

Effect of different additives on quality of napiergrass silage⁽¹⁾

Yu-Kuei Cheng⁽²⁾⁽⁴⁾ and Ping-Wu Peng⁽³⁾

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Abstract

The objectives of this experiment were to investigate the effect of different additives on quality of napiergrass (*Pennisetum purpureum* Schum) silage. Napiergrass Taishi No. 2 (cv. TLG2) with high water soluble carbohydrates was used to make silages added with corn meal or wheat bran, followed by adding with or without enzyme. Crude protein, acid detergent fiber, neutral detergent fiber, water soluble carbohydrates and volatile fatty acid contents of silage were determined to evaluate silage quality. The results showed that cv. TLG2 could make good silages without any additives added, while the dry matter percent was low. Napiergrass added with 5 -10% of corn meal or wheat bran not only increased the dry matter and crude protein contents, but it also decreased the contents of acid detergent fiber and neutral detergent fiber. Lactic acid was the main preservative organic acid in all silages. The main effect of the enzyme product was the decrease of neutral detergent fiber content of silage and the best result was obtained from the control treatment with an enzyme product added to cv. TLG2. According to the quality of silages and the cost of additives, it was suggested that it might be a better choice by adding with 5 -10% of wheat bran in napiergrass to make silage.

Key words: Napiergrass, Silage, Additives, Forage quality.

Introduction

Napiergrass (*Pennisetum purpureum* Schum) is one of the major forage species grown in Taiwan. How to provide a steady supply of forage with good quality to the ruminants in the whole year is a problem to be solved. In the growth season with high rainfall and temperature, grasses grow vigorously leading to high content of cell wall constituents. In addition, the forage supply varies during this season. In autumn and winter, napiergrass grow slowly and bloom, and the forage is in short supply. Stockpiling of forage on farm is generally not an effective storage method because the nutritive value of forage declines rapidly,

(1) Contribution No.1229 from Livestock Research Institute, Council of Agriculture, Executive Yuan.

(2) Forage Crop Division, COA-LRI, Hsinhua 712, Tainan, Taiwan, R.O.C.

(3) Hengchun Branch, COA-LRI, Pintung 946, Taiwan, R.O.C.

(4) Corresponding author.

in the rainy season. Making silage could be advantageous on dairy farm to ensure a steady supply of forage in the whole year. However, it is not a common practice to ensile napiergrass in Taiwan. The reason is that napiergrass is high in water content and low in water-soluble carbohydrates, and the silage quality is not satisfactory. Napiergrass cv. TLG2 with high forage yield and quality has been released and recommended to farmers to grow (Cheng *et al.*, 1997). Therefore, the objectives of the present study were to investigate the ensiling characteristics of cv. TLG2 with or without additives.

Materials and Methods

Napiergrass cv. TLG2 planted at Hengchun was harvested at 9 weeks regrowth by harvest machine in July 2000 and was chopped to a length less of than 1.5 cm. The chopped forage was mixed with corn meal or wheat bran and an enzyme product which contained cellulases, xylanases, glucose oxidase, *Pediococcus acidilactici* and *Lactobacillus plantarum*. The treatments were as follows: A. TLG2 + 5 % corn meal, B. TLG2 + 10 % corn meal, C. TLG2 + 5 % wheat bran, D. TLG2 + 10 % wheat bran, E, TLG2 (control). AZ. Treatment A + Enzyme, BZ. Treatment B + Enzyme. CZ. Treatment C + Enzyme, DZ. Treatment D + Enzyme, EZ. Treatment E + Enzyme. The concentration of the enzyme was 0.15 ml/kg fresh weight. Then the mixtures were packed into a polyethylene pipes (20.5 cm in diameter, 50 cm high and 0.5 cm thick) and were kept at ambient temperature for 1.5 months. A completely randomized design (CRD) was used with 3 replications. Chemical analyses were done including dry matter contents (DM), crude protein (CP) (AOAC, 1984), acid and neutral detergent fiber (ADF, NDF) (van Soest, 1967), water soluble carbohydrates (WSC) (Morris, 1948), pH value, lactic acid (LA) and acetic acid (AA) (Jones and Kay, 1976). Data were run on the SAS and means were tested by Duncan's multiple range test (SAS Institute Inc, 1988).

