

## THE USE OF MOLASSES AS ADDITIVE WITH DIFFERENT ENSILING TIME AND PHYSICAL QUALITY, pH AND NUTRITIVE OF VALUE MAIZE STOVER SILAGE

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### ABSTRACT

*The objectives of this experimental research was to determine the effect of different ensiling time of maize stover silage with molasses as additive on physical quality, pH and nutritive value. The experiment used Factorial Randomized Completely Design (RCD) of two factors (maize stover = A and maize stover + 10% molasses = B), 3 ensiling time (0, 7, 14 days) and 4 replications. The treatments consisted of (A<sub>0</sub> = maize stover without incubation, A<sub>1</sub> = maize stover incubated for 7 days, A<sub>2</sub> = maize stover incubated for 14 days) and (B<sub>0</sub> = maize stover + 10% molasses without incubation, B<sub>1</sub> = maize stover + 10 % molasses incubated for 7 days, and B<sub>2</sub> = maize stover + 10 % molasses incubated for 14 days). The variable was measured physical quality, pH and nutritive value. The results showed that incubation time of A and B gave significant effect on physical quality and pH silage, maize stover silage without and with 10 % molasses incubated 14 days gave the best result of physical quality and pH (A = 4.00 and B = 3.89) silage. The result showed that incubation time of A and B gave highly significant effect (P<0.01) on Dry Matter (DM) and Ether Extract (EE), however it did not give significant effect (P>0.05) on Organic Matter (OM). It can be concluded that maize stover silage with 10% molasses incubated for 14 days could increase physical quality, decreased pH and maintain nutritive value.*

**Keywords :** *Maize stover, molasses, physical quality, pH and nutritive value*

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## INTRODUCTION

Maize stover is part of a corn plant that is two month old before corn is harvested. The maize stover contains CP of 12.06%, CF 23.3%, Ca 0.25% and P 0.23% (Htet *et al.*, 2016) the availability of maize stover is abundant during the rainy season, so that excess maize stover can be stored and using during the dry season. One of the preservation technologies that can be used to preserve fresh maize stover is silage. Making silage is one of the forage preservation strategies to overcome the shortage of forage during the dry season. The principle of making silage is to use anaerobic fermentation techniques and pH <4. The success of the silage making process is to achieve stable silage conditions as quickly as possible namely an-aerobic conditions and pH <4.

The addition of molasses as a Water Soluble Carbohydrate (WSC) can be done in making silage to support the activity of lactic acid bacteria in order to produce organic acids that are useful for lowering the pH in making silage. The use of monosaccharides such as glucose and fructose can accelerate the decrease in pH resulting in the accumulation of lactic acid (Santoso *et al.*, 2009). The ensilage process begins with the microbes that break down the nutrients contained in the silage material

A<sub>0</sub> = maize stover without ensilation

A<sub>1</sub> = maize stover ensiled for 7 days

A<sub>2</sub> = maize stover ensiled for 14 days

B<sub>0</sub> = maize stover + 10% molasses without ensilation

B<sub>1</sub> = maize stover + 10 % molasses ensiled for 7 days

B<sub>2</sub> = maize stover + 10 % molasses ensiled for 14 days

To make silage, the maize stover material was chopped into lengths of about 2 to 5 cm. Approximately 1.2 kg of both maize stover with and without molasses was placed in plastic jar (3.5 liter), the top of jar warped with plastic wrap and then stored in dark place. After 7, 14 and 21 days of ensiling, representative samples were removed for further chemical analysis, pH

through the fermentation process under aerobic conditions. Aerobic fermentation will end if the oxygen in the silo is exhausted, then the condition becomes anaerobic and the aerobic microbes begin to actively decompose food substances, especially carbohydrates into lactic acid. Molasses has >40% WSC content which provides fermentation substrate for Lactic Acid Bacteria during ensiling (Lima *et al.*, 2010).

