Original Research Article

Comparative Performance of Grower Sheep Fed with Pelleted Napier (*Pennisetum purpureum*) Grass – Based Complete Ration Mix (CRM)

ABSTRACT

Aims: To determine the comparative growth performance of grower sheep fed with pelletized napier (*Pennisetum purpureum*) grass-based complete mix ration (CRM) in terms of feed intake, weight gain and to determine the degradability in terms of the amount and rates of roughage disappearance in the rumen with respect to time.

Study design: Paired T-test

Place and Duration of Study: Sacdalan Farm, Binoligan, Kidapawan City, North Cotabato from December 2013 to February 2014

Methodology: A Fabricated heavy-duty pelleting machine were used to pelletize the mixed ingredience containing the formulated ration as stipulated in the in test. And an *"in sacco"* method was used in determining the amount and rates of roughage disappearance in the rumen with respect to time comparing the 60% Napier grass-based pelleted feeds versus 80% Napier grass-based pelleted feeds. There were four (4) heads of sheep assigned per test group. The sheep was confined and provided with daily nutritional requirement according to weight and dry matter requirement.

Results: A highly significant difference was observed (P 0.01) in feed intake with mean of 0.92 kg, sheep in Test Group B fed an 80:20 ration of pelleted napier grass-based complete ration mix (CRM) outperformed sheep in Test Group A, which had 60:20 diet of pelleted napier grass-based complete ration mix (CRM) with a mean feed intake of 0.78 kg. However, no significant difference was obtained between Test Group A (60:40) and Test Group B (80:20), having a mean of 0.14 kg and 0.09kg for the average daily weight gain, and for feed conversion efficiency with mean of 5.59 kg and 10.49 kg respectively.

The disappearance rate and percentage degradability have the same trend as the weight of the residues decreases over time, percentage degradability also illustrate patterned with weight loss of pelleted napier using "in sacco" technique. As 0.05g, 0.10g, 0.10g, 0.15g, 0.20g, 0.30g, 0.45g, and 0.50g for 0, 6, 12, 24, 48, 72, 96, and 120 hours, respectively for disappearance rate, and 2.5%, 5.0%, 7.5%, 10%, 15%, 22.5%, and 25% for 0, 6, 12, 24, 48, 72, 96, and 120 hours respectively for percentage degradability.

Keywords: Pelleted, Napier, Sheep, Complete Ration Mix (CRM)

***(Note:** 1. Case Reports should follow the structure of Abstract, Introduction, Presentation of Case, Discussion, Conclusion, Acknowledgements, Competing Interests, Authors' Contributions, Consent (where applicable), Ethical approval (where applicable), and References plus figures and/or tables. Abstract (not more than 250 words) of the Case reports should have the following sections: Aims, Presentation of Case, Discussion and Conclusion. Only Case Reports have word limits: Papers should not exceed 2000 words, 20 references or 5 figures. Other Type of papers have no word limits.*

2. Review papers may have different headings of the sections and are exempted from following these suggestions.

3. Research Papers and Short Notes should follow the structure of Abstract, Introduction, Methodology, Results and Discussion, Conclusion, Acknowledgements, Competing Interests, Authors' Contributions, Consent (where applicable), Ethical approval (where applicable), and References plus figures and/or tables.)

1. INTRODUCTION

Sheep are ruminant animals that help digest fibrous meals by relying on a mutually beneficial connection with bacteria, protozoa, and fungi in their rumen. As a result, diets must be designed with the notion of feeding the rumen to the sheep. Body upkeep, physical activity, growth, milk production, reproduction, and health are all dependent on nutrient intake. Although certain mobilization of body tissues can provide some nutrients and energy for brief periods of time, such as in early breastfeeding, all of the nutrient needs must be satisfied by the diet in the end (www.hccmpw.org.uk).

