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Sustainability of Forage Systems in Small Holder Dairy Cattle in The Plateau in East Java

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Abstract. This study aimed to describe the sustainability of forage system in the small holder dairy cattle in the plateau in East Java, in particular related to the nutrient content. The method used was survey (interviews, questionnaires, field observations and sampling) at the cooperation unit, farmers, livestock and farming location in one of the areas of dairy cattle cooperation in the plateau (Cooperation of SAE Pujon-Malang). The data obtained were analyzed through descriptive and regression statistics. The results showed that forage system dominantly given during dry and rainy seasons are elephant grass and corn stalks. Linear regression equation for the nutrient content of elephant grass is TDN= 40.516 + 1.404 CP, while corn trees is TDN= 56.212 + 0.740 CP. The conclusion showed that the dependent variable is largely influenced by external factors (environment). Improved continuity of availability of forage can be done by increasing the feeding system in the region (plateau) as well as the support from outside the region.

Key words: plateau, dairy cattle, forage

Abstrak. Penelitian ini bertujuan untuk mendiskripsikan keberlanjutan sistem pakan hijauan pada peternakan sapi perah rakyat di wilayah dataran tinggi di Jawa Timur, khususnya tentang kandungan nutrisi. Metode yang digunakan adalah survei (wawancara, pengisian angket/kuesioner, observasi, dan pengambilan sampel) di koperasi, petani ternak dan lokasi peternakan di salah satu wilayah koperasi persusuan di dataran tinggi (Koperasi SAE Pujon-Malang). Data yang didapat dianalisis dengan regresi dan statistik diskriptif. Hasil penelitian menunjukkan bahwa pakan hijaun yang dominan di musim kemarau dan hujan adalah rumput gajah dan tebon jagung. Persamaan regresi linier untuk kandungan nutrisi rumput gajah adalah TDN= 40,516 + 1,404 PK, sedangkan tebon jagung adalah TDN= 56,212 + 0,740 PK. Kesimpulannya adalah variabel dependen sebagian besar dipengaruhi oleh faktor luar (lingkungan). Peningkatan kontinuitas ketersediaan pakan hijauan dapat dilakukan dengan peningkatan sistem pakan di wilayah (dataran tinggi) dan dukungan sistem pakan dari luar wilayah.

Kata kunci: dataran tinggi, sapi perah, pakan hijauan

Introduction

East Java becomes one of Indonesian dairy farm centers since the total population of dairy cattle in the area is approximately ± 612,939 head (Dirjen. Peternakan dan Kesehatan Hewan, 2013). The farms are generally run by farmers who become members of dairy cooperatives (Rahardjo, 2012). 37.34% of the total numbers of dairy cattle are spread in East Java Plateau, 17.83% of them are in plains and the remaining 44.84% are spread in the lowlands (Rahardjo, 2010). Populations of dairy farms in an area grow with the establishment of new dairy cooperatives. Cooperatives established more than 30 (thirty) years ago are generally located in plateaus or highlands.

In general, dairy cattle's feed are concentrates and grass but the main feed still the grass. Dairy cattle main consume grass so that the sustainability of a dairy farm depends heavily upon farmers' ability in collecting the grass. Highland generally has relatively high rainfall and low temperature which makes the area an ideal place for FH and PFH dairy cattle. Grass and leaves as food sources for cattle can also grow well. However, such area is steep, and as the effect the management of a dairy

farm located in such area is quite expensive, not to mention, landslide which becomes a common phenomenon in mountainous areas.

Due to some issues encountered by dairy farms located in highlands, a study on the sustainability of forage in locally-owned dairy farm in East Java Plateau should be conducted.

Materials and Methods

Determination of the study area based on dairy cooperative working area. There are eight cooperatives in East Java, obtained by simple random sampling SAE Cooperative Pujon-Malang. The characteristic of the study areas can be seen in Table 1.

