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RESEARCH ARTICLE

Complete Silage Using Mixture of Sugar Cane Treetop (*Saccharum Officinarum Linn.)* and *Indigophera Sp.* As Goats Feed

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ABSTRACT

Ensiling is one of the solutions to overcome the shortage of forages during the dry season in tropical region.The treetops of sugarcane is one of the plant residues which is can be conserved as silage.Indigofera is a legume that has high productivity and good nutrient content, especially for the high protein content in it which is used as animal feed such as nitrogen, phosphorus, potassium and calcium.The aim of this study was to determine the quality of complete silage using sugarcane treetops and indigopheramixing.
This study was designed based on a completely randomized design with five treatments that are p0 = 50% sugar cane treetops + 50% indigofera, p1 = 75% sugar cane treetops + 25% indigofera, p2 = 25% sugar cane treetops + 75% indigofera, p3 = 100% sugar cane treetops, and p4 = 100% indigofera, incubated for 21 days.The observed variables included organoleptic quality (color, scent, texture, and presence of fungi)and physical quality (acidity).The results showed that both of the single silage making and using the mixing one did not significantly affect organoleptic quality. The results of the duncan test can be seen that mixed silage produces the highest pH, that is P4 which is significantly different from P1 and P3, but not significantly different from P0 and P2. The lowest pH content is P3 which is not significantly different from P1. The decrease in silage pH in this study was caused by acids produced by bales during ensilase.

Keywords- : pH, silage, sugar cane treetops, indigophera sp.

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INTRODUCTION

Feed is the main factor that needs to be considered in developing livestock businesses. Feed costs, which spend 60 - 80% of the total cost of production, require a farmer to substitute ordinary feed to several feed sources whose procurement does not compete with human needs. Animal feed quality depends on the composition of nutrients contained in it, especially in dry matter, crude protein, crude fat, crude fiber, and digestibility (Kuswandi, 1990; Khuluq, 2012). Sugarcane treetops are plant wastes that are very potential as animal feed because they are available in large quantities and do not compete with human needs. Sugarcane produce 30% sugar cane treetops wastes. Sugar cane treetops content 39.9%, crude protein 7.4%, crude fiber 42.30%, crude fat 2.90%, BETN 40.00%, and ash 7.40% (Murnidkk., 2008; Silitonga., 1985; Lamiddkk., 2012).

Based on the study result of (Mochtar and Tedjohwahjono, 1985; Setiyawati, 1993) sugar cane treetops can replace elephant grass which is commonly used as forage for livestock without a negative influence on animal weight gain. Sugar cane treetops can also replace a portion of the amount of elephant grass used as a source of forage for dairy cows without reducing the quality and quantity of milk. The use of sugar cane treetops as animal feed has several weakness including low protein content, high crude fiber in the form of lignocellulose, lignohemelulose, and silica bonds, and low minerals and vitamins. Several efforts to increase the nutritional value of sugar cane as ruminant feed can be done by adding protein sources or by using physical, biological and chemical treatments, one of the effort which can be done is making silage(Fariani, 2012). Although it is quite productive and the nutritional value is high, the quality decreases rapidly with the aging of the plant. One way to complete the needs of livestock that given old forage is to mix it with legumes. Legumes are not as fast as grass inidecreasing its nutritional value with aging (Bamualim, 1998; Tumianti, 2016).

