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Cassava Forage (*Manihot esculenta* Crantz) Ruminant Feed Nutritional Value at Altitudes in the West Java

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Cassava leaves as a source of high protein for ruminants and high potential was necessary to be explored as a feed. The cassava leaves was suitable for farmers because its availability was quite a lot, especially during cassava harvest. The purpose of this study was to determine the content of cassava leaf substances grown at various altitudes in the West Java. The study was conducted from May to June, 2016. Determination of area (village) was based on the number of cattle in the area. The sampling was done in stages (multistage sampling) to get secondary data. Selected villages were taken six times sample on each height (low, medium and high). The variables measured in this study were dry matter, crude protein, crude fat, crude fiber, calcium, phosphorus and TDN (Total Digestible Nutrient) derived from cassava leaf. The method used was experimental with Completed randomized design (CRD). The results showed that the content of dry matter, crude fiber and phosphorus in the highlands was greater than the medium and low plains. Crude Protein, Calcium and TDN showed the same value at various altitudes. Crude fats in the highlands and medium produce were the same but were higher than in the lowlands.

Keywords: *Cassava leaves, Nutrient content, altitud.*

In developing Countries, small-scale livestock and agriculture play an important role in agricultural systems. Plant and animal waste can be used for fertilizers that increase agricultural production, food for consumption and as a source of income. Agriculture has dominated the economy in developing countries where the livestock could be more developed than the crops. Livestock systems usually use grass field that fluctuates in quality and quantity and then decreasing the livestock performance. Lack of livestock nutrition is a common problem in developing Countries which is a major factor in livestock development (Sere *et al*., 2008).

Ruminant farms were developed to improve farmer welfare. The dry matter intake is very important that most influence the performance of the livestock, which means the good ruminant feed must be provided (Guimaraes *et al*., 2014). The quality of feed depends on the content of the food substances especially on dry matter, crude protein, crude fiber and digestibility. The main ruminants feed can be consisted of forage, agricultural or plantation waste, beans and concentrates. The

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productivity of ruminants depends on the feed; therefore the animal feed should be paid more attention for its quality, quantity and availability. Unsuccessful ruminant development can be caused by minimum consideration of agricultural waste utilization as forage while the provision of grass and other forages of feed is very limited.

Cassava plants (root, tubers, leaves and the residual processing) can be used as an important source of feed for ruminants. Cassava leaves in the form of hay can be used as a worm medicine and therapy because it contains thick tannin. Products from cassava plants and by-products can serve as alternative feeds as a source of carbohydrates and proteins for feeding rations (Anjos *et al*., 2014). The tubers in the fresh and dry state can be consumed in various forms (cut, sliced and mashed). As ruminant forage, cassava plants are generally harvested at the age of 3-4 months (USDA NRCS, 2005).

The inhibiting factor in expanding the livestock industry in the developing and tropical regions is due to the high cost and traditionally feed supply, unsustainable weather and rainfall, reduced soil fertility, limited feed forages and erratic supply of cereal and plant protein sources. On the other hand, there are a large variety of leftover products that have potential for feed, for example the cassava leaves (Ravindran, 1993). Cassava leaves availability is strongly influenced by the pattern of crop farming in an area. According to Koubala *et al*., (2015), cassava leaves are very important as a source of macronutrient, micronutrient and antioxidant minerals that can be used to cure chronic nutritional deficiencies to achieve better welfare. Dawodu and Abdulsalam (2015) argued that cassava leaves has an alternative to feed protein sources. From the exposure, the research objective is to know the content of food substances of cassava leaves at various altitudes (high, medium and low) in the West Java.

MATERIAL AND METHODS

The research was performed in May, 2016 until June, 2016, the research was survey method, and executed the sampling in stages (multistage sampling). First stage, determined the district area using purposive sampling wich considered: the potential of feed biomass, planting area and production capacity, density of livestock, land use, which basically derived data from statistical data (secondary data) available for the region of West Java. Next stage, determined the region of the selected district. Finally the sampling was used for primary data retrieval. The data obtained from the research results were analyzed using the experimental method. The design used was Completed Randomized Design (CRD) with three factorial patterns which were repeated six times. The data were then analyzed by variant analyses. To test the average difference in each treatment, it was performed by Duncan's multiple-range test.