Table 1. Characteristics of the study area

	Description
Cooperative	SAE
District	Pujon-Malang
Village population[#]	30
Altitude	± ≥ 1,200 m
Temperature (^{o}C)	<21
Dairy farmer population	6,551
Dairy cattle population[#]	
- Males (h)	1,497
- Female calves (h)	6,471
- Lactation (h)	10,070
Milk production (l/h/d)[#]	9.0
Fertility of the soil	Good
Area (ha)	15,109.29

Source: Rahardjo et al. (2014) and [#]Koperasi SAE(2014)

Location studies is based on: the population in general is dairy farmers; easy access to information and cattle density is relatively high, but allow to be developed (Rahardjo, 2012 and Rahardjo et al., 2014). Furthermore, the selection of samples by simple random sampling. Data description comes from questionnaires with 160 respondents and observation data with 40 samples. The data obtained were analyzed by descriptive statisctics, regression and corelations are used in data analysis (Steel and Torrie, 1991) employing SPSS version 13.0.

Result and Discussions

Climate and height of a location. Two elements of the climate that play important roles in farm animal life and forage crops are rainfall and temperature. Figure 1a and 1b show monthly rainfall and temperature in the plateau which becomes the study area and East Java.

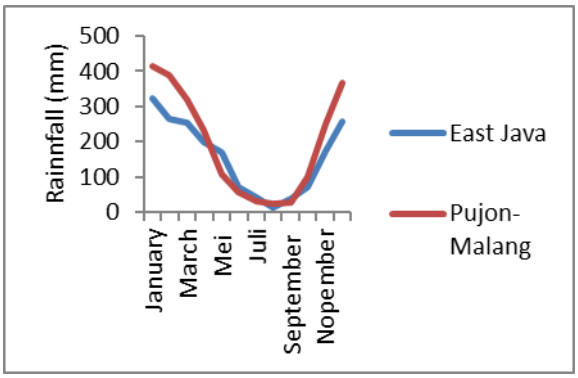

Figure 1a. Monthly rainfall in Pujon-Malang and East Java

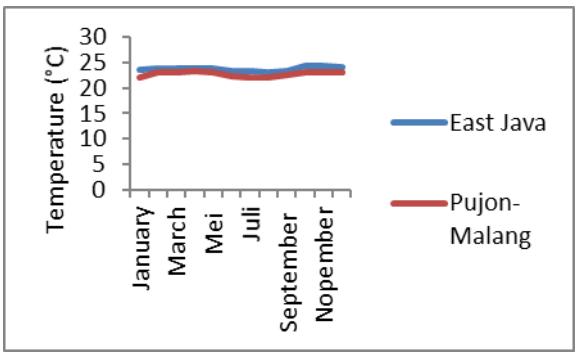

Figure 1b. Monthly temperature in Pujon-Malang and East Java

Based on the data in Figure 1a, we can see that the rainy season in the Pujon-Malang starts from January until April and November until December. The area has higher monthly rainfall than East Java. The data from Figure 1b shows that the monthly temperature in Pujon-Malang is lower than that in East Java. The picture also shows that the monthly temperature is relatively stable. Generally, the rainfall in the Plateau does not influence the dairy cattle because they are kept in sheltered place. The temperature is suitable for FH/PFH cows because the species came from an area with

temperate climate and low termonetral. The cattle are sensitive to the change of temperature (Yani and Purwanto, 2006). The production of milk is going to be disturbed when the cattle are not placed in comfortable zone (Echeverri et al., 2015).

Highlands have 3 (three) characteristics namely high rainfall, low temperature, and fertile soil which is the result of the two former characteristics of the highlands (Soemarno, 2004). Leaves and grass also grow well in the area (Kocho and Geta, 2011).

The total area of highlands in Pujon-Malang is 15,109.29 ha (Table 1) which consists of residential area, agricultural area, plantation, forest, meadows and so on (Table 2).

