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Productive Performance of Local Pasture in Manufahi District, East Timor

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ABSTRACT

Background: The nutritional value of feed is often of poor quality and seasonal supply erratic resulting in low levels of the carrying capacity of pastures. Local pasture needs to be managed and recorded for their existence because they are a valuable source of feed cheap and easy to obtain: botanical, chemical composition and carrying capacity, of grasses and legumes is being investigated.

Methods: A survey and measurements direct observation in field. Measuring forage production using the "Actual Weight Estimate" method to obtain total forage production, botanical composition and carrying capacity. Chemical composition tested by Weende analysis.

Result: Grasses species are dominant at Dotik while Legume at Fatucahi. The carrying capaicity is higher at Dotik but chemical comptotion of the forages is tend to similar at both areas.

Key words: Botanical composition, Carrying capacity, Chemical composition, Local pasture.

INTRODUCTION

The strategic plan for the National Development of East Timor 2011-2030 states that the source of revenue for the State of East Timor comes from 3 important pillars such as oil/natural gas, tourism and agriculture sectors. The livestock subsector has an important task to contribute the revenue, due to farming is the main source of income for more that 80 percent of rural households in Timor-Leste. Livestock helps on food supply, family nutrition, family income, asset savings, soil productivity, livelihoods, transport, agricultural traction, agricultural diversification and sustainable agricultural production, family and community employment, ritual purposes and social status (Moyo and Swanepoe, 2010). There frore, the existing resources and the other resources that must be prepared. East Timor is included in the category of tropical country with a dry agroclimate with low rainfall of <1,500 mm/year, has areas of local pasture of 208.705 ha (Bamualim *et al.,* 1997). The problem faced by farmers every year is that in the dry season, ruminants often suffer from forage shortage and forage quality is also not favorable because most farmers keep their livestock with extensive system, many cattle or buffalos and goats/sheeps are not caged and are very dependent on pasture forage. In the TAC (2019), it is written that more than 80% of the population of East Timor works as farmers and livestock breeders where 62% of the population raises large ruminants such as cows, buffaloes, 92% raises small animals such as pigs/ pigs, goats, sheeps and 92% raise chickens/poultry. East Timor as a meat importing country: from 2017-2020, imported 1.045.725.505 kg of chicken breast, 23.077.065 kg of beef, 631.534 kg of lamb, 128,395 kg of duck meat and 85.005 kg of other meat from cattle (TAC, 2019). Based on the project, the livestock subsector has an important task to contribute with the existing resources and the resources that must be prepared in the future in order to be able to sustain the need for general meat consumption during the year.

The important factors to increase livestock productivity are genetic (internal) and environmental (external) factors. Herianti and Suharta (2013) reported that human population development and beef production depend on genetic and environmental factors. One of the environmental factors is forage availability. Natural pasture fields are like pastures that consist of dominant plants like grasses, herbs and weeds in small amounts and can be covered with other plants in the field. Usually the local pasture can be called a permanent field, as there is no human intervention for the composition of the flora (grasses and legumes), only farmers who frequently monitor the cattle that graze and graze on it (Reksohadiprodjo, 1985).

Correia *et al.* (2009) reported that the botanical composition of the local pasture of the District of Lautem East Timor, in the plateau, is different from that of the plain and is dominated by grasses compared to legumes (85% vs 15%) such as the grass *Paspalum conjugatum* (71.43%),

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Schizachyrium saginneum (58.33%), *Sorghum timorense* (58.33%), *Alysicarpus vaginalis* (66.67%) on *Desmodium triflorum* (48,33%). Tavares *et al.* (2019) found in their research on forage production in local pasture at Balibo and Atabae, of Bobonaro district East Timor dominated by grass species (91.35%) when compared to leguminous species (6.09%) and weeds or other plants not identified (2.55%). It is very important to know the botanical composition of the forage in the local field, because if there is no balance of the flora (grass or grass with legumes) there will be an impact on the growth and production of ruminants that consume forage in the field, therefore, it will have an impact on the production of cattle and in the quality of the meat produced. According to Correia *et al.* (2009) that the botanicals and chemical compositions of the local pasture in Municipio Lautem, in the highlands are different to those on the coast and are different in season before the rain, during the rain and after the rain. Moreover, the production of local pastures made up of forage (grasses and legumes) is highly dependent on the man or the breeders who graze their cattle in these fields.

