78.4	68.6	84.8
Legacy	77.2	80.4	77.5	90.5
Prestige	47.2	77.5	83.3	83.8
Hobby	59.1	67.7	70.6	87.6
Beef	55.1	75.5	63.7	89.5
Investment/Savings	40.2	66.67	56.9	85.7

Table 6. Forage management by agroecosystem on Timor Island

Feed Management	Agroecosystem			
	Pasture	Agriculture	Plantation	Forest
	...............................%...............................			
Preservation of feed				
(-). Continue	1.6	5.9	12.8	0.0
(-). Sometimes	11.8	17.7	17.7	2.9
(-). Never	86.6	76.4	69.6	97.1
Total	100.0	100.0	100.0	100.0
The need of feed 10% of the cattle's body weight				
(-). Enough	33.1	85.3	61.8	10.5
(-). Not enough	58.3	8.8	34.3	89.5
(-). Do not know	8.6	5.9	3.9	0.0
Total	100.0	100.0	100.0	100.0
Feed management in the dry season				
(1). Just hope in nature	80.3	62.8	8.8	58.1
(2). Sickle	10.2	24.5	65.7	41.9
(3). Rent a sickle service	6.3	3.9	15.7	0.0
(4). Buy feed	3.2	8.8	9.8	0.0
Total	100.0	100.0	100.0	100.0
Additional feeding				
(-).There is	1.6	61.8	100.0	13.3
(-). Sometimes	5.5	28.4	0.0	12.4
(-).There is no	92.9	9.8	0.0	74.3
Total	100.0	100.0	100.0	100.0
Additional types of feed				
(-). Superior grass	0.0	44.6	33.3	0.0
(-). Legume	66.7	81.5	100.,0	85.2
(-). Concentrate	33.3	87.0	17.7	48.2

influenced by the feed economy where plantation and agricultural agroecosystems require financing to buy feed and pay for labor, while farmers in agricultural agroecosystems consider the expenditure aspects of the planting season more. Some researchers report that the total cost of feed in livestock business is on average > 61.1% of the total business costs so that overfeeding livestock is not economical in terms of business profits (Indrayani and Andri, 2018; Nur *et al.*, 2015; Riwukore and Habaora, 2018).

Feed interventions in the dry season are needed by livestock because the availability of feed-in nature is very limited. The display of feed interventions from farmers in each agroecosystem is presented in Table 6. As a result, most farmers in a pasture, agriculture, and forest agroecosystems only hope in nature, and generally, farmers in plantation agroecosystems do not only hope in nature. Motivation and capital factors greatly influence the feed intervention model in the dry season by farmers. Social and uneconomic motives tend to be carried out by farmers in pasture and agricultural agroecosystems, and farmers in forest agroecosystems tend to raise livestock extensively traditionally rather than economic (economic) motives carried out by farmers in plantation agroecosystems. Luanmase *et al.* (2011) stated that farmer income is positively related to farmer characteristics (motivation) and livestock raising systems.

The provision of additional types of feed to cattle according to the information in Table 8 shows that most farmers in pasture and forest agroecosystems do not provide additional types of feed such as superior grass and concentrates to cattle because the maintenance patterns tend to be traditional extensive. Most of the farmers in agricultural agroecosystems provide additional

feed to livestock from agricultural waste products such as rice bran as a concentrate. All farmers in plantation agroecosystems provide superior grass and concentrate as additional feed for their cattle such as Leucaena leaves and plantation waste. Farmers who provide additional feed such as superior grass, legume, and concentrate to their livestock are influenced by the farmer's awareness that this additional feed can accelerate the growth and development of Bali cattle. In addition, because this type of additional feed is a byproduct of the main production of agricultural agroecosystems. The low productivity of cattle in Indonesia is due to the fact that the feed given is only oriented to one feed ingredient, such as rice straw, corn straw, and field grass. Ediset and Heriyanto (2012) reported that beef cattle farmers in Indonesia who provide superior grass feed to their livestock are only 7.6-20% of farmers, the legume is only 6.3% of breeders, and only 11.6% of farmers are using a concentrate.

Good feed management affects the ability of livestock to digest feed ingredients, the adequacy of feed substances for basic life, growth, and body function of the type of feed used. The need for feed for an animal is 10% of body weight and if added concentrate it should only be 1-2% of body weight (Indrayani and Andri, 2018; Priyanto *et al.*, 2015; Riwukore and Habaora, 2018).

