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EFFECT OF CORN FLOUR ADDITION ON THE PHYSICAL AND CHEMICAL QUALITY OF *WEDELIA TRILOBATA* (L) HITCHC WEED SILAGE FOR RUMINANT LIVESTOCK FEED

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Abstract

Research on the physical and chemical quality of weed silage with the addition of corn flour has been carried out. The research was carried out on November 30, 2024 – February 25, 2025 at the Animal Nutrition Laboratory of the Animal Husbandry Study Program, Mercu Buana Yogyakarta University and the Chem-Mix Bantul laboratory, Yogyakarta. The study used an experimental method with a complete random design (RAL) in a unidirectional pattern using 4 treatments, namely P0 (no treatment), P1 (1% corn flour), P2 (3% corn flour) and P3 (5% corn flour), then each treatment was replicated three times. In each treatment, molasses was added 0.6%, and EM4 1%. The observed variables including the physical quality of silage, namely aroma, color, mold presence, texture and pH, while the chemical quality included moisture content, crude protein content and crude fiber content. The data obtained was tabulated and analyzed by variance analysis, if there were differences, further tests were carried out with Duncan's New Multiple Range Test (DMRT). The results of the variance analysis showed no significant difference (P>0.05) in the variables of Aroma, pH, and mold presence, but indicated significant effect in the color and texture variables (P<0.05). The average moisture content of the silage in this study was P0: 54.53%; P1: 57.35%; P2: 55.79%; and P3: 55.42%, crude protein content P0: 10.27%; P1: 11.00%; P2: 9.58%; and P3: 10.05%, crude fiber content P0: 34.51%; P1: 33.69%; P2: 34.78%; and P3: 36.58%. The results of the variance analysis showed no significant difference (P>0.05) in all treatments. It can be concluded that the addition of corn flour to weed silage affects the quality of Color, and Texture, but does not affect the Aroma, Mold, pH and chemical quality. The use of 1% corn flour produced the best quality of silage.

Keywords: Silage, Wedelia Weed, Physical Quality, Chemical Quality, Ruminant

PENGARUH PENAMBAHAN TEPUNG JAGUNG TERHADAP KUALITAS FISIK DAN KIMIA SILASE GULMA WEDELIA TRILOBATA (L) HITCH UNTUK PAKAN TERNAK RUMINANSIA

Abstrak

Penelitian ini dilakukan untuk mengetahui mutu fisik dan kimia silase gulma dengan penambahan tepung jagung. Penelitian ini telah dilaksanakan pada tanggal 30 November 2024 – 25 Februari 2025 di Laboratorium Nutrisi Ternak Program Studi Peternakan Universitas Mercu Buana Yogyakarta dan laboratorium Chem-Mix Bantul Yogyakarta. Penelitian menggunakan metode eksperimen dengan rancangan acak lengkap (RAL) pola searah dengan menggunakan 4 perlakuan yaitu P0 (tanpa perlakuan), P1 (tepung jagung 1%), P2 (tepung jagung 3%) dan P3 (tepung jagung 5%), kemudian masing-masing perlakuan diulang sebanyak tiga kali. Pada masing-masing perlakuan ditambahkan molases 0,6% dan EM4 1%. Peubah yang diamati meliputi mutu fisik silase yaitu aroma, warna, keberadaan kapang, tekstur dan pH sedangkan mutu kimia meliputi kadar air, kadar protein kasar dan kadar serat kasar. Data yang diperoleh ditabulasi dan dianalisis dengan analisis varians, jika ada perbedaan, tes lebih lanjut dilakukan dengan Duncan's New Multiple Range Test (DMRT). Hasil analisis varians menunjukkan tidak ada perbedaan yang nyata (P> 0,05) pada variabel Aroma, pH, dan keberadaan jamur, tetapi menunjukkan pengaruh yang nyata pada variabel warna dan tekstur (P < 0,05). Rata-rata kadar air silase dalam penelitian ini adalah P0: 54,53%; P1: 57,35%; P2: 55,79%; dan P3: 55,42%, kadar protein kasar P0: 10,27%; P1: 11,00%; P2: 9,58%; dan P3: 10,05%, kadar serat kasar P0: 34,51%; P1: 33,69%; P2: 34,78%; dan P3: 36,58%. Hasil analisis varians menunjukkan tidak ada perbedaan yang nyata (P>0,05) pada semua perlakuan. Dapat disimpulkan bahwa penambahan tepung jagung pada silase gulma berpengaruh terhadap kualitas Warna, Tekstur, namun tidak berpengaruh terhadap Aroma, Kapang, pH dan Kualitas Kimia. Penggunaan tepung jagung 1% menghasilkan kualitas silase terbaik.

