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The Influence of Fermentation and Long Storage on the Silage of Corn Tebon

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Abstract

The study aims to determine the effect of fermentation time complete feed and silage of Tebon corn to changes in pH and nutrient content. This research was conducted in January to March 2015, in the Laboratory airy College of Agricultural Sciences (STIPER) Kendari and analysis of feed materials to be carried out at the Laboratory of Animal Nutrition and Feed Faculty of Animal Husbandry Haluoleo university. Materials used in this study were aged 60-70 days corn Tebon, pollard 20%; copra 20%; premix 30%; corn Empok 25%; salt 2.5%; minerals 2.5%, Aquadest, a buffer solution pH 7. The catalyst, concentrated H2SO4, distilled water, 0,1N H2SO4, NaOH 40%, indicatormix, 0,1N NaOH. Equipment used in this study include: chopper, plastic, rope scales, vacuum, freezer, Erlenmeyer, pH meter, analytical balance, pumpkin Kjedahl, Erlenmeyer, glass beaker, destructor, distillation, titration tools, ovens and furnaces. The method used in this study is completely randomized design experiment Nested with 2 treatments, three long storage and 3 replicates (2x3x3) on each treatment. The treatment tested was: Concentrate + Tebon corn with different fermentation time, concentrate + corn silage Tebon with different fermentation time, then do Silage-making, mixing Silage, Silage Testing. The parameters in this study the degree of acidity (pH), nutrient content includes dry matter (DM), organic matter (OM) and crude protein (CP) before and after fermentation. Based on the results of complete feed nutrient content analysis showed that each - each fermentation time treatment effect (P<0,01) to change the content of DM, OM and CP when compared to the control with the average low enough pH ranged from 4.18 to 4, 38. Based on this research can be concluded that the fermentation time very real impact on the quality of corn silage Tebon. Fermentation feed concentrate and corn Tebon (KT) decreased nutrient content higher than the complete feed made from concentrates and corn Tebon silage (KS).

Keywords: Tebon corn, fermentation, complete feed

A. Introduction

Problems of general farm in tropical countries like Indonesia are a factor of the ambient temperature is high enough. These conditions have a direct impact on metabolic systems and thermoregulation in the body of livestock. Relatively hot environment causes some animals to lose appetite, so that the quantities of intake of food (nutrients) that enter the body are also less. Nutrient intake was essential to meet basic needs (maintenance), development of the body and to the need to reproduce. The implications of the condition of nutrition of livestock is less, leading to weight gain daily (average daily gain / ADG), which is still very far from the expected results at both farm people and industry.

Complete feed is a mixture of feed materials including crude fiber source with balanced proportions that is processed and blended into the mixture with a uniform nutrient content in accordance with the needs of livestock. The advantage in the use of complete feed, among others: provide balanced nutrition for cattle; can control the balance between forage and concentrates; increasing the value to agricultural wastes; reduce residual feed; reduce the selection by livestock (Reddy, 1988). In an effort to maintain the availability of complete feed,

it can be done by preserving complete feed. One way to preserve the complete feed is fermented.

The changes that occur during the fermentation process is largely influenced by the activity of microorganisms. With the activity of microorganisms is then preserved material will undergo changes such as the level of acidity (pH) and nutrient content. The quality of fermented complete feed will depend on a long fermentation process to achieve stable phase. The faster the fermentation entered the stable phase (pH 4) the damage caused by microorganisms will become smaller. This is because microorganisms will not actively degrade the nutrient content material on the condition of low pH (acidic).

The length of time needed to reach the stable phase is influenced by several factors such as substrate / material to be fermented, type of microorganisms that thrive and environmental conditions (temperature, oxygen and water content). So that the fermentation can run well then be provided the substrate that contains soluble carbohydrates (WSC). One of the constituents of complete feed containing carbohydrates is dissolved Tebon corn. Based on the above explanation it is necessary to investigate the effect of fermentation time Tebon complete feed and silage corn to changes in pH and nutrient content.