Silage making is ideally ensiling for 21 days but if the ensilage process can reach a stable condition faster before 21 days it would be better. The aim of this research is to determine the making of corn sugarcane silage by adding 10% molasses with incubation time of 0, 7 and 14 days.

## MATERIAL AND METHOD

### Experimental Materials and Design

Fresh maize stover was harvested at 45-65 days from cropland in Malang City, East Java Province, Indonesia. The fresh maize stover samples harvested in the morning were used to prepare silage. The maize stover treated with and without molasses then mixed thoroughly prior to ensiling. For the maize stover, commercial molasses was added in proportion 10% (fresh weight). The experiment consisted of 6 treatments:

analysis, and physical qualities following and adapted from (Mustika and Hartutik, 2021).

### Chemical analysis

Dry matter, crude ash, crude protein (CP), crude fiber (CF), and ether extract (EE) contents of samples were measured following Association of Official Analytical Chemists (AOAC) (2005) methods.

### pH and physical characteristic

Physical characteristics analyses conducted on silage sample using color, flavor, texture, the presence of molds. Determination of pH was using a pH meter, and distilled water was added to samples in a ratio 10:1 and pH can recorded (Nahm, 1992).

### Statistical analysis

The data on nutrient composition and pH were analyzed using analysis of variance with Factorial Completely Randomized Design. The experimental design consist of 2 factors and 4 ensiling time and also 4 replications each factor. Physical quality data was analyzed by using descriptive analysis.

## RESULT AND DISCUSSION

### Physical Quality and pH

The physical quality of the silage are shown in Table 1. Maize stover silage without molasses and maize stover silage with adding 10% molasses had different color, aroma and texture at ensiling time 7, 14 and 21 days. Table 1 shows that maize stover silage with and without the addition of 10% molasses caused differences in

color, flavor and silage texture, both in incubation of 7, 14 and 21 days. Maize stover silage with 10% molasses and 21 days ensiling times produces the best color, flavor and texture, which has a yellowish green color with a slightly acidic flavor, soft texture and no fungus. According to Rahayu *et al.* (2017) good silage has a yellowish green or brownish green color and the silage's flavor was fresh acid as a characteristic of high lactic acid and the decay that causes silage smells of butyric, silage has a dense and soft texture and is not slimy and moldy. Treated silage has fragrant flavor compare to the control silage and silage without inoculant and WSC showed the worst flavor compare with others (Sofyan *et al.*, 2017; Mustika and Hartutik, 2021).

This is in accordance with the opinion of Despal *et al.* (2011) which states that silage given molasses has a slightly moist texture so that it is in accordance with ideal conditions for bacterial growth. The palatability was influenced by taste, texture and also flavor (Sofyan *et al.*, 2017). The result showed that silage with 10% molasses addition with 21 days ensiling times more palatable than others.

**Table 1.** Physical Quality of Silage

Sample	Ensiling Time (Days)	Parameters observed			
		Color	Flavor	Texture	LFC
Maize Stover Silage	0	Fresh-Greenish	Fresh	Hard	Absent
	7	green-browning	Moderately acidic	Slightly soft	Absent
	14	green-browning	Slightly acid	Slightly soft	Absent
	21	green-browning	Slightly acid	soft	Absent
Maize Stover Silage + 10% Molasses	0	Light yellow, a little bit greenish	Fresh moderately sweet	Hard	Absent
	7	green-browning	Moderately acidic	Slightly soft	Absent
	14	green-browning	Slightly acid	soft	Absent
	21	green-yellowish	Slightly acid	Soft and Slightly wet	Absent

