International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

The Effect of Corn Flour on Crude Fiber Content and Physical Quality of Cogongrass (Imperata cylindrica) Silage

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Abstract— *This study aimed to determine and examine the effect of corn flour on crude fiber content and physical quality of cogongrass silage. This research consisted of two stages, the first being the fermentation of cogongrass (Imperata cylindrica) with the addition of corn flour, conducted on March 21 to April 17, 2023, at the UPT Teaching Farm of Mercu Buana Yogyakarta University. The second stage, was carried out on May 15 to June 5, 2023, involved the analysis of crude fiber content at the Laboratory of the Quality Testing and Feed Certification Center in Bekasi, West Java. This study used a Completely Randomized Design (CRD) in a one-way pattern consisting of 4 treatments and 3 replication. This research treatments used corn flour P0 (0%); P1 (5%); P2 (10%); and P3 (15%). The variables observed were aroma, color, mold, texture, pH and crude fiber. The data obtained were analyzed using analysis of variance (ANOVA), and in case of differences, Duncan's new multiple range test (DMRT) was performed. The results of the variance analysis showed that cogongrass silage with the addition of different corn flour levels had a significant effect (P<0.05) on pH, aroma, mold, color and crude fiber, but did not have a significant effect (P>0.05) on texture. Based on the results of the study, it can be concluded that the addition of corn flour at the 5% level can already reduce crude fiber and produce the best physical quality of cogongrass silage*.

Keywords— *Cogongrass silage, physical quality, crude fiber, corn flour*.

I. Introduction

Feed is everything that can be consumed by livestock as a source of energy and nutrients, provided it does not have negative effects on livestock. Providing feed for livestock is a crucial element in the process of growth, production and survival of the livestock (Nuriyana et al., 2020).

During the dry season, farmers struggle to find forage, so the livestock are only given whatever feed that is easily available in their surroundings. Then, when the rainy season arrives, the availability of livestock forage is so abundant that it can exceed the needs of livestock. This situation triggers the emergence of ways to preserve fresh forage feed so that it can last longer and its nutritional value does not decrease significantly, one of the methods that can be applied is by utilizing silage technology (Herlinae et al., 2015). Silage is the process of preserving forage feed ingredients by fermentation in anaerobic conditions. Lactic acid-producing bacteria can work optimally if anaerobic conditions are achieved in silage (Aglazziyah et al., 2020). The use of silo technology is one of the solutions to eliminate the availability of food during the dry season and additional food during the rainy season.

Cogongrass or *Imperata cylindrica* is a perennial grass that grows almost all over the world and is considered a weed plant on agricultural land (Hendrawan et al., 2019). Although its presence is not desired by farmers, young cogongrass can still be utilized as feed for ruminant livestock as an additional forage feed. However, the level of preference among livestock for cogongrass is very low (Mudita & Wirapartha, 2007). Due to the high production of cogongrass, special efforts are needed to increase its palatability in livestock. one of the efforts that can be made is the utilization of silage technology.

according to Kojo et al. (2015) the use of additives in silage making is often used to improve or maintain silage quality. corn flour can be used as a source of soluble carbohydrates in silage production. The use of corn flour is very beneficial because of its easy availability and low price value. the addition of corn flour is expected to improve the physical quality of cogongrass silage as well as the level of palatability for livestock.

II. Research Materials And Methods

Place and Time of Research

This research consisted of two stages, the first of which took place from March 21 to April 17, 2023, involving the fermentation of cogongrass (Imperata cylindrica) with the addition of corn flour, conducted at the UPT Teaching Farm, University of Mercu Buana Yogyakarta. The second stage was from May 15 until June 5, 2023, the analysis of crude fiber content was carried out at the Laboratory of the Quality Testing and Feed Certification Center in Bekasi, West Java.

Tools and Materials

The main material used in this research was 12 kg of cogongrass (*Imperata cylindrica*) sourced from Gunung bulu, Argorejo, Sedayu, Bantul, Yogyakarta. Other materials include wheat flour, EM4, molasses, water, wastewater and sewage sludge.

The tools used in this research were machetes, pH meters, 5-liter jars, 5-kg plastic bags, trash bags, 250 ml beaker glass, measuring cups, SF-400 digital scales, raffia ropes, scissors, duct tape, a set of laboratory equipment for proximate analysis (Erlenmeyer flask, furnace, oven, funnel, filter paper,

Nur Rasminati, Dhika Dwi Wangsa, Ajat Sudrajat, Setyo Utomo, "The Effect of Corn Flour on Crude Fiber Content and Physical Quality of Cogongrass (Imperata cylindrica) Silage," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 4, pp. 145-148, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

desiccator) cabinet dryer, mesh sieve, universal mill and stationery.

