Physical Characteristic and Palatability of Wafer Complete Ration Based on Sugar Cane Sprout and Bagasse on Friesen Holstein's Calves

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Abstract. This research was aimed to study the physical characteristic and palatability of wafer complete ration based on sugar cane sprout and bagasse. Physical characteristic measured were water content, water activity and density. Data of physical characteristics were analyzed using Completely Randomize Design, with four treatments and three replications. Analysis data of palatabity test used were T-test method i.e., rations of R0 vs R1 R2 R3, ration of R1 vs R2, ration of R0 vs R3, ration of R3 vs R2. The treatment was wafer complete ration with different fiber source, i.e. R0 = 80% concentrate + 20% field grass; R1 = concentrate 80% + 20% bagasse; R2 = concentrate 80% + sugar cane sprout 10% + bagasse 10%; R3 = concentrate 80% + 20% sugar cane sprout. The data were analyzed using ANOVA and continued with Contrast Orthogonal Test. The result of this research showed that the wafer complete ration that contains sugar cane sprout had better physical characteristics. Palatability of wafer complete ration containing field grass and sugar cane sprout was more preferred than that containing combination of bagasse and sugar cane sprout. The average consumption of wafer complete ration on FH's calf containing 20% of field grass was ranged at 44–48%, ration containing 20% of bagasse was at 6–10%, ration containing 10% of sugar cane sprout and 10% bagasse was at 13–16% and ration containing 20% of sugar cane sprout was at 30–33%.

Key Words: physical characteristic, palatability, wafer, bagasse, sugar cane sprout.

Introduction

Most of farmers in tropical and subtropical countries used agricultural by-product as major component of diet for large ruminant for considerable part of or throughout the year (Leng, 1990). Generally, agricultural by-products have low quality because they have high crude fiber content but low crude protein and digestibility value (Santoso and Hariadi, 2009).

The limited accessibility of forage causes more fibrous feed exploitation from agricultural waste. Fibrous waste has been an important feed source for ruminant until these days, therefore farming system effort at limited forage region must integrate with agricultural system as source of feedstuff (Pangestu, 2003). There are several benefits if sugar cane waste becomes the feed source for ruminant such as being tolerant of dry season, resistant from pest and disease and available at dry season (Pangestu, 2003).

NDF of sugar cane sprout contains 72.33% and ADF is 49.60%, NDF of bagasse contain 83.04% and ADF is 45.75% (Analysis Laboratory of Feed Technology IPB, 2008). Field grass contains 63.61% NDF and 40.32% ADF (Suharto, 2004). Bagasse that contains a lot of fiber can be made as source of energy (Tarmidi, 2006). Bagasse does not have benefit if it is given as single feed because it has low nutrient with protein content less than 4% and TDN less than 40% of dry matter, therefore it needs to combine with high quality concentrate source of fiber to fulfill the animal needs (Kamil et al*.,* 2004). Molasses has high NFE from dry matter (Bata, 2008).

The low content of protein and dry matter digestion ability of sugar cane sprout and bagasse are the restraint usage factors, therefore it is need to look for solution, by adding the concentrate with protein source, energy, vitamin and mineral. However, the sugar cane sprouts and bagasse is easily damaged during the storage, therefore it needs

preservation. One of the preservation methods is wafer forming. Wafer complete ration is feed that has compact and concise physical type. It is expected to be easy to handle and transport despite the complete nutrition content and simple technology use, therefore it is applicable (Trisyulianti et al., 2003). This research aimed to compare physical characteristics and palatability of FH's calf.

Materials and Methods

Equipment test

Equipment utilized in this research was hammer mill swing's type, bin, plastic bag (30x50 cm and 10x15 cm), wafering machine (temperature 150^{o}C, pressure 200-300 kg/cm^{2} up to 20 minutes), water activity meter.

Raw material of complete ration

The complete ration utilized in this research contained raw material concentrates, such as pollard, corn, coconut meal, vitamin, urea and mineral. The fiber source utilized was field grass, bagasse and sugar cane sprout. The field grass was obtained from the field around The Faculty of Animal Science Agriculture of Bogor Institute, Bogor, while sugar cane sprout and bagasse were obtained from Sugar Factory PG Jatitujuh, Cirebon, West Java.