Table 2 . Use of land in the highlands

Use of Land	Width (ha)
Residential area	569.28
Agricultural Area	3,183.13
Plantation	102.28
Forest	10,628.95
Meadows	-
Others	525.65
Total	15,109.29

Source: Rahardjo dan Wadjdi (2014)

The data in Table 2 shows that most of the area of the highlands is protected forests of which sustainability should be kept. Only about 21.07% of the area of the protected forests is used for agriculture. Landslides and high cost for management are two setbacks for dairy farms in areas located >1.200 m above the sea level (Ritung et al., 2007). The higher altitude an area has, the smaller chance it has to use as agricultural area (Kocho and Geta, 2011).

Dairy production and the cooperative's concentrated. The population of dairy cattle in the areas that become the setting of the study is approximately ± 18,038 head; 55.83% of them are milking cows, 20.45% of them are heifers, 15.42% of them are calves and the remaining 8.30% are bulls (Koperasi SAE, 2014).

Support and guidance are vital in the development of traditionally-managed dairy farms (Rivera et al., 2015). The roles of the cooperatives include marketing and providing concentrated (Rahardjo, 2012). The cooperatives have positive contribution in the development of the dairy farms so that they can produce up to 32,803 thousand liters of milk per year (Anonymous, 2014). The comparison between the milk the cooperatives has sold and the concentrated meal it distributed has met the requirements of cooperative regulation in terms of selling concentrated meal to farmers that is 2:1. The comparison means each 2 (two) liters of milk a farmer sells, he buys a kilogram of concentrated (Figure 2a and 2b).

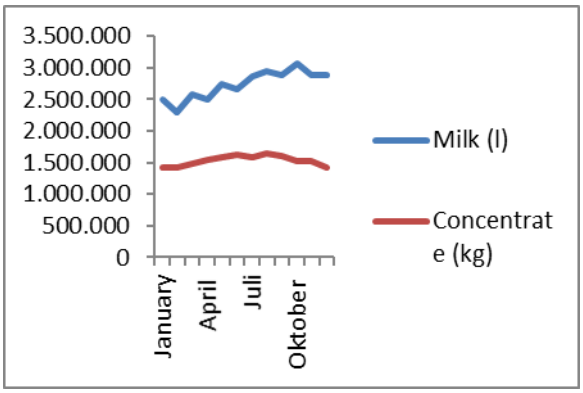

Figure 2a. Monthly average of milk and concentrate sold by the cooperative

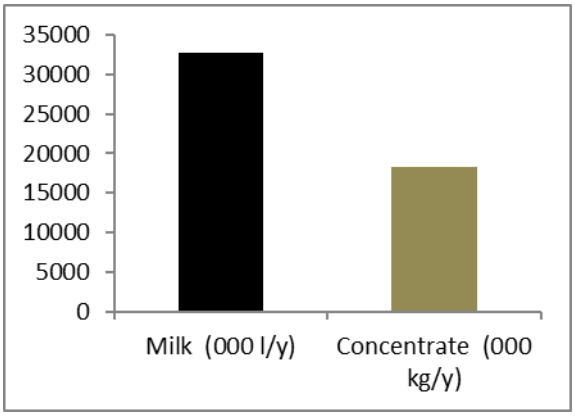

Figure 2b. Comparison between the milk the cooperatives has sold and the concentrated meal it distributed

The shortness of forage generally occurs in the dry season (Manyeki et al., 2015). The

amount of forage is plentiful in the rainy season and as the result, the production of milk is increasing. However, the amount of milk production is relatively stable (Figure 2a). The condition is caused by relatively stable use of the concentrate (Figure 2a) and guidance from the cooperatives (Figure 2b). In the dry season, the availability of forage in the plateau is decreasing. Buying the forage from other areas is the solution to overcome the shortness of forage in the dry season.