B. Methodology

1. Materials

This research was conducted in January through March 2015, conducted in the laboratory airy College of Agricultural Sciences (STIPER) Kendari and analysis of feed materials to be carried out at the Laboratory of Animal Nutrition and Feed Faculty of Animal Husbandry Haluoleo university. Materials used in this study is Tebon corn umur60-70hari, pollard 20%; copra 20%; premix 30%; corn Empok 25%; salt 2.5%; minerals 2.5%, Aquadest, pH7 buffer solution. The catalyst, concentrated H2SO4, distilled water, 0,1N H2SO4, NaOH 40%, indicatormix, 0,1N NaOH. Equipment used in this study include: chopper, plastic, rope scales, vacuum, freezer, elenmeyer, pH meter, analytical balance, pumpkin Kjedahl, Erlenmeyer, glass beaker, destructor, distillation, titration tools, ovens and furnaces.

2. *Method*

The method used in this study is Complete Randomized Design (CRD) Nested with 2 treatments, three long storage and 3 replicates (2x3x3) on each treatment. The treatment tested was:

a) Concentrate + corn tebon fermentation period of 21 days KT (L31)
b) Concentrate + corn tebon fermentation period of 31 days KT (L41)
c) Concentrate + corn tebon fermentation period of 41 days KT (L51)
d) Concentrate + corn tebon silage fermentation time 15 days KS (L10)
e) Concentrate + corn tebon silage fermentation time 25 days KS (L20)
f) Concentrate + corn tebon silage fermentation time of 35 days KS (L30)

3. *Research procedure*

a. Silage making

There are also ways of making silage of Tebon corn is as follows:

a) Tebon corn after the cut withered for 1 day.
b) Tebon corn chopped (chopper) with a length of approximately 3-5 cm.
c) Aerated for 1 day.
d) Put in a silo or a plastic bag under anaerobic conditions.
e) Stored for 21 days.
f) For the treatment (KTL31-KTL51) Tebon corn that has been chopped and aerated directly mixed with the concentrate and vacuumed.

b. Mixing silage

This mixing of Tebon corn silage with concentrate (KSL10-KSL30) so that a complete feed with a proportion of 50% silage and concentrates 50% based on the dry matter content. Initial nutrient content of the complete feed is obtained from the calculation based on the results of laboratory analysis and a large percentage or a proportion of each ingredient is used as a constituent of complete feed.

c. Testing of Silage

Silage Tests conducted in the laboratory with the Method of Analysis

- The degree of acidity (pH) That
- Dry Mater (DM) That
- Organic Mater (OM) That
- Protein Rough

4. *Observation variable*
   The variables that observed in this study as follows:
- The degree of acidity (pH).
- Nutritional content includes dry matter (DM), organic matter (BO) and crude protein (CP) before and after fermentation.

5. *Statistical analysis*

The data obtained in this study will be tabulated with Excel program for further analyzed using analysis of variance (ANOVA) with Complete Randomized Design Nested. In case of differences continued by Least Significant Difference (Sastrosupadi, 2000).

C. Results and Discussion

The results of the analysis of the nutritional content of the raw materials making up complete feed and complete feed initial nutrient calculations are presented in Table 1

Table 1. Nutrient content of the raw material of complete feed and initial nutrient calculation complete feed.

Raw Material	DM (%)	OM (%)	CP(%)
Corn Tebon *	24.03	90.76	9.65
Corn Tebon silage *	21.85	87.22	7,93
Concentrate *	88.90	85.89	15.60
KT **	56.46	88.33	12.63
KS **	55.37	86.56	11.76

Description: * The results of laboratory analysis.
**the calculation results.
KT = Concentrate + Tebon corn.
KS = Concentrate + Silage of Tebon corn.

The results of the analysis of the content of DM Tebon maize by 24.03% (Table 1) was obtained after corn Tebon silage undergo withering before it is made. As for the content of DM corn Tebon silage (21.85%) lower or decreased since been through the process of silage. The crude protein content of silage of corn Tebon of 7.93% (Table 1) according to reports Preston (2006) which states that, silage maize plants including fruits, young (corn silage, milk stage) has a nutrient content DM 26%, TDN65%, CP 8 % and SK 26%.

The decline in the nutrients that occur in silage of Tebon corn due to the utilization of the substrate contained in the material by microorganisms to grow and develop during the silage process lasts. If the bacterial growth is dominated by BAL then the silage process will go well, because the lactic acid produced by BAL will lower the pH of silage.

The Physical Quality of Complete Feed

Observations physically against each treatment silage of Tebon corn including color, texture, smell and presence / absence of fungi during fermentation are presented in Table 2.

