Comparative Evaluation of the Nutritive Values of Dried Ryegrass and Clover

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ABSTRACT

In pasture production ryegrass and clover was the main source to feed livestock such as cattle, sheep and goats especially to fulfil the requirement in providing adequate amounts of nutrients that the animal need. This experiment was conducted to see which source has the highest nutritive values and which source is the best to feed livestock. There were six nutritive values that were important and be calculated throughout this experiment. The nutritive values that being calculated are valued on dry matter, crude protein, neutral detergent fibre (NDF), acid detergent fibre (ADF), ether extract (EE) and ash. The feeder supply used in this experiment is dried ryegrass and clover. The experiment was based on the ruminant requirement within limited feeds sources during winter season. Dries ryegrass has a higher NDF and ADF, a good percentage of EE and CP can be given to ruminant's especially growing cattle. It was important in order to increase an optimum metabolism and improve rate growth. Furthermore, this experiment also discusses about the clover which has a lower NDF and ADF, but high in fats and crude protein. However, it was more suitable for lactating cows which depend on more energy and other minerals were required for the production of milk. Nevertheless, increase the optimum requirement of the cattle depending on their stages of growth and also their weight for better production.

Keywords: *feeds, ryegrass, clover, nutritive value, ruminants*

Introduction

Most feeding practices to feed ruminants is ryegrass and clover species. Both of those have been used in Australia to feed their livestock. Ryegrass and clover have a good reputation for mix pasture which provide the best result of livestock feeds. Indeed, ryegrass was a native plant and a perennial grass that live freely in natural ecosystem for temperate climates. Therefore, in this case it can grow widely using tillage method in order to generate faster. It is highly nutritious in winter and spring. Furthermore, it is best suited to fertile soils (NSW DPI, 2008). Then, for clovers it can grow well in any type of condition. In addition, it is more tolerated with acidic soil and cool environment. Based from Ayres & Lane (2008) clover can produce an intensive regeneration system and seed bank storage that can rotate the vegetation. Clover was produced to increase nitrogen fixations that help to improve the soil. These shows how useful it is in applications for growing ryegrass and clover in paddock with the intention that it can increase yield plus increase livestock production.

The pasture which can produce highly nutritive value can be identified by laboratory test that investigates the content of the pasture. This includes protein, carbohydrate, fat, water content and fiber percentage. This data is important to identify the key feature to improve the demand and supplies for livestock feeding. This includes the livestock diet and cost in feeding practices. The contribution of these nutrients towards livestock farming were demanding

Methods

In this experiment, we determined the number of percentage of dry matter, ash percent for minerals, crude protein, ether extract (total fat), neutral detergent fibre (aNDF) and also acid detergent fibre (ADF). Therefore, in these analyses we used two types of feed which are Dried Ryegrass (sample A) and Clover (sample B).

1. **Percent Dry Matter**
   Ceramic crucibles were used in this experiment must be dried at a temperature of 150°C for 24 hours and placed in desiccators with a drying agent. Ensure the lid was left slightly ajar. Then, after two minutes, the desiccator is sealed to give the crucible time to cool for at least 5 minutes but, should not more than 20 minutes. Therefore the formation of vacuum can be prevented. The crucible was weighed and 1g of sample is added. The samples were left dried in the temperature of 105°C for 24 hours and being placed in a desiccators as in the early procedure.

The weight of crucible and sample then was recorded in order to calculate the percent of dry matter. The formula to identify the percent of dry matter is as below:

$$\frac{\text{Dry sample weight}}{\text{Wet sample weight}} \times 100 = \%\ \text{DM}$$

2. **Percent Ash for Minerals**

Samples from dry matter were used and being placed in a cool muffle furnace in order to let it run at 600°C for 8 hours. After 8 hours, the furnace was turned off and left to cool itself until the temperature falls to 200°C. The crucibles were then placed in the desiccators. This was the procedure as %DM. The ash and crucible were then weighed and ash percentage was calculated. The formula used was as below:

$$\frac{\text{Ash sample weight}}{\text{Dry sample weight}} \times 100 = \%\ \text{Ash}$$

$$100 - \%\ \text{Ash} = \%\ \text{organic matter}$$

3. **Crude Protein Analysis**

Kjeldahl method were used in this analysis. A labelled sample container with 1g of sample in it was weighed and recorded. The contents were then transferred into a number Kjeldahl tube and the results were recorded. Meanwhile, in the tube, two high selenium catalyst and 12ml of concentrated sulphuric acid were added and a condenser was placed in the tubes. Then, it is placed in the heating block at 150°C for 15 minutes. Then the temperature were left to increased by 360°C. The heating process were continued until the contents of the tubes turned clear or pale straw colour (pale yellow).Then,the heater block is turned off until the tubes reached room temperature and the fume cupboard were turned off. The tube was then placed in the Kjeldahl unit, using the total nitrogen (TN) program and 5 drops of methyl red/bromocresol the green indicator solution were added to the receiver container. When the distillation process were complete , the receiver container was removed and the contents were transferred into a conical flask for titration. Zeroed the burette, the solution were titrated to the endpoint and the number of moles of acid used and the molarity of the acid was recorded. The formula used is as below:

$$\%N = \frac{14.01 \times (\text{mls of titrate sample} - \text{mls of titrate blank}) \times \text{molarity of titration acid}}{\text{Sample weight (grams)} \times 10}$$

$$\%\ \text{Protein} = 6.25 \times \%N$$

4. **Ether Extract (Total Fat)**

The flat bottom flask (containing 3-4 boiling chips) were dried for 3-4 hours at 105°C, desiccated for 45-60 minutes and being weighted. About 2g of sample were weighed into the cellulose thimble and were placed in the Soxhlet apparatus and the condenser was installed. In the fume hood, 30-40ml of hexane were added to the round bottom flask and fixed below the extractor. The condenser water supply and heating were then turned on and the extraction process last for at least 5 hours. When the extract was left cool, the flask was removed from the apparatus and allowedthe solvent to evaporate. When it is completely dry and no hexane fumes remained, the flask were left dried at 105°C for 30 minutes and once again left cooled in desiccators until reached room temperature. The flask was weighed and recorded. The calculations used are:

$$\text{Ether extracts, \%} = \frac{\text{weight ether extract}}{\text{(Sample wt.) (DM)}} \times 100$$

5. **Neutral Detergent Fiber (aNDF)**

A total of 3 filter bags were used and weighed (W_1). The bags were labelled and 0.5g of sample (W_2) was weighed, grounded to pass through a 1mm screen into the bags. The third bag was left empty in order to determinedblank bag correction (C_1). The bags were then sealed 0.5cm from the open edge and the sample in the bags were spread evenly in order to eliminate clumping. The bags were then put in the bag suspender (maximum 24 bags) for processing.

During processing, 1900-2000ml of ambient Neutral Detergent solution was added into ANKOM Fiber Analyser vessel and 20g (0.5g/50ml of ND solution) of sodium sulphite and 4ml of heat stable alpha-amylase was added to the solution in the vessel. After 75 minutes and the solution has been exhausted, approximately 2000ml of hot (90-100°C) water and 4ml of alpha-amylase was added to the first and second rinses with each rinse about 3-5 minutes. The filter bags were then removed and excess water was pressed out gently, placed in a beaker and soaked in acetone. Bags were separated in sequence to soak for 3 minutes and excess acetone was pressed lightly, spread out and dried. Drying was completed in the oven at 105°C for at least 2 hours. The bags were removed from oven, placed directly into Moisture Stop, weigh pouch and flatten to remove air. Bags were left cooled and weighed (W_3). The calculations were:

$$\text{aNDF (as-is basis)} = \frac{(W_3-(W_1 X C_1))}{W_2} \times 100$$

$$\text{aNDF (DM basis)} = \frac{(W_3-(W_1 X C_1))}{W_2 X DM} \times 100$$

$$\text{aNDF}_{OM} \text{ (DM basis)} = \frac{(W_4-(W_1 X C_1))}{W_2 X DM} \times 100$$

6. Acid Detergent Fibre (ADF)

The procedure of weighing the three bags was the same with Neutral Detergent Fibre but instead of ambient Neutral Detergent solution, ambient acid Detergent solution was added into the ANKOM Fibre Analyser vessel. The rest of the procedure was the same with determining the Neutral Detergent Fibre. Instead of 75 minutes in the Bag Suspender, this method only need 60 minutes. The calculations were the same with the Neutral Detergent Fibre.

Results and Discussion

Ryegrass and clover nutritive value has been observed in the laboratory. It shows difference feed content including the percent dry matter, percent ash for minerals, crude protein, ether extract (total fat), neutral detergent fibre (aNDF) and acid detergent fibre (ADF). In this, **Table 1** define difference between ryegrass and clover of the nutritive values (% Means ±SD):

Feed	DM	CP	NDF	ADF	EE	Ash
Ryegrass	93.6 ± 1.7	14.9 ± 1.7	55.8 ± 3.1	32.3 ± 3.5	2.5 ± 0.2	10.0 ± 1.5
Clover	92.1 ± 2.1	43.9 ± 3.3	44.6 ± 3.6	27.4 ± 4.9	4.7 ± 0.3	9.4 ± 1.3

Table 1: Comparative evaluation of the nutritive values (% Means ±SD) of Dried Ryegrass and Clover

