The Effect of Effective Microorganisms-4 (Em 4) Addition on the Physical Quality of Sugar Cane Shoots Silage

Sofia Sandi, Muhakka, & Ardi Saputra*

Study Program of Animal Science, Faculty of Agriculture, University of Sriwijaya, Jl. Raya Palembang Km.32, Inderalaya, Ogan Ilir, Sumatera Selatan, 30662, Indonesia
**e-mail:sofiasandi_nasir@yahoo.com*

Abstract

This research aimed to find out the physical quality of silage sugarcane shoots with the addition of Effective microorganism (EM-4). This research was conducted in the Laboratory of animal science and in the Laboratory of Chemistry and Microbiology the Faculty of Agriculture Sriwijaya University. Shoots of sugar cane were cut into pieces as long as pieces 2-3 cm and dried up to obtain water levels 60-70%,then the addition of EM4 was done according to dose treatment and stored for 21 days. Physical observation, temperature and the amount of lactic acid bacteria were analyzed descriptively while the measurement of the degree of acidity and percentage fungi of used Completely Randomized Design with 5 treatments and 3 replications. The treatments were: T0= shoots of sugar cane without treatment (control), T1= shoots of sugar cane+4%EM4 (v/w), T2= shoots of sugar cane+6%EM4 (v/w), T3= shoots of sugar cane+ 8%EM4 (v/w), T4= shoots of sugar cane+10%EM4 (v /w). The results showed that the temperature of silage sugar cane ranges from 27.5-29oC.The ever increasing doses of EM4 showed a yellowish green color. The flavor was sour and fresh fragrant, the increase in the amount of lactic acid bacteria, significantly affect (P<0.05) pH (4.3-5.2) and the percentage of fungi (0.52-2.29%). The conclusion of this research is with increasing the dose of the effective microorganism 4 treatment up to 10 % can retain physical qualities of shoots of sugar cane shoots silage.

Key words: effective microorganism-4, physical quality, silage, sugar cane shoot

Introduction

Cane is chief source of sugar confection replace rain large tropical countries and subtropical . Plantation in pt nusantara (PTPN) vii in love sweet south sumatra cane crop production in 2010 reached 69.23 ton/hectares from the acreage of the sugar cane plantations 12.715 and produce 14% shoots of sugar cane from produc-

tion (Koeshartowo, 2011). Shoots of sugar cane is waste not much used by producers sugar potentially as providing fodder potential. Besides, plant cane ordinary harvested season so that can be used as an alternative a grass substitute who in the season persediaannya greatly reduced. According to Muchtar *et al*. (1983) declaring that shoots of sugar cane as a grass substitute elephant not give negative influence against cattle cut and dairy.

Shoots of sugar cane can be given in the form of fresh or dried. But weakness of shoots of sugar cane was to have the nature of quick-drying, wilt and yellow in time relatively quickly, therefore necessary preservation as silage. Prayitno (2010) reported that ingredients nutrients shoots of sugar cane processed better than given fresh. Sumasih et al. (2009) declaring that silage is the storage and fermenting forage fresh in anaerobic condition with the help of lactic acid bacteria. Composition nutritional value in silage will experience change namely carbohydrates should abate, but protein rough on silage good will not undergoing many changes.

Effective microorganism 4 (EM-4) is a mixture of various microorganisms which can be utilized as a source of inoculum in improving feed quality. Utilization of the EM-4 as a source of mikrobia in sugar cane shoots in silage laboratoris can improve nutrition and expected to play a role in overcoming the constraints of lack of feed dry all season.

Materials and Methods

This research was carried out at the farm as well as Enclosure Experiment Laboratory of Nutrition and Chemical Laboratory and Microbiology Agricultural Faculty of Agriculture University of Sriwijaya for 4 months.

The materials used in this research is derived from the shoots of sugar cane sugar cane plantations love sweetly district of suspects ogan, ilir effective microorganism-4 (em-4) derived from palembang cinde market and chemicals and equipment for analysis .

