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Study of Pasture Productivity for Semi-Intensive Cattle System during Dry Season in the South Konawe Regency, Southeast Sulawesi

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ABSTRACT

This study was aimed to evaluate the characteristics and productivity of pasture for semi-intensive cattle system in South Konawe Regency during dry season. The study was conducted in August-September 2019 as dry season based on the weather condition and was determine by Department of Statistics Center of South Konawe Regency. A total of 55 selected smallholder farmers in two areas in South Konawe Regency, namely West Ranomento (30) and Konda (25) Districts. Data were obtained by interview to find out the farmers profile and pasture characteristics. Production was measured by forage sampling (1x1m) to calculate annual production. Samples were proximately analyzed to calculate dry matter production and the carrying capacity. Data were analyzed descriptively and statistically with an independent sample *t-test*. The botanical composition in both locations was highly dominated (>90%) by field grasses. The grassland ownership was not different between two areas. Grassland ownership at West Ranomento and Konda were 0.78±0.14 and 0.21±0.04 Ha/farmer, respectively. The pasture production between West Ranomento (2.27±0.10 ton/ha) and Konda District (1.76±0.05 ton/ha) was significantly different ($p<0.05$),. Pasture production and carrying capacity indicated that conditions in West Ranomento were significantly higher ($p<0.05$) compared to Konda District. The fresh forages production was 10.98±2.26 vs. 2.17±0.51 ton/year, forages that can be consumed was 3.30±0.67 vs. 3.30±0.67ton/year, dry matter production was 0.72±0.15 vs. 0.18±0.04 ton/year and carrying capacity was 0.22±0.04 vs. 0.05±0.01 AU/year respectively. It was concluded that the pasture productivity at the study area during dry season was very low based on productivity and carrying capacity.

Keyword: Carrying capacity, Dry condition, Forages production, Grassland, Pasture management

Introduction

South Konawe Regency is the largest beef cattle producing region in Southeast Sulawesi Province with a population of 67,746 head and is increasing every year (Badan Pusat Statistik, 2019[a]). South Konawe Regency is a source of breeding and fattening of beef cattle for Southeast Sulawesi Province. The biggest population is Bali cattle with a semi-intensive production system. Grassland as the primary source of forage is essential in semi-intensive production systems.In recent, grassland in this area is decreased because of the increasing population, resulted in land conversion for housing and expanding agricultural land.

Smallholder farms in Indonesia carry out a semi-intensive production system by utilizing home yards as grassland. Most natural grassland in Indonesia was not cultivated and appropriately managed, causing low livestock production. The main factors for determining pasture and grassland for livestock are the production of forages, the quality of forages, and the carrying capacity. Pasture management has long been known by farmers in Indonesia for traditionally maintenance system but has not been done well (Syamsu *et al.*, 2019). The measurement of forage production and its quality is required to utilize the forage to increase the livestock population in the area. Observation of plants that can grow well in terms of quality and quantity is needed to know the development of pastures (Umami *et al.*, 2018).

The season would have an impact on the comfort of livestock due to changes in

environmental conditions. The problem with maintenance cattle on grassland is the hot condition at dry season (Aditia *et al.*, 2017). This condition significantly affects livestock productivity and forage production, especially livestock weight loss due to low forage production at grassland. Furthermore, in hot climatic conditions, the low rainfall affecting the quality of forage, especially the nutrient content that will decrease, so that the nutrient requirement of livestock is not fulfilled (Pérez-Prieto *et al.*, 2018). The condition resulting in limited availability of feed and low nutrition of grass whereas farmers rely solely on natural forages that grow on grassland without additional forage planting and cultivating. Based on these conditions, this study aimed to evaluated the pasture productivity for semi-intensive cattle system during dry season in South Konawe Regency. The result of this research can be used for the basic data and information to develop the pasture and grassland for a livestock production system in south Konawe Regency, Southeast Sulawesi Province.

Materials and Methods

Study area and sampling

The study was conducted in dry season (August-September 2019) with the average of rainfall was 210.1 and 166.5 mm/year, while the amount of rain are 22 and 15 days. In August and September are the month with lowest rainfall in one year. (Badan Pusat Statistik, 2019[a]). According to the Meteorology, Climatology and Geophysics Agency of Southeast Sulawesi, the peak of the dry season in South Konawe Regency in 2019 occurred on the 3rd week of July to September. The research location was in West Ranomeeto and Konda District, South Konawe Regency Data collection was carried out based on purposive sampling by selecting smallholder farmers that kept cattle in a semi-intensive system with the number of cows kept above three as respondents. The number of respondents consisted of 30 farmers in the West Ranomeeto District and 25 farmers in the Konda District. Proximate analysis of forages sample at The Laboratory of Animal Feed Science, Faculty of Animal Science Universitas Gadjah Mada.