Results and Discussion

The chemical compositions of the napiergrass silage with different additives were shown in Table 1. The dry matter (DM) content of silage added with corn meal or wheat bran increased significantly. No significant difference in DM was observed between 5% corn meal and wheat bran added or between 10% corn meal and wheat bran added. The crude protein of silage also increased with corn meal or wheat bran added. Those with wheat bran was better than corn meal added, and the highest one was observed with 10% wheat bran added. The contents of both ADF and NDF decreased significantly. Those with corn meal were lower than those with wheat bran. The lowest one was observed with 10% corn meal added. The contents of water soluble carbonhydrates in silages with wheat bran were higher than those with corn meal. The main preservative organic acid was lactic acid in all silages, and acetic acid was next. Butyric acid content was negligible (not shown in table). The lactic acid content in silages with wheat bran was higher than that with corn meal. Catchpoole and Henzell (1971) reported that fermentation of tropical forages had not resulted in production of large concentrations of lactic acid. In this report, we found that the lactic acid was the main organic acid which might be due to the high content of water soluble carbonhydrates in napiergrass. The pH values of all silages were below 3.9 and higher in silages with wheat bran added than the others. Woodard *et al.* (1991) reported that the pH values of napiergrass silage were 3.8-4.4 and depended on harvest

frequency and genotype of the forage. Hsu *et al.* (1990) reported that quality of napiergrass silage could be improved by adding corn meal or wheat bran, and the best one was added with 10 % corn meal during ensiling .

Table 1. The chemical composition of napiergrass (TLG2) silages with different additives

Treatment	DM***	CP	NDF	ADF	WSC	LA	AA	pH
			%			g/kg		
A**	24.5 ^{b*}	9.6 ^c	60.9 ^c	40.0 ^b	0.31 ^c	6.43 ^c	1.24	3.61
B	27.0 ^a	9.5 ^c	53.9 ^d	33.7 ^c	0.33 ^{bc}	6.37 ^c	1.20	3.63
C	24.5 ^b	10.5 ^b	65.3 ^b	41.0 ^b	0.41 ^a	7.65 ^{ab}	1.26	3.72
D	26.6 ^a	11.7 ^a	63.0 ^{bc}	37.9 ^b	0.40 ^{ab}	8.03 ^a	1.28	3.81
E	21.9 ^c	8.2 ^d	71.2 ^a	48.2 ^a	0.39 ^{ab}	7.22 ^b	1.29	3.64

* Means with the same letters in the same column are not significantly different at 5% level.

** A : TLG2 + 5 % corn meal; B: TLG2 + 10 % corn meal; C: TLG2 + 5 % wheat bran; D: TLG2 + 10 % wheat bran; E: TLG2 (control).

*** DM : dry matter contents ; CP: crude protein; NDF : neutral detergent fiber; ADF:acid detergent fiber; WSC : water soluble carbohydrates; LA: lactic acid ; AA : acetic acid ; pH: pH value.

The effects of the enzyme product on the quality of silages were shown in Table 2. There were no significant differences in DM contents or pH values. Only the control treated with the enzyme product had higher crude protein. NDF contents of all treatments decreased. NDF in silages with wheat bran or control treated by the enzyme product decreased significantly. In ADF content, only the control treated with the enzyme product was significantly different. Silage treated with the enzyme product had higher content of water soluble carbohydrate, and it increased significantly for the control treated by the enzyme product. As for the lactic acid, the control and the silages with wheat bran had higher contents. It was shown that the enzyme product might be capable of breaking down structural polysaccharides to enhance preservation by increasing levels of lactic acid compared with untreated silages. The silage without any additives used was the best response for the enzyme product treatment. Silage additives (*e.g.*, bacterial inoculants, enzymes, acids, nutrient sources, *etc.*) played significant roles in enhancing quality. The benefits of these additives includes stimulation of lactic acid fermentation, inhibition of microbial growth, inhibition of aerobic fermentation, and provision of nutrients (Ojeda and Caceres, 1985; Panditharathne *et al.*, 1986; Yokota *et al.*, 1991, 1994; Jacobs and Mcallan, 1991; Jacobs *et al.*, 1991). From the results, it was evident that cv. TLG2 could make good silage without any additives, but the DM was low. Adding corn meal or wheat bran to cv. TLG2 could increase the DM and improve the silage quality. In addition, adding enzyme to cv. TLG2 also improved the silage quality. According to the quality of silages and the cost of additives, it was suggested that adding wheat bran to cv. TLG2 during ensiling might be a good choice to improve the silage quality.