Indigofera sp. is one of type from legume group (family Fabaceae) with the genus Indigofera. This legume has a high prodicivity and fairly good nutrient content, especially its high protein. This plant can be used as forage which is rich in nitrogen, phosphorus, potassium and calcium (Simanihuruk and Sirait., 2009). Abdullah (2014), reported that the indigophera forage (leaves and branches) contents was as follows: crude protein 29.16%; crude fiber 14.02%, crude fat 3.62%, Ca 1.78% and P 0.34%. Furthermore Akbarillah et al., 2002; Simanihuruk and Sirait., 2009, stated that as a source of protein, Indigofera leaf flour contains fairly high pigments such as xantophils and carotenoids. Therefore the legume tree has the potential to be used as a basal grass feed substitute in goat livestock. Expected Indigofera sp. later can be used as a cheap source of protein for ruminants including goats and at the same time can substitute some protein ingredients such as fish flour, soybean and coconut which prices tend to be more expensive. The nutritional characteristics of these feed ingredients are generally characterized by relatively high fiber content and low levels of protein and undigested ingredients, especially during the dry season. Therefore, nutritional intake of livestock that consumes these feed ingredients is often only enough for basic living needs (Leng., 1997; Tarigan and Ginting., 2011). In such situations, forages with high protein content and low fiber such as tree legumes are a good alternative source feed for ruminants (Van et al., 2005; Salem et al., 2006; Sanon et al., 2008; Tarigan and Ginting., 2011).

Silage is one of the preserved forms of forage through a fermentation process. Making silage is a way to prepare

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feed supplies in the dry season by utilizing the abundance of forages in the rainy season. By making silage, forages can last longer (KalekaandHaryadi, 2013).Silage production has been known for a long time and growing rapidly in cold and sub-tropical region. The principle of making silage is the forage fermentation done by microbes that produce a lot of lactic acid. The most dominant microbes are those of the lactic acid bacteria group that are capable of fermentation in anaerobic conditions. Lactic acid produced during the fermentation process will act as a preservative so that it can avoid the growth of decay microorganisms (Tumianti, 2016). Complete silage research using the mixture of sugar cane treetops and indigophera is expected to have good silage characteristics, so that the high quality silage will be obtained as animal feed.

RESEARCH METHODS

This research was conducted at Animal Feed and Nutrition Laboratory, Agricultural Development Polytechnic (Polbangtan) Malang. Ingredients of sugar cane treetops (Saccharumofficinarum, Linn) and Indigofera sp. which was used came from Sumberejo Village, Gedangan District, Malang Regency. The silage was carried out on a laboratory scale using plastic with a capacity of 5 kg as a silo and anaerobically fermented for 21 days.

The observedparameterswere organoleptic and physical silage quality. After harvesting, the silage mixture placed on a table for organoleptic testing includes color, scent, texture, and the presence of fungi. The organoleptic test assessment scores are shown in Table 1 with a total of 11 panelists. Physical testing is the pH level using a pH meter. This study uses a Completely Randomized Design (CRD). The statistical data obtained are then analyzed by analysis of Variance (ANOVA). If the treatment shows a significant influence, then there will be further testing with Duncan's test (Steel &Torie, 1995; Jasin., 2014).

The research began by preparing forage materials, that are sugar cane treetops and indigofera which were drifted / aerated for 12 hours, then sugarcane treetops cut into 3-5 cm lengths. The sugar cane treetops and indigofera were divided according to the different treatment compositions randomly into 20 experimental units, each weighing 5000 grams / 5 kg.P0 treatment used amixture of 50% sugar cane treetops + 50% indigofera, P1 used 75% sugar cane treetops + 25% indigofera, P2 used 25% sugar cane treetops + 75% indigofera, P3 used 100% sugar cane treetops, and P4 used 100% indigofera . Then mixed evenly until homogeneous. Then the forage has been put in a plastic bag. The air is made as little as possible between the forages by being compressed (pressed), then the plastic is tightly tied. The air from outside is attempted not to enter the bag so that anaerobic conditions can be achieved. Each plastic bag in each treatment was coded according to the treatment and stored for 21 days.

After 21 days, each study material sample was opened, then observed the pH level with a pH meter, while the characteristic test included: color, scent, texture and presence of fungi in silage using the organoleptic test scoring method (Soekanto et al., 1980; Lamid et al., 2012). It is expected that the forage has become a good silage, characterized by a rather greenish color, a fragrant sour scent, no fungi, and the pH level is between 3.5 - 4 (Lamid et al., 2012).

