



Research Article

Evaluation of Nutritional Content and Physical Quality of Complete Feed Silage Using Different Forages Types

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Abstract

Background: The year-round availability and nutritional adequacy of forage for ruminants can be effectively addressed through the development of complete feed silage, as conventional forage sources often lack sufficient crude protein to meet dietary requirements. **Purpose:** The aim of the study was to determine the differences in the different types of forage used in making complete feed silage on physical quality and nutritional content. **Methods:** The research method used a completely randomized design experiment consisting of 3 treatments and 4 replications. The treatment consisted of P1: 50% concentrate + 50% odot grass, P2: 50% concentrate + 50% corn stalks and P3: 50% concentrate + 50% kolonjono grass. Parameters measured were physical quality (color, aroma, texture and presence of mushrooms) and nutritional content consisting of dry matter, organic matter, crude protein and crude fiber). Data were analyzed using ANOVA and continued with Duncan. **Results:** The results showed that complete feed silage using different forages produced good physical quality the color is yellowish green to brownish green, the aroma is slightly sour to sour, the texture is hard to slightly soft and not moldy. **Conclusion:** complete feed silage, using corn stalks produces the best crude protein, namely 14.11%.

Keywords: concentrate; forage; nutrition; silage

INTRODUCTION

Forage available around the ruminant livestock environment, it is hoped that its availability can be maintained throughout the year. Forages such as kolonjono grass, odot grass and corn stalks are very common in the ruminant livestock community, but their availability still needs to be anticipated with several treatments so that their continuity is maintained. Even though in ruminants forage is the staple food, giving forage alone to ruminants has not been able to meet their nutritional needs, considering that the need for nutrients such as crude protein (CP) in ruminants such as beef cattle is around 12%, while forage such as from the grass group averages On average, it only has a crude protein content of around 8-10%. Nutrient content is still limited in forage feed,

Feed treatment that can be done is to make complete feed, where complete feed is a mixture of forages and concentrates that contain nutrients for livestock to meet basic life needs and production without additional feed (Mide, n.d.). The treatment gave rise to some unfavorable effects, especially in terms of self-life. Complete feed made in fresh form causes a short shelf life and causes easy damage to the quality and quantity of the feed. Handling is done to overcome this by making complete feed silage. Complete feed silage is one of the most effective and efficient handling of forage feed because technically feeding livestock does not require mixing other feed ingredients, so it is easier to give to livestock. and again complete feed silage contains higher nutrients so that it can meet 70- 90% of the nutritional needs of ruminants (Allaily et al., 2011). The above description is the basis for knowing the nutritional content and physical quality of complete feed silage with different forage raw materials.

MATERIALS AND METHODS

Materials

The primary forages used in this study were *Pennisetum purpureum* cv. Mott (odot grass), corn stalks, and kolonjono grass.

1. Forage, Odot grass with a cutting age of around 50-60 days and a height of approximately 100 cm, corn stalks, and kolonjono grass around 50-60 days and a height of approximately 175 cm.
2. Concentrate source,

The concentrate is composed of rice bran, pollard, coconut cake, palm oil cake, DDGS and molasses as well as vitamins and minerals. The nutritional content of the concentrate is in Table 1.

Table 1. Concentrate Nutrition Content

Sample	Content (%)			
	DM	OM	CP	CF
Concentrate	87.66%	94.77%	18.13%	11.24%

Notes:

DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fiber

Methods

The research method used was an experiment with 3 treatments and 4 repetitions. This research applied a Completely Randomized Design (CRD) with three treatment groups and four replications for each treatment. The treatment groups were as follows:

P1 : 50% concentrate + 50% odot grass,

P2: 50% concentrate + 50% corn kernels

P3: 50% concentrate + 50% kolonjono grass

Analysis Data

All collected data were subjected to Analysis of Variance (ANOVA) to determine significant differences among treatments. When significant differences were observed, further comparison was conducted using Duncan's Multiple Range Test at a significance level of 5%.

Research Variable

The variables observed and measured in this study included physical quality consisting of color, aroma, texture and presence of mushrooms, as well as nutritional content

RESULT AND DISCUSSIONS

This study evaluated the physical quality and nutritional content of complete feed silage made from different forage sources combined with a standardized concentrate formulation. The assessment was conducted to determine how the choice of forage—odot grass, corn stalks, or kolonjono grass—affects the quality of the resulting silage. The analysis focused on two main aspects: the physical attributes of the silage, which reflect its preservation quality and acceptability for feeding, and its nutritional composition, which determines its value in meeting livestock dietary requirements. The findings are discussed below.

Silage Physical Quality

The physical quality of the silage, including color, aroma, texture, and mold presence, is presented in Table 2. The color of silage in all treatments (P1, P2, and P3) ranged from yellowish green to brownish green, indicating good silage quality (Kojo et al., 2015). Complete feed silage is made from the raw material, which is fresh forage with a green color like leaves in general, but due to the ensilage process the color changes, which is due to the respiration process which then causes the sugar content in the material to oxidize so that the temperature during the ensilage process rises, and causing discoloration to yellowish or brownish (Kojo et al., 2015).

