2013_IJSE

by Munasik M

International Journal of Science and Engineering (IJSE)

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Physical Characteristics of Pressed Complete Feed for Dairy Cattle

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Abstract - *The study was aimed to evaluate the physical characteristics of the pressed complete feed in the forms of cube, cylinder and ball. The study was conducted to get a complete feed of dairy cows that can be developed commercially. The evaluation was done on a physical test : bulkiness, hardness and hygroscopic properties of pressed complete feeds. The results of this research showed that the bulkiness of pressed complete feed in the forms cubes, cylinders and balls were between 0.20 up to 0.48 liter/kg; the hardness of pressed complete feed, cylinders and balls were 3 lbs up to 14 lbs; the hygroscopic factor of pressed complete feed in the forms cubes, cylinders and balls were around 1.10% up to 9.69%. The pressed complete feed in the forms of cube and cylinder are better than the form of ball in physical characteristics.*

Keywords - pressed complete feed; physical characteristics.

Submission: December 10, 2012 Corrected : March 5, 2013 Accepted: March 7, 2013

Doi: http://dx.doi.org/10.12777/ijse.4.2.2013.61-65

I. INTRODUCTION

This study began with the planting of napier grass mutants (mutagenesis results) as a source of forage in the manufacture of complete feed for dairy cows. Forage is the main feed of ruminants, especially dairy cows, but the provision of forage alone is not enough for livestock production. The grasses in the tropics are less digestible so that the consumption of nutrients that can be digested by dairy cows is low (Raghuvansi et al., 2007). To overcome the shortage of rations of dairy cows, concentrate are being added. The use of the concentrate is intended to improve the digestibility of nutrients (Santra et al., 2002). Therefore we need a variety of strategies of appropriate technology approach in the concentrate supplementation in dairy cow rations, among others through the complete feed processing technologies (complete feed). Complete feed containing starch tubers banana varieties of stone, can improve the performance weighting goat carcass (Aswandi et al., 2012), did not cause hematological disorders which showed by the blood profiles and liver function were in normal range (Mayulu et al., 2012).

In general, the manufacture of supplement block rations that are often used are the manufacture of urea molasses blocks (UMB). Complete feed is a feed that contains enough nutrients for animals in certain physiological level established and administered as the only feed that is able to meet basic living needs and production without any additional substances other than water (Hartadi et al., 1997). It is defined also that complete feed is all good forage feedstuffs (basal feed) and concentrates that are mixed in one form of feed (Ensminger and Olentine, 1978). To increase the commercialization of complete feed, the products need to be made in various forms of cube, cylinder and ball. The research was aimed to evaluate the physical properties of the pressed complete feed in the form of cube, cylinder and ball.

Several shapes and sizes of pressed complete feed forms were evaluated in this research, namely c1 = cube (3.22 x 3.22 x 3.22 cm^3), c2 = cylinder (volume 33.5 cm^3, with a height of 3.92 cm and 3.3 cm diameter) and c3 = ball (volume 33.5 cm^3, with a diameter of 4 cm). The objective of this study were to evaluate physical characteristics of the forms of pressed complete feed in the form of cube, cylinder and ball on bulkiness, hardness and hygroscopic properties of pressed complete feed.

II. MATERIALS AND METHODS

Material Research

The research materials were Napier Grass mutant milling, feedstuff (corn milling, coconut cake, soybean meal, pollard, onggok (by product of cassava), ultramineral, salt and molases. The manufacture of complete feed was with a ratio of forage: concentrate of 50:50 (Suherman, 2003). The composition of complete feed were listed in Table 1.