In a process called as "ruminating" or "chewing the cud," the sheep regurgitates, chews, and then swallows the food numerous times. The rumen microorganisms, as well as the sheep eating and rechewing the food, allow the food to break down sufficiently for the animal to absorb the nutrients. Sheep owners should be aware that the rumen fluid's microbial composition changes when the kind of diet is changed, thus any feed change should be introduced gradually. A abrupt shift in feed (from dry to lush, from pasture to grain, etc.) can quickly make a sheep sick and even kill it (Hobby Farmers, Basic nutrition for sheep, Tasmania).

The objectives of the study were a) to determine the degradability of napier grass (*Pennisetum purpureum*) using *"in sacco"* method in terms of the amount and rates of roughage disappearance in the rumen with respect to time, b) To determine the comparative growth performance of grower sheep fed with pelletized grass-based complete mix ration in terms of feed intake, weight gain and feed conversion efficiency. The study was conducted at the Sacdalan Sheep Farm, Binoligan, Kidapawan City, North Cotabato from December 2013 to February 2014.

2. MATERIAL AND METHODS

2.1 Experimental Design and Treatment

The study was carried out in T-test design comparing two test rations with four heads of sheep assigned per test group. The animals were fed with the following:

Group A: grass-based pelleted complete ration mixed 60:40 ratio Napier:Indigofera

Group B: grass-based pelleted complete ration mixed 80:20 ratio Napier:Indigofera

2.2 Source of Grasses and Legumes

The grasses and legumes were harvested from the USM Germplasm collection garden. The grasses were cut 3-4 inches from the ground after each has been initially cut for regrowth stages.

2.3 Cutting of the Grasses

The grasses were cut according to their standard cutting stages. Napier was cut at 40 days, after regrowth stage. The grass and legumes were sundried for 3-4 days to reach about 14% moisture content, this was processed and ground with a laboratory grinder passing a sieve at 22 microns.

2.4 Characteristic of the Nylon Bag

The bags were prepared from nylon or synthetic fiber material with a pore size of 41µ. The pore size is a compromise between minimal losses of small particles and making sure that microbes, including protozoa, can enter the bags uninhibited and also that gas can escape from the bags.

2.5 Digestibility Using "*In Sacco"* Method

The ground samples weighing 2g were placed inside the nylon bag. The bags were sewn with nylon thread with double seam and close stitching. These were tied with a separate length of nylon thread (e.g., fishing line) and attached to a long string in a plastic tube once the pre- weighted samples were filled-in. The bags were anchored with about 50 cm of nylon thread (about 25cm of nylon for sheep/goats) to the cannula top and suspended deep into the rumen. The bags were reused as long as no holes were found. The bags were always checked for breakages.

*2.*6 *"In Sacco"* Incubation

Each sample was incubated at periods of 0, 6, 12, 24, 36, 48, 72 96 and 120 hours using 32nylon bags. All bags were incubated on day one at the same time and withdrawn at different times (sequential withdrawal) for less disturbance to the rumen environment.

2.7 Washing and Drying

After the withdrawal of the samples, the bags were immediately dipped into cold water to stop further microbial activity and then rinsed in cold tap water to remove the rumen matter from outside of the bag. The bags were washed under running cold water for about 30 minutes with tap water while rubbing gently between thumb and fingers until the water runs clear. The washed bags were dried in an oven at 60-65 ^{0}C for about 48 hrs and samples were weighed after oven drying.

2.8 Procedures in Making Pelleted Ration

2.8.1 Harvesting grasses

The grasses were cut at vegetative stage and airdried and/or sundried until it reached 14% moisture content. The dried grasses were hammered finely using a hammer mill.

2.8.2 Preparation and formulation of test feeds

A ration for grower sheep containing to 16-18 % crude protein (CP) was formulated with a ratio of 60:40 for test group A and 80:20 for the test group B (grass: legumes)

2.8.3 Preparation of concentrate

The concentrate ingredients were bought from a reliable source from the market. The ingredients for the concentrate were rice bran D1, corn bran, soybean oil meal, copra meal, salt and limestone. These ingredients were weighted according to the feed formulation prior to mixing.

