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Nutritional Evaluation of Corn Fodder with Hydroponic System with Different Harvest Days as a Substitute for Concentrate Food

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Abstract*. This study aims to find out the effect of harvest time done on corn fodder hydroponic system on the content analysis of ash content, moisture content, coarse protein content, coarse fat content, coarse fiber content, and optimal energy content to be given as animal feed. This study used a Complete Randomized Design (RAL) with 4 treatments and 5 replays where the treatment is P0 = Grass odot harvest age 40 days, P1 = hydroponic corn fodder harvest age 7 days, P2 = corn fodder hydroponic harvest age 9 days, P3 = corn fodder hydroponic harvest age 11 days. The observed parameters are analysis of ash content, moisture content, coarse protein content, coarse fat content, coarse fiber content, and energy content. The results showed that the analysis of the highest ash levels was P0 with an average ash content of 15.36% and differed very noticeablely against P1 with an average low ash content of 7.08%. The highest water content analysis is P3 with an average water content of 87.29% and differs greatly and differs very noticeablely against the P0 with an average water content of 80.86%. The highest rough protein content analysis was P1 with an average rough protein content of 16.04% and differed unreally against P3 with the lowest coarse protein content of 12.63%. The highest rough fat content analysis was P2 with an average rough fat content of 2.33% and differed very noticeablely against P0 with the lowest coarse fat content of 0.44%. The highest rough fiber content analysis was P0 with an average rough fiber content of 22.29% and differed very noticeablely against P0 with the lowest coarse fiber content of 9.82%. The highest energy level analysis is P0 with an average energy content of 3971 kcal and differs very noticeably against P0 with the lowest energy content of 3571 kcal.*

Keywords*: Nutrient Evaporation, Corn Fodder, Harvest Age*

INTRODUCTION

One of the important factors in the success of small-scale farmers in raising ruminant livestock in tropical countries like Indonesia is the consistent availability of feed sources that are cheap but have high nutritional value. Limited supply and fluctuations in the quantity and quality of feed sources throughout the year can hurt livestock productivity, which in turn affects the profits obtained from livestock activities (Yulistiani, 2012).

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Innovation in the world of animal husbandry involves the use of agricultural waste and fisheries waste which can be processed into complete feed and concentrate to increase livestock body weight. Although this step is appropriate, this method is not completely acceptable for small farmers because the price is expensive and unaffordable. As an alternative to concentrate feed, forage can be given by developing a hydroponic-based feed manufacturing strategy.

Hydroponics is a term for growing crops without using soil as a planting medium, but only using a mixture of essential nutrients that dissolve in water. The hydroponic system can produce forage with quality nutrition in a short time. The advantage of hydroponics is that it does not depend on the season, so it can be applied throughout the year, making it an ideal solution for breeders who have limited land. One of the plants that has been tested and developed as animal feed is corn.

Corn, as a cereal commodity, has a strategic role as the main source of carbohydrates with high Total Digestible Nutrients (TDN) and Net Energy (NE). The advantage of corn grown using a hydroponic system is that it grows quickly, allowing production in a short time. Therefore, research is needed regarding the nutritional content of corn fodder grown using a hydroponic system to produce quality and sustainable forage for livestock.

Plant age affects the decrease in protein, mineral, and soluble carbohydrate content, while the crude fiber content increases. Determining the right harvest age is very important to ensure the high production of plants with adequate nutritional value as animal feed (Koten et.al., 2012). Therefore, harvest age greatly influences the nutritional quality of hydroponic corn fodder as a substitute for concentrate feed. Proximate analysis is a method that provides estimates of nutritional value without in-depth details, developed by Henneberg and Stockman and the Weende Experiment Station in Germany in 1865 (AAK., 2003).

Based on the discourse above, the researcher wants to research how harvest time in hydroponic corn fodder affects the content. Analysis of ash content, water content, crude protein content, crude fat content, crude fiber content, and optimal energy content to be given as animal feed.

RESEARCH METHOD(S)

Place and Time of Research

This research was carried out in Kedondong Tengah Hamlet, Jentera Stabat Village, Wampu District, Langkat Regency, and Sahabat Laboratory on Jl. Gatot Subroto, Medan Sunggal District, North Sumatra Province.

