International Journal on
Advanced Science
Engineering
Information Technology

Vol.5 (2015) No. 6
ISSN: 2088-5334

Analysis of Feed for Digestibility Bali Cow in Group "Simantri" Program in Bali on Different Topographic

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***Abstract*— This study aims to determine the availability of feed ingredients, types and diversity as well as the proportion, relation to digestibility, VFA production and N-NH3 for Bali cow holding in the group "Simantri" program in Bali on the different topography. Retrieving data using the method of observation at 27 group "Simantri", at 3 altitude / topography (lowland, medium and high). Variables measured: feed amount given, type and diversity of feed ingredients and proportions, sampling of feed materials, and take the liquid contents rumen. Sampling feed material to determine the nutrient content and digestibility of the ration, while knowing VFA rumen fluid contents (total and partial) and N-NH3. The results showed the higher the percentage of a natural grass in the lower ration. This condition causes the higher topography and diversity of the types of feed materials more and more. The proportion of shrub legume Gliricidia leaves of trees, especially in the diet is relatively small (6.6%), while the potential of Gliricidia leaves pretty much at all altitude. Judging from the fulfilment of nutrients, Bali cow rations at all topographic meet the needs/head/day in the range of 6.10 to 8.14 kgDM, protein (CP) ± of 750,2g and energy ± 12 526 kcal ME. In the test VFA rumen fluid obtained from 71.68 to 85.07 mMol in the category enough, while N-NH3: 5,21-6,11mMol still relatively low. From this study we can conclude supply of feed for Bali cow in the group "Simantri" program in Bali nutrient content rations have to meet the needs. The higher the proportion of legume shrub tree (*Gliricidia* leaves) the digestibility, VFA production and N-NH3 getting better.**

***Keywords*— food availability; fulfillment of nutrients; digestibility; Bali cow**

I. Introduction

Bali cattle as one type of livestock offspring Bos-bibos (Bos sondaicus) which has a uniqueness that must be preserved and protected and maintained its purity. Some advantages compared to other cows such as: performance, fertility, carcass percentage, and adaptation to the environment. Feared a decline in genetic quality of Bali cattle that occurred a long time, it is necessary to the efforts of various parties to maintain. One of the programs carried out the Bali province government through the program "Simantri" (Integrated Farm Management System) between livestock farming by forming groups of cattle. The program began in 2009, and now has formed 550 groups of cattle across Bali. Each group consisted of 20 members, and are given assistance in the form of: 1 unit of colony cages, 20 head of cows, manure treatment facilities (Bio-dung and urine) and bio-gas installations. While management and feeding, the responsibility of each member of the group.

Provision of feed for cattle holding in Bali is still done in the pattern of farm people in traditional farming systems. Cattle generally always be integrated with traditional agriculture (agroforestry systems), there is no special land available for growing forage [1]. The maintenance of cattle in Indonesia is still largely done traditional patterns of farm people, the low value of the effectiveness and efficiency as well as innovation and technology uptake is slow [2]. System of feeding cattle in Bali at large prioritize the availability of feed ingredients on a daily basis according to the number of animals was maintained. Feeding regardless of how many cattle feed is needed, how the quality, and sufficient or whether feed given according to the physiological status of livestock.

Feed quality is affected by the altitude, because the altitude of different types and diversity of feedstuffs are also different. In the low-lying areas where farming system wetlands (rice), the source of cattle feed more than grass field. While in the plains area and upland farming systems upland moor and plantation, then the source of feed ingredients in addition to the grass pitch also tend to use legume shrub/tree.

Qualitatively more feed than grass field contains higher crude fibre and protein were lower than leguminous shrub/tree. Coarse fibrous foods high in addition to qualitatively lower also produces emissions of methane (CH_4) is higher, this is caused by the increasing diversity of methanogens and metabolic activity [3].

Fig. 1 Bali cattle cow in group program simantri

II. Literature Review

Cattle growing in Indonesia today is largely a farm people who do traditional cultivation systems are social, the low value of the effectiveness and efficiency as well as innovation and technology uptake is slow [4]. It has also become a cause of the development of local cattle population of Indonesia comparatively very low (0.21% per year).

Currently the Bali province is the only province that is designated as an area of Bali cattle purification for the national interest. Cows kept the public in an integrated farming system (crop livestock system) by utilizing local resources to produce a calf or beef [5]. Based on the total area of bali province 5636.66 km2 and a population of Bali cattle in 2011 as many as 637 437 individuals [6], then the cattle density per unit area of very high (1.18 birds/ha) and most populous in Indonesia.