Carrying capacity is the ability of the pasture to produce forage needed by a number of livestock grazing in a certain unit area of grazing ability for accommodate livestock per hectare. Capacity is the capacity in analyzing an area of pasture land in accommodating a number of livestock, so enough forage needs are met in one year, Rinaldi *et al.,* (2012); Rusnan *et al.,* (2015). The carrying capacity of grazing reflects balance between the forage available and the number of units of livestock grazed within per unit time (Rusdin *et al.,* 2009). Capacity is closely related to forage productivity in a livestock grazing area. getting higher Forage productivity in a grazing area is also higher livestock carrying capacity as indicated by the number of livestock that can shepherded (Reksohadiprodjo, 1985).

Carrying capacity is based on livestock production and is closely related to forage material. Carrying capacity is the estimate an area of pasture that can produce forage to maintain the needs of the group of ruminant livestock units that consume it in the area (Reksohadiprodjo, 1985). Carrying capacity is like a capacity to accommodate animal units (AU) that are included in the field area, so that it can guarantee the productivity of the field and there can be neither overgrazing nor undergrazing. Carrying capacity in the tropics is 2-7 AU/ha/year. Some founds in East Timor reataed to Carrying capacity were: Marques (2011) stated that the carrying capacity on local pasture in Tapo-Memo village is 0.58 AU/ha/year. On the other hand, Barreto (2010) described that the carrying capacity in the Rairobo village pasture is 0.67 AU/ha/year. The carrying capacity on local pasture at the end of the rainy season in the Tapo-Memo village,district of Bobonaro is 0.52 AU/ha/year, In Balibo and Atabae district, Bobonaro East Timor, the carrying capacity is at 1 AU/ha/year (Tavares *et al*., 2019), while in Sumba Indonesia 1.001 AU/ha/year (Hae *et al.,* 2020)

The chemical composition of a plant is highly dependent on the soil and the diversity of vegetation that grows and develops in the planted area, as well as the age at which the plant is harvested. The chemical composition of forage plants is related to soil productivity, plant growth stage and harvest time. Chemical compositions for late rainy season grass species such as *Timorese Sorghum* are 96.4% dry matter (DM) 8.67% crude protein (CP) 1.4% crude lipid (CL) 51.71% crude fiber (CF). *Heteropon contortus* contain of 96.53% DM 9.56% CP 2.75% CL 50,11% CF (Correia *et al.,* 2009). and the chemical composition for the grass species *Dichanthium aristatum* contains a DM of 92.78%, CP 7.61%, CL 1.57%, CF 35.78%. *Timorese Ischaenum* contains DM 91.63%, CP 7.88%, CL 1.15%, CF 35.12%, *Timorese Sorghum* contains DM 92.13%, CP 9.33%, CL 1.68%, CF 34.71%. Nowadays, the problems faced by farmers in East Timor are lack or less of information and database on productivity, botanical composition, chemical composition of forage plants, including the value of the carrying capacity of ruminant animals in local pasture of East Timor, especially in the Manufahi District. The general objective of this research is to obtain infromation the potency of forage production in local pasture at Dotik and Fatucahi village, Manufahi, East Timor district including carrying capacity, botanical composition and its chemical composition.

MATERIALS AND METHODS

The performance of native pasture in the research refered to forage species, dry biomass weight, dry matter and botanical composition. The method research used in this study was a descriptive method with case study (Nazir, 2003). As the case study was at local pastures and ruminant breeding sites in Dotik and Fatucahi village, Manufahi district. The value of forage production using the “Actual Weight Estimate” method (Susetyo, 1980), that was, using a quadratic with the size of 1 m × 1 m. The placement of the quadratic in pasture was carried out randomly and symmetrically and the forage cut was then placed in a plastic bag to be weighed.