Material

The equipment used in this research was a wooden shelf, tray, ladle, cloth, water tank, 100 L plastic drum, water pipe, filter, pH meter, TDS meter, parent, digital scale, ruler, and stationery. The materials used in this research were yellow corn kernels, ab-mix, bayclin, and water.

Research Methods

This research method uses a non-factorial completely randomized design (CRD) consisting of 4 treatments and 5 replications. The treatment given is as follows:

P0 = Control (Odot grass with the same harvest period)

P1 = Corn fodder with a harvest age of 7 days

P2 = Corn fodder with a harvest age of 9 days

P3 = Corn fodder with a harvest age of 11 days

Research Implementation

Planting and Watering Corn Fodder

The corn to be used is first sorted by soaking it in water for 15 minutes. The floating corn is then separated, after which the corn is sterilized using a bayclin. Next, the corn is washed again and soaked in water for 24 hours. After 24 hours the corn is removed and drained. Then spread it on a tray or shelf and cover it with a cloth. Corn is watered 3 times a day with water added to a nutrient solution. On the 2nd day, small shoots or roots begin to appear. Then watering is carried out again continuously and harvesting is carried out at the age of 7, 9, and 11 days.

Parameters Observed

The research parameters are analysis of ash content, water content, crude protein content, crude fat content, crude fiber content, and optimal energy content to be given as animal feed.

FINDINGS AND DUSCUSSION

Recapitulation of Research Results

The recapitulation of nutritional evaluation of 40-day harvested dwarf elephant grass and hydroponic system corn fodder with different harvesting ages (7 days, 9 days,

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11 days) on all parameters is presented in Table 1.

Table 1. Recapitulation of Proximate Analysis of 40-Day Harvest Age Odot Grass and Hydroponic System Corn Fodder with Different Harvest Age

Parameter	Treatment			
	P0	P1	P2	P3
Ash content analysis (%)	15.36^{A}	7.08^{B}	6.04^{B}	7.96^{B}
Moisture content analysis (%)	80.86^{C}	82.08^{BC}	84.53^{AB}	87.29^{A}
Crude protein content analysis (%)	13.18^{tn}	16.04^{tn}	14.71^{tn}	12.63^{tn}
Crude fat content analysis (%)	0.44^{B}	2.31^{A}	2.33^{A}	2.23^{A}
Crude fiber content analysis (%)	22.29^{A}	9.82^{B}	11.79^{BC}	12.52^{C}
Energy content analysis (kcal)	3572^{tn}	3971^{tn}	3959^{tn}	3924^{tn}

Note: tn (not significant).

Table 1 shows that the results of ash content analysis obtained the highest value in treatment P0 (15.36%) and the lowest value in treatment P2 (6. 04%), the highest value of moisture content analysis in P3 treatment (87.29%), and the lowest value in P0 treatment (80.86%), the highest value of crude protein content analysis in P1 treatment (16.04%) and the lowest value in P3 treatment (12.63%), the highest value of crude fat content analysis in P2 treatment (2, 33%) and the lowest value in treatment P0 (0.44%), analysis of crude fiber content the highest value in treatment P0 (22.29%) and the lowest value in treatment P1 (9.82%), analysis of energy content the highest value in treatment P1 (3971 kcal) and the lowest value in treatment P0 (3571 kcal).

Discussion

1. Ash Content Analysis

Data on the average ash content analysis of 40-day harvested dwarf elephant grass and corn fodder with different harvesting ages are presented in Table 1, the average ash content analysis in this study ranged from 6.04-15.36%. The highest ash content analysis was found in treatment P0 (40-day harvested dwarf elephant grass) which was 15.36% and the lowest was found in treatment P2 (9-day harvested corn fodder) which was 6.04%.