A good cow is the who first give birth at a relatively young age and the distance between the two lambing time (*calving interval*) at short. The effects of nutrition and energy balance on reproduction, is probably the most important nutritional factors associated with reproductive function in cattle [7]. Nutrients needed by ruminants can be grouped into two general categories: (1) the need for the microbes in the rumen and (2) the need for the animal itself. Optimize microbial protein production, by providing the appropriate N compounds in the rumen, will improve the status of lactating cow protein and other productive ruminants. Non-protein nitrogen (NPN) can replace only part of the diet because rumen degradable protein (RDP) of peptides and amino acids stimulate microbial protein synthesis in both the number and efficiency of fermentation proteins are formed per unit of energy [8].

Energy requirements are expressed in units of calories determined by TDN or ME on each of the different livestock affected by body weight and physiological status of the animal. Adult cattle that have a body weight of 350 kg basic nutrient needs of life (no growth) per day of 5.7 kg DM, 2.6 kg TDN, PK 432 g, 12 g and 12 g P. Ca traditional food standards based on energy metabolizable (ME) on food, have a general and theoretical relationship between ME/kg of feed and growth (g / unit ME intake [9]. The period of greatest nutritional requirement is the third stage, shortly after giving birth. A cow is needed to produce milk for calves thrive, he should regain the lost weight immediately before and after birth and eventually improve the reproductive tract to become pregnant within three months after birth. During this phase usually takes cattle feed as much as he could to support himself [10]. The local feed resources is very important to feed ruminants, especially in tropical and sub-tropical regions. These resources can be formed, developed and utilized for feed and processed commercially by industrial companies [11].

The diversity of feed ingredients in the ration and botanical composition largely determines the quality is, in general, cattle feed ingredients rations consisted of grass and legume. At the level of crude fibre content of the same, the grass has a dry matter digestibility were higher than legumes [12]. Further explained that CP in higher than grass legume (129 compared to 115 g/kg DM). Differences in the composition and type of forage in the ration provide real difference to the heat production of beef Bali, the more servings of *Gliricidia* in the ration causes more nitrogen consumption [13]. Further in its findings made clear that differences in the types and composition of different forage in the ration causes differences in microbial activity and product rumen fermentation (pH, N-NH_3, VFA total and partial), digestibility of nutrients and the bacterial population.

Leaves of legumes and nuts tropics as an alternative feed can improve production performance and secondary metabolic such as tannins and saponins to reduce methane in the rumen and can markedly increase the digestibility of dry matter [7]. The use of secondary metabolic plant (ie: saponins, tannins, essential oils) as a substitute for feed additives can chemically modify rumen fermentation and reduce the production of CH_4 [14]. The use of source tannin tannins 2 g/kg DM feed can reduce the production of CH_4, ammonia and microbial populations protozoa as well as reduce the ratio of acetate: propionate without affecting the proportion of total VFA [15]. Option in the management of feeding can unless implemented to reduce methane emissions in cattle without reducing the production [16]. This is also reinforced by the statement of Williams [17] that some forage legume species contain tannins that can reduce methane emissions and increase the production of NH_3-N in the rumen as a result of direct or indirect inhibition of methanogens. Thus, forage legumes provide benefits to improve nutrient utilization for production and environmental sustainability.

III. Research Methods

A. *Method of Collecting Data*

In this study, data were collected using a survey method with observation technique. Observation is done by observing the amount of feed given, the diversity of food, measurement of body dimensions and collecting sampling cattle feed and rumen fluid.

B. Determination of Sample Research Sites

Collection of field data from nine regency in Bali, set 3 Regency as sampling locations where research is: Tabanan, Buleleng and Karangasem. Each regency is divided into 3 altitude (lowland, middle land, high). At each altitude selected by purposive sampling 3 groups of cattle, so the number of samples are 27 groups of cattle. Livestock group selected as samples at each height are geographically far apart.

C. Implementation of the Phase I study

In phase I conducted observations for field data collection include: (1) The amount of feed given; by weighing the feed given in 1 day; (2) The botanical composition and proportion of feed; separating each type of material then weighed; (3) Sampling of feed; as much as ± 300 g for the purposes of laboratory analysis; (4) Measurement of body dimensions; to calculate the weight; (5) The contents of rumen fluid sampling; for VFA analysis and $N\text{-}NH_3$.