Table 1. The composition of complete feed

Ingredient	Complete feed			
	Control	Cube	Cylinder	Ball
Napier grass	60 kg			
Napier grass mutant (%)		47.50	47.50	47.50
Consentrate (%)	10 kg	47.50	47.50	47.50
Molases (%)		5.00	5.00	5.00
Total (%)		100	100	100
Chemical composition				
Crude Protein (% DM)	13.07	14.29	14.29	14.29
Crude Fat (% DM)	4.19	0.44	0.44	0.44
Crude Fibre (% DM)	22.19	18.93	18.93	18.93
Ash (% DM)	11.63	9.82	9.82	9.82
NFE (% DM)	43.38	43.37	43.37	43.37
TDN (%)*	65.65	64.65	64.65	64.65

*Calculation according to Sutardi (2001) : TDN = 70.60 + 0.259 CP + 1.01 Fat – 0.76 CF + 0.0991 NFE. TDN = Total Digestible Nutrient, NFE = Nitrogen Free Extract

Research Methods

The research was carried out experimentally. The treatments were arranged in a completely andomized design with three treatments (pressed complete feed cube, cylinder and ball). The treatments were repeated six times. The variables that were measured were physical tests of pressed complete feed (cube, cylinder, ball) on the value of bulkiness, hardness, and hygroscopic factor (Ramanzin et al., 1994).

The proportion of the raw material of the concentrates control rations and treatment rations were the same, namely paddy bran 23 %, corn milling 5 %, coconut cake 20 %, soybean meal 9 %, pollard 28 %, onggok (by product of cassava) 12 %, ultra mineral 2 % and salt 1 %. The manufacturing of pressed complete feed with a ratio of forage to concentrate was 50 : 50. The pressed complete feed manufacturing procedures were (a) Preparation of the feed formulation, (b) Napier grass mutant was cut manually with a knife, dried in the sun until dried and milled, (c) consentrate material that represented large particles such as coconut cake and onggok (by product of cassava) also were needed to be reduced in size by grinding, (d) mix the concentrate with the smallest proportion were evenly mixed first and then the larger proportion were to follow, (e) After the mixture was surely homogen then it was mixed with ground grass. The mixture then was inserted into the container and mixed the molasses that had been diluted 6 times with water, stirred until evenly distributed, (f) And then mold by the molding press which had been prepared at a pressure of 70 kg/600 cm^2, (g) Then the outcome was placed on the container (pan) made of aluminum and zinc for further action for drying by inserting into the oven at a temperature of 70-80 °C, (h) It was waited until dry with a moisture content of 13.15%, (i) Finally, it was packed with boxes that had been prepared. The volume of each pressed complete feed was 33.5 cm^3, which were similar for each form of pressed complete feed.

The procedure of measurement of bulkiness. The pressed complete feed was dried in an oven at a temperature of 105°C until the water level reached 0 %. Weigh a beaker glass of 1000 ml. Input pressed complete feed into a beaker glass of 1000 ml and weighed. The formula figures of bulkiness = the volume of space occupied/weight of material.

The procedure of measurement of hardness. The pressed complete feed was placed above a petri dish. Put in a perpendicular manner instrument-breaking pressed complete feed with a modified measuring instrument of land hardness as a substitute for the spring of hardness tester. Press pressed complete feed to rupture. Then the measurements were repeated six times. Hardness = The magnitude of pressure in lbs.

The procedure of measurement of hygroscopic. The pressed complete feed was placed on a tray. Put water in the tray, enter into an oven until the water boilled to make the air saturates (100 % relative humidity). The running of boiling water went at 105 °C oven temperature to make a constant 100% relative humidity in the oven. Measures the water content of pressed complete feeds after six hours in the oven. A factor of hygroscopic was counted as follows.

$$Hygroscocpi = \frac{Change\ of\ watercontent\ 6\ hours}{6} = \%\ hour$$

The collected data of each unit experimental sample that were to be measured were bulkiness, hardness and hygroscopic. The statistical analysis used analysis of variance and continued with Duncan Multiple Range Test (Steel and Torrie, 1993).