Research Design

The research was designed using a Completely Randomized Design (CRD) in a one-way pattern consisting of 4 treatments.
P0 = Cogongrass (1000 g) + Molases (6 g) + EM 4 (6 g) + Water (150.33 ml)
P1 = Cogongrass (1000 g) + Molases (6 g) + EM 4 (6 g) + Water (179.29 ml) + Corn flour (50 g)
P2 = Cogongrass (1000 g) + Molases (6 g) + EM 4 (6 g) + Water (208.25 ml) + Corn flour (10 g)
P3 = Cogongrass (1000 g) + Molases (6 g) + EM 4 (6 g) + Water (237.21 ml) + Corn flour (150 g)

Research Methodology

The cogongrass used were chopped approximately 2-5 cm. The cogongrass were then weathered for 8-12 hours. Then each replicate consisted of 1000 g cogongrass, 0.6% molasses, 0.6% EM4 and added corn flour at different levels in each treatment, namely 0%, 5%, 10% and 15%. All ingredients in each treatment were mixed evenly and put into the silo. During the process of placing into the silo, it must be pressed as hard as possible so that there is no space left for oxygen. The silo used for fermentation was a 3-kg plastic bag (doubled) placed inside a jar. The jar was tightly closed and secured with additional duct tape, then stored for 21 days.

Variables Observed

The variables observed were crude fiber content and physical quality of silage, which includes pH, aroma, mold, texture and color.

Data Analysis

The data obtained were analyzed using analysis of variance with a completely randomized design (CRD) in a one-way pattern, and if differences were found, further test was carried out with Duncan's new multiple range test (Dmrt) (Astuti, 2007).

III. Results and Discussion

pH

pH is the degree of acidity or basicity of a solution which is one of the parameters to determine the physical quality of cogongrass silage. The data results of the average pH value of cogongrass silage with the addition of corn flour can be seen in Table 1.

Table 1. Average pH value of cogongrass silage (%) at various levels of corn flour addition

Corn flour treatment (%)	Replicate (%) I	II	III	Means*
P0 (0)	4.3	5.3	4.5	4.70[b]
P1 (5)	3.7	3.3	4.1	3.70[a]
P2 (10)	3.8	3.2	3.3	3.43[a]
P3 (15)	3.4	3.0	3.3	3.23[a]

Note : * Means in the same column with different superscripts differ significantly (P<0,05).

The results of the variance analysis showed that the average pH value of cogongrass silage with the addition of corn flour had a significant difference ($P < 0.05$), compared to the pH value of cogongrass silage. The results of the Duncan's Multiple Range Test (DMRT) indicated that the P0 treatment had a significant difference compared to treatments P1, P2 and P3 ($P<0.05$), while the P1 treatment had a difference that was not significant with the P2 and P3 treatments. According to Aglazziyah et al. (2020), silage quality based on pH value is divided into four categories, namely very good (pH 3.2 - 4.2), good (pH 4.2 - 4.5), medium (pH 4.5 - 4.8) and poor (pH > 4.8).

P0 had a significant difference ($P<0.05$) with P1, P2, and P3 because P0 served as the control without the addition of corn flour resulting in the rapid development of spoilage bacteria and the absence of bacteria that produce lactic acid. As a result, the bacteria (Lactobacillus sp) that work to produce lactic acid become less optimal, causing the silage to be less acidic. The acidity level of silage is very important as an indicator of the success of silage making. Acidic conditions can prevent forage from rotting due to decomposing microbes (Artadiasta, 2019). The treatments P1, P2 and P3 showed no significant differences ($P>0.05$) due to Lactic acid bacteria (LAB) produce the same amount of lactic acid. The addition of microorganism starter (EM4) and molasses in all treatments with the same level and duration of fermentation can yield lactic acid in equal quantity. According to Budi (2022), silage treated with the same amount of microorganism starter (EM4) can produce the same amount of lactic acid to degrade dry matter.

Aroma

Aroma is one of the parameters for determining the physical quality of beetroot cheese. Good silage is characterized by a sour but fresh and pleasant taste as well as aroma. The average data on the aroma value of cogongrass silage can be seen in Table 2.