The making of silage shoots of sugar cane

The shoots sugar cane first cleaned then will be cut with 2-3 cm and dikering anginkan to the water level 60-70%. Each sample was em-4 in accordance with the dose of the treatment. Later included in into the plastic bags to dense and bound to happen anaerobic condition and deposited for 21 days. After the fermentation of the 21 days finished, the sample measure temperature it is, and then opened and was taken immediately samples analyzed.

Research design and data analysis

The design that was used in this study is a randomized design complete (RAL) consisting of 5 and 3 times a recycling treatment:

T0 = Shoots sugar cane without treatment (control)
T1 = Shoots sugar cane + 4% EM-4 (v/w)
T2 = Shoots sugar cane + 6% EM-4 (v/w)
T3 = Shoots sugar cane + 8% EM-4 (v/w)
T4 = Shoots sugar cane + 10% EM-4 (v/w)

Data is processed and analyzed with the fingerprint of the deskriftif variety in accordance with the draft is used, If the treatment effect is real then conducted tests in Multiple Areas of Advanced Multiple Range Test Duncan (DMRT) (Steel and Torrie, 1991).

Variable

The variables observed ware the physical characteristics including temperature, color, aroma and texture of a percentage of the fungi (Yusmadi, 2008), pH (AOAC, 1990), and the amount of lactic acid bacteria (Fardiaz, 1987).

Results and Discussion

Characteristics of Silage

The temperature of the sugar cane shoots during the process of silage ensilase ranges from 27.5-29 ^{o}C, temperature is a characteristic of a good silage. This is in accordance with statement Okine *et al*. (2005), which reported good quality silage is produced at temperatures between 25 to 37 ^{o}C. The difference in temperature is due to the existence of the activity of micro-organisms that produce carbon and heat production due to the process of respiration in the initial phase (phase aerobic) ensilase so that the formation of carbon dioxide (CO_2), water (H_2O) and heat (Coblentz, 2003).

Research results show that sugarcane shoots aromatic treatment T0, T1, T2, and T3 is an aromatic acid, whereas treatment T4 was flavorful fragrant fermentation. The difference in this fragrance guess because the higher the level the use of EM-4 to 10% dose (T4), leading to an increased number of lactic acid bacteria (Table 1), in which the bacteria that produce fragrant aroma of fermenting. Smells sour on treatment of T0, T1, T2, and T3 is allegedly the end product of fermentation lactic acid not only alone, but also produces butyric and acetic acid, alcohol. Abdelhadi *et al*. (2005), stating the characteristics of good silage is aromatic acids and fragrant fermentation (Abdelhadi *et al*., 2005).

Color observation silage sugarcane shoots on each treatment having the same color from fresh green before ensilase to green yellowish. The addition of the EM-4 to 10% of the dose of the accelerating phase of anaerobic, as more and more adding EM-4 to dose 10% then the more the amount of lactic acid bacteria too which helps speed up anaerobic phase. Coblentz (2003) States that the increase in temperature can affect the structure of silage for example color change silage becomes dark.

Tabel 1. The physical characteristics, pH and total of lactic acid bacteria silage shoots of sugar cane

Treatment	Tempera-ture	Colour	Aromatic	Texture	pH	% fungi	∑ LAB
T0	29	Green yellowish	Acid	rather delicate	5.2 ± 0.1^{c}	2.29 ± 0.25^{b}	3.4×10^{8}
T1	28	Green yellowish	Acid	rather delicate	4.6 ± 0.1^{b}	2.24 ± 0.20^{b}	4.1×10^{8}
T2	28	Green yellowish	Acid	rather delicate	4.5 ± 0.0^{b}	2.16 ± 0.44^{b}	4.6×10^{8}
T3	28	Green yellowish	Acid	rather delicate	4.5 ± 0.0^{b}	1.49 ± 0.87^{b}	4.9×10^{8}
T4	27.5	Green yellowish	Fragrant	refined	4.3 ± 0.0^{a}	0.52 ± 0.41^{a}	5.2×10^{8}

Note: different supercript shows significant ($P<0.05$).