Kata Kunci: Silase, Gulma Wedelia, Kualitas Fisik, Kualitas Kimia, Ruminansia

INTRODUCTION

Feed is one of the important components in the livestock industry. Forage is needed to support the production of ruminant livestock such as dairy cows, beef cattle, buffaloes, goats, and sheep. The availability of animal feed forage is a problem for many farmers in Indonesia, especially during the dry season. During the dry season, farmers have difficulty in getting forage feed, so farmers only provide

makeshift feed obtained from the surrounding environment. However, makeshift feeding can also affect livestock productivity. Meanwhile, in the rainy season, as the rainfall is high, the availability of forage will be very abundant, so that it exceeds the needs of livestock.

The forage available can be in the form of grasses that come from grazing fields, moors, plantations, riversides, or roadsides. In addition, it can also be used to use plants that interfere with agriculture or plantations that have the potential to be used as ruminant livestock feed and are still little known for their benefits by the community, namely weeds.

Weeds are unwanted plants in crop production, and their existence is detrimental to farmers. Weeds grow in dormant land, coastal areas, riverbanks, agricultural areas, forestry, and plantations. Weeds are actually already used as animal feed, and one of them is *Wedelia trilobata* (L.) Hitchc Weed *Wedelia trilobata* (L.) Hitchc is native to the Americas and belongs to the plant species of the family Asteraceae (Isa, 2012). These plants cause damage to the ecosystem and can reduce native plant biodiversity (Hidayat, 2014). When compared to other forage feeds such as field grass, Wedelia weed production is almost the same, having an average production of 1.88/kg/m^2, so Wedelia weeds have good potential to be used as an alternative forage feed (Sudrajat *et al*., 2024).

Research that has been conducted has studied the use of weeds for urban parks, herbal medicines, organic fertilizers and as a source of ruminant animal feed which has a crude fiber content of 23% and crude protein 16-22%, but information on processing weeds into silage and its use for animal feed is still limited (Sudrajat et al., 2021; and Sudrajat et al., 2022). Therefore, for the use of weeds as feed for ruminant livestock, both fresh and in silage form, it is necessary to conduct research or studies on their physical quality, nutritional content, feed technology, and application to livestock. Based on this, research was carried out on feed preservation technology in the form of weed silage, so that later the weeds can be stored for a long time. The results of this study are expected to be one of the possible solutions in the provision of an alternative forage feed and can provide reference/information regarding the quality of Wedelia weed silage. The produced weed silage can be utilized as feed for both dairy and beef cattle.

MATERIALS AND METHODS

The implementation of the research began on November 30, 2024, and continued until February 25, 2025, at the Laboratory of Animal Nutrition, Animal Husbandry study program, Universitas Mercu Buana Yogyakarta, and the Chem-Mix laboratory in Bantul, Yogyakarta. The research material consisted of *Wedelia trilobata* (L) Hitchc weed as much as 1000 g per replicate, 1% EM4, 0.6% Molasses, and corn flour at the amounts of 0%, 1%, 3% and 5%. Then fermented for 14 days.