Table 2. Average aroma value of cogongrass silage (%) at various levels of corn flour addition

Corn flour treatment (%)	Replicate (%) I	II	III	Means*
P0 (0)	2.9	2.6	2.7	2.73[c]
P1 (5)	2.2	1.9	1.8	1.96[b]
P2 (10)	1.9	1.7	1.6	1.73[ab]
P3 (15)	1.4	1.6	1.2	1.40[a]

Notes: * Means in the same column with different superscripts differ significantly (P<0,05).

The results of the variance analysis of variance showed that the average aroma value of cogongrass silage with the addition of corn flour had a significant difference ($P < 0.05$). Based on the results of Duncan's Multiple Range Test (DMRT), it showed that P0 had a significant difference ($P<0.05$) with P1, P2 and P3, but P1 had no significant difference ($P>0.05$) with P2 and P3.

The P0 treatment is significantly different from P1, P2, and P3 due to the absence of additives in the form of corn flour, because additives act as a source of nutrients to supply lactic acid bacteria that produce lactic acid, enzymes, or microbes that can enhance the availability of carbohydrates or nutrients needed by lactic acid-forming bacteria.

P1 is not significantly different from P2 and P3 because the addition of corn flour at the 5% level is sufficient as a source of carbohydrates that serves as an energy source for bacteria. The sufficiency of energy sources will accelerate the formation of lactic acid and lower the silage pH. The low pH of silage can produce a good-quality aroma of cogongrass silage, which is sour in scent. In general, good silage is characterized by a fresh and pleasant sour taste and aroma (Larangahen et al., 2017).

Mold

Mold is one of the parameters to determine the physical quality of cogongrass silage. The presence of mold such as Clostridium, Enterobacteriaceae, yeast and mold can lead to significant damage to silage. The results of the data on the average value of cogongrass silage mold can be seen in Table 3.

Table 3. Average mold value of cogongrass silage (%) at various levels of corn starch addition

Corn flour treatment (%)	Replicate (%)			Means*
	I	II	III	
P0 (0)	2.9	2.5	2.8	2.73^{b}
P1 (5)	2.7	2.5	2.6	2.60^{b}
P2 (10)	2.2	2.4	2.2	2.26^{a}
P3 (15)	2.2	1.8	2.1	2.03^{a}

Notes: *Means in the same column with different superscripts differ significantly (P<0,05).

Data from the analysis of variance showed that the mean value of cogongrass silage mold with the addition of corn flour had a significant difference (P < 0.05) on the presence of cogongrass silage mold. The average pH value in this study was 2.03 - 2.73 indicating that the presence of cogongrass silage mold was small. Based on the results of Duncan's Multiple Range Test (DMRT), it showed that P0 had a significant difference with P2 and P3 (P<0.05) but P0 had no significant difference with P1 (P>0.05). In addition, P2 had no significant difference with P3 (P>0.05).

In P0, there was no significant difference from P1 because the addition of corn flour at a 5% level did not meet the needs of active bacteria working to produce lactic acid, resulting in the presence of mold in cogon grass silage. P0 had a significant difference with P2 and P3 because P0 serves as a control without the addition of corn flour, which leads to a decrease in the availability of soluble carbohydrates as an energy source for the bacteria. The small amount of lactic acid produced in the fermentation process is caused by non-optimal bacterial activity, so that the silage in the silo becomes less acidic. This situation causes the presence of the mold in cogongrass silage (Darjianto, 2021).

Texture

Texture is one of the parameters to determine the physical quality of cogongrass silage. The average texture value of cogongrass silage can be seen in detail in Table 4.

Table 4. Average texture value of cogongrass silage (%) at various levels of corn flour addition

Corn flour treatment (%)	Replicate (%)			$Means^{ns}$
	I	II	III	
P0 (0)	1.4	1.6	1.2	1.40
P1 (5)	1.3	1.5	1.2	1.33
P2 (10)	1.5	1.1	1.3	1.30
P3 (15)	1.1	1.3	1.0	1.13

Note : ns : Not significant (P>0,05).

The results of the variance analysis showed that the average texture value of cogongrass silage with the addition of corn flour had no significant difference (P>0.05) compared to the texture of cogongrass silage, indicating that the texture value of cogongrass silage was not clumpy and not slimy.

P0, P1, P2 and P3 had no significant difference (P>0.05) due to the similarity of the percentage of substrates in the form of molasses and EM4 at the level of 0.6% added to all treatments. According to Rahayu (2017,) the addition of substrates with the same percentage amount in all treatments in silage production can result in a similar silage texture. Najmah (2022) stated that a good silage texture is one that is not lumpy and not slimy. The reason of the silage texture is not clumpy and not slimy is due to the abundance of soluble carbohydrates available during the fermentation process which leads to a decrease in pH and inhibits mold growth.