D. Implementation of the Phase II study

Phase II studies conducted in the laboratory test to determine: (a) Proximate analysis of the feed; (1) include of dry matter, organic matter, and crude fibre according [18], (2) the crude protein based on the "double distillation apparatus", and (3) energy ration is based on the method of "bomb calorimeter "; (b) Test the level of digestibility of feed through the analysis of In-vitro dry matter and organic matter ; (c) The concentration of N-NH3 with phenol hypochlorite method through reading with Spectrophoto meter, and measure total VFA by steam distillation method according to the General Laboratory Procedure (1966).

E. Data Analysis

Data were analysed by using descriptive comparative analysis with quantitative and qualitative. Comparative analysis aims to find solutions for dealing with the situation or phenomenon investigated or comparing one factor with other factors. To determine the availability and level of nutrition, then all the data analysis of the quality of the feed material made ration formulation at each observation unit. Ration formulation is then compared to standard cow suit the needs of their physiological status based on standards from Kearl [19].

IV. Results and Discussion

A. Botanical Composition and Amount of Feed Rations Awarded.

Factors altitude and agricultural land use affect the species diversity of feed ingredients and the proportions in the ration. In Table 1 can be seen in the low-lying land use more wet farming for rice, the type and variety of feed materials less than the plains and plateaus. In the middle latitudes relative diversity of types and most good, where the source of the feed material is integrated with plantation crops.

TABLE I
Types of Animal Feed Ingredients and Proportions in Rations

R	Lowland		Middleland		Highland	
	Diversity	%	Diversity	%	Diversity	%
A	Native grass	90,3	Native grass	82,2	Native grass	53,9
	Broadleaf	9,7	Pennisitum	9,8	Pennisitum	44,3
			Broadleaf	4,8	Banana stem	1,8
			Rice straw	3,0		
			banana stem	3,4		
B	Native grass	26,7	Native grass	62,7	Native grass	56,8
	Pennisitum	9,0	Pennisitum	6,5	Pennisitum	33,1
	Rice straw	54,5	Broadleaf	10,6	Broadleaf	0,9
	Mimosa leaf	3,8	Rice straw	5,5	Leucaena	1,4
	Spinach leaf	8,6	Imperata	10,9	Fern leaf	0,9
	Casava leaf	0,7	banana stem	3,5	*Dadem* leaf	2,5
	Cornhusk	10,9			*Sasak* leaf	2,4
					Banana stem	1,6
C	Native grass	56,3	Native grass	11,8	Native grass	9,1
	Pennisitum	13,0	Pennisitum	39,2	Pennisitum	54,2
	Rice straw	8,9	Broadleaf	1,9	Broadleaf	2,6
	Gliricidia	4,2	Pod cacao	8,7	Caliandra	22,0
	Peanuts straw	18,7	*Bentenu* leaf	4,3	Fern leaf	2,6
			Jackfruit leaf	5,6	Casava leaf	10,9
			Cacao leaf	4,8		
			banana stem	3,4		
			Awar2 leaf	12,3		

Note : R (Regency), A (Tabanan), B (Buleleng), and C (Karangasem)

Natural grass became the basic feed in the ration at all altitudes, the average of the highest lowland (57.76%) and a higher percentage of natural grass is getting a little bit in the ration. In the lowlands the use of rice straw is quite high with the average 21.15% were not treated at all. This is due to the lowland rice straw is easy to come by and the availability of enough. The higher the place, the balance of natural turf with grass and legume leaves the better, but the amount of the provision legume percentage is still low when its potential is quite a lot. This is due to the low level of knowledge about the importance of farmers still legume in the mixed ration.

B. Weight and Total Feed Awarded

The amount of feed given to livestock must consider the cow body weight and physiological status, because it determines the amount of feed nutrient fulfilment. Table 2 shows only the body weight and the amount of feed given, regardless of the physiological status. At all altitude can be seen the amount of feed given flats nearly equal, but far in excess of body weight that is 10%. This is due to the low level of knowledge about the number of farmers still feed requirements, so that the excess feed will be wasted.