Data collection and analysis

The data collected consisted of primary and secondary data. Primary data were collected by interviews and direct observation with farmers to know the farmers profile and characteristics of pasture. The interview was based on a questionnaire that has been prepared. Secondary data was obtained from the institutions and agencies involved in this study, such as the Central Statistics Agency, The Animal Husbandry and Animal Health Office of South Konawe Regency, Southeast Sulawesi Province.

The types of questions asked related to the farmers' profile, including name, age, education level, occupation, cattle farming experience, the number of family members, cattle ownership, cattle farming motivations, and the participation of family members in cattle farming activity. The cattle farming motivations, each farmer gave a rating of the importance of cattle farming. Motivation questions related to the functions of livestock as savings, primary livelihood and income, and manure production. There were three ratings given by the farmers. They were first rating of 3 (very important), second rating of 2 (important), and third rating of 1 (not important). The participation of family members in cattle farming activity was analyzed in a similar way to the analysis of the ratings of cattle farming motivations. The scale of interest consisted of three activity levels (3 = very active, 2 = active, and 1 = inactive). The data related with characteristics of pasture is grazing land ownership and land area.

Forages production estimation was measured by random sampling using a quadrant (1x1m) 5 times in each location of grassland owned by farmer respondents. Forage contained in the frame was cut as close as possible from the ground surface and then observed its botanical composition. Forages sample was collected and put in a bag then weighed. Forage samples were proximately analyzed to calculate the dry matter (DM). Furthermore, forage production (g/m^2) was converted to ton/ha. The calculation of the carrying capacity was done by the estimation method. It is assumed that the pasture undergoes six times/year of harvest. Proper Use Factor (PUF) of 30% was used because the assumption in grassland is in accordance with the criteria of soil erosion and property is medium, range condition is poor and range trend is constant or static (Badjian *et al.*, 2007, 2005; Karami *et al.*, 2014). The dry matter requirement for 1 unit of livestock/animal unit (AU) is 3% per day of body weight. One AU is one adult cow with a bodyweight of 300 kg, so the dry matter of requirement of one AU is 3.3 ton/years (Rinduwati, 2017). Data were analyzed descriptively and statistically with an independent sample *t-test* to differentiate between two districts.

Results and Discussion

General information of study area

South Konawe Regency with the capital city of Andolo is an expansion area of Konawe Regency. The Regency officially was established on the Act No. 4 of 2003 and consisted of 11 districts, and then the new regency was split up in 2018 into 25 districts. Based on 2010 census, the population of the regency was 264,587 people with 90% of their livelihoods of being farmers. Based on 2018 survey, the population increased to 309,298 people at the growth rate of 1.97% (Badan Pusat Statistik, 2019[b]). Geographically, South Konawe Regency is situated in the southern part of the equator, right across the North-South area at 3°58.56' South latitude, stretches from West to East between 121.58' and

123.16' East longitude. The land area of the South Konawe Regency is 451,421 ha or 11.83% of the land area of Southeast Sulawesi province, while the total area of sea is 9,368 km^2.

Topographically, the land is in general mountainous and hilly flanked by lowlands, which is very potential for the development of agricultural sector and have two seasons, which are dry and rainy season. The rainy season usually occurs from November to March and the dry season occurs from April to October. The rainfall in the South Konawe Regency in 2018 reached 3,179 mm in 194 rainy days. The mean ambient temperature is 28°C and humidity is 77% (Badan Pusat Statistik, 2019[b]). The area of the study was West Ranomeeto District with the territory of 76.07 km^2 or 1.69%. The topography was non-coastal plain at the altitude of 112.8 above sea level, with the temperature of 23-34°C and the humidity of 83%. The district consists of 9 villages and the area of the Sindan Kasih Village for observation site is 8.55 km^2. Konda District has the territory of 21.37 km^2. The topography of the district is plain at the altitude of 22.06 above sea level, with the temperature of 23-34°C and the humidity of 81%. The district consists of 17 villages and the observation site included Alebo Village with the territory of 2.30 km^2, Morome Village with the territory of 2.57 km^2, and Lambusa Village with the territory of 4.80 Km^2 (Badan Pusat Statistik, 2019[a]).