Complete ration formulation

Wafer complete ration formulation was formulated to supply the need of cow age 3-4 months with crude protein between 16% and TDN 70% (NRC, 1989). The composition of feedstuff composing complete ration and the chemical composition of the ration are presented in Table 1.

Experimental design

Data of physical characteristic were analyzed using Completely Randomize Design, with four treatments and three replications. The treatment was wafer complete ration with different fiber source, i.e. R0 = 80% concentrate + 20% field grass; R1 = concentrate 80% + 20% bagasse; R2 = concentrate 80% + sugar cane sprout 10% + bagasse 10%; R3 = concentrate 80% + 20% sugar cane sprout. Analysis data of palatability test used were T-Test method i.e., rations of R0 vs R1 R2 R3, ration of R1 vs R2, ration of R0 vs R3, ration of R3 vs R2.

Wafer examination

Wafer examinations were: (a) wafer cut into size of 5x5x1 cm was taken as the sample for proximate analysis (protein, crude fiber and TDN) and physical characteristic test (water content, density and water activity); (b) the palatability test of the ration was done by allowing the animal to cafeteria feeding system to consume the ration voluntarily 4 calves age 3-4 months. Each calf got four kinds of ration as much as 3% of body weight.

Observed variable

The examinations of physical characteristic and palatability of wafer complete ration were : Water content (AOAC, 1984), wafer density (Trisyulianti et al., 2003), water activity as the AW meter's instruction, palatability (Patrick and Schaible, 1980). The Palatability examinations utilize Fries Holland Calf with early weight 72-96 kg, totals 4 calves in individual pen of the Beef Cattle Nutrition Laboratory, Faculty of Animal Science IPB. The feed was given as much as 3% of body weight. The palatability level was detectable by counting the difference between total feed that had been given and the rest of the feed consumed by Fries Holland calf for 7 days prelims and 3 days for palatability test with feeding cafeteria system. Each cattle was given four kinds of ration treatment, which could be freely chosen by the cattle (Patrick dan Schaible, 1980). The formulas for calculating the cattle fondness tests is: dry material consumption (g/head/day) = % dry material x consumption (g).

Table 1. The composition and content of food substance in wafer complete ration.

Raw materials	R0	R1	R2	R3
	.....(%).....			
Sugar cane sprout	-	-	10	20
Bagasse	-	20	10	-
Field grass	20	-	-	-
Pollard	29	30	29	29
Corn	24	23	24	24
Coconut meal	20	20	20	20
Molasses	5	5	5	5
Vitamin	0.5	0.5	0.5	0.5
Urea	0.5	0.5	0.5	0.5
Mineral	1	1	1	1
Total	100	100	100	100
Composition of food substance based on dry materials (100%)				
Dry Matter	85.01	85.33	85.55	87.00
Ash	5.33	4.20	4.70	5.13
Crude Protein	16.36	16.03	16.84	17.26
Crude Fat	4.62	5.66	4.08	4.07
Crude Fiber	15.33	13.08	14.19	14.39
NFE	58.36	61.03	60.19	59.15
TDN	72.72	76.97	74.14	73.72

R0 = 80% concentrate + 20% field grass; R1 = concentrate 80% + 20% bagasse; R2 = concentrate 80% + sugar cane sprout 10% + bagasse 10%; R3 = concentrate 80% + 20% sugar cane sprout

Diagram process of wafer complete ration based on sugar cane sprout and bagasse

Here is a diagram process of complete ration wafers ranging from raw materials forage and concentrates to the wafer complete ration based on sugar cane sprout and bagasse (Figure 1).

Results and Discussion

Water content

The water content of Wafer is the amount of water that remains in intra cellular of cell cavity and among the particle during the adhesive ossification process using heat-pressing machine. In this research, the value of water content is 13.00–14.99% with average value of 14.28% mostly because of early water content conditions of the particles.

The field grass has higher water content than sugar cane sprout. The wafer with fibrous grass field has fewer cavities, therefore the evaporation runs slower, while on wafer with sugar cane sprout fiber source has more and bigger cavity, and therefore the evaporation runs faster. The Average result of Physical Characteristic test of the sugar cane sprout and bagasse wafer complete ration is shown on Table 2.