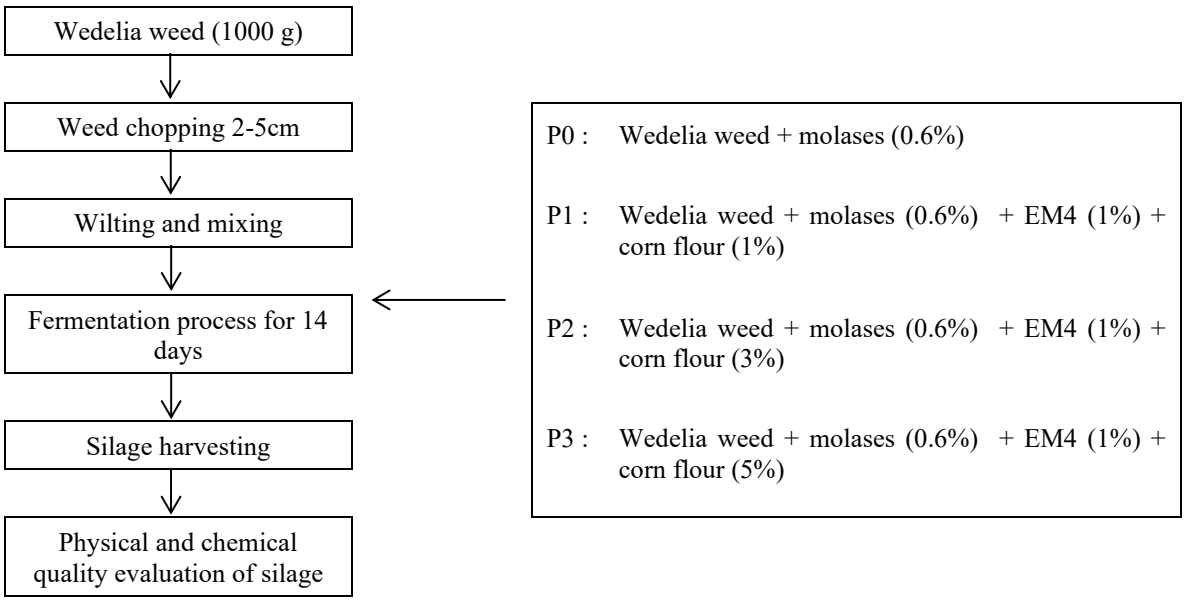

Figure 1. Process of Making Wedelia Weed Silage.

This study used an experimental approach with a Completely Randomized Design (CRD) in a one-way pattern consisting of 4 treatment groups : P0 (no treatment), P1 (1% corn flour), P2 (3% corn flour) and P3 (5% corn flour). Each treatment was replicated three times. The variables observed included the physical quality of silage, namely aroma, color, mold presence, texture, and pH, while the chemical quality parameters included moisture content, crude protein content, and crude fiber content. The data obtained was tabulated and analyzed using analysis of variance (ANOVA), if significant differences were found, further analysis was conducted using Duncan's New Multiple Range Test (DMRT). The process of making wedelia weed silage can be seen in Figure 1.

RESULTS AND DISCUSSION

Physical Quality of Wedelia Weed Silage

The results of the assessment on the physical quality of silage which includes color, texture, aroma, pH and the presence of mold from the effect of corn flour addition on Wedelia weed silage are presented in Table 1.

Color

The color of silage is one of the indicators of the physical quality of silage. Silage that retains its original color is of good quality, while silage that deviates from the original color is of low-quality silage (Kurniawan et al., 2015). In this study, P0 and P1 were significantly different ($P < 0.05$) from P2 and P3. P0 and P1 showed that Wedelia weed silage was coloured brownish-yellow, while P2 and P3 showed yellowish-green wedelia weed silage. The color of this silage showed that the ensilage process ran normally and met the good color criteria for silage. Good quality silage will almost match the color of the plant or feed before being ensilaged. Aglazziyah et al. (2020) also stated that good silage quality produces colors such as green or yellowish green.

Aroma

The addition of corn flour to Wedelia weed silage showed no significant difference ($P > 0.05$) in silage aroma. The aroma of Wedelia weed silage was slightly sour. The insignificant difference was caused by the relatively high crude fiber content in Wedelia weed silage, which can be utilized by bacteria as an energy source. Sufficient energy sources for bacteria serve to accelerate the formation of lactic acid, accompanied by increasing acidic conditions, which can lower the pH of the silage. The low pH of the produced silage can result a good quality reed silage with a sour aroma (Herlinae et al., 2015). This is also supported by Anjalani et al. (2017), who stated that good silage has a sour aroma and a pleasant fermentation smell, while poor-quality silage has an unpleasant odor like compost and may contain mold due to the production of lactic acid during the fermentation process.