The research results of texture for silage sugarcane shoots silky-textured show that until rather delicate. The addition of the EM-4 at a dose of 10% (T4) can fine-tune the texture of sugar cane, silage at the helm had expected the EM-4 can be rough fibers and degrades the Flex bond lignoselullosa, so that the texture of silage sugarcane shoots becomes refined. This is in accordance with statement Darmawan (2010), which reported the use of EM-4 in fermentation can lower the levels of crude fiber. Good silage will see a refined texture (Ratnakomala *et al*., 2006; Ridla *et al*., 2007).

Statistical results show the addition of the EM-4 at the helm of different silage sugarcane real ($P>0.05$) against the percentage of fungi. T4 treatment has the lowest percentage of fungi (0.52%) while the highest on treatment T0 (2.29%). The addition of the EM-4 to 10% of the dose of the accelerating phase of anaerobic, because the higher the addition of EM-4 to 10% of the dose the higher the amount of lactic acid bacteria too which helps speed up anaerobic phase so that the fungus cannot grow with fertile, while in treatment T0 (control) is allegedly a longer phase of aerobnya because it is not added to the EM-4 so slow lactic acid bacteria evolved as a result of fungi can utilize aerobic phase to grow and thrive. Fungal growth on this research only at the top of the course, because dense less than perfect, so the process of respiration continued as a result formed CO_2, H_2O and heat. Water that is formed, causing difficult going anaerobic conditions, so that fungi grow and develop. This fungus will produce mikotoksin/toxins that can interfere with the health of cattle (Coblentz, 2003).

pH Silage Shoots of Sugar Cane

The results showed the addition of diverse EM-4 silase in the sugar cane

different real (P>0.05) in degrees acid (pH). The result showed that the continued degrees acid (pH) silase this research is varied in sugar cane criteria from good to bad. The quality of a good silase found in treatment T4 (4.3) and the quality of poor for treatment T0 (5.2). Macaulay (2004) said that can silase the quality of being inducted into four categories, which is well (pH 3.2-4.2), good (pH 4.2-4.5), bad (pH 4.5-4.8), and very bad (> 4.8). The addition of the EM-4 pH affect the quality of silage, because the higher the awarding of EM-4 to 10% dose, then the greater the decrease in pH. A decrease in the pH of the silage is influenced by lactic acid bacteria during the process of ensilase. With the large number of lactic acid bacteria contained in the silage sugarcane leaf would be more effective to facilitate the process of ensilase and will continue to progress until the pH is low enough to inhibit the growth of mikoorganisme predominantly adverse (Lopez, 2000).

Total Lactic Acid Bacteria

Lactic acid bacteria are a group of bacteria that are capable of converting carbohydrates (glucose) into lactic acid. Bakterisidal effects of lactic acid are associated with a decrease in the pH of the environment being 3 to 4.5 so that the growth of other bacteria including pembusuk bacteria will be hampered. The largest amount of lactic acid bacteria in treatment of T4 (5.2 x 108 CFU/gr), while the lowest treatment T0 (3.4 x 106 CFU/gr). The difference in the amount of lactic acid bacteria is affected by pH of silage. the pH will determine which microorganisms are active in making silage. Lactic acid bacteria shows optimal activity at pH= 4.3 (Woolford, 1984). Treatment with additional t4 EM-4 to 10% placeman phænogamous during the lowest ensilase. With the number of lactic acid bacteria contained in silage shoots of sugar cane of inhibiting the growth will mainly mikoorganisme is harmful. Chen and Weinberg (2008), declare silage good dominated by working lactic acid bacteria and produces lactic acid on the contrary, the process of fermentation silage a less well cause clostridia develops characterized by high levels of butyric acid (elferink *et al*., 2000).