Table 2. The results of physical examination each treatment

Treatment	Colour	Texture	Smell	Mushroom
KT (L_{31})	Yellowish green	Soft	Acid	Nothing
KT (L_{41})	Yellowish green	Soft	Acid	Nothing
KT (L_{51})	Yellowish green	Soft	incisive acid	Nothing
KS (L_{10})	Yellowish green	Soft	Acid	Nothing
KS (L_{20})	Yellowish green	Soft	Acid	Nothing
KS (L_{30})	Yellowish green	Soft	incisive acid	Nothing

Table 2 shows that, in principle, complete feed fermentation is conducted in this study occurs in anaerobic so the resulting forage conditions became greenish-yellow, soft texture, smell sour and not moldy. This is consistent with the statement of McDonald (1981) that the anaerobic fermentation is a process that will lead to forage ensilage not brown or black,

smelled sour, not moldy, not slimy, like the original texture and pH of 4.2 or less. A color change in the fermentation ensilage may be due to the Maillard or browning reaction as a result of excessive heat production (Wallace & Chesson, 1995).

When compared between treatments, the physical condition of each complete feed is relatively the same, except for the treatment with the longest length of fermentation showed differences in a relatively sharper smell. This shows that the longer the storage time cause acidity is increased as a result of the dominance of lactic acid bacteria.

pH For Silage Feed of Corn Tebon

pH measurement results from the fermentation of Tebon corn in this study showed no difference from each treatment will however be seen that the pH of each treatment, the lower along with the duration of fermentation. If the material contains a lot of WSC then dominant microorganisms is BAL, but if it contains protein Clostridium bacteria will thrive and inhibit a decrease in pH. The content of complete feed fermentation pH (Table 3)

Table 3. Mean pH fermented of complete feed.

Treatment	pH
KT (L_{31})	4,38
KT (L_{41})	4,23
KT (L_{51})	4,22
KS (L_{10})	4,24
KS (L_{20})	4,31

Description: The same Superscript in the same column showed no significant differences (P> 0.05).

Decrease in pH during fermentation due to the soluble carbohydrate content in complete feed is available in sufficient quantities, so that it will support the activities of BAL to produce organic acids that are useful for lowering the pH in the silo. In addition to soluble carbohydrates, protein content in complete feed is not too high (11-12%), so the opportunity to dominate the Clostridium bacteria are also becoming smaller. This is supported by a statement McDonald (1981), to produce the quality silage protein content of 10% of dry matter. If the raw material contains high protein then it will hinder the ongoing decrease in the pH during ensilage.

Fermented all treatments showed the average pH low enough ranged from 4.18 to 4.38. Referring to Kusumawardana (2007) states that the silage with a pH of 4 to 4.5 is still quite good silage. This indicates there has been a process of anaerobic fermentation involving BAL activity which revolutionized carbohydrates into lactic acid so that the condition of complete feed pH drops to a more acidic than the initial conditions.

The Nutritional Content of Silage Corn Tebon

The results of the analysis of the nutrient content of complete feed showed that each treatment and fermentation time effect (P <0,01) to change the content of BK, BO and PK when compared with controls. The average is the result of complete feed nutrient content analysis is presented in Table 4.

Table 4. Average of the Nutrient Content of Corn Tebon Silage

Treatment	Nutrient content (%)		
	DM	OM*	CP*
KT(L_0)	56,46[b]	49,08[b]	8,09[b]
KT(L_{31})	33,50[a]	28,72[a]	3,74[a]
KT(L_{41})	31,78[a]	27,17[a]	3,48[a]
KT(L_{51})	31,60[a]	26,63[a]	3,43[a]
KS(L_0)	55,37[b]	47,71[b]	7,80[b]
KS(L_{10})	34,62[a]	29,01[a]	3,90[a]
KS(L_{20})	33,42[a]	28,55[a]	3,72[a]
KS(L_{30})	31,96[a]	26,73[a]	3,50[a]

Description :*)in a state *as fed*.

[a-b] Different superscripts in the same column indicate a significant influence (P<0,01).

Dry matter content show differences to control each treatment. This may be due to indications of increasing water produced during fermentation as a result of an overhaul of the nutrients in complete feed both for respiration and activity of microorganisms. Mc Donald (1981) and Foley et al., (1973) states that water produced during the fermented of is produced as a result of respiration which still goes on, because at this stage the carbohydrate is simple to be converted into CO2, H2O and heat. A decrease in dry matter is also affected by changes in protein and organic matter because both are still included in the fraction of dry matter.