Farmers profile

Profiles of beef cattle farmers with the semi-intensive cattle grassland at different district in the South Konawe Regency were presented in Table 1. The mean age of the farmers with semi-intensive cattle grassland ranged from 25-62 years. The age factor had significant impact on the working productivity of the farmers and not significantly different between two districts. Most of the farmers were in the productive working age since they had aged less than 50 years old. Productive age was very important because people spent their time to work in the period of time (Haq *et al.*, 2016). The productive working age is expected that it will influence their production positively. The common belief is that the productivity of a farmer increases with age, reaches some mid-age peak, and then decreases with further age (Budisatria *et al.*, 2019). Cattle farming experience was one of the important factors in improving cattle farming management to increase livestock production (Budisatria and Udo, 2013; Haq *et al.*, 2019). The experience of the farmers was not significantly different. The range of the cattle farming experience in the study was from 10 to 20 years. The experience was related to age, in which older farmers usually had more experience than young farmers. Many beef cattle farmers had started their businesses at a relatively young age, inherited from their parents from generation to generation (Budisatria *et al.*, 2019). The family members of the farmers were not any significant difference, which average of 4 individuals. The cattle ownership was not significant different, which ranged is 3-6 head/farmers. The condition indicated that farmers were categorized as small businesses operate.

The education level of the farmers in the study was still very low. The majority of them only completed elementary education and Senior high school, even though some of them not had education in the school. Budisatria *et al.* (2019) reported that smallholder farmers only have a low level of educational background, more than 75% farmers only finished elementary and junior high schools. Agus and Widi (2018) stated that smallholder farmers are the most vulnerable stakeholder in the beef cattle production system in Indonesia. Smallholder farmers often have limited access to the inputs, information, and services they require to grow a better future. They need to be continuously empowered in terms of input technologies, financial support, information, and markets. Haq *et al.* (2019) suggested that the farmers with higher education levels would more quickly implement innovation. On the contrary, those with low education levels tended to avert innovation. The education level would also directly

Table 1. Farmers profile with the semi-intensive cattle system at the different district in South Konawe Regency

Variables	West Ranomento (*N*=30)	Konda (*N*=25)
Age (years) [ns]	46.93 ± 6.86	46.89 ± 9.54
Cattle farming experience (years) [ns]	18.06 ± 8.14	18.20 ± 12.50
Number of family members (people) [ns]	4.03 + 1.22	4.24 ± 1.20
number of cattle ownership (head) [ns]	4.43 ± 2.53	6.04 ± 3.14
Education (%)		
Not school	23.33	8.00
Elementary school	43.33	36.00
Junior high school	23.33	32.00
Senior high school	3.33	24.00
University	6.67	0.00
Cattle farming motivation*		
Saving and insurance[ns]	2.83 ± 0.31	2.92 ± 0.25
Primary livelihood and income[ns]	1.76 ± 0.67	1.96 + 0.61
Produce fertilizer[ns]	1.10 ± 0.31	1.12 ± 0.33
Participation of family members in the cattle farming activity**		
Husband[ns]	2.90 ± 0.29	2,78 ± 0,42
Wife[ns]	1.73 ± 0.52	1.96 ± 0,35
Child[ns]	1.27 ± 0.44	1,16 ± 0,37

*The rank of motivation is 1: not important, 2: important and 3: very important
**The rank of participation is 1: inactive, 2: active and 3: very active
[ns]Non-significant

influence the mindset and the behavior of the farmers in doing business.

There was significant difference in the motivation of the farmers. The main motivation for livestock farming in the two districts was savings. The motivation as savings among the farmers was still relevant because of their primary job as farmers, while cattle farming served only as side job. The cattle served as savings because the farmers could sell them any time when they need ready cash and it was still the dominant function of the cattle. Budisatria *et al.* (2019) stated that the main job of the farmers was farming activities which is indicated that keeping cattle is a secondary activity, and it was supported by the objective of keeping cattle are saving, if they need urgent cash, they can sell the cattle. Similar to Budisatria and Udo (2013), stated that keeping livestock were multifunctional purposes, the economic benefits of keeping animal, however, were low. All farmers had 4 family members in average. In rural areas, the family member usually actively involved in keeping cattle. Achmad and Mulyo (2019) was also reported that small-scale beef cattle business only used as a side job for savings so that beef cattle farmers tend to rely on the science of livestock farming which was inherited from generation to generation and did not need high education to be able to run it. There was nonsignificant difference in the family participation in cattle farming. The most significant family participation in cattle farming is still dominated by the heads of the farmer families (husbands), while the participation of their wives was not significant.