The research sites were determined by intentional sampling based on ruminant population distribution, local pasture area and plant species that can be consumed by livestock. The data were analyzed by statistical analysis with simple tabulation to determine fresh forage weight, dry forage weight, botanical composition, chemical composition. The chemical composition analysed including: The dry matter (DM) content of each sample was measured by drying (in duplicate) in a laboratory oven 55°C for 24 hours (AOAC, 2005). The samples were cooled in a desiccator for 30 minutes before weighing. The dry weight was recorded and dry matter calculated as percent (%). Crude fiber is determined gravimetrically as the residue remaining after the acid and alkaline digestions. The method has a detection limit of 0.5%. Sample amount requested: 10 g (Sample

particles cannot be less than 1mm -that is, 18 mesh sieve). The Ash test result is expressed as % ash. A magnified optical examination of the ash residue is performed to determine if the ash is glass, mineral, or a combination of both. The total ash content equals the weight of the ash divided by the weight of the original sample multiplied by 100%. Crude fat is determined by hydrolysis of a sample with HCl and subsequent extraction. The sample is weighed and dispersed in boiling water to gelatinize starches and aid in subsequent hydrolysis of starches and lipid materials in boiling HCl. The hydrolysate is filtered. Protein Analysis: Protein was determined using the Kjeltec digestion block (model 2006) and Kjeltec 1002 distillation unit (Foss, 2003).

Estimation of carrying capacity was based on formulation cited by Reksohadiprodjo (1985). The formula for determining the botanical composition (%) between grasses and legumes is to estimate the percentage weight of the sample for each species.

The profer use factor (PUF) is 30% with a grazing period(s) of 30 days and rest period(s) of 60 days.

The estimate of land use/head/year (Reksohadiprodjo, 1985).

$$Y = (r/s) + 1$$

Description:

Y= Conversion rate of land area needed per head of cattle per year to needs per month.

S= Grazing period (s= 30 days).

R= Rest period (r= 60 days).

$$\text{Carrying capacity} = \frac{1}{\text{Land used/head/year}}$$

RESULTS AND DISCUSSION

Forage species at dotik and fatucahi village

The data of forage species, dry biomass weight, dry matter, botanical composition of native pasture of Dotik village as described in Table 1, it shows that the dominant grass and legume species that can be consumed by cattle on local pasture in Dotik village are *Dichanthium annulatum, Bothriochoa bladii, Ischaenum timorense* with *legume species namely Desmodium triflorum* and *Alycicarpus vaginalis*. Value DM of grasses were varying around 15.84-20.91% and legumes were around 18.06-22.16%. In the botanical composition it shows that grasses were dominate the field with a value of 84.63% and legumes was 11.88%. If pastures are dominated by grass, the competitiveness of legumes has decreased. Hae *et al.* (2020) said that the strong roots of grass cause the space for legume roots to be low, so that a pasture will be dominated by grass.

The dominant grass and legume species that can be consumed by cattle on local pasture in Fatucahi village are namely *Imperata cyliandrica, Dichanthium annulatum, Ischaenum timorense* with *legume species being Desmodium triflorum* and *Alycicarpus vaginalis* (Table 2). The DM of grasses varied between 18.14-20.59% and legumes at 17.34-21.69%. In the botanical composition it shows that grasses dominate in that field with was a value of 72.62% and legumes was 13.51%. Forage plants in local pastures is very important to determine the development of ruminant animals in East Timor, especially at Manufahi district. Morais *et al.* (2009), described that some of the dominant grass and legume species in the local pasture in the Fuiloro village, Lospalos in the first months (May-June) of the time of the second rainy season namely *Bothriochoa bladii, Desmodium triflorum* and *Alycicarpus vaginalis* that were no differences with the result of this research. Manu (2013) reported that in local pastures in West East Nusa Tenggara Timur (NTT), Indonesia grass species *Ischaenum timorense, legume Alycicarpus vaginalis* and *Desmodium sp.* were dominant.