Differences in organic matter content of each treatment with control occurs because of an overhaul of soluble carbohydrates which is a fraction of the organic material by microorganisms during fermentation to produce acid - an organic acid that is useful in lowering the pH conditions of complete feed. Besides, the oxidation process in the initial fermentation will also affect the content of organic matter.

The decline in crude protein occurs in KT and KS treatment. According to Yani (2001), the protein will be overhauled by microbes, especially microbial proteolytic into amino acids and NH3 during the fermentation process, which causes a decrease in protein. Each treatment showed a difference only to controls. While between each treatment showed no difference. This indicates that the long fermentation and treatment of complete feed with different constituent materials (Tebon corn and silage Tebon corn) has no effect on changes in nutrient content complete feed.

The Decline in Nutrient Content of Complete Feed

Consequences must be received in the fermentation process is the decline in nutrient content of feed, it is because the process of respiration at the beginning of incubation and overhaul performed by microorganisms to grow and progress. The magnitude of the decline that occurred as a result of the fermentation process will affect the quality of complete feed. The greater the reduction that occurred then the quality of complete feed would be lower. The results of calculations of reductions in nutrient content in complete feed fermentation are presented in Table 5.

Table 5. The Average of Reduction in the Nutrient Content of Complete Feed.

Treatment	Decrease in Nutrient Content		
	CP	DM	OM
KT(L_{31})	22,96	20,36	4,35
KT(L_{41})	24,69	21,91	4,61
KT(L_{51})	24,86	22,46	4,66
Rata-rata	**24,168^{b}**	**21,579^{b}**	**4,544^{B}**
KS(L_{10})	20,75	18,70	3,90
KS(L_{20})	21,95	19,16	4,08
KS(L_{30})	23,42	20,98	4,30
Mean	**22,042^{a}**	**19,612^{a}**	**4,093^{A}**

Description: $^{A-B}$different superscripts in the same column indicate a significant influence (P<0,01).

$^{a-b}$Different superscripts in the same column shows the real effect (P<0,05).

Based on the above table it can be seen that the length of fermentation does not affect the decline in nutrient content. But the effect of treatment of complete feed KT and KS indicate a difference. It can be caused due to the treatment of KT process of respiration occurs more frequently during the early incubation. While the treatment of KS, as a starting material to be fermented is already in the form of silage, the respiration process is not running. This is in accordance with the opinion of McDonald (1981) which states that the reduction in dry matter may occur at this stage of aerobic and anaerobic. At this stage of aerobic dry matter decline occurred because respiration continues, so that glucose is the fraction of dry matter will be converted into CO2, H2O and heat. While the decline in the anaerobic stage because the glucose is converted into lactic acid, ethanol, acetic acid and CO2 by BAL, protein is converted into amino acids and ammonia by proteolytic bacteria and fat will be converted into VFA by bacterial lipolytic (Wallace & Chesson, 1995).

According to Kusumawardana (2007) a decrease in organic matter due to the overhaul of food substances, one of which is the use of organic materials in the form of carbohydrates dissolved from the raw materials for the activity of LAB to produce organic acids that are useful for lowering the pH during ensilage. The difference between treatments was shown

complete feed can be caused due to the availability of different initial organic material. In the treatment of complete feed KS, because the constituent materials have first undergone a process (silage), the availability of the initial organic material will be lower. The end result will be decreased lower.

Decrease in crude protein content greater in KT treatment ($P < 0.01$), indicating that the treatment of Clostridium activity in breaking down the protein remains high. While on treatment of KS because the constituents of complete feed has undergone a process in advance (silage), so it already has the acidic conditions that will inhibit the growth of proteolytic bacteria. In accordance with the opinion of Wallace and Chesson (1995) that, proteolytic Clostridia will ferment amino acids that are building blocks of protein into ammonia, amines and volatile organic acids. The average of crude protein content of the final outcome fermentation complete feed from each treatment were worth approximately 11% is still considered good enough. This is in accordance with the opinion of Suryadi (2006), that the complete feed with a crude protein content of approximately 12% ready to be given to cattle without other ingredients blended.

D. Conclusion

Based on this research can be concluded that the fermentation time is very real impact on the quality of silage of corn Tebon. Fermentation feed concentrate and Tebon corn (KT) decreased nutrient content higher than the complete feed made from concentrates and silage of Tebon corn (KS).

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