2.8.4 Preparation of binder (Cassava)

Cassava tubers were cooked properly and cooled before mixing with the formulated ingredients and passed through the pelleting machine

2.8.5 Mixing of Ingredients

The ingredients were mixed thoroughly following the quadrat dilution process.

2.8.6 Pelleting and drying of the pellets

The mixed ingredients were pelleted using a fabricated pelleting machine. The pelletes were sundried for 1-2 hours and then air dried until the desired moisture was attained.

2.9 Feeding of Pelleted CRM

Feeding of pelleted CRM to grower sheep was based on their daily nutrient requirement according to their weight and dry matter requirement. Since the weight of grower sheep is 13kg and it's about 6% of the live weight, then 780g of pelleted feeds were fed for one animal each day at 7am feed refuse was checked at 5:00 in the morning (Plate 4).

2.10 Housing of Grower Sheep

The experimental animal was confined in cages (Plate 5). The flooring was covered with bedding materials made of sawdust, sand and salt at 3 parts sawdust, 1 part of sand and 200g salt mixed

properly. The sheep house at Sacdalan farm was prepared seven days prior to the transfer of experimental sheep. It was sprayed with IMO on the sides and floors (Plate 6).

2.11 Identification of the Grower Sheep

Proper identification of grower sheep was done using neck chains and plastic ear tags with corresponding numbers for proper monitoring and recording.

2.12 Wool Shearing

The wool was shorn accordingly, weighed and deducted from the initial body weight of the sheep. Second cut of wool was also recorded and computed as portion of the final weight

2.13 Health Care and Sanitation

Daily observation was done to check the condition and performance of the grower sheep. The sheep pen was disinfected every week to avoid odor and flies. Feed troughs and waterers were washed thoroughly with antibacterial dishwashing soap. Changing of litter materials and disposal of manure was done every 15 days.

2.14 Feeding Trial

Preliminary feeding was done by gradually diluting conventional feeds with the CRM. Dilution starts at 20% until they adopt fully the new feed. More or less 7 days was scheduled to finish depending on the animal adapting to the new ration. The feeding trial commenced by introducing full feeding of pelleted CRM as diet for test groups A and B.

2.15 Data Gathered

2.15.1 Weight of grower sheep

The initial weight of experimental grower sheep was recorded at the start of the study. Weight gain was determined by getting the difference between the final weight and the initial weight. The formulae used were:

Initial weight (Kg/Sheep) = Fasted weight of Individual Sheep (kg)

Final Weight (Kg/Sheep) = fasted weight of individual sheep at termination of feeding trial

Weight Gain = Final Weight – Initial Weight

$$\text{Average Daily Weight Gain (kg)} = \frac{\text{Total Weight Gain}}{\text{No. of Days}}$$

Final Weight (Kg/Sheep) = Final weight – Wool weight

2.15.2 Feed intake

The feed intake of experimental sheep was recorded at the start up to the termination of the study in order to determine the consumption of the sheep. The feed conversion efficiency was also computed. The formulae used were as follows:

$$\text{Total feed intake} = \frac{\text{Total feed offered (kg)} - \text{Total feed refused (kg)}}{\text{Number of Sheep (kg)}}$$

$$\text{Average Daily feed Intake (kg)} = \frac{\text{Total Feed intake}}{\text{Number of days}}$$

$$\text{Feed Conversion Efficiency} = \frac{\text{Feed intake}}{\text{Weight Gain (kg)}}$$

2.15.3 Feed cost

The feed cost was determined based on the total feed intake starting from the feeding trial up to the termination period of the study and the total feed cost was taken from the inputs of the preparation and production of pellets. The formulae used were:

Cost of formulated ration = feed ingredients price x prevailing price/ unit

Cost of cutting/drying of grass or legumes = time of cutting x weight x number labor x (man- day rates)

Cost of chopping / Grinding = (time x weight x labor x machine rental) + (production / minute x cost) (fuel)

Pelleting cost = (time x weight x labor x machine rental x fuel x cost binder)