The percentage of grasses and legumes in the local pasture in the research varies around 72.62-84.63% and 11.88-13.51% there is no significant difference comparing with the result of Morais *et al.* (2009) in Fuiloro village, Cardoso, *et al.* (2009) in Mehara vilage-Lospalos, East Timor but different to what was reported by Costa *et al.* (2011), the composition between grasses and legumes in local pasture in Raerobo village, Bobonaro East Timor is 93.4% vs 6.6%. Most of the forage in pastures is natural grass, namely above 70%, there are only relatively few legume plants. Susetyo (1980) stated that the ideal condition for a pasture is with a balance of 60% grasses and 40% legumes. The lack of proportion of legume plants in natural grasslands causes low forage quality, especially during the dry season the proportion of legumes is no longer there, where natural grass has become very low quality, in most natural grasslands in East Timor it is dominated by the weed *Chromolena odorata* which increasingly narrows the land grazing. The lack of proportion of legume plants in natural pastures causes low quality of forage, especially during the dry season the proportion of legumes is no longer there, where natural grass becomes very low quality (Manu, 2013). With the data obtained, it is necessary to improve the botanical composition by planting legumes that have high productivity, high competitiveness, well adapted to the local environment and palatable.

Forage chemical composition at Dotik and Fatucahi village

The chemical composition listed in Table 3. demonstrates that the grass species that dominate the pasture at Dotik at the beginning of the rainy season present the DM content ranging from 91.20-92.71%, CP ranging from 7.82-10.25%, CL between 1.12-3.12%, CF between 29.02-36.58% and ash varies between 6.62-9.42%. However, the leguminous species *Desmodium triflorum* and *Alycicarpus vaginalis* each have a nutritional value of DM (88.25-89.27%), CP (14.23-16.60%), CF (2.70-4.53%), FB (29.57-30.03%) and ash (7.68-10.15%).

In the local pasture of Suco Fatucahi, the chemical composition for the dominant grasses respectively are

Imperata cyliandrica, Dichanthium annulatum, Ischaenum timorense with the DM value varies between 89.27-92.13%, CP (6.5-11.94%), CL (1.53-1.78%), CF (32.62-37.82%) and ash (8.29-12.25%). The legume *Desmodium triflorum* and *Alycicarpus vaginalis* has the nutritive value of DM between 88.57-89.30%, CP (14.30-16.87%), CL (2.85-4.59%), CF (29.40-29.65%) and ash (7.25-10.02%).

Manu (2013) underlined that crude protein crude protein content fluctuates greatly according to seasonal changes. In the wet season the cell wall content of grass local to the island of Timor consisting of cellulose, hemicellulose and lignin is 65% and increases to 85% in the dry season. The crude protein content of local grass on the Timor is land on at the end of the dry season is 2.26% and becomes 8-10% in the rainy season. According to the results of this research, the CP value of the grass is a little higher (11.15%). Comparing also with the research results of Ximenes *et al.* (2011) that the CP value of *Dichanthium annulatum* in the middle of the rainy season in the plateau is 8.59%, *Imperata cyliandrica* (6.25%) in local pasture in the Fuiloro village between the month of May-June (beginning of the month of the rainy season) (Pinto *et al*., 2010).

Carrying capacity of dotik and fatucahi villages' pasture

Data on Table 4 is not attached shows the carrying capacity of the local pasture in the Dotik village is 2.22 AU/ha/year

Table 1: Forage species, dry biomass weight, dry matter, botanical composition of native pasture of Dotik village.

Grass species	BDW (g/m^2)	DM (%)	G/L (%)
Dichanthium annulatum	192.0	20.09	84.63
Bothriochoa bladii	128.3	15.84	
Ischaenum timorense	139.4	20.91	
Legume species			
Desmodium triflorum	40.0	18.06	11.88
Alycicarpos vaginalis	45.5	22.16	

Description: WDB = Weight of dry biomass; DM= Dry matter; G= Grass; L= Legume.

Table 2: Forage species, dry biomass weight, dry matter, botanical composition of native pasture of Fatucahi village.