LFC: Level of Fungal Contamination

Table 2 shows that the maize stover silage treatment without molasses addition had the lowest pH at 21 days ensiling time at 4.00 compared to 0 days i.e. 5.81, 7 days at 4.13 and 14 days at 4.02. Whereas maize stover silage with the addition of 10% molasses had the lowest pH at 14 days

incubation at 3.89 compared to 0 days at 5.67, 7 days 4.92 and 21 days 4.25. The decrease in pH is due to an increase in the number of lactic acid bacteria so that lactic acid increases. In the treatment of maize stover with 10% molasses with 14 days ensiling, the optimum pH (acid) was

reached, which was 3.89. This happens because the Water Soluble Carbohydrate available (WSC) in maize stover was sufficient for the growth of lactic acid bacteria. Lactic acid bacteria are main key in succeed for fermentation process (Kung *et al.*, 2018; Sjoftan *et al.*, 2021; Sjoftan and Adli, 2021). The low pH from lactic acids killing the microbes intolerant to the low pH and also stabilize the fermentation process (Kung *et al.*, 2018).

Table 3 shows that maize stover silage with and without 10% molasses addition had a very significant effect ( $P < 0.01$ ) on OM and CP, but had no significant effect ( $P > 0.05$ ) on DM, CF and EE. Maize stover silage using 10% molasses with 14 days ensiling time was the best treatment,

indicated by the low pH and CF values of 3.98 and 26.84% respectively and high OM and CP values of 7.98% and 9.95% respectively.

The optimal ensiling time for microbial growth was 14-days in the process of microbial degraded lignin, so that cellulose and hemicellulose in forage can be used as the main energy source for ruminants. The presence of lignin will reduce the digestibility of carbohydrates through the formation of hydrogen bonds on the critical side, thereby limiting the activity of cellulase enzymes. Crude fiber is a factor that affects digestion. In general the lower the SK the higher the digestibility and the rate of degradation of feed ingredients in the rumen (Rahayu *et al.*, 2017).

**Table 2.** Power of Hydrogen (pH) Silage

Sample	Ensiling Time (Days)			
	0	7	14	21
Maize Stover Silage	5.81 <sup>c</sup>	4.13 <sup>bc</sup>	4.02 <sup>b</sup>	4.00 <sup>a</sup>
Maize Stover Silage + 10% Molasses	5.67 <sup>c</sup>	4.92 <sup>bc</sup>	3.89 <sup>a</sup>	4.25 <sup>b</sup>

Different superscript in same column or row showed a significant difference ( $p < 0.05$ )

**Table 3.** Chemical Composition of Silage

Sample	Time (Days)	DM (%)	Nutritive Value (% DM)				
			OM	Ash	CP	CF	EE
Maize Stover Silage	0	27.24	7.07 <sup>c</sup>	92.93	10.05 <sup>a</sup>	29.06	1.58
	7	26.92	6.73 <sup>b</sup>	93.27	14.32 <sup>c</sup>	28.84	2.35
	14	27.75	6.85 <sup>bc</sup>	93.25	11.61 <sup>bc</sup>	28.35	2.03
	21	24.67	6.42 <sup>a</sup>	93.58	10.89 <sup>b</sup>	27.73	2.79
Maize Stover Silage + 10% Molasses	0	29.12	7.42 <sup>b</sup>	92.58	9.25 <sup>c</sup>	28.00	2.15
	7	28.57	7.63 <sup>bc</sup>	92.37	9.08 <sup>a</sup>	27.03	1.59
	14	27.24	7.98 <sup>c</sup>	92.02	9.95 <sup>b</sup>	26.84	1.92
	21	27.22	6.99 <sup>a</sup>	93.01	10.06 <sup>bc</sup>	26.55	2.50

Different superscript in same column or row showed a significant difference ( $p < 0.05$ )

The CP content of silage from maize stover using 10% molasses in 7 days ensiling time has decreased, this is indicated by the presence of bacteria, especially clostridia, which actively reforms proteins and produces ammonia. At week 2 (incubation 14 days) CP increases, this is caused by microbes that have good growth and breeding, so that it can change more constituent components originating from the

microbial body itself which will increase the crude protein content of the substrate.

## CONCLUSIONS

Maize stover silage with 10% molasses addition with 14 days ensiling time was the best treatment based on pH and silage content.

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