According to Trisyulianti et al. (2003), microorganism activity can be pressed at water content around 12%-14%, therefore the feed will not easily mildew and decay. The storage condition would possibility increase the water

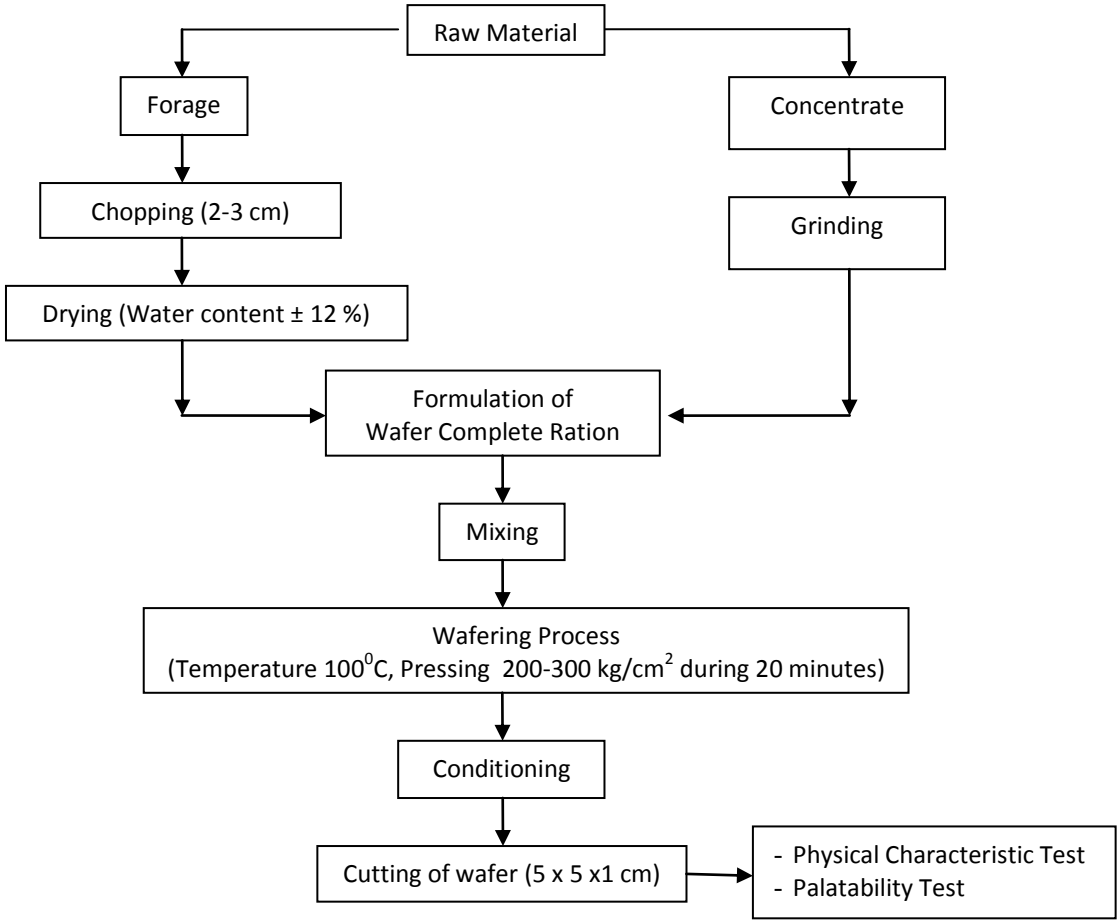

Figure 1. Diagram process of wafer complete ration based on sugar cane sprout and bagasse

Table 2. The average result of physical characteristic test of the sugar cane sprout and bagasse wafer complete ration

Treatment	Ration				Average
	R0	R1	R2	R3	
Water content (%)	14.99±0.00	14.67±0.00	14.46±0.10	13.00±0.00	14.28±0.79
Density (g/cm^3)	0.60±0.05	0.55±0.03	0.70±0.34	0.68±0.38	0.68±0.27
Water activity	0.80±0.01	0.80±0.07	0.80±0.07	0.80±0.07	0.80±0.06

R0 = 80% concentrate + 20% field grass; R1 = concentrate 80% + 20% bagasse; R2 = concentrate 80% + sugar cane sprout 10% + bagasse 10%; R3 = concentrate 80% + 20% sugar cane sprout

content because of the humidity and temperature of the storage environment.