III. RESULTS AND DISCUSSION

The bulkiness, hardness and hygroscopic of pressed complete feed in the form of cubes, cylinders and balls showed significant differences (P<0.05). The bulkiness of pressed complete feed in the form of cylinder had lower value compared to pressed complete feed in the form of cube and ball. The hardness of pressed complete feed in the form of cubes had higher value compared to pressed complete feed in the form of cylinder and ball. The hygroscopic of pressed complete feed in the form of cylinder was lower value compared to pressed complete feed in the form of cubes and balls. The bulkiness, hardness and hygroscopic of pressed complete feed in the form of cubes, cylinders and balls was presented in Table 2.

Table 2. The bulkiness, hardness and hygroscopic of pressed complete feed in the forms of cubes, cylinders and balls

Pressed complete feed	Weigh /unit (g)	Bulkiness (liter/kg)	Hardness (lbs)	Hygroscopic (%)
Cube	7.58	0.26 ± 0.02^b	12.50 ± 1.64^a	3.30 ± 1.31^b
Cylinder	7.76	0.21 ± 0.01^c	9.66 ± 2.42^b	2.41 ± 1.29^b
Ball	7.50	0.45 ± 0.02^a	4.50 ± 1.38^c	8.55 ± 0.90^a

Note : Same superscript on the same colum are not significant different (P>0.05)

1. Bulkiness

The results of this research showed that the rate of bulkiness of pressed complete feed in the forms of cubes, cylinder and ball were between 0.20 to 0.48 liter/kg. The results of bulkiness of pressed complete feed was still far greater than the bulkiness of Napier grass that was 0.004 liter/kg (Ramanzin et al., 1994). This was presumably because of the gap space that could not be charged in full due to the form of pressed complete feed. It was expressed by Sekine et al. (2003) that the rate of dry forage bulkiness receive linearly depends on the pressure.

The smaller bulkiness of pressed complete feed meant that it needed also a smaller space for storage. The differences in bulkiness of pressed complete feed in the form of cube, cylinder and ball were to explain that the difference of space storage or packaging needed for each form of pressed complete feed. This was indicated that the sidelines of ball of pressed complete feed in storage was larger than the sidelines of a storage space in pressed complete feed in the form of cube and cylinder, so as cylinder of pressed complete feed had the best bulkiness.

The differences in bulkiness of pressed complete feed of cube, cylinder and ball were still low, it proven that there were similarity of the feed intake of dry matter and organic matter, thus the capacity of the digestive tract of dairy cattle was still able to accommodate the number of pressed complete feed that were given, either the form of cube, cylinder and ball.

In general based on analysis of regression (Table 3) the higher bulkiness of pressed complete feed would be significantly lower to hardness followed the equation Y = - 0.021 X + 0.493 with correlation r = - 0.742 and R^2 = 0.551, but the higher hygroskopic followed an equation Y = 0.032 X + 0.155 with correlation r = 0.896 and R^2 = 0.803. The higher hardness of pressed complete feed was significantly lower in term of hygroskopic followed the equation Y = - 0.957 X + 13.441 with correlation r = - 0.749 and R^2 = 0.561.

The results of regression analysis, analysis of varian and Duncan Multiple Range Test explained that the best bulkiness of pressed complete feed was the form of cylinder followed by the form of cube and ball. The best hardness of pressed complete feed was the form of cube followed by the form of cylinder and ball. The best hygroscopic of pressed complete feed was cylindrical form followed by the form of cube and ball.

The review of each form of pressed complete feed also showed that the form of cube and cylindrical had relatively similar physical qualities. The relation between bulkiness, hardness and hygroscopic of the form of each pressed complete feed was peresented in Table 3.