This is in line with Tjatur et al. (2011) study which states that the meal consumed in the East Java Plateau has met the cattle's need in terms of DM and is in line with NRC 2001. However, during dry season from May to October, the price of forage is increasing and, as the effect, some forage has to be imported from other areas.

Quality of the farmers' forage. The forage crops available in the pastures during the rainy seasons generally has better nutrient content than those during the dry seasons (Mayouf and Arbouche, 2015).

Elephant grass, corn stalk, nature grass, *Calliandra calothyrsus*, *Laucena glauca* (lamtoro), crop waste or fruits are some examples of forage the farmers gave for the cattle. However, elephant grass, and corn are the ones used most commonly in dry season. Based on their nutrients, those two types of meal has relatively good nutrient (Figure 3a and 3b).

The result of regression analysis of the nutrients elephant grass, and corn stalk with TDN as dependent variable and CP as independent variable results in TDN = 40.516 + 1.404 CP as linear regression equation with R^2 = 0.141 as determination coefficient. On the other hand, the linear regression equation of the corn is TDN = 56.212 + 0.740 CP with R^2 = 0.360 as determination coefficient. Low determination score on forage shows that only small percentage of TDN scores being influenced by PK and most of them is influenced by the external factor or the environment. Furthermore, the fact that the determination score of elephant grass is lower than that of the corn may possible be caused by the places these two grow. The elephant grass grows in rice fields/moors, dykes, *galengan sawah/tegalan*, river banks, side of the roads and wildlife reserve, while the corn grows in rice fields/moors only. In general, forage crops grown by the dairy farmers have better sustainability of nutrient content compared to those come from communal land (Manyeki et al., 2015).

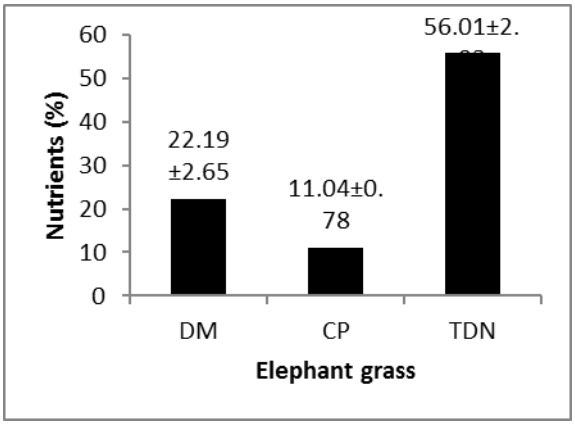

Figure 3a. Nutrients of the farmers elephant grass

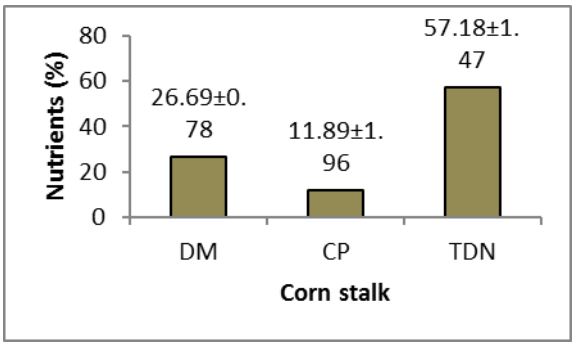

Figure 3b. Nutrients of the farmers corn stalk

Conclusion

Elephant grass and corn are the dominant forage during dry and rainy seasons. The linear regression equation of the elephant grass nutrient is TDN = 40.516 +1.404 CP, meanwhile that of the corn nutrient is TDN = 56.212 +

0.740 CP. Dependent variable of the elephant grass is (R^2 = 0,141) and that of the corn is (R^2 = 0.360) and most of them are influenced by the environment as external factor. Developing meal system within the area of the Plateau and adding that from areas outside the Plateau are two methods that can improve the continuity of the forage

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References

Dirjen Peternakan dan Kesehatan Hewan. 2013. Statistik Peternakan dan Kesehatan Hewan. Kemenetrian Pertanian (In Indonesia).