RESULT AND DISCUSSION

Organoleptic quality test results for silage characteristics is based on pH measurements and physical observed include: color, texture, scent and presence of fungi. The heat that produced from the process increases the temperature in the

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silo, the increased temperature affects the dark color changes in silage. Silage characteristics that are good quality are acidic, not sticky, the color is close to the original (brown) (Sianipar and Simanihuruk, 2009; Zakariah, et al., 2015).

Silage pH

Based on the results of research on sugarcane treetops and indigoferasp in 21 days, analyzed by Analysis of Variants (ANOVA) showed that the use of a mixture of 50% sugar cane treetops + 50% indigophera (P0), 75% sugar cane + 25% Indigofera (P1), 25% sugar cane shoot + 75% indigofera (P2), 100% sugar cane shoot (P3), and 100% indigofera (P4) showed significant differences in pH. The Duncan test results show that the mixture silage that produces the highest pH is P4 which is significantly different from P1 and P3, but not significantly different from P0 and P2. The lowest pH content is P3 which is not significantly different from P1. The decrease in silage pH in this study was caused by the acid produced by BAL during ensilase.

The pH value produced by the treatment in Table 2 shows that the silage pH value ranged from 5 to 6 which indicates that the use of sugarcane treetops and indigofera can affect pH but it means that silage pH is a bad quality because of the pH level is above 4, 8. This is accordance with the opinion of Ratnakomala et al., 2006; Tumianti (2016) that the optimum pH of silage is between 3.8-4.2. Silage pH in this study has not reached <4.5 but has reached an acidic condition so that to produce a low pH it takes a longer fermentation time for the ensilase activity carried out by lactic acid bacteria will cause pH to be low because lactic acid bacteria will break down the carbohydrate substrate into lactic acid so that the pH becomes low.

Based on the research of Jasin (2014), the success of making silage is influenced by forage water content, dissolved sugar levels, the number of lactate-producing bacteria and oxygen levels. Lack of dissolved sugar levels in the ensilase process causes lactic acid bacteria to lack energy intake to carry out its activities, so lactic acid bacteria will use other substances contained in forages that allow it to be used as an energy source and cause a reduction in the nutritional value of the forage. To ensure the availability of dissolved sugar levels which guarantees the success of the ensilase process, additives substance must be added. Lactic acid bacteria are naturally present in plants so that they can automatically play their role during fermentation, but to optimize the ensilase phase it is recommended to add additives substance such as BAL inoculums and other additives to ensure perfect lactic acid fermentation. BAL inoculum is a popular additive among other additives such as acids, enzymes and carbohydrate sources (Bolsen et al., 1995; Jasin., 2014).

Color

Physical observations of silage after 21daysensilase process showed good results. All the natural green silage or yellowish green were given a score of 1, for silage which was dark green or brownish yellow with a score of 2 and brown to black with a score of 3. However, these differences do not show any significant differences. This shows that silage using a mixture and without using a mixture can show the results of silage which is good in color. These physical observations include the color of silage which is on the average treatment P0, P1, P2, P3, and P4 is yellowish green. This is in accordance with the opinion of Salim et al., 2002; Tumianti, 2016, thatin generalgood silage has a characteristic that is still green or brownish in color. Color changes that occur in plants undergoing the ensilase process are caused by changes that occur in plants because the process of aerobic respiration that lasts as long as the supply of oxygen is still there, until the plant sugar runs out (Reksohadiprodjo,

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1998; Tumianti, 2016). In this study all treatments had a yellowish green color, so that overall silage produced are good silage in color.

Smell/Scent

Physical observations showed that the use of sugarcane treetops and indigofera silage mixture did not significantly affect sugarcane treetops silage odor. All the resulting silages that have acidic smell/well fragrance given a score of 1. According to Ensminger and Olentine, 1978; Lamid et al., 2012, the characteristic of good silage is that it smells more acidic. This is also supported by Siregar's opinion, 1996; Lamid et al., 2012 stated that, in general, good silage has characteristics that are sour taste and acidic smell, but fresh and tasty. The acidic smell produced from all treatments and controls is one of the good quality silage characteristics. The acidsmell produced by silage was produced in the process of making silage anaerobic bacteria actively works to produce organic acids. The ensilase process occurs when oxygen has been used up, plant's respitory will stop and the atmosphere becomes anaerobic. In such conditions, mushrooms can not grow and only anaerobic bacteria are still active especially acid-forming bacteria (Susetyo et al., 1969; Lamid et al., 2012). In this study all treatments contained acidic smell, so that the complete silages which were produced are good silage in terms of smell.