Beef cattle Production system in Ranomeeto Barat District was found as a whole with a semi-intensive system different from Konda District was found intensively and semi-intensive (Hasirudin *et al.*, 2015), Semi-intensive system was carried out by released of cattle on pasture or grassland, both their own land and free land that has not been utilized by their owners. The purpose of maintenance management is to produce calf (*cow-calf operation*) with natural matting. The intensive system, the purpose is fattening by on the farm without being released in the pasture or grassland (Rauf *et al.*, 2015).

Pasture productivity

Based on observations and data analysis in the West Ranomeeto District and Konda District, it was pointed out that pastures production during dry season was low. The results of pasture production during dry season at the different districts in the South Konawe Regency shown in Table 2.

The pasture for livestock grazing that owned by farmers at two districts in South Konawe Regency showed very low, and there was nonsignificant difference. The low area of grassland of the two districts because of the increasing population and the expansion of agricultural land so that the cattle grassland was decreasing. The results of other studies explained that the average land area of south Konawe 80% is used as agricultural and 20% of the yard and pasture land with an area of 1 Ha (Sani *et al.*, 2010). The high land use for agricultural on smallholder farmers due to farming as the main source of livelihood with higher products than the results of livestock (Attamini, 2011). Furthermore, Budisatria and Udo (2013) suggested that raising livestock is only a side job with motivation as savings. The condition resulted in livestock management was not too important, both from the grassland and forages production.

The land for grassland was dominated by field grass that grows alone without planting. Based on observations, the percentage of botanical composition in West Ranometo and Konda District was dominated by field grass by 62% and 67%, while legumes were 20% and 21% and Weeds 18% and 12%. This was in line with report by (Hawolambani *et al.*, 2015), that the natural grassland conditions in the Kupang area, dominated by field grass by 60.4%, legumes 20.82% and weeds 19.14%. The condition of botanical composition produced in the observation area was certainly not ideal, because (Junaidi and Sawen, 2010), stated that the ideal of botanical composition for cattle grazing areas if the proportion of grass compared to legume is 3: 2. The farmers in two districts were not cultivated and appropriately managed the pasture is the main factor for the growth inhibits the other type of grass. The results of the other studies (Rauf *et al.*, 2015) in a similar province showed that hot environmental conditions in grassland resulted in forages, elephant grass, weeds, and legumes death. Environmental conditions were hot with temperatures of 27-32^{o}C and 29-34^{o}C in West Ranomeeto and Konda District, respectively.

The botanical composition of the two districts is similar, some types of field grass include *Axonopus compressus, Cynodon dactylon, Imperata cylindrica*, while the types of legumes and weeds that can be identified are

Table 2. Pasture productivity for semi-intensive cattle system during dry season at the different district in South Konawe Regency

Variables	West Ranomento (*N*=30)	Konda (*N*=25)
Grassland ownership (Ha)^{ns}	0.78±0.14	0.21±0.04
Forage production (tons/Ha)	2.27±0.10^{a}	1.76±0.05^{b}
Forage production (tons)	1.83±0.38^{a}	0.36±0.08^{b}
Fresh/asfeed production (tons/year)	10.98±2.26^{a}	2.17±0.51^{b}
Can be consumed (tons/year)	3.30±0.67^{a}	0.65±0.15^{b}
Dry matter production (tons/year)	0.72±0.15^{a}	0.18±0.04^{b}
Carrying capacity (UT)	0.22±0.04^{a}	0.05±0.01^{b}

^{ab}Different superscripts on the same line show significant differences ($p<0.05$).
^{ns}Non-significant

Mimosa pudica Centrosema pubescens and *Cyclosorus parathelyptens.* The quality of a grassland was related to the botanical composition contained in the grassland (Rinduwati, 2017). classified forage for grassland into three parts, namely forage for light, moderate and heavy grazing (Prawiradiputra *et al.*, 2006). *Centrosema pubescen* or centro is a feed crop suitable for medium grazing types, while *Cynodon dactylon* is a suitable for heavy. Infitria and Khalil, 2014) reported that species were found in the grassland dominated by *Pennisetum purpureum* of 39.69%, *Axonopus compressus* of 8.45%, *Imperata cylindrica* of 7.84%. *Calopogonium mucuniodes* of 5.29%, *Mimosa pudica* of 3.68%, Stylosanthes of 2.89%. *Cyclocorus parathelypteris* of 5.64%.