The results of the BJND test on ash content analysis in Appendix 1 show that the production of ash content of 40-day harvested dwarf elephant grass has a very significant effect on hydroponic system corn fodder with a harvest age of 7, 9, and 11 days. This is because the nutrients contained in corn fodder are higher than the nutrients of dwarf elephant grass. Zheo *et al*. (2009), states that the mineral or ash content is the result of burning organic material, organic material in the combustion process will burn but the

inorganic components will not, that's why it is referred to as ash content. The determination of ash content is used for various purposes, including to determine whether or not the feed ingredients used are good, and as a determinant of the nutritional value of a feed ingredient.

2. Moisture Content Analysis

Data on the average water content analysis of 40-day harvested dwarf elephant grass and corn fodder with different harvest ages are presented in Table 1. The average water content analysis in this study ranged from 80.86-87.29%. The highest water content analysis was found in the P3 treatment (corn fodder harvest age of 11 days), which was 87.29% and the lowest was found in the P3 treatment. 87.29% and the lowest was found in the P0 treatment (40-day harvest grass) which was 80.86%.

The results of the analysis of variance show that the average analysis of moisture content is significantly different ($P < 0.01$), meaning that 40-day harvest age dwarf elephant grass and different harvest age corn fodder affect moisture content.

The production of water content in Table 1 shows the water content of 40-day harvest age dwarf elephant grass and hydroponic system corn fodder with different harvest ages tends to be higher in the P3 treatment (11-day harvest age corn fodder) which is 87.29% and the lowest is in the P0 treatment (40-day harvest age dwarf elephant grass) which is 80.86. Based on research conducted by Amung Logam Saputro (2018), the water content of corn fodder was 88.99%. Based on these two studies, it can be concluded that the comparison between the two is not much different. Ella (2002) stated that young harvested forages have high protein content and water content but low fiber content. This is because corn fodder at the harvest age of 7, 9, and 11 days is still sprouting, and corn fodder still gets food or nutrients from food reserves stored in corn kernels.

3. Analysis of Crude Protein Content

Data on the average crude protein content is presented in Table 1. The average crude protein content analysis in this study ranged from 12.63-16.04%. The highest crude protein production was in the P1 treatment (corn fodder harvest age of 7 days) with a value of 16.04% and the lowest crude protein content was in the P3 treatment. with a value of 16.04% and the lowest crude protein content was found in the treatment P3 (corn fodder harvest age of 11 days) with a value of 12.63%.

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The results of the analysis of variance contained show that the crude protein of 40-day harvested dwarf elephant grass and hydroponic system corn fodder with different harvest ages has no significantly different effect (P>0.05). This is because the difference between the mean crude protein of each treatment is not much different. Analysis of crude protein content with the highest average in treatment P1 (corn fodder harvest age 7 days) 16.04% and the lowest in treatment P3 (corn fodder harvest age 11 days) 12.63%. This is due to the crude protein contained in corn fodder at harvest age 7 days not being utilized at all for growth. This is the opinion of Arifin (2003) which states that corn plants, especially young plants, have higher protein production.

4. Analysis of Crude Fat Content

Based on the results of the study, the crude fat production of 40-day harvested dwarf elephant grass and hydroponic system corn fodder of different harvest ages in Table 7 shows that the average crude fat ranges from 0.44-2.33%. The highest crude fat production was in the P2 treatment (corn fodder harvest age 9 days) with a value of 2.33% and the lowest fat content was in the P0 treatment (dwarf elephant grass harvest age 40 days) with a value of 0.44%.

The results of the analysis of variance contained show that the crude fat of 40-day harvested dwarf elephant grass and hydroponic system corn fodder of different harvest ages has a very significant effect (P <0.01), meaning that 40-day harvested dwarf elephant grass and hydroponic system corn fodder have a very significant effect (P <0.01). harvest age of 40 days and corn fodder of different harvest ages have a very significant effect on crude fat content.

The production of crude fat content in Table 1 shows that 40-day-old dwarf elephant grass and hydroponic system corn fodder with different harvest ages tend to be higher in the P2 treatment (9-day-old corn fodder) with a value of 2.33% and the lowest in the P0 treatment (40-day-old dwarf elephant grass) with a value of 0.44. The peak of fatty acid hydrolysis for growth needs is thought to occur at 9 days of harvest. According to Geonadi and Sudharama (2005), the absorption of nutrients such as carbohydrates, lipids, and proteins in young plants occurs in the age range of 8 days to 11 days.