P1 = Lowland (<500 m asl)
P2 = Medium plain (500-700 m asl)
P3 = Plateau (> 700 m asl)

Samples taken in each site were six samples, so the total samples of cassava leaf taken was 18 samples. The cut sample was weighed, and then dried. After obtaining the dried sample, it was weighed and analyzed for dry matter, crude protein, crude fat, crude fiber, phosphor, calcium and TDN (Total Digestible Nutrient).

DISCUSSION

Cassava plant consists of two main parts namely tubers and tops. The top of the cassava plant includes leaves, stems and branches of cassava (Antasari and Umiyah, 2009). Several studies on cassava leaves for ruminant livestock showed a positive influence on livestock performance, and replacing 50% concentrates (Sirait and Simanihuruk, 2010).

Agricultural waste in the form of cassava leaves as ruminants feed is well known. Cassava leaves are one of the abundant agricultural waste available throughout the year. The quality of food substances for cassava leaves is presented in Table. 1.

Table 1 shows that cassava leaves has a high value content of food substances on the plateau i.e. 31.867% DM (Dry matter), 23.387% C Fiber (Crude Fiber), and 0.615% P (Phosphorus). Food substances CP (Crude Protein) shows an equal value on all plains (low, medium and high) that is 23,124% for low land, 22,159% for medium plain and 22,885% for plateau area. The highest concentration of crude fat is in the medium plain (5.313%) and significantly different to the crude

Tabel 1. Nutritional values of Cassava forage at various altitudes in the West Java

Altitudes	Nutritional Value (% Dry Matter)						
	DM	CP	C Fat	C Fiber	Ca	P	TDN
			%				
Lowland	24,393 b	23,124 a	3,844 b	18,552 b	0,967 a	0,505 b	67,519 a
MediumPlain	26,818 b	22,159 a	5,313 a	18,886 b	0,951 a	0,457 c	68,902 a
Plateau	31,867 a	22,885 a	4,670 ab	23,387 a	0,967 a	0,615 a	64,348 a

Notes: Different letters in the same column indicate the significantly different (P<0,05)

fat content in the lowland (3,844%) and not significantly different to the crude fat content in the plateau (4,670%). Ca (Calcium) content for all plains were the same (not significantly different) i.e. 0.97% in lowland, 0.951% in medium plain and 0.967% in plateau. Similarly, the Total Digestible Nutrient (TDN), for all terrain (low, medium and high) has the same TDN content of 67.519% in the lowlands, 68.902% in the plains and 64.348% in the plateau. The results of this study is greater than the results of research conducted by Rochana *et al*. (2016) on the plateau that produce field nutrition value of field grass 16.29% CP, 2.48% Crude Fat, 22.06% Crude Fiber, 0,39% Ca and 0.194% Phosphorus.

On the plateau, the content of DM cassava plants forage is 31.867% and higher when compared to the results of Mitchel *et al*. (2015), wich says that the content of DM cassava leaves in the form of hay is 30% and given for sheep feed mixture. Results of research conducted by Khang *et al*., (2005) said that cassava leaves harvested at 285 days after planting yielded the DM content of 29.28%. International Institute of Tropical Agriculture / IITA, (1990) stated that the leaves of cassava varieties of TMS 30572 produced the DM of 31.5%.

Generally the protein content in the young plants is higher than the older plants. Cassava plant 45 days age resulted the forage of 20,87% crude protein content and significantly higher when compared to 285 days old cassava plant, which has 19.03% crude protein content (Khan, 2005). The results achieved in the research were higher for the crude protein content in various altitudes, i.e. on the plateau of 22.885%, 22.159% on the medium land and 23.124% on the lowland. In the Mitchel study (2015), shows that the crude cassava protein content given to sheep was 15.5%, indicating that the crude protein content was lower when compared with the results of various height (low, medium and high) in this studies. In research conducted Raimi and Monsurat (2014), the cassava leaf protein produced was 21.16%. The results of research conducted by Indriani *et al*. (2016) showed that the crude protein content fertilized by rock phosphate 200 kh / ha P_2O_5 with mycorrhizal inoculation in legumes of Centosema pubescens was 22.89%.