The one of the parameters used to assess grassland quality is its nutritional content. The results of proximate analysis of forage samples in grassland at the two study locations were presented in Table 3.

The analysis showed that the nutrients content of forages in the grassland at two different districts in South Konawe Regency were similar. The average of nutritions content consisting of DM, OM, CP and CF was 22.93, 87.17, 11.52 and 28.35%, respectively. This value was lower than reported by (Abadi *et al.*, 2019), that DM and OM of forages in grassland in West Muna Regency was 29.05 and 92.51%, and the report of (Infitria and Khalil, 2014), that DM of forage in grassland in Padang was 34.20%. CP value is greater than the report of Infitria and Khalil (2014), that CP of forage in grassland in Padang was 10.60% and lower than the (Rinduwati, 2017), that CP of forage in grassland in Gowa was 14.74% and dominated by *Axonopus compressus* grass. Therefore, the grassland in South Konawe Regency can be categorized as grasslands with poor nutrients, it needs legume had contain high CP nutrients to be planted. The important factors for nutrient quality in the grassland were defoliation intervals (Syamsudin, 2013), type of fertilizer applied, soil fertility, air and sunlight (Mufarihin *et al.*, 2012).

Dry season factors affected the results of forage production, especially in the grassland. Forages production was low in the two districts of 2.27 and 1.76 tons/ha, respectively. Although statistically in this study area had a significant difference ($p<0.05$) but it could not meet the requirement of cattle because of the farmers kept 3-6 cattle. Another research found that forages production of grassland in Gowaduring rainy season reaches 3.67 tons/Ha (Rinduwati, 2017). So that the forage production at dry season is twice lower than at rainy season. Therefore, the availability of forage production was influenced by environmental conditions. Other studies explain that crop production is influenced by solar radiation and hot ambient temperatures (Abadi *et al.*, 2019; Pérez-Prieto *et al.*, 2018).

The total forage production during dry season in the two districts showed a significant difference ($p<0.05$). The low forage production of Konda District was due to the lack of land area, because where farmers only used backyards as a cattle grazing. Unlike the case at West Ranometo District, the farmers release their cattle on free land, and the land ownership was significant. Although the forage production of the West Ranomeeto District area was higher ($p<0.05$), it could not also fulfill the livestock requirement that was kept. This condition due to the forages contained was dominated by field grass without cultivation of legume. The absence of pasture management and dry environmental conditions affected that can found the other plants like legumes (Hawolambani *et al.*, 2015). The study of Critchley *et al.* (2008) explained that the growth of forages was greatly influenced by environmental temperatures, during wet season the condition of wet soil affected the grass plants grew fast, but if the conditions were dry it would slow down growth and even cause death.

Based on the result of annual forages production in the grassland between the two districts were significantly different ($p<0.05$). West Ranomeeto District was five times higher than the Konda District. Dry matter production showed that the West Ranomeeto and Konda District experienced significant differences ($p<0.05$), but it was low. The carrying capacity of the two research locations showed significantly different ($p<0.05$). The dry season condition affects the capacity of the different districts in Bombana Regency ie, 0.66 AU/ha/year (Rauf *et al.*, 2015). Another study found that the carrying capacity on the Flores, Sumba, and Timor island has a carrying capacity of 1.66, 1.56, 0.845 AU/Ha, respectively (Wirdahayati, 2010). Based on the calculated of carrying capacity, the grassland at South Konawe Regency during dry season was categorized as low productivity. The good and ideal of carrying capacity for grassland in the tropic was 2.5 AU/Ha/year (Reksohadiprodjo, 1994).

Tabel 3. Nutrients content of forages sample in grassland for semi-intensive cattle system during dry season at the different district in South Konawe Regency

Districts	Nutrients content (%)					
	DM	OM	CP	EE	CF	Ash
West Ranomento	21.93	86.63	11.57	1.34	28.66	13.37
Konda	23.93	87.71	11.46	1.23	28.03	12.29
Average	22.93	87.17	11.52	1.29	28.35	12.83

DM: dry matter, OM: Organic matter, CP: crude protein, EE: extract eter, CF: crude fiber.

Conclusions

It was concluded that the pasture productivity at the study area during dry season was very low based on productivity and capacity. West Ranomeeto has higher grassland ownership, forage production, and carrying capacity than Konda District.

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