Color

Color is one of the parameters to determine the physical quality of cogongrass silage. The complete average data of the color values of cogongrass silage can be seen in Table 5.

Table 5. Average color value of cogongrass silage (%) at various levels of corn flour addition

Corn flour treatment (%)	Replicate (%)			Means*
	I	II	III	
P0 (0)	3.2	3.2	3.1	3.16^{d}
P1 (5)	2.6	2.4	2.3	2.43^{c}
P2 (10)	2.3	2.0	2.1	2.13^{b}
P3 (15)	1.8	1.6	1.7	1.70^{a}

Notes: *Means in the same column with different superscripts differ significantly (P<0,05).

Data from the variance analysis indicated that the average color value of cogongrass silage with the addition of corn flour had a significant difference (P < 0.05). Based on the results of Duncan's Multiple Range Test (DMRT), it showed that P0, P1, P2 and P3 had significant differences (P<0.05). The average color values are as follow: P0: 3.16 indicates that the silage color is brown, P1: 2.43, P2: 2.13 indicates that the color of silage is brownish-yellow and P3: 1.70 indicates that the color of cogongrass silage is yellowish-green.

In P0, there was a significant difference compared to P1, P2, and P3 because P0 served as the control without the addition of corn flour, resulting in a lower quality cogongrass silage color, which is brown. This is due to the lack of sufficient food sources or energy for microbes, so that the fermentation process is not optimal. In accordance with the statement of Kurniawan et al. (2015, silage that deviates from its original color is considered to be of low quality.

In P1, P2 and P3, there were significant difference compared to P0, as this is due to the presence of corn flour as a source of soluble carbohydrates which functions to produce lactic acid bacteria that show an optimal oxidation process and generate temperatures that are not excessive during the ensilage process. As a result, the silage produced has a good color, namely brownish-yellow and yellowish-green, which is close to the original color of the cogongrass. According to Aglazziyah et al. (2020), that high-quality silage produces a green color similar to its original material or yellowish-green.

Crude Fiber

Crude fiber is a compound that cannot be hydrolyzed by alkali or acid. Most of the crude fiber in feed cannot be digested by non-ruminants but is widely used in ruminant livestock. The results of the average crude fiber content of cogongrass silage can be seen in Table 6.

Table 6. Average crude fiber content of cogongrass silage (%) at various levels of corn flour addition

Corn flour treatment (%)	Replicate (%)			Means*
	I	II	III	
P0 (0)	33.31	35.31	36.71	35.11[b]
P1 (5)	32.11	31.29	32.65	32.01[a]
P2 (10)	33.09	29.71	30.87	31.22[a]
P3 (15)	29.31	29.49	32.15	30.31[a]

Notes: *Means in the same column with different superscripts differ significantly (P<0,05).

The results of the variance analysis showed that the average value of crude fiber content of cogongrass silage with the addition of corn flour had a significant difference (P <0.05). Based on the results of the Duncan's Multiple Range Test (DMRT), it showed that the average crude fiber content of cogongrass silage (*Imperata cylindrica*) at P0 had a significant difference compared to P1, P2 and P3. Furthermore, P1, P2 and P3 showed no significant difference (P>0.05).

P0 had a significant difference compared to P1, P2 and P3 (P<0.05) because P0 is the control without the addition of corn flour. The absence of soluble carbohydrates in this treatment results in a lack of energy sources for microbes, which prevents the enzymes produced by the microbes from increasing and breaking down cellulose and hemicellulose. According to Pendi (2021) cellulose and hemicellulose can be broken down into simpler components if there is sufficient energy source for the microbial bacteria that produce enzymes, thereby reducing the crude fiber in silage.

P1, P2 And P3 had a significant difference form P0 due to the addition of corn flour as an energy source for microbes that play a role in decomposition during the fermentation process. according to riswandi (2014), silage given soluble carbohydrates can increase the availability of energy sources for microbes, thereby enhancing the population as well as the activity of cellulose and hemicellulose degrading microbes. during the fermentation process, the microorganisms involved will break down cellulose and hemicellulose into simpler components. thus, in the end, it can enhance the palatability of livestock, and the silage produced will be easier to digest.

IV. CONCLUSIONS

The use of corn flour at the 5% level can already affect the ph, aroma, mold, color and reduce the crude fiber value of silage, but it does not affect the texture of Cogongrass (Imperata Cylindrica) Silage.