5. Crude Fibre Content Analysis

Based on the results of the study, the results of crude fiber content are presented

in Table 1, the average analysis of crude fiber content in this study ranged from 9.82-to 22.29%. The highest analysis of crude fiber content was found in treatment P0 (40-day harvested dwarf elephant grass) which was 22.92% and the lowest was found in treatment P1 (7-day harvested fodder jagug) which was 9.82%.

The results of the analysis of variance show that the crude fibre of 40-day harvested dwarf elephant grass and corn fodder hydroponic system with different harvest ages had a very significant effect ($P < 0.01$), meaning that 40-day harvested dwarf elephant grass and corn fodder of different harvest ages had a very significant effect on crude fibre content. Analysis of crude fibre content with the highest average in treatment P0 (40-day harvest age dwarf elephant grass) 22.92% and the lowest in treatment P1 (7-day harvest age corn fodder) 9.82%. This is due to because the harvesting of dwarf elephant grass is longer than corn fodder. The difference in harvesting age of plants affects the crude fibre content of plants due to the increase in dry matter which also contributes to the crude fibre content of plants. The longer the harvest age of the plant, the higher the crude fibre content, on the contrary, too early or harvested at a short age, the forage will always be in a young state so that the protein content and moisture content are high but the fibre content is low (Widayanti, 2008).

The crude fibre content contained in hydroponic maize based on the results of proximate analysis shows the results of 7-day harvest age maize fodder is lower in crude fibre compared to 11-day harvest age maize fodder. Suryono (2016) stated that when compared to the crude fibre of 3-month corn plants, hydroponic corn contains lower crude fibre because the older the age of the plant, the higher the crude fibre content and the lower the crude protein content. Young harvested forage has high protein and moisture content but low fibre content (Ella, 2002).

Hermayati *et al.* (2006) stated that the components of crude fibre have no nutritional value but fibre is very important for the process of facilitating digestion in the body so that the digestive process is smooth.

6. Energy Content Analysis

Based on the results of the study, the production of energy content in Table 1 shows that the average energy content analysis in this study ranged from 3572-3971 kcal. The highest energy production was in the P1 treatment (corn fodder harvest age 7 days) which was 3971 kcal and the lowest was in the P0 treatment (dwarf elephant grass

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harvest age 40 days) which was 3572 kcal.

The results of the analysis of variance show that 40-day harvest age dwarf elephant grass and hydroponic system corn fodder with different harvest ages has no significant effect on energy content (P>0.05). This is because the difference between the mean energy content of each treatment is not much different. Analysis of energy content with the highest average in treatment P1 (3971 kcal) and the lowest in treatment P0 (3572 kcal). Sutardi (2012) states that Total Digestible Nutrient (TDN) is the total energy of food substances in livestock that is equal to energy and carbohydrates and can be obtained by biological tests or calculations using data from proximate analysis. TDN is used to measure the energy content of food ingredients TDN levels of food ingredients are generally inversely related to their crude fibre content. TDN will increase if ash, PK, and LK increase, while TDN will decrease if SK increases. Based on this, PK is positively correlated with TDN if PK increases then TDN will increase (Owens et al., 2010).

CONCLUSION AND RECOMMENDATION

Conclusion

1. The harvesting age of hydroponic system corn fodder has a very significant effect on ash content, crude fat, crude fibre, moisture content.
2. Hydroponic system corn fodder with longer harvest age produces lower protein content and higher crude fibre content.
3. The nutritional quality of hydroponic system corn fodder with different harvest ages as a substitute for concentrate feed is best found in treatment P1 (corn fodder harvest age 7 days) with a value of PK 16.04%, SK 9.82%, LK 2.31%, WATER 82.08%, ABU 7.08%, ENERGY 3971 kcal.

Recommendation

It is necessary to socialize to the community that hydroponic corn fodder can be used as a substitute for concentrate feed because the nutritional content is good and the harvest period is short.

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