2.15.4 Return of investment

The return of investment was determined based on the total feed cost from the start of the feeding trial up to termination period of the study and the price per kilo of the total weight per animal. The formula used was:

$$\text{Return of investment} = \frac{\text{Total weight gain x price per kilo}}{\text{Total feed cost}}$$

2.15.5 Degradability of feeds

The ruminal degradability was calculated using the formula:

Disappearance = (SWa-BW) x DMa-(SWB-SW) x DMb(Swa-Bw) x DMa

Where: SWa = Weight of the original sample + nylon bag
BW = Weight of empty nylon bag
SWb = Weight of sample + nylon bag after incubation
DMa = Dry matter of feed sample
DMb = Dry matter residue sample

2.15.6 DM Disappearance

The nylon bag technique described by Ørskov,et.al., (1980) for the determination of the degradation of feedstuffs in the rumen at various incubation periods applying this equation:

$Y = a + b (1\text{-}e\text{-}ct)$…….. Ørskov and McDonald (1979)

$Y = a + b (l\text{-}e\text{-}c (t\text{-}tl))$……. McDonald (1981) model with lag

Where: Y = degradability at time (t)
a = intercept
b = potentially degradable fraction
c = rate of degradation of b
t_l = lag time

2.15.7 Percent Degradability

The percent degradability was calculated using the formula:

$$\text{Percent degradability} = \frac{\text{Degraded materials (g)}}{\text{}} \times 100$$

Weight of sample (g)

2.15.8 Statistical Analysis

The data gathered were compared and analyzed using paired T-test for independent samples to compare the different between treatments.

3. RESULTS AND DISCUSSION

3.1 Feed Intake

Statistical analysis revealed a highly significant difference (P< 0.01) between treatment means. The sheep in Test Group B fed with 80:20 ration of pelleted napier grass-based complete ration mix (CRM) had a feed intake of 0.92 kg performed better than sheep in Test Group A with 60:20 ration of pelleted napier grass-based complete ration mix (CRM) with mean value of 0.78 kg. The average daily feed intake of grower sheep fed with pelleted napier grass-based complete ration mix (CRM) is shown in Table 1. Column 2. This implies that the grower sheep fed with pelleted napier grass – based complete ration mix (CRM) with 80:20 ration is palatable and performed better than grower sheep fed with pelleted napier grass – based complete ration mix with 60:40 ration. As Napier grass is a high yielding fodder crop with good palatability, highly nutritious especially when young, dark green leaves and less than 1 metre tall. (http://www.nafis.go.ke/fodders/napier-grass/)

3.2 Weight gain

Statistical analysis revealed no significant difference between test means. The average daily weight gain of grower sheep fed with pelleted napier grass-based complete ration mix (CRM) is shown in Table 1 Column 3.

Table 1. Summary on the results of the comparative test of means on feed intake, average weight gain, feed conversion efficiency of the grower sheep fed with pelleted napier grass-based complete ration mix (CRM). Sacdalan farm, Binoligan, Kidapawan City, North Cotabato. 2014.

Treatment	Feed intake (kg)	Average daily weight gain (kg)	Feed conversion efficiency (kg)
A (60:40)	0.78[b]	0.14	5.59
B (80:20)	0.92[a]	0.09	10.49
t	-2.64	2.35	-1.95
df	77.18	5.69	3.27
p-value	0.00	0.06	0.14
Significance	**	ns	ns

ns = not significant
** = highly significant at 1% level

This implies that the average daily weight gain of grower sheep is not influenced by the CRM ration. The average daily gain of grower sheep fed with pelleted napier grass-based complete ration mix (CRM) in Test Group A (60:40) was 0.14kg and 0.09 kg for sheep in Test Group B (80:20). This implies that the average daily weight gain of the grower sheep not influenced by the CRM ration.