Table 2. The chemical composition of napiergrass (TLG2) ensiled with the enzyme product

Treatment	DM***	CP	NDF	ADF	WSC	LA	AA	pH
			%				g/kg	
A***	24.2	9.8	61.5	40.7	0.21 ^b	6.38	1.24	3.62
AZ**	24.8	9.3	60.4	39.2	0.41 ^a	6.48	1.23	3.60
B	27.3	9.6	54.5	35.0	0.26	6.33	1.22	3.65
BZ	26.7	9.5	53.4	32.3	0.40	6.42	1.18	3.60
C	25.2	10.8	67.1 ^a	40.6	0.34	7.31 ^b	1.28	3.71
CZ	23.9	10.2	64.4 ^b	40.4	0.49	7.98 ^a	1.24	3.72
D	26.0	11.7	64.1 ^a	38.1	0.27	7.87	1.29	3.81
DZ	27.2	11.8	61.9 ^b	37.7	0.38	8.18	1.27	3.80
E	21.7	7.9 ^{b*}	74.0 ^a	52.9 ^a	0.26 ^b	6.87 ^b	1.31	3.64
EZ	22.0	8.5 ^a	69.6 ^b	45.4 ^b	0.51 ^a	7.56 ^a	1.27	3.64

*Means with the same letters within the same column of same treatment A, B, C, D, or E are not significantly different at 5% level.

** AZ: Treatment A + Enzyme; BZ: Treatment B + Enzyme; CZ: Treatment C + Enzyme; DZ: Treatment D + Enzyme; EZ: Treatment E + Enzyme.

*** As shown in Table 1.

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不同添加劑對於狼尾草青貯料品質之影響⁽¹⁾

成游貴⁽²⁾⁽⁴⁾ 彭炳戊⁽³⁾

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摘 要

狼尾草為國內草食動物主要牧草來源，為能全年穩定供應，於盛產季節調製青貯料為一可行之方法，因此，本試驗目的在於瞭解不同添加劑對於狼尾草台畜草二號青貯品質之影響，以供狼尾草青貯調製時之參考。試驗處理包括於適期收穫之狼尾草添加 5 - 10% 玉米粉、5 - 10% 麩皮及牧草纖維分解酵素等。青貯品質分析項目包括乾物質、粗蛋白質、中洗與酸洗纖維、水溶性碳水化合物、脂肪酸等。由試驗結果顯示，狼尾草台畜草二號可單獨調製為良好青貯料，然乾物質偏低，添加 5-10% 之玉米粉或麩皮，不但青貯料乾物質增加，粗蛋白質亦增加，而中洗與酸洗纖維降低，乳酸為青貯料脂肪酸之主要部分，然水溶性碳水化合物降低。酵素處理之效果以降低中洗纖維最為明顯，其中以狼尾草台畜草二號單獨以牧草纖維分解酵素處理效果最佳，不論粗蛋白質、中洗與酸洗纖維、水溶性碳水化合物及乳酸含量皆有顯著差異。由青貯品質與添加劑成本等考量，建議以添加 5-10% 麩皮為適宜之選擇。

關鍵詞：狼尾草、青貯料、添加劑、牧草品質。

(1) 行政院農業委員會畜產試驗所研究報告第 1229 號。
(2) 行政院農業委員會畜產試驗所，飼料作物組。
(3) 行政院農業委員會畜產試驗所恆春分所。

(4) 通訊作者。