Grass species	BDW (g/m^2)	Total DM (%)	G/L (%)
Imperata cyliandrica	156.1	18.14	72.62
Dichanthium annulatum	144.2	20.59	
Chloris inflate	103.5	18.41	
Legume species			
Desmodium triflorum	26.3	21,69	13.51
Alycicarpos vaginalis	20.3	17.34	

Description: BFW= Biomass fresh weight; BDW= Biomass dry weight; DM= Dry matter; G= Grass; L= Legume.

Table 3: Chemical composition of forage plants at native pasture of Suco Dotik and Suco Fatucahi, Manufahi.*

Grass species	DM (%)	CP (%)	CL (%)	CF (%)	Ash (%)
			Dotik village, District Alas		
Dichanthium annulatum	91.20	8.58	1.12	36.58	9.42
Bothriochoa bladii	92.71	10.25	3.12	29.02	8.62
Ischaenum timorense	92.01	7.82	1.12	35.11	8.85
Legume species					
Desmodium triflorum	89.27	16.60	2.70	29.57	7.68
Alycicarpos vaginalis	88.25	14.23	4.53	30.03	10.15
			Fatucahi village, District Fatuberliu		
Imperata cyliandrica	89.67	6.50	1.67	37.82	8.29
Dichanthium annulatum	92.13	8.61	1.53	35.42	9.25
Chloris inflate	89.27	11.94	1.78	32.62	12.25
Legume species					
Desmodium triflorum	89.30	16.87	2.85	29.40	7.25
Alycicarpos vaginalis	88.57	14.30	4.59	29.65	10.02

Description: DM= Dry matter; CP= Crude protein; CFT= Crude lipid; CF= Crude fiber.

*Results of Laboratory Analysis of the Faculty of Animal Husbandry, Undana Kupang 2021.

Table 4: Carrying capacity value of native pasture for Dotik village and Fatucahi village in the Manu-fahi District.

Dotik village	Total
Biomass (DM) (kg/ha)	5161.9
Profer use factor (PUF) 30% (kg)	1548.57
Animal DM consumption (animal/month (kg)	225
land use/head/month (ha)	0.15
Land use/head/month (ha)	0.45
Estimated of carrying capacity (animal unit)	2.22 AU/ha/year
Fatucahi village	
Biomass (kg/ha)	4070.9
Profer use factor (PUF) 30% (kg)	1221.27
Animal DM consumption (animal/month (kg)	225
land use/head/month (ha)	0.18
Land use/head/month (ha)	0.54
Estimated of carrying capacity (animal unit)	1.85 AU/ha/year

Description: AU= Animal unit.

and in the Fatucahi village it is 1.85 AU/ha/year. These results indicated that in the Dotik village pasture, it could only be consumed by 2 heads of cattle with a live weight of 300 kg and one cattle aged 12 months. On the contrary, at Fatucahi village, can only consume 1 head of cattle with a live weight of 300 kg and one cattle aged less than 12 months. Fluctuating natural grass production causes the number of livestock that can be accommodated per unit area of grazing area to also fluctuate. In Dotik and Fatucahi there is a sharp decline in the capacity of pasture during the dry season. Natural grass production becomes very low during the peak of the dry season so that the tamping capacity is only 1.85-2.22 AU/ha. This is due to the absence of grass growth during the absence of rainfall in the mid to late dry season when this research was carried out, coupled with increasing environmental temperatures and decreasing humidity so that the air becomes very dry. Thus, the role of feed originating from outside grazing land becomes very important during the mid to late dry season, especially in areas with high livestock densities.

From existing data, pastures in East Timor are no longer able to provide sufficient grass. This lack of quantity is compounded by the quality of the grass which has decreased due to the high content of crude fiber, NDF and low protein. This can result in a decrease in the productivity of livestock grazed on these pastures.