Table 2. Average Physical Quality of Silage

Treatment	Colour	Aroma	Texstur	Presence of mushrooms
P1	3.23 ^a ± 0.79	3.64 ^a ± 0.43	2.89 ^a ± 0.44	4.70 ^a ± 0.38
P2	3.10 ^a ± 0.23	3.56 ^a ± 0.44	3.11 ^a ± 0.46	4.68 ^a ± 0.49
P3	3.45 ^a ± 0.53	4.10 ^a ± 0.47	3.65 ^b ± 0.59	4.84 ^a ± 0.48

The aroma produced in making this silage can be seen in Table 2, which shows that the aroma produced at both P1 P2 and P3 is not different. The resulting aroma is a distinctive sour aroma like a fermented product. (Yanti et al., 2022) states that the aroma of silage produced is slightly sour to sour, which is a normal aroma and is good for silage. The sour aroma produced in the finished silage product is due to the role of lactic acid bacteria which produce organic acids and what is produced is lactic acid, propionate, succinic formic and butyrate (Chesson & Wallace, 1995)

The texture of complete feed silage produced that with different forage types produced a very significant effect ($P < 0.01$). Complete feed silage with P1 and P2 treatments has a slightly soft texture, does not clump and crumbs, whereas when compared to P3 it has a hard texture but does not clump and still has a crumbly texture. When viewed as a whole, the textures produced in P1, P2 and P3 are still good. The texture of the resulting feed silage is related to the water content contained therein. Silage with a soft texture indicates that the silage contains a lot of water content and allows for the growth of fungi in the silage. In accordance with (Kojo et al., 2015) that the texture is still at a level that is considered good for silage products.

The presence of fungi in complete feed silage is shown in Table 2, that at P1, P2 and P3 it showed no fungi formed in the silage. This can be interpreted that the silage has good quality (Bahri et al., 2022). Sometimes in some situations, the presence of mushrooms in making silage is considered to be a natural thing, in small quantities and usually located in areas that are easy for air to enter and leave.

Nutritional Content

The nutritional content of complete feed silage in sequence is attached in Table 3. These results show that using different grasses in making silage has a very significant effect ($P < 0.01$) on dry matter content (DM). A high BK will prolong the shelf life of silage and silage that has a high water content will easily cause silage to become damaged or rotten. Rotten silage is caused by bacteria *Clostridium* growing (Hidayati et al., 2022) The use of different forages in the manufacture of complete feed silage has a significant effect on reducing dry matter content (DM). During the ensilage process, there is a loss of BK content and an increase in water content caused by the first stage of ensilage when the respiration process is still ongoing which causes glucose to be converted into CO_2 , H_2O and heat (Hidayat, 2014). Kolonjono grass has a tougher shape and low water content will make it more difficult to compact so that there is more oxygen available in the silo which causes the respiration process to take longer, decompose more nutrients and produces excessive heat.

Table 3. Complete Feed Silage Nutrition Content

Treatment	Nutritional Content (%)			
	DM	OM	CP	CF
P1	31.08 ± 0.56 ^a	86.59 ± 0.20 ^a	12.29 ± 0.95 ^b	24.40 ± 1.38 ^{ab}
P2	38.40 ± 3.23 ^b	89.59 ± 0.43 ^b	14.11 ± 0.86 ^b	25.67 ± 1.49 ^b
P3	34.06 ± 0.33 ^b	87.10 ± 0.57 ^{ab}	9.45 ± 0.95 ^a	22.89 ± 0.46 ^a

Notes: DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fiber

The results of the use of different forage grass in the manufacture of complete feed silage gave a very significant effect ($P < 0.01$) on organic matter content (OM). According to (Saelan & Lestari, 2021) that the OM of complete feed silage after fermentation has decreased due to a long respiration stage, where glucose will be broken down into H_2O , besides that it will also convert organic acids and gases such as CO_2 and heat. The content of OM and DM in a feed or feed ingredient, shows a value that is directly proportional.

The use of different forages in the complete feed silage had a very significant ($P < 0.01$) effect on crude protein (CP) content. (Rinca et al., 2023) stated that the fermentation process is the biological activity of lactic acid bacteria converting simple sugars into acids (especially lactic acid). The sugar component is used starting from the initial ensilage phase until the stable phase is reached which is characterized by the dominance of lactic acid bacteria and no further decrease in pH. The resulting protein remains high because it comes from the lactic acid bacteria's own protein. According to (Landupari et al., 2020), in the bacterial structure there is protein content in several parts, namely the cell wall, cell membrane and ribosomes. The proteins in the cell wall are in the form of amino acids, namely L-alanine acid, D-alanine acid and D-glutamic acid.

Different grass forages in the complete feed silage had a significant ($P < 0.05$) effect on crude fiber content (CF). This was due to the already high CF content of the P3 treatment, while the addition of the same amount of concentrate from each treatment. Lactic Acid Bacteria (BAL) produce enzymes cellulase and hemicellulase which will break down lignin bonds in forage stems (Alwi et al., 2024). In addition, the high decrease in P3 is due to the physical shape of the sugar cane shoots and the porosity of the stems is bigger and harder and the low water content makes it more difficult to compact, so that there is more oxygen available in the silo which causes the respiration process to take longer. It is hoped that this reduction in CF content will benefit the improvement in silage quality and is expected to increase the digestibility value.

CONCLUSION

This study demonstrated that complete feed silage formulated with odot grass, corn stalks, or kolonjono grass in combination with concentrate resulted in silage with favorable physical characteristics, including a yellowish to brownish-green color, slightly sour aroma, acceptable texture, and absence of mold growth. Among the treatments, the use of corn stalks (P2) produced the highest crude protein content, indicating its superior nutritional value. These findings suggest that the choice of forage significantly influences the nutritional and physical quality of complete feed silage and that corn stalks are a promising forage component for enhancing protein content in silage.

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AUTHORS' CONTRIBUTIONS

DAW, IN, and A: designed, conceptualized, supervised, analyzed data and wrote the manuscript, DAW and PA: performed the experiment, analyzed data and wrote the manuscript All authors have read and approve the final manuscript

CONFLICT OF INTEREST

The authors declare no conflict of interest in the publishing of this manuscript.

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