TABLE II
MEANS BODYWIGHT AND FEED AMOUNT GIVEN

R	Group	Lowland		Midleland		Highland	
		Body weight (kg)	Ration (kg)	Body weight (kg)	Ration (kg)	Body weight (kg)	Ration (kg)
A	1	235	27,63	235,9	23,93	261,4	32
	2	262,2	45,83	242,6	20,9	241,2	30,03
	3	255.94	29,57	247,4	30,23	257,6	38,3
	Means	251,1	34,34	241,9	25,02	253,4	38,3
B	1	211,1	44,67	240,9	40,47	288	39,97
	2	279,2	41,87	283,5	40,6	219,1	28,77
	3	218,9	38,47	215,7	40,1	229,7	33,53
	Means	236,4	42,67	246,7	40,39	245,6	34,09
C	1	231,9	25,1	253	37,17	299,4	37,4
	2	218,5	32,47	287,7	30,57	243,9	36,5
	3	199,5	38,97	251,7	29,8	304,6	31,3
	Means	216,6	32,18	264,1	32,51	282,7	35,06
Means		234,7	36,06	250,9	32,64	260,6	34,19

Note : A (Tabanan), B (Buleleng), and C (Karangasem)

C. *Nutrient Content Rations*

Altitude effect on temperature and humidity, the higher the temperature and humidity where the lower. At lower temperatures, the nutritional quality of forage as well. The plateau obtained crude protein (CP) feed material is higher than the lowlands, while the crude fiber (CF) on the lower plateau than lowland on natural pastures in Bali [20].

Table 3 shows the type and diversity of feed ingredients in the ration on lowland less, the proportion of grass highest court, the highest ration DM. With the amount of DM higher percentage of crude fiber (CF) is relatively higher in the lowlands, the protein content (% / kg) tends to be the lowest, on the one hand the energy content (kcal/kg) highest ration. This shows that the composition of human resources higher and higher CF causes a higher energy content as well. Crude fiber is a constituent component of carbohydrates as an energy source in the feed material.

Carbohydrates (crude fiber) reformed into VFA as the main energy source for the landlord, while the protein in food ingredients reformed into NH3 for rumen microbial growth as a source of essential amino acids [24]. High or low content of crude fiber in the diet will determine the product of fermentation in the rumen (ruminal VFA). Protein feed degraded in the rumen microbes will be split into groups and NH3 carbon chain, which means it will lose its function as a source of amino acids necessary livestock [21].

TABLE III
NUTRIENT CONTENT RATION

Altitude/ Topography	Regency	DM (kg)	CF (%/kg)	Protein (%/kg)	Energy (Kkal/kg)
Lowland	Tabanan	6,47	28,56	9,91	3632,31
	Buleleng	9,92	29,22	11,81	3683,68
	Karangasem	8,03	27,67	10,75	3579,80
	Means	8,14	28,48	10,82	3631,93
Midle	Tabanan	4,31	29,80	9,99	3623,90
	Buleleng	7,02	27,73	11,32	3571,09
	Karangasem	6,97	27,72	11,75	3621,16
	Means	6,10	28,41	11,02	3605,38
High	Tabanan	6,51	29,45	9,90	3343,31
	Buleleng	5,44	28,10	11,18	3419,41
	Karangasem	7,24	26,91	11,73	3448,59
	Means	6,39	28,15	10,93	3403,77

D. *Total Nutrition in Rations*

Based on the amount of DM in the ration and nutrient content of the ration, it can be calculated the total nutrient in the diet can be seen in Table 4. The average total protein content of the ration as 733,36 g, higher than [19] recommend in cows with a body weight of 300 kg, 3 months of gestation before giving birth needs 614 g protein. Research [23] getting protein requirement of Bali cattle growing weight of 300 kg as much as 679.57 g, while [22] recommend the protein to the basic necessities of life as much as 432 g.

TABLE IV
AVERAGE OF TOTAL NUTRIENTS IN THE RATION

Altitude	Regency	DM (kg)	Protein (g)	GE (Mkal)	DE (Mkal)	ME (Mkal)
Lowland	Tabanan	6,47	641,18	23,50	15,28	12,98
	Buleleng	7,53	889,29	26,99	17,54	14,91
	Karangasem	8,03	863,23	28,74	18,68	15,88
	Everage	7,67	830,32	27,62	17,95	15,26
Midle	Tabanan	4,31	430,57	15,62	10,15	86,29
	Buleleng	7,02	794,66	25,07	16,29	13,85
	Karangasem	6,97	818,97	25,24	16,41	13,94
	Everage	6,10	672,22	21,99	14,29	12,15
High	Tabanan	6,51	644,49	21,76	14,15	12,03
	Buleleng	5,44	608,19	18,60	12,09	1028
	Karangasem	7,24	849,25	24,97	16,23	13,79
	Everage	6,39	698,43	21,75	14,14	1202
Everage		6,72	733,66	23,78	15,46	13,14

When viewed from the total energy content of the ration in the group Simantri in Bali with the average 13.14 Mkal ME, higher than standard [19], [13], and [9] ie: 12.40 Mcal ME, 9.94 Mkal ME, and 9.82 Mkal ME.