Health management

Information in Table 7 regarding livestock vaccination shows that most of the cattle in pasture agroecosystems, agricultural agroecosystems, and plantation agroecosystems have been vaccinated. However, there are some cattle that have never been vaccinated at all, especially in pasture agroecosystems (14.2%) and forest agroecosystems (26.6%). Livestock raising

Table 7. Vaccination and livestock hygiene by agroecosystem on Timor Island

Vaccination	Agroecosystem			
	Pasture	Agriculture	Plantation	Forest
	........................%............................			
Vaccination				
There is	66.9	98.0	92.2	44.8
Sometimes	18.9	2.0	7.8	28.6
There is no	14.2	0.0	0.0	26.6
Total	100.0	100.0	100.0	100.0
Body Hygiene				
Clean	27.0	41.7	44.7	25.4
Enough	47.0	45.8	47.9	52.0
Very dirty	26.0	12.5	7.4	22.6
Total	100.0	100.0	100.0	100.0

that is still traditional in both agroecosystems is presumably the cause of livestock not being vaccinated. Berek *et al.* (2015) reported that the traditional (extensive) cattle rearing system and the difficult topography on Timor Island were the main obstacles in implementing the livestock vaccination program. Livestock that is not vaccinated is very vulnerable to the spread of dangerous diseases. According to Mulyo *et al.* (2012) stated that vaccination should be done every 2-3 months which is useful for prevention against infectious diseases.

The aspect of body hygiene based on the information in Table 9 shows that there are still most farmers in each agroecosystem who have not paid attention to the hygiene aspects of cattle. The reason for farmers who do not pay attention to aspects of livestock hygiene is influenced by extensive maintenance, vaccination of livestock, and water sources for bathing livestock which begin to dry out entering the dry month. The reason for farmers who pay attention to the aspect of body hygiene is that farmers want to maintain the health of their cattle and also for aesthetics. Mulyo *et al.* (2012) and Yuliantonika *et al.* (2013) reported that the average perceptions of beef cattle farmers in Indonesia on aspects of body hygiene tend to pay less attention (45.0%), pay enough attention (33.5%), and pay attention (21.5%). Even so, the health status of the cattle that are not vaccinated and the hygiene of the livestock which is not given enough attention, according to the farmer's observation, is in a healthy condition. This is very likely influenced by the genetic ability of the cattle body from the influence of traditional extensive rearing which has adapted to the environment. Berek *et al.* (2015) stated that the vaccination program carried out on Timor Island was able to protect 76% of the cattle population and also found cows that were never vaccinated but had protective immunity.

Information on the handling of the Bali cattle epidemic according to Table 8 shows that the role of paramedics is still very low, namely <25.5%. The role of medical officers (Mantri and veterinarians) in handling sick cattle is quite low because farmers are accustomed to treating or just letting sick cattle recover. This may be due to the location where the officers live to the livestock raising location is quite far away and if handled by medical personnel, it will certainly increase the cost of the farmer.

The types of livestock medicines commonly used by farmers according to the information in Table 8 show that in pasture and agricultural agroecosystems they tend to use traditional medicines, in plantation agroecosystems they tend to use livestock medicines, while in forest agroecosystems they tend to be untreated. The types of drugs used by farmers to treat sick cattle are very much influenced by aspects of the experience they have experienced when treating sick cattle, economic motivation so that livestock can be sold, distance to officers and drugstores, maintenance management, and the ability to adopt sick cattle handling technology. Several research results report that there is a close relationship with the handling of sick cattle to the characteristics of the farmers, the location and available resources, and technology (Luanmase *et al.*, 2011; Mulyo *et al.*, 2012; Berek *et al.*, 2015; Anggraeni and Mariana, 2016).

The handling of dead cattle with the highest value is according to the information in Table 8, namely in the pasture agroecosystem and forest agroecosystem it is discarded, in the agricultural agroecosystem it is sold/consumed, and in the plantation agroecosystem is the report of the officer. The results of this study indicate that the provision of meat food on the Timor Island has the potential for non-ASUH (safe, healthy, hygienic, and halal) with a high prevalence of dangerous disease spread if evaluated based on the handling of dead livestock by disposing and selling/consuming it, then the potential areas the highest is pasture agroecosystem followed by agricultural agroecosystem, plantation agroecosystem, and forest agroecosystem. The pasture agroecosystem is an endemic area for Brucellosis, so it is very dangerous if the meat from dead livestock is consumed by humans. Riwukore and Habaora (2019b) report that the Brucellosis endemic areas in NTT include Belu, Malaka, and Timor Tengah Utara districts which are the sampling areas for the pasture agroecosystem in this study. However, it is possible for farmers to have the ability to identify types of dangerous diseases so that cattle that die from dangerous diseases are not discarded or sold/consumed. This is because most farmers in pasture agroecosystems and other agroecosystems (> 58.3%) have been able to recognize and identify symptoms of disease