Conclusions

Based on the research inconclusive that increases in dosages effective microorganism- 4 treatment of 10% dosages can improve the physical quality of of silage shoots of sugar cane.

References

Abdelhadi LO, Santini FJ, Gagliostro GA. 2005. Corn silase of high moisture corn supplements for beef heifers grazing temperate pasture; effects on performance ruminal fermentation and in situ pasture digestion. *Anim. Feed Sci. Technol.*

118: 63-78.
AOAC. 1990. *Official Methods of Analysis*. 15th ed. Washington DC : Association Official Analytic Chemist.
Chen, Y. dan Z. G. Weinberg. 2008. Changes during aerobic exposure of wheat silages. Anim. Feed *Sci. Technol*.154: 76 -82.
Coblentz, W. 2003. Principles of Silase Making. University of Arkansas. Payetteville. http:/www.uaex.edu. [May 2011].
Darmawan, k. 2010. Rice straw fermented feed alternatives. http://em4organic.blogspot.com. [May 2011].
Elferink, S. J. W. H. O., F. Driehuis, J. C. Go schal, dan S. F. Spoelstra. 2000. Silage fermentation processes and their manipulation. In: Mannetje, L.T. Silage making in the tropics with particular emphasis on smallholders. Proceedings of the FAO electronic conference on tropical silage 1 September to 15 December 1999.
Fardiaz, S. 1987. The practice of microbiology food. Resources information, Bogor Agriculture University . Bogor
Koeshartowo. R. 2011. PTPN VII will add acreage sugarcane. Sripo Online.http://www.bumn.go.id/ptpn7/id/uncategorized/. [October 2011].
Lopez, J. 2000. Probiotic in animal nutrition. Asian-australas. *J. Anim. Sci*. 13:12-26.
Macaulay A. 2004. Evaluatingsilage quality. Http/www.agri.gov.ab.Ca/$department Deptdocs nsf/all/for4909.html. [May 2011].
Muchtar, M., S. Tedjowahdjono, Y. Kurniawan, dan U. Mardiyanto. 1983. "A potential byproduct of sugar industry in the development of animal husbandry in Indonesia%". Proceedings Of The Seminar. National Institute Of Chemistry LIPI. Jakarta.
Okine, A., M. Hanada, Y. Aibibula dan M. Okamoto. 2005. Ensiling of potato pulp with or without bacterial inoculants and its effect on fermentation quality, nutrient composition and nutritive value. *Anim. Feed Sci. Technol*. 121: 329–343.
Ratnakomala.S, Ridwan R. Kartina G, Widyatuti Y. 2006. Influence of inoculum *Lactobacillus plantarum* 1A-2 and to the quality of silage 1BL-2 elephant grass (*pennisetum purpureum*). *Biodivertas*. 7(2):131-134
Ridla M, N. Ramli, L Abdullah dan T. Toharmat. 2007. Milk yield quality and satiety of dairy cattle fed silage composed of organic components of garbage. *J. Ferment. Bioeng*. 77(5):572-574.
Stell, R.G.D. and Torrie. 1991. Principles and procedures of statistics a biometric approach. Gramedia, Jakarta.
Sumarsih, S. Sutrisno, CI. dan Sulistiyanto, B. 2009. Study of adding drops as organoleptik and adiftif to the quality of silage banana peel nutrients. National Seminar On The Resurrection Of The Farm. Semarang.
Prayitno E. 2010. Shoot sugar cane. http://science.blogspot.com/2010/02/sugarcane.

html. [October 2011].
Woolford, MK 1984. The Silage Fermentation.Microbiology series. vo1.l4. Marcel Dekker Inc., NewYork.
Yusmadi. 2008. Study of quality and palatabilitas silage and hay complete ration-based organic waste primer on avoiding goat etawah. [Thesis]. Graduate Programs. Bogor Agricultural University. Bogor.