E. *Rations Digestibility*

Digestibility is physical and chemical changes experienced food in the digestive tract, the change in the form or structure of the refining feed into smaller particles. Digestibility of dry matter and organic matter is influenced by factors of feed and microbes, is an important factor in determining the quality of feed [2]. Based on in-vitro analysis of the ration (Table 5) obtained dry matter digestibility and organic matter digestibility in lowland average relatively higher than the plains and the lowest in the highlands.

TABLE V
DRY MATTER AND ORGANIC MATTER DIGESTIBILITY

Variable	Altitude/Topography		
	Lowland	Midleland	Highland
1. Dry matter digestibility (%)	45,65	42,65	42,51
-Fermentatif(%)	21,25	19,82	20,60
-Hidrolitik (%)	24,41	22,83	22,03
2. Organic matter digestibility	38,10	34,65	32,34
-Fermentatif(%)	25,28	23,99	24,47
-Hidrolitik (%)	12,82	10,66	7,87

Judging from the composition of feedstuffs in the ration, the lowland species and the least diversity and the use of natural grass and hay highest and highest crude fiber content, the digestibility should be the lowest. This was probably due to the percentage of Gliricidia leaves lowland highest ration. Gliricidia besides classified as a feed source of protein and more fiber fermentable so easily degraded by microbes rumen (RDP) so as to meet the needs of the rumen microbes will be the availability of N-NH_3 [23]. Leaves of legumes and nuts tropics as an alternative feed can improve production performance and secondary metabolic such as *tannins* and *saponins* to reduce methane in the rumen and significantly ($P <0.05$) can improve the digestibility of dry matter (DM) [7].

F. Production of VFA and N-NH_3 Rumen Fluid

The most important concept to note in feed for ruminants strategy is that the microbial protein available and the amount of volatile fatty acids (VFA) produced in the rumen. Based on the type and diversity of feed ingredients in the ration given by farmers for cows and of making use of cattle rumen contents samples, then after the test analysis VFA production and N-NH_3 is obtained as shown in Table 6.

TABLE VI
VFA AND N-NH_3 FLUID RUMEN PRODUCTION

No	Variable	Altitude/ Topography		
		Lowland	Midleland	Highland
1	VFA Partial (mMol)			
	-As.asetat	56,08	46,76	50,41
	-As.propionat	16,79	15,01	14,40
	-As.iso butirat	2,77	2,47	2,22
	-As.n butirat	6,67	5,57	4,77
	-As. iso valerat	1,56	1,39	0,90
	-As.n valerat	1,20	0,82	0,47
2	Total VFA (mM)	85,07	71,68	73,17
3	N-NH_3 (mM)	5,76	6,11	5,21

In general, total rumen VFA obtained in the range is good enough 71.68 - 85.07 mMol, in accordance with that recommended by [25] that normal concentrations between 70-130 mMol. [23] mentions that the VFA number varies between 80-160 mMol depending on the type of feed and the time after feeding. Moments after feeding, increased VFA production and decline thereafter. Decrease in total VFA concentration can reach 30 mMol and could increase to 200 mMol. For the production of N-NH_3 rumen in the research sample of rumen contents were taken in the third place obtained the average height range of between 5.21 to 6.11 mMol. These results are relatively low when referring to the statement Mc.Donald [15] that the range of concentrations of NH_3 are optimum for rumen microbial protein synthesis between 6-21 mMol.

V. CONCLUSIONS

The quantitative amount of rations given everage meet the needs of livestock. When linked with the availability of nutrients in the diet (protein and energy) and the fulfillment of the Bali cattle nutrients for the parent group Simantri program in Bali, then the average crude protein (CP) 750.2 g ration and energy as much as 13141.85 kcal ME, has been fulfilling the above basic living needs.

The type and diversity as well as the proportion of feed ingredients in ration effect on digestibility. The proportion of Gliricidia leaves growing in the ration can improve the digestibility of dry matter and organic matter digestibility of fibrous diets high rough.

Production of VFA and N-NH_3 in the rumen of bali cow at group “Simantri” program in Bali with traditional breeding system is still relatively low, nearly equal at all altitudes.

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