Table 8. Epidemic management based on agroecosystem on Timor Island

Handling of epidemic	Agroekosistem			
	Pasture	Agriculture	Plantation	Forest
	....................................%..........................			
Handling sick cattle				
(-). Officer report	7.9	18.6	25.5	11.4
(-). Traditional/self-medication	59.1	60.8	50.0	31.4
(-). Shaman	3.2	4.9	7.8	1.9
(-). Just ignore it	19.7	8.8	12.8	41.0
(-). Sell	10.2	6.9	3.9	14.3
Total	100.0	100.0	100.0	100.0
Types of drugs used				
(-). Mild medicine	10.2	10.8	31.4	28.6
(-). Traditional medicine	40.2	37.3	13.7	3.8
(-). Animal medicine	17.3	31.3	38.2	12.4
(-). There is no mild medicine	21.3	12.8	4.9	22.9
(-). Sometimes treated	11.0	7.8	11.8	32.3
Total	100.0	100.0	100.0	100.0
Handling of dead livestock				
(-). Obsequies	26.0	34.3	22.6	18.1
(-). Officer report	14.2	21.6	33.3	17.1
(-). Throw away	32.3	8.8	12.7	39.1
(-). Sell/consumption	27.6	35.3	31.4	25.7
Total	100.0	100.0	100.0	100.0
Knowledge of sick cattle				
(-). Eye disorders	79.5	82.4	78.4	89.2
(-). Abnormalities in the fur	79.5	76.5	86.3	93.1
(-). Strange cattle activity	67.7	84.3	85.3	88.2
(-). Feed consumption drops	58.3	81.4	82.4	84.3
(-). Nose disorder	77.2	76.5	85.3	91.2
(-). Digestive disorders	63.0	81.4	81.4	81.4
(-). Body disability	65.4	74.5	86.3	80.4
(-). Reproductive disorders	71.7	87.3	78.4	65.7
(-). Weight loss	76.4	92.2	83.3	75.5

Table 9. Cattle epidemic by agroecosystem on Timor Island

Cattle Epidemic	Agroecosystem			
	Pasture	Agriculture	Plantation	Forest
	....................................%..........................			
Average Sick Calves				
Calf is sick	44.6	41.9	33.6	47.0
Calf healed	51.6	53.5	35.5	51.2
Calves are dead	48.4	46.5	64.5	48.8
Total	100.0	100.0	100.0	100.0
Young Cattle Average				
Sick	22.8	25.4	20.6	25.2
Healed	60.7	58.7	54.1	60.7
Dead	39.3	41.3	45.9	39.3
Total	100.0	100.0	100.0	100.0
Mature Cattle Average				
Sick	18.9	15.4	17.7	23.6
Healed	54.2	53.8	53.6	64.4
Dead	45.8	46.2	46.4	35.6
Total	100.0	100.0	100.0	100.0

suffered by livestock according to the information in Table 10. The ability of farmers to identify and recognize the condition of sick cattle is influenced by the experience of farmers that average >10 years. Utami *et al.* (2016) stated that long enough farming experience indicates that farmers' knowledge and skills in livestock raising management have better abilities.

Information about the Bali cattle epidemic according to the data in Table 9 shows that the highest percentage of calf cattle epidemics (47.0%) and mature cattle (23.6%) occurred in forest agroecosystems than other agroecosystems. For veal, the highest epidemic occurred in agricultural agroecosystems (25.4%) than in other agroecosystems. But based on the highest percentage ratio of the epidemic for cattle that are declared cured, in agricultural agroecosystems for calves, in forest

agroecosystems for calves, in forest agroecosystems for mature cattle. The main cause of the epidemic of sick, recovered, and dead cattle is very much dependent on the accuracy in the management of the care and handling of livestock health when the cattle are attacked by a disease. The role of medical officers is still low, the habits of farmers who often treat their livestock independently, the traditional handling of dead cattle by throwing them away/just being left alone, and the existence of livestock that has never been vaccinated are suspected to be the cause of the high cattle epidemic. Willa (2013) stated that the delay in handling sufferers by local health workers is one of the factors in the high rate of livestock mortality. Then cattle that are not vaccinated have a higher risk of disease than vaccinated cattle (Berek *et al.*, 2015).

Table 10. Epidemic types based on agroecosystems on Timor Island

Epidemic types	Agroecosystem			
	Pasture	Agriculture	Plantation	Forest
	.......................%..............................			
Diarrhea/Stomach Pain	48.6	54.3	65.7	68.6
Worms	42.9	40.0	71.4	48.6
Umbilical cord infection	8.6	11.4	31.4	34.3
Abortion	42.9	0.0	2.9	5.7
Pesticide poisoning	2.9	57.1	25.7	0.0
Fracture	17.1	14.3	45.7	28.6
Skin disease	17.1	11.4	20.0	20.0

The type of cattle epidemic that is often suffered by cattle, according to the information in Table 10 shows the incidence of diarrhea and abortion commonly suffered by cattle in pasture agroecosystems, pesticide poisoning is generally suffered by cattle in agricultural agroecosystems, worms are commonly suffered by cattle in plantation agroecosystems, and diarrhea occurs more frequently in forest agroecosystems. The circumstances of this study indicate that the incidence of epidemics varies from one agroecosystem to another. For example, the highest incidence of abortion occurs in the pasture agroecosystem because this area is endemic for brucellosis.

Conclusions

The results showed that for the aspect of feed management, feed preservation was only done by some farmers, with the highest to lowest percentage of actors being plantation agroecosystems (12.8%), agriculture, (5.9%), pasture (1.6%) and forest (0%). Whereas in the aspect of livestock health, the highest to lowest vaccination implementers were carried out in agricultural agroecosystems (98.0%) followed by plantations (92.2%), pasture (66.9%) and forests (44.8%).

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