Texture

The addition of corn flour to Wedelia weed silage showed a significantly different effect ($P < 0.05$) between P0 and P1, P2, and P3 on the texture of the silage. The average texture result of Wedelia weed silage was non-clumpy and non-slimy. Silage texture is influenced by factors in the silage fermentation process, particularly moisture content and the availability of energy sources for lactic acid-forming bacteria. The source of energy for lactic acid-forming bacteria is found in the silage additives, such as molasses and EM4 (Harifuddin et al., 2023). This study showed that Wedelia weed silage had a good texture as it was neither clumpy nor slimy.

Mold

The addition of corn flour to Wedelia weed silage showed no significant different effect ($P > 0.05$) on silage mold growth. The average mold presence data in this study indicated that no mold was found in the Wedelia weed silage. This Wedelia weed silage produces good-quality silage because no mold was found in the silage. This is in accordance with the opinion of Raldi *et al*. (2015), who suggest that good silage is silage that does not contain fungi or mold. The absence of fungus and mold means that the content of Wedelia weed silage and the addition of corn flour at different levels can already meet the needs of active bacteria that will produce lactic acid. The acceleration of the rate of lactic acid formation depends on the amount of soluble carbohydrates and complex enzymes present.

pH

The addition of corn flour to Wedelia weed silage showed a statistically non-significant effect (P>0.05) on silage pH. This is due to the sufficient content of water-soluble carbohydrates (WSC) already present in the Wedelia weed silage, which diminished the observable impact of corn flour on pH reduction. According to the opinion of Syaiful et al. (2014), corn flour serves as a source of carbohydrates for microorganisms to produce lactic acid and lower the pH. Organic acids formed in silage are highly dependent on WSC content; higher content of soluble carbohydrates will produce silage with higher lactic acid. The higher the addition of corn flour into Wedelia weed silage, which serves as a source of soluble carbohydrates, the faster the ensilage process will be, and the lower the pH value will become.

Chemical Quality of Wedelia Weed Silage

Moisture content

The average moisture content of Wedelia weed silage from each treatment was P0 (54.53%), P1 (57.35%), P2 (55.79%), and P3 (55.42%). The data is presented in Table 2, the average value of the moisture content of Wedelia weed silage shows non significant (P>0.05). This is due to the wilting process of Wedelia weed, causing water loss from plant tissues through transpiration and evaporation, thereby reducing the moisture content of the forage before ensiling begins. According to Septian *et al.* (2023) if wilting is carried out, the moisture content will decrease, making the softening of plant tissue easier. As a result, the plant cells and bacteria can accelerate the ensilage process with the heat converted from plant's glucose. In addition, the lack of corn flour addition level in Wedelia weed silage resulted in slower growth of lactic acid bacteria.

In silage making, lactic acid bacteria play a very important role. To produce the lactic acid needed as a preservative, these bacteria require environmental conditions with sufficient moisture levels. This lactic acid will prevent the growth of spoilage microorganisms. Kurnianingtyas et al. (2012) stated that loss of moisture content in silage can be caused by high levels of cellulose due to plant age. This can affect the substrate content needed for fermentation. The addition of corn flour at various levels produced silage with an average moisture content of 54.53-57.35%.

Crude Protein

The average crude protein of Wedelia weed silage from each treatment was P0 (10.27%) P1 (11.00%) P2 (9.58%) P3 (10.05%). The data is presented in Table 3.

The results of the variance analysis found that the addition of corn flour to Wedelia weed silage was non-significant (P>0.05) to crude protein. The additives used in this study have not been able to accelerate the fermentation process, the lack of adequate addition of corn flour inhibits microbial growth, resulting in no increase in protein. Corn flour as a soluble carbohydrate is utilized by anaerobic microbes, especially lactic acid bacteria, as their energy intake. The growth of lactic acid bacteria in silage produces lactic acid. This lactic acid plays a role in stopping the growth and development of micerobes, thereby ensuring that the fermentation process continues to run and function properly (Septian *et al*., 2022). The slow increase in crude protein content in Wedelia weed silage fermentation is most likely caused by inhibited microbial growth.