Density

Density is a size of particle size cohesiveness in sheet and it is very dependent to raw material density that is utilized and the high pressure given during the process of sheet production. The wafer density determines the dimension stability and physical appearance of wafer complete ration. (Jayusmar et al., 2002). The density of fibrous field grass is equal to the density of fiber source combination between sugar cane sprout and bagasse. The density of fiber source bagasse is equals to the density of fiber source sugar cane sprout. However, the density of fiber source bagasse and sugar cane sprout are more higher if compare to fibrous field grass or the combination between sugar

cane sprout and bagasse. The ration density of fibrous field grass showed the type of wafer texture that was not too solid, very fragile and hollow; therefore, it was estimated not to last long in the storage.

The highly dense wafer feed will give a thick and hard texture so it is easy to handle even in storage and shock-resistant during the transport and it was estimated to be more durable in storage. However, the high density would cause difficulty to the cattle to consume the wafer complete ration directly (Trisyulianti et al., 2003). The density value of wafer complete ration is shown in Table 3.

Water activity

Water in food material is one of the factors which influence the metabolism activity as enzyme activity, chemical activity which cause rancid and enzymatic reactions that cause conversion of taste and its nutrient value. The water activity of feed material is free water contained in feed material which can be used by microbe for its growth (Syarif and Halid, 1993). Water activity on bagasse and the combination of sugar cane sprout and bagasse were higher, hence it support the growth of molds. Low water activity prevented the growth and durability of microbe. Water activity has a relationship with titratable water, wafer made from fibrous field grass have fewer cavity, hence it has slower evaporation. Meanwhile sugar cane sprout had more and bigger cavities so the sublimation happened faster.

Palatability

The palatability of cafeteria system in feed application as wafer complete ration in this research was used as supporter or indicator to know how many of the calf preferred the wafer complete ration. The average of food substance consumption during the research can be seen on Table 3.

The total consumption of fresh ration and dry material at the moment of palatability examination was 4383 and 3759 g/head/day or equal to 3.9% of body weight average research cattle. The result of T-tests according to Steel and Torrie (1981) specifically for dry material consumption showed that wafer ration R0 was the best (P<0.05) preferred 44-48% of ration, followed by wafer ration R3, 30-33% of rations. According to Dhalika et al. (2003), the palatability of sugar cane sprout is relatively equal with other forage type that is usually consumed by cow. Wafer ration R1 and R2 were the lowest to consume, namely around 6-16% of rations. The early weights of the experimental cattle were 72-96 kg and final weights were 96–120 kg. It pointed out that on early weight range; the rumen adaptation was more ready, therefore, there is an increase in weight (up to 10 days research) as much as 17–24 kg or 1.70– .40 kg/head/day. The increase of body weight was much higher than the NRC recommendation (1989) which was 1.1–1.3 kg/day. The increase of body weight possibility was caused by compensation growth and

Table 3. The average of consumption of palatability test

Consumption	Ration			
	R0	R1	R2	R3
Fresh consumption (g/head/day)	2082 [a]	284 [c]	575 [c]	1442 [b]
Dry Material consumption (g/head/day)	1771 [a]	242 [c]	492 [c]	1254 [b]

Values bearing different superscript at the same row differ significantly (P<0.05).
R0 = 80% concentrate + 20% field grass; R1 = concentrate 80% + 20% bagasse; R2 = concentrate 80% + sugar cane sprout 10% + bagasse 10%; R3 = concentrate 80% + 20% sugar cane sprout.

excess consumption of Crude Protein and TDN that exceeded the NRC standard (1989).

Conclusions

Based on physical characteristic, the ration containing sugar cane sprout had a better physical characteristic, observed from low water content, the highest wafer density, low water activity and high specific gravity. The palatability of wafer ration containing field grass and sugar cane sprout was preferred to bagasse and the combination of sugar cane sprout and bagasse.

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