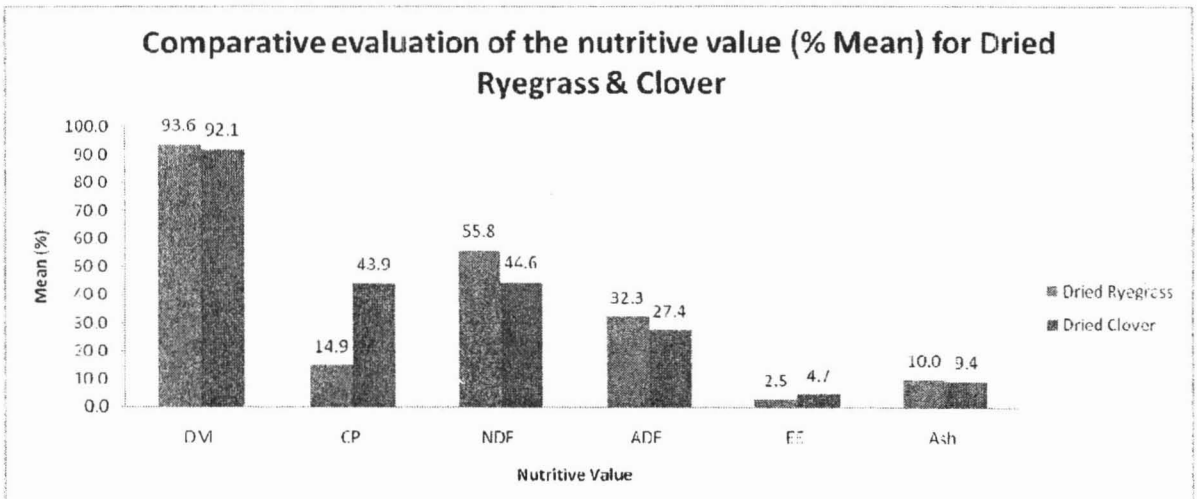

Figure 1: The graph shows the comparative nutrition in ryegrass (Feed A) and clover (Feed B)

The graph shows the comparative nutrition in dried ryegrass (Feed A) and clover (Feed B) where the percent of dry matter was almost the same and do not have any effect against each other.

Clover can increase livestock production by providing forage of high quality, increases total pasture yield and extends the seasonal distribution of pasture growth and improves soil fertility by nitrogen fixation (NSW DPI, 2008)

Based on the graph above, we can see that the dry matter percentage was almost the same between the two feeds, thus they does not play an important role in affecting the livestock intake. The main purpose of dry matter was that they provide an energy source for the ruminants, but if the levels of dry matter are too high, the excess energy is stored as fats and this increase the ruminant's body weight.

As for the percentage of crude protein, the standard requirement is about 16% (NSW DPI, 2008). In an example of housed Hereford steer eating 7kg mixed diet dry matter per day (77MJ ME) and gaining 1kg live weight per day, the dietary crude protein which is required is 101g CP/kg DM, when converted to percentage is about 10% (Standing committee on Agriculture Ruminants Subcommittee 1990, p.114). This shows that feed A which is dried ryegrass fulfilled the crude protein requirement for ruminants about 15%. The crude protein of clover is too high based on the standard requirement. Perhaps this was caused by maybe some experimental error. The protein requirements in ruminants must be carefully monitored because a high intake of protein not only increases the costs of the product but it will also be a source of energy for the ruminant.

The high NDF percentage in feed A have an impact on the dry matter intake of the ruminants. As the NDF percentage increase, dry matter intake of that particular feed decreases. However, if NDF digestibility (NDFD) which was the percentage of NDF increases in a feed, the dry matter intake will also increase (Hoffman P. & Combs D. 2004). Different form NDF, the ADF shows a negative correlation with a digestible forage or feed could happened when being fed. Thus, as ADF increases, the forage or feed becomes less digestible (North Dakota State University 2004). This was because the main component in ADF was lignin which was difficult to digest.

Next we were shown the total fats (Ether Extract) in the feed. In feed A, the amount of fat present was fulfilling the standard requirement which was about 2% to 3%. However, feed B was above standard requirement about 4.7%. Ruminants should not be given too much fat because it may damage the rumen fermentation since rumen microorganism could not tolerate with high levels of fats. Besides that, the fats could also affect the ruminants' meat tenderness.

Last not least, the ash content that shows almost the same pattern about 10% burn. Ash shows carbon content was very important for ruminants. Because it provide the total amount of minerals present within a food, whereas the *"mineral content"* was a measure of the amount of specific inorganic components present within a food, such as Ca, Na, K and Cl. According to McClements (2005) ash content helps in microbiological stability, nutrition essential for diets, processing affects on the physicochemical food properties and quality of feeds.

Conclusion

As a conclusion, feed A have a higher NDF and ADF, a good percentage of EE and CP can be given to ruminants especially growing cows. Cattles which have 400kg live weight, require about 12% of crude protein and about 77% of dry matter (McDonald *et al.* 1995). This was because protein was important in order to promote an optimum fermentation, improve rate growth, repair of tissues and many more. Feed B which has a lower NDF and ADF, high fats and crude protein was more suitable for lactating cows. Lactating cows which produce milk indicates of 38g fat and 34g protein/kg and weighing 650kg require high energy, high crude protein about 29% and moreover a good amount of dry matter (McDonald *et al.* 1995). This was because during lactation, more energy and other minerals were required for the production of milk. The type and amount of nutrients given to the lactating cows can affect the milk yield and also the quality of the milk. Thus, every producer must calculate the optimum requirement of the cows depending on their stages of growth and also their weight.

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