3.3 Feed Conversion Efficiency

The statistical analysis revealed no significant difference between test means. The feed conversion efficiency of grower sheep fed with pelleted napier grass-based complete ration mix (CRM) in Test Group A (60:40) was 5.59 kg and 10.49 kg for sheep in Test Group B (80:20). This implies that the feed conversion efficiency of grower sheep is not influenced by the CRM ration.

3.4 Disappearance of Napier Grass

The result of the rate of disappearance of napier grass substrates is shown in appendix D. The mean disappearance in appendix D Column 5 were 0.05g, 0.10g, 0.10g, 0.15g, 0.20g, 0.30g, 0.45g, and 0.50g, for 0, 6, 12, 24, 48, 72, 96, 120 hour respectively. In the case of 0 hour (where no microbial influence) cannot be compared to the samples with incubation process. The trend shows that residue weight decrease with time and consequently, the computed disappearance follow the same trend.

3.5 Percent Degradability

The result of the percent degradability of napier grass under " in sacco" method is shown in Table 2. The computed percent degradability were 2.5%, 5.0%, 5.0%, 7.5%, 10%, 15%, 22.5% and 25% for 0, 6, 12, 24, 48, 72, 96, 120 hour respectively. In the case of 0 hour (where no microbial influence) cannot be compared to the samples with incubation process. The trend shows that disappearance weight increased with time and consequently, the computed degradability follows the same trend.

Table 2. Summary results on the rate of percent disappearance of napier grass under "in sacco" method. Department of Animal Science, CA Annex 2, University of Southern Mindanao, Kabacan, Cotabato. 2014.

Material	Period (hrs)	Sample (g)	Residue (g)	Disappearance (g)	Degradability (%)
Napier Grass	0	2	1.9	0.05	2.5
	6	2	1.8	0.10	5.0
	12	2	1.8	0.10	5.0
	24	2	1.7	0.15	7.5
	48	2	1.6	0.20	10.0
	72	2	1.4	0.30	15.0
	96	2	1.1	0.45	22.5
	120	2	1.0	0.50	25.0

4. CONCLUSION

Based on the results of the study it is concluded that the grower sheep Test Group B with 80:40 (napier: indigofera) ration is more palatable compared to grower sheep Test Group A with 60:40 ration.

REFERENCES

Blazer, R. E., Ritchey, G. E., Kirk, W. G. and Arnold, P. T. IX. (1955). Experiments with Napier Grass. University of Florida Agricultural Experiment Station. 7JBulletin 568 September 1955

Chiba, L. I. (2009). Sheep Nutrition and Feeding. Animal Nutrition Handbook Section 16: Sheep Nutrition and Feeding Page 426-446.

Devendra, C., and Faylon P. S. (1988). Sheep Production in Asia. Proceedings of the Workshop on sheep production in Asian PCARRD, Los Banos Laguna, Philippines April 18-23, 1988. Book Series No. 80/1989

Doreau, M. B., and Noziere, P. (1999). The in sacco method prediction of the degradation of dietary components in the rumen. INRA Prod. Anim., 12(3), 195-206.

Khan, B. B., Iqbal, A., Mustafa, M. A. (2003). Sheep and Goat Production. Department of Livestock Management University of Agriculture Faisalabad 2003, part 1, pages 34-5

Nissanka, N. P. C., Bandara, R. M. A. S., and Disnaka, K.G.J.S. (2010). A comparative study on feeding of total mix ratio vs conventional feeding on weight gain in weaned friesean heifers under tropical environment. The Journal of Agricultural Sciences, 2010, vol. 5, no 1, page 42-51

Promkot, C., Wanapat, M. and Rowlinson P. (2007). Estimation of Ruminal Degradation and Intestinal Digestion of Tropical Protein Resources Using the Nylon Bag Technique and the Three-step *In vitro* Procedure in Dairy Cattle on Rice Straw Diets. Asian-Aust. J. Anim. Sci. Vol. 20, No. 12: 1849 – 1857 December 2007 www.ajas.info

DEFINITIONS, ACRONYMS, ABBREVIATIONS

.

CRM: Complete Ration Mix