The magnitude of hardness of pressed complete feed in the form of cube was higher compared to the pressed complete feed of cylindrical form and ball. It meant that the pressed complete feed in the form of cube was lowered the level of the damage in terms of packing/of packaging, transporting and storaging. The higger the numbers of hardness would determin the stability of the dimensions and physical appearance of complete feed (Jayusmar et al., 2002). The complete feed that had high density would give a solid and hard textures, therefore, it was easy to handle both in storage or transportation and it was estimated that the cube form would be more durable in storage (Trisyulianti et al., 2003). On the contrary, the form that had low density would show the less durable storage time, because they had a softer

Table 3. The relation between bulkiness, hardness and hygroscopic of pressed complete feed

Correlation between	Equation	r	R^2
Pressed complete feed			
Bulkiness-hardness	Y= - 0.021 X + 0.493	0.742*	0.551
Bulkiness-hygroscopic	Y= 0.032 X + 0.155	0.896*	0.803
Hardness-hygroscopic	Y= - 0.957 X + 13.441	0.749*	0.561
Pressed complete feed cube			
Bulkiness-hardness	Y= 0.002 X + 0.232	0.218ns	0.048
Bulkiness-hygroscopic	Y= 0.007 X + 0.283	0.545*	0.297
Hardness-hygroscopic	Y= -0.481 X + 14.087	0.384*	0.147
Pressed complete feed cylinder			
Bulkiness-hardness	Y= -0.003 X + 0.244	0.244*	0.601
Bulkiness-hygroscopic	Y= -0.006 X + 0.225	0.225*	0.305
Hardness-hygroscopic	Y= 0.058 X + 9.526	0.031ns	0.001
Pressed complete feed ball			
Bulkiness-hardness	Y= 0.13 X + 0.392	0.889*	0.789
Bulkiness-hygroscopic	Y= -0.002 X + 0.465	0.067ns	0.005
Hardness-hygroscopic	Y= -0.095 X + 5.313	0.062ns	0.004

Note : * = significant (P<0.05); ns = non significant

and porous texture, it was expected that the low density form could only survive in storage some time only.

The hygroscopic of pressed complete feed in the form of cube was same compared to the hygroscopic of pressed complete feed of cylindrical form. The pressed complete feed in the form of ball had the higher hygroscopic than pressed complete feed in the form of cube and cylinder.

2. Hardness

The results showed that the hardness of pressed complete feed in the form of cube, cylinders and the ball was 3 up to14 lbs. The results of this large number was still within the range of hardness that existed with the hardness number of research results of complete feed of Susanti and Widyastuti (2007) was 1 up to 25 lbs.

The hardness of pressed complete feed in the form of cube was higher compared to the amount of force of pressed complete feed in the form of cylinder and ball. It meant that pressed complete feed in the form cube was lower level of damage in terms of packing/of packaging, transporting and storaging. The bigger hardness would determine the stability of the dimensions and physical appearance of complete feed (Jayusmar et al., 2002). Complete feed that had high density will give textures that are solid and harder, it was easy in handling both in storage or transportation and estimated at the time would

be more durable in storage (Trisyulianti et al., 2003). On the contrary, on the weft of which have the density is low will show the form of a wafer the weft of which is not too dense and of textures that are more soft and porous (hollow), it is expected can only survive in storage some time.

3. *Hygroskopic factor*

The results showed that the hygroscopic factor of pressed complete feed in the form of cube, cylinders and balls ranged 1.1 - 9.69%. The results of hygroscopic factor of this magnitude was still greater than the hygroscopic factor of the research results of complete feed of Susanti et al. (2010), 0.1755 to 0.2525%. This was presumably because the extent of the outside part of the complete feed was also pressed so that there was more extensive contact with the outside air.

The hygroscopic of pressed complete feed in the form of cube was the same compared to the hygroscopic of pressed complete feed in the form of cylinder. The pressed complete feed in the form of ball had the higher hygroscopic than pressed complete feed in the form of cube and cylinder.

IV. CONCLUSION

The rate of bulkiness, the hardness the hardness and the hygroscopic factor of pressed complete feed in the forms of cubes, cylinder and ball ranged from 0.20 to 0.48 liter/kg, 3 to14 lbs and 1.1 - 9.69%, respectively. The physical characteristics of pressed complete feed in the forms of cube and cylinder are better than the form of ball.

ACKNOWLEDGEMENT

This research was supported by funds Doctorate Grants from the Directorate General of Higher Education, Ministry of Education and Culture Republic Indonesia.

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