Result of this research on the carrying capacity of local pasture in these two sites are higher compared to Morais *et al.* (2009) in the local pasture in the Fuiloro Suco, Lospalos in the first months (May-June) of the time of the second rainy season 1.38 AU/ha/year and reported by Onesimus *et al.* (2013) in West Papua which is 0.48-1.70 AU/ha/year. Reksohadiprodjo (1985), revealed that the carrying capacity of local pasture in tropical areas varies between 2-7 AU/ha/year. In Balibo and Atabae District, Bobonaro, East Timor, the carrying capacity is at 1 AU/ha/year (Tavares *et al*., 2019). Yoku *et al.* (2014) reported that the carrying capacity of pastures in the Bitawi area of Kampung Inam, West Papua was 1.77 AU/ha/year. The difference was caused by differences in research locations and time of research implementation. As is known, each location has physical and chemical soil properties that affect the growth and production of forage plants in the pasture area.

CONCLUSION

In local pasture at Dotik village, the proportion of grasses were more dominant than legumes (84.63% vs 11.88%), the botanical composition showed that the species of grasses and legumes more dominant namely are *Dichanthium annulatum, Bothriochoa bladii, Ischaenum timorense, Desmodium triflorum* and *Alycicarpus vaginalis*. The average value of CP content of the dominant grass species varies between 7.82-10.25% and legumes between 14.23-16.60%. The carrying capacity is 2.22 AU/ha/year.

The proportion of grasses in local pasture in Fatucahi was higher comparing those of legumes (72.62% vs 13.51%), with the dominant grass and legume species namely are *Imperata cyliandrica, Dichanthium annulatum, Ischaenum timorense, Desmodium triflorum* and *Alycicarpus vaginalis*. The protein content value of the dominant grass species is between 6.50-11.94% and the legumes is between 14.30-16.87%. The carrying capacity is 1.85 AU/ha/year.

Most of the forage in pastures is natural grass, namely above 70%, there are only relatively few legume plants. The lack of proportion of legume plants in natural grasslands causes low forage quality, especially during the dry season the proportion of legumes is no longer there, where natural grass has become very low quality, in most natural grasslands in East Timor it is dominated by the weed *Chromolena odorata* which increasingly narrows the land grazing.

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Conflict of interest

All authors declare that they have no conflict of interest.

REFERENCES

AOAC, (2005). Association of Official Agricultural Chemists, 13th ed., Benjamin Franklin Station, Washington DC.

Bamualim, A., Wirdahayati, R.B. and Saleh, A. (1997). Production and Quality of Local Grass and Cattle Productivity in East Timor Province. EIVS-AusAid Dili East Timor Project "CHAPS II Meeting". Center for the Study of Agricultural Technology (BPTP) Naibonat, Kupang NTT.

Barreto, M., Correia, B.A., Afonso, A.B.M., da Cruz, A. (2010). Analysis of Botanical Composition and Carrying Capacity in Local Pasture in Rairobo, Bobnonaro, East Timor. Thesis. Faculty of Agriculture National University Timor Lorosa'e.

Cardoso, H., Tilman, Z.V. and Correia, B.A. (2009). Analysis of Botanical Composition and Carrying Capacity in Local Pasture in Fuiloro juice. Thesis. Faculty of Agriculture National University Timor Lorosa'e.

Correia, B.A., Gomes, L., Correia, L.T., da Cruz, A., Afonso, A. and Rendes, F.J. (2009). Analysis of the Botanical and Chemical Composition of Local Pastures in the Mid-Rainy Season Plateau and Coast of the Lautem District. National University of Timor Loro Sa'e (UNTL).

Costa, E.S., Afonso, A.B.M. and Correia, A.B. (2011). Analysis of Botanical Composition and Carrying Capacity in Local Pasture at the Beginning of the Rainy Season in the Plateau, Suco Raerobo, Sub-District Atabae, Municipio Bobonaro. Thesis. Faculty of Agriculture National University Timor Lorosa'e.

Hae, V.H., Kleden, M.M., Temu, S.T. (2020). Production, botanical composition and carrying capacity of forage in local grassland at early dry season. Jurnal Nukleus Peternakan 7(1): 14-22.

Herianti, I. and Suharta. (2013). Study on Food Improvement of Local Beef Cattle in Popular Livestock, Kebumen District. Proceeding. National Seminar on Sustainable Livestock. Innovation in Livestock Agribusiness for Food Security. Faculty of Animal Science, Padjadjaran University, Bandung. 121-126.