Texture

Physical observations showed that the use of sugarcane treetops and indigofera did not significantly affect the silage texture. Silage making in this study produces silage which is good in terms of texture. According to Siregar, 1996; Lamid et al., 2012 stated that, in general, good silage has characteristics that are still clear as the natural texture. Textures that do not clot and not slimy which are owned by silage show that the silage mixture of sugarcane treetops and indigofera is a good quality. This is influenced by the fermentation process which produces good quality silage which has a soft texture, not slimy and not moldy (Ridla et al., 2007; Zakariah et al., 2015).

Fungi

Physical observations showed that the use of sugarcane treetops and indigoferawas not significantly affect the presence of fungi in silage. This happens because of in theensilase process there are other well-developed lactic acid bacteria, singly produce silage with organoleptic test results for low / non-existent fungi.

CONCLUSION

The use of sugar cane treetops and indigofera does not have a significant effect on silage characteristics which include color, smell, texture and presence of fungi. In terms of the silage's pH, the mixture of sugar cane treetops which were added by several levels of indigophera composition gave medium quality results.

SUGGESTION

Further research is needed on the use of sugar cane treetops and indigophera silage mixtures by adding additives / energy intake to ensure the availability of dissolved sugars which guarantees the success of the silage process.

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Table-1: value of organoleptical test for panelist

No.	Silage			
	Color	Scent	Texture	Fungi
1	Natural green or yellowish green	Acidic smell /well fragrance	Solid	No
2	Dark green or brownish yellow	Acidic smell or not bad-smelling	Quite mushy	little
3	Chocolate to black.	Smells bad	mushy	Much

Table-2: The average of silage mixture's pH

Composition of Silage Mixture (%)	pH silage X±SD
P_o (50% sugar cane treetops + 50% indigofera)	6,0000 $_{bc}$ ±0,0000
P_1 (75% sugar cane treetops+ 25% indigofera)	5,5000 $_{ab}$ ±0,5774
P_2 (25% sugar cane treetops+ 75% indigofera)	6,0000 $_{bc}$ ±0,0000
P_3 (100% sugar cane treetops)	5,0000 $_{a}$ ±0,0000
P_4 (100% indigofera)	6,5000 $_{c}$ ±0,5774

Note: different superscripts in the same column show significant differences (p <0.05)

Table-3: The average of silage's characteristics scor value

Composition of Silage Mixture (%)	Silage Characteristic			
	Color	Scent	Texture	Fungi
P_o (50% sugar cane treetops+ 50% indigofera)	1,8100±0,1273	1,0675±0,0450	1,4050± 0,0519	1,0000±0,0000
P_1 (75% sugar cane treetops+ 25% indigofera)	1,5625±0,1132	1,0225±0,0450	1,2700± 0,1039	1,0000±0,0000
P_2 (25% sugar cane treetops+ 75% indigofera)	2,2025±0,0450	1,3150±0,1558	1,8325± 0,8617	1,0000±0,0000
P_3(100% sugar cane treetops)	1,7075±0,6364	1,1575±0,8617	1,4500± 0,1273	1,0000±0,0000
P_4 (100% indigofera)	2,0900±0,0000	1,4500±0,0000	1,5400± 0,0735	1,0000±0,0000

Note: different superscripts in the same column show no significant differences (p <0.05)

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Figure-1: Sugar Cane Treetops

Figure-2: Indigophera sp

Figure-3: Weighing Forage

Figure-4: Mixing Forage

Figure-5: Ensiling Process (±21 days)

Figure-6: Complete Silage