The results showed that the crude fat in medium and high plains were 5.313% and 4.670%, respectively. In the research conducted by Anbuselvi and Balamurugan (2013), the crude fat content of cassava leaves was 3.6%, while the results of Dawodu and Abdulsalam (2015), reported that crude fat content of sweet cassava leaf meal was 3.01%. In addition to protein and energy, high fat content and low fiber in forages are allowed to gain the ruminant productivity.

It can be seen in the above table that the content of crude fiber forage cassava is the same, the average content of 20.275% in various altitudes, while the protein content is higher than the crude fiber of 22.723% average. This is in accordance with the research of Ngiki *et al*. (2014) that the crude fiber content of cassava forage was 14.50%, while the crude protein forage was 26.7%. This is similar to Diarra *et al*. (2017), the crude fiber content of 13.91% and the crude protein of cassava leaves is 25.8%. In Ukanwoko and Beawuch's research (2014), the crude protein content of cassava leaves was 25.10%, and crude fiber by 7.9%.

Minerals in the research has been analyzed and the highest content of phosphorus found in the plateau that is equal to 0.615% and Calcium content on all plains are the same, on the average of 0.962%. In the Mzengereza *et al*. (2014) study,

it produced only 0.29% phosphorus content, but the calcium content was higher at 1.62%. According to Razaq *et al*., (2017), phosphorus is indispensable for the growth and rooting of seed germination. On the growth seeds with lack of phosphorus, shows a deficiency in plant height, root diameter, chlorophyll and carotene. The opinion of Veum (2010) that calcium and phosphorus in livestock are essential nutrients involved in various biological processes. These minerals are the most abundant element in the body with 98% Ca and 80% P stored in bone as hydroxyapatite. The remaining Ca is stored in extracellular, plasma and in-cell fluids and acts as a pivotal in metabolism, blood clotting, enzyme activation and neuromuscular function.

The content of TDN on cassava plant given to sheep is 64.7% (Mitchel, 2015). This has been similar to the results of the research in all plains (high, medium and low) that is 64.348%, 68.902% and 67.519% respectively. The standard for the basic needs of adult female sheep for CP and TDN content were 9.4% and 55% respectively. Even for flushing female sheep feed 2 weeks before birth up to 3 weeks after birth, the required protein and TDN content is only 9,4% and 60% respectively (Somanjaya, 2015). Sufficient TDN content is expected for the energy and carbon in the bones are also sufficient. Increased protein in feed, will also increase N-NH3. These conditions, TDN and protein can increase the population of microorganisms and enzymes that result in increased organic matter digestibility (Mayulu, 2014).

Based on the nutritional value of food substances, the cassava plant is very suitable to be planted in the plateau, this is in accordance with the nutritive content of cassava leaves that generally have a high value content of food substances. As explained by Nassar (2012), that cassava species are generally suitable to be planted in the highlands with a range of between 720-1200 m above sea level. According to Kartika and Budiono (2015), cassava plants can grow well on the plateau even more than 800 m above sea level. Cassava leaves are presented in the form of hay, can replace the use of soybean meal on ruminants in the tropics. Cassava leaves other than a source of protein for livestock, also acts as an anti-worm (anthelmintic) and anti-nutritional content in the form of tannins, potentially increasing endurance of livestock gastrointestinal tract against parasitic / bullying microorganisms (Wanapat, 2007; Wanapat and Knampa, 2006).

CONCLUSION

Based on the content of food substances (DM, CP, C Fat, C Fiber, Ca, P, and TDN) cassava plants are very suitable to be planted in the plateau.

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