Echeverri M, L Galeano-Vasco, M Cerón-Muñoz and SM Márquez-Girón. 2015. Efecto de las variables climatológicas sobre la producción de leche de vacas Holstein. Livestock Res. for Rural Development. 27(12):248-257 (In Spanish with abstract in English).

Kocho T and E Geta 2011. Agro-ecologic mapping of livestock system in smallholder crop-livestock mixed farming of Wolaita and Dawuro districts, Southern Ethiopia. Livestock Res. for Rural Development. 23(3):51-66.

Koperasi SAE. 2014. Laporan Tahunan Koperasi Peternakan dan Pemerahan Air Susu Rakyat SAE. Pujon-Malang (In Indonesia).

Manyeki J K, EC Kirwa, PB Ogillo, WN Mnene, R Kimitei, A Mosu and R Ngetich. 2015. Economic analysis of natural pasture rehabilitation through reseeding in the southern rangelands of Kenya. Livestock Res. for Rural Development. 27(3):49-61.

Mayouf R and F Arbouche. 2015. Seasonal variations in the chemical composition and nutritional characteristics of three pastoral species from Algerian arid rangelands. Livestock Res. for Rural Development. 27(3):42-49.

Mukson, Isbandi, SI Santoso and Sudjadmogo. 2011. Potensi dan Faktor Pengembangan Sapi Perah di Wilayah Jalur Pemasaran Susu di Jawa Tengah. Proceeding in the National Seminar of Developing Zootechnical Aspect to Encourage Local Dairy Farms and Resources, Diponegoro University, Semarang. 10:19-20 (In Indonesia).

Rahardjo L, I Subagiyo, S Chuzaemi and BA Nugroho. 2010. Perkembangan Sapi Perah di Jawa Timur Menuju ke Arah Dataran Rendah. Faculty of Animal Husbandry, Islamic University of Malang, (Unpublished, in Indonesia).

Rahardjo L. 2012. Implikasi Variabilitas Pakan Konsentrat dalam Feeding Sistem Pada Usaha Peternakan Sapi Perah Rakyat. Dissertation. Faculty of Animal Husbandry, Brawijaya University, Malang (In Indonesia with abstract in English).

Rahardjo L, I Subagiyo, S Chuzaemi and BA Nugroho, 2014. Effect of Agro-ecological Zone on the Dairy Cattle Production System in East Java. Livestock Res. for Rural Development. 26(4):67-81.

Rivera JE, CA. Cuartas, JF Naranjo, O Tafur, EA Hurtado, FA Arenas, J Chará and E Murgueitio. 2015. Efecto de la oferta y el consumo de *Tithonia diversifolia* en un sistema silvopastoril intensivo (SSPi), en la calidad y productividad de leche bovina en el piedemonte Amazónico colombiano. Livestock Res. for Rural Development. 27(10):189-200 (In Spanish with abstract in English).

Soemarno. 2004. Potensi Penggunaan Sumberdaya Lahan di Jawa Timur Serta Permasalahannya. Graduate Program Brawijaya University, Malang (In Indonesa).

Stell RGD and JH Torrie. 1991. Prinsip dan Prosedur Statistik. Gramedia. Jakarta (In Indonesia).

Tjatur ANK and MN Ihsan. 2011. Penampilan Reproduksi Sapi Perah Friesian Holstein (FH) pada Berbagai Paritas dan Bulan Laktasi di Ketinggian Tempat Yang Berbeda. J. Ternak Tropika. 11(2): 1-10 (In Indonesia).

Yani and BP Purwanto. 2006. Pengaruh Iklim Mikro Terhadap Respon Fisiologis Sapi Peranakan Fries Holland dan Modifikasi Lingkungan untuk Meningkatkan Produktivitasnya. J. Media Peternakan. 4:36-46 (In Indonesia).