V. SUGGESTIONS

The use of corn flour at the level of 5% is more economically efficient. in addition, further research is needed to determine the chemical quality of cogongrass (Imperata Cylindrica) Silage.

REFERENCES

[1]. Aglazziyah, H., Ayuningsih, B., & Khairani, L. 2020. Pengaruh Penggunaan Dedak Fermentasi Terhadap Kualitas Fisik dan pH Silase Rumput Gajah (Pennisetum Purpureum) The Effect of Fermented Bran on the Physical Quality and pH Of The Elephant Grass (Pennisetum Purpureum) Silage. *Jurnal Nutrisi Ternak Tropis Dan Ilmu Pakan*, *2*(3), 156–166.
[2]. Artadiasta, C. 2019. Pengaruh Macam Inokulum terhadap Karakteristik Fisik dan Fraksi Serat Silase Eceng Gondong (*Eichhornia crassipes*). *Skripsi*. Fakultas Agroindustri. Universitas Mercu Buana Yogyakarta. Yogyakarta.
[3]. Budi, S. A. 2022. Kualitas Fisik Silase Daun Ubi Kayu (*Manihot esculenta*) Yang Di Beri Dedak Padi Dengan Dosis Yang Berbeda. *Skripsi*. Fakultasi Agroindustri. Universitas Mercu Buana Yogyakarta. Yogyakarta.
[4]. Darjianto, A. 2021. Kualitas Fisik Silase Alang-alang (*Imperata cylindrica*) Dengan Berbagai Konsentrasi Akselerator Dedak Padi. *Skripsi*. Fakultas Agroindustri. Universitas Mercu Buana Yogyakarta. Yogyakarta.
[5]. Hendrawan, Y., Yosua, Y., & Ulfa, S. M. 2019. Pengolahan Alang-Alang (*Imperata cylindrica*) Sebagai Bahan Baku Furfural Melalui Pretreatment Pemanasan
[6]. Resistive. *Jurnal Teknotan*, *12*(2), 23. https://doi.org/10.24198/jt.vol12n2.1
[7]. Herlinae, Yemima, & Rumiasih. 2015. Pengaruh Aditif EM4 dan Gula Merah Terhadap Karakteristik Silase Rumput Gajah (Pennisetum purpureum). *Jurnal Ilmu Hewani Tropika*, *4*(1), 27–30.
[8]. Kojo, R. M., Rustandi, Y. R. L. Tulung dan S. S. Malalantang. 2015. Pengaruh Penambahan Dedak Padi dan Tepung Jagung terhadap Kualitas Fisik Silase Rumput Gajah (*Pennisetum purpureum* Cv. Hawaii). *Jurnal Zootek*. 35 (1): 21-29.
[9]. Kurniawan, D., Erwanto dan F. Farida. 2015. Pengaruh Penambahan Berbagai Starter pada Pembuatan Silase terhadap Kualitas Fisik dan pH Silase Ransum Berbasis Limbah Pertanian. *Jurnal Ilmiah Peternakan Terpadu*. 3(4) : 191-195.
[10]. Larangahen, A., Bagau, B., Imbar, M. R., & Liwe, H. 2016. Pengaruh Penambahan Molases Terhadap Kualitas Fisik Dan Kimia Silase Kulit Pisang Sepatu (Mussa paradisiaca formatypica). *Zootec*, *37*(1), 156. https://doi.org/10.35792/zot.37.1.2017.14419
[11]. Mudita, I. M. dan Wirapartha, M. 2007. Pemanfaatan Berbagai Kultur Mikroorganisme Untuk Meningkatkan Nilai Organoleptik dan Komposisi Kimia Silase Rumput Alang-alang (*Imperata cylindrica*). *Laporan Peneltian*. Fakultas Peternakan Universitas Udayana. Bali.
[12]. Nuriyana, Andayaningsih, S., & Marhumi, S. 2020. Model Pengendalian Persediaan Pakan Usaha Ternak Ayam Broiler. *Jurnal Mirai Management*, *5*(1), 2597–4084.
[13]. Pendi, F. 2021. Pengaruh Penambahan Tepung Jagung Terhadap Kualitas Kimia Silase Rumput Setaria (*Setaria sphacelata*). *Skripsi*. Fakultas Agroindustri. Universitas Mercu Buana Yogyakarta. Yogyakarta.
[14]. Riswandi. 2014. Kualitas Silase Eceng Gondok (Eichornia crassipers) dengan Penambahan Dedak Halus dan Ubi Kayu. *Jurnal Peternakan Sriwijaya*. *3*(1), 1–6.