The addition of corn flour at different levels resulted in differences in the number of microbes in each treatment, with the same amount of nitrogen and energy supply, leading to a relatively consistent increase. This is because the microbes in the fermentation process are still in a state of adaptation; besides that, microorganisms require sufficient energy for metabolism. Without an adequate energy supply, the cellular protein production will be disrupted. Liizza (2017) stated that the efficiency of microbial protein formation is strongly influenced by the alignment between ammonia availability and the rate of carbohydrate fermentation. Excessive ammonia availability will lead to waste and decreased efficiency.

Crude Fiber

The average crude fiber content of Wedelia weed silage from each treatment was P0 (34.51%) P1 (33.69%) P2 (34.78%) P3 (36.58%). The data is presented in Table 4. The results of the variance analysis showed that the addition of corn flour to Wedelia weed silage had no significant effect on crude fiber (P > 0.05). This was likely due to the insufficient

level of corn flour addition in Wedelia weed silage, so that the energy source for microbes cannot increase to break down cellulose and hemicellulose. Furthermore, the high content of crude fiber in Wedelia weed silage may have slowed microbial activity in degrading the crude fiber.

Microorganisms in Wedelia weed silage utilize nutrients from the crude fiber of Wedelia weed. The nutrients include cellulose, hemicellulose, polysaccharides, and lignin. According to Wahyani et al. (2022) microorganisms involved in silage storage lack the ability to break the lignocellulosic bonds in lignin. Lignin, which is rich in carbon and also contains hydrogen and oxygen, cannot be broken down by microorganisms to produce energy. As a result, the presence of lignin in crude fiber remains indigestible by microbes due to the absence of enzymes capable of converting lignocellulose into sugars needed as nutrients. Hading (2014) stated that as the forage matures, changes occur in the proportion of its structural components. The average crude fiber content of Wedelia weed silage in this study is adequate to meet the fiber needs of ruminant livestock such as dairy cattle, beef cattle, buffalo, sheep, and goats.

Table 1. Physical Quality of Wedelia Weed Silage with Corn Flour Addition.

Treatment	Parameter				
	Color	Aroma	Texture	Mold Presence	pH
P0 (0% Corn flour)	2.2^{b}	2.4^{a}	1.2^{b}	1.0^{a}	4.28^{a}
P1 (1% Corn flour)	2.2^{b}	2.0^{a}	1.0^{a}	1.0^{a}	4.13^{a}
P2 (3% Corn flour)	1.9^{a}	1.8^{a}	1.1^{ab}	1.0^{a}	4.18^{a}
P3 (5% Corn flour)	1.8^{a}	1.9^{a}	1.0^{ab}	1.0^{a}	4.13^{a}

Note: Different superscripts in the same column indicate significant differences (P<0.05).

Table 2. Average Moisture Content Value of Wedelia Weed Silage (%).

Corn Flour Treatment (%)	Replicates (%)			Mean^{NS}
	I	II	III	
P0 (0)	54.17	55.11	54.33	54.53
P1 (1)	54.56	55.64	61.87	57.35
P2 (3)	56.42	55.24	55.71	55.79
P3 (5)	55.47	55.32	55.48	55.42

Note : NS (Non Significant)

Tabel 3. Average Crude Protein Value of Wedelia Weed Silage (%).

Corn Flour Treatment (%)	Replicates (%)			Mean^{NS}
	I	II	III	
P0 (0)	9.61	9.92	11.28	10.27
P1 (1)	11.13	11.77	10.11	11.00
P2 (3)	10.11	9.04	9.60	9.58
P3 (5)	10.17	10.60	9.38	10.05

Note: NS (Non Significant)

Table 4. Average Crude Fiber Content of Wedelia Weed Silage (%).

Corn Flour Treatment (%)	Replicates (%)			Mean[NS]
	I	II	III	
P0 (0)	34.43	34.28	34.83	34.51
P1 (1)	34.60	36.31	30.18	33.69
P2 (3)	34.32	34.60	35.43	34.78
P3 (5)	37.12	36.47	36.17	36.58

Note: NS (Non Significant).

CONCLUSIONS

The addition of corn flour to weed silage affects its color and texture quality, but does not affect the aroma, mold, pH, and chemical quality. The use of 1% corn flour produced silage with the best quality.

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