Manu, A.E. (2013). Productivity of the West Timor Savannah Grassland. Proceeding. National Seminar II Association of Forage Plant Scientists of Indonesia in Collaboration with the Director General of Livestock and Animal Health of the Republic of Indonesia (HITPI). Local forage in the Integrated System of Food Security and National Livestock Economy. Denpasar, Bali 28-29. 6: 130-133.

Maques, M.L. Correia, B.A., da Cruz, A (2011). Analysis of Botanical Composition and Carrying Capacity in Local Pasture in Tapo, Bobnonaro, East Timor. Thesis. Faculty of Agriculture National University Timor Lorosa'e.

Morais, V.B., Correia, B.A., Afonso, A.B.M. (2009). Analysis of Botanical Composition and Carrying Capacity in Local Pasture in Fuiloro, Lospalos, East Timor. Thesis. Faculty of Agriculture National University Timor Lorosa'e. 17-20.

Moyo, S. and Swanepoe, F.J.C. (2010). Multifunctionality of Livestock in Developing Communities. Co-published by the Technical Centre for Agricultural and Rural Cooperation (CTA). Sun Media Bloemfontein and CTA. 1-12.

Nazir, M. (2003). Panel Research Method. Ghalia Indonesia Publisher. Jakarta.

Onesimus, Y.S., Andoyo, S., Trisiwi, W., Iriani, S. (2013). Seminar II association of forage plant scientists of indonesia in collaboration with the director general of livestock and animal health of the republic of indonesia (HITPI). Local forage in the Integrated System of Food Security and National Livestock Economy. Denpasar, Bali 28-29 June 130-133.

Pinto, J., Afonso, A.B.M., Correia, B.A. (2010). Analysis of the chemical composition and carrying capacity of local pastures at the beginning of the rainy season in the Fuiloro village. Thesis. Faculty of Agriculture National University Timor Lorosa'e. 26-28.

Reksohadiprodjo, S. (1985). Production of Forage Crops from Tropical Animals. BPFE. Yogyakarta.

Rinaldi, R., Hairul, B., Dan, M. (2012). Erosion hazard and conservation efforts for cattle grazing in Aceh Besar. Jurnal Manajemen Sumber Daya Lahan. 1(2): 136-145.

Rusdin, I.M., Purwaningsih, S., Andriana, A., dan Dewi, S.U. (2009). Study of the potential of the central lore area for the development of beef cattle. Media Litbang Sultel. 2(2): 94-103.

Rusnan, H., Kaunang, C.L, dan Tulung, Y.L.R. (2015). Analysis of the potential and development strategy of beef cattle with a pattern of integrated coconut-cow in South Halmahera Regency, North Maluku Province. Jurnal Zootek. 35(2): 187-200.

Susetyo, (1980). Shepherd Field. Introduction to Pastures and Pasture Processing. Faculty of Animal Science. IPB. Bogor.

TAC (Timor-Leste Agricultura Census). (2019). General Directorate of Statistics and Ministry of Agriculture and Fisheries of East Timor.

Tavares, L., Widi, T.S.M., Baliarti, E., Noviandi, C.T. (2019). Production System and Productivity of Bali Cattle in East Timor. The 1st Join Graduate Seminar of Animal Science. Departement of Animal Science, Faculty of Agriculture, University Putra Malaysia, Faculty of Animal Science, Universitas Gadjah Mada, Indonesia-Malaysia.

Ximenes, B. da C., Correia, B.A., Afonso, A.B.M. (2011). Analysis of the chemical composition and carrying capacity of local pastures at the beginning of the rainy season in the Fuiloro village. Thesis. Faculty of Agriculture National University Timor Lorosa'e. 22-25.

Yoku, O., Andoyo, S., Trisiwi, W., Iriani, S. (2014). Production of natural grazing and potential development of Bali cattle in support of the meat sufficiency program in West Papua. Pastor. 3(2): 102-105.