Fermentation Quality and Chemical Composition of Napier Pakchong 1 Silage Supplemented with Lactic Acid Bacteria

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Introduction

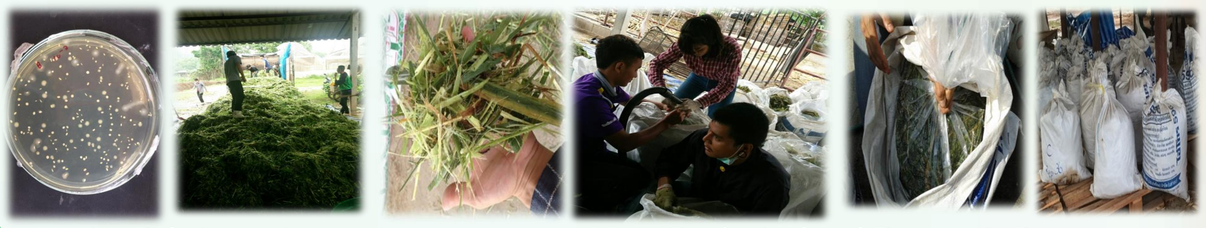
Napier Pakchong 1 grass (Pennisetum purpureum x P. americanum cv. Pakchong 1) has been developed by the Nakhonratchasima Animal Nutrition Research and Development Center, Thailand (Sarian 2013). Napier Pakchong 1 grass is one of the most promising grasses available for ruminant production because of its high yield and high nutritional value (Cherdthong et al. 2015). However, forage is abundant during the rainy season, which grows well and there is more than enough for a cattle. While, in dry season is scarce. Preserving forage yield during the rainy season should be made in form silage.

The preservative the nutrients in the silage can be achieved by speeding up the process of fermentation plants earlier than usual by causing anaerobic conditions faster. This can be done by adding the bacteria that can live in anaerobic conditions and has the ability to inhibit and destroy microbes that use oxygen to decrease such as lactic acid bacteria. Therefore, used of starter cultures such as lactic acid bacteria (LAB) can be increase the fermentation process faster.

It was expected that inoculants containing LAB would lower pH more quickly and more effectively than naturally occurring epiphytic bacteria, which low pH inhibits the growth of many detrimental microorganisms and helps reduce proteolysis and other plant enzyme activity (Kleinmans et al., 2011). Therefore, the objective of this study were to evaluate effect of lactic acid bacteria supplementation on fermentation quality and chemical composition of Napier Pakchong 1 silage

Material and Methods

- Approximately 10 grams of corn silage were collected at 21 days of fermentation
- Lactic acid bacteria was screened. The isolates was grown in MRS agar plate at 37°C for 48 hours in anaerobic condition
- Lactic acid bacteria was cultivated in MRS broth



- Napier Pakchong 1 grass was grown at Mae Hia Agricultural Research Demonstrative and Training Center, Faculty of Agriculture, Chiang Mai University, Chiang Mai, Thailand
- The grass was harvested at 45 days of maturity and chopped at 3–8-cm length.
- The experimental design was a completely randomised design. Napier Pakchong 1 Silage were divided 2 groups (control and supplemented with LAB with 1×105 cfu/ml concentration)
- The experimental silages were packed tightly in two-layered plastic bags and vacuumed. Silage was collected at 14, 21, 28, 35 days of ensiled times

- The sample of each silage was used for determination of pH by pH meter, lactic acid by high performance liquid chormatography (HPLC) (Madrid et al., 1999) and volatile fatty acids by gas chromatograph (GC) (Cao et al., 2009).
- Dry matter (DM), crude protein (CP), ether extract (EE) and crude fiber (CF) were analyzed according to AOAC Methods (AOAC, 2000). The neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were analysed by detergent methods (Van Soest et al. 1991).

Results and Discussion

- pH value of Napier Pakchong 1 silage supplemented with LAB were lower than control group
- Lactic acid concentration was higher in Napier Pakchong1 silage supplemented with LAB.
- The DM content of Napier Pakchong 1 silage supplemented with LAB were lower than control group, presumably reflecting the increased water production due to greater fermentative activity (McDonald et al., 1991).
- The CP and ADF concentration of Napier Pakchong 1 silage declined as the increasing of ensiling time. The CP and EE concentration of Napier Pakchong 1 silage supplemented with LAB were higher than control group (8.57 vs 7.98% and 2.50 vs 2.31 %).
- The CF concentration of Napier Pakchong 1 silage supplemented with LAB were higher than control group.
- A significant interaction of the effects of the inoculants and periods of fermentation ($P<0.01$) was observed on the acetic acid, propionic acid, lactic acid and NDF.
- The grass was harvested at 45 days of maturity and chopped at 3–8-cm length.

Table 1. The pH, volatile fatty acid, lactic acid and chemical composition (%DM basis) of Napier Pakchong 1 silage at different ensiling period

Item	Treatment	Ensiling period				Avg	P-value		
		14	21	28	35		Time	LAB	T*L
pH	control	4.16	4.26	4.31	4.29	4.31[b]	0.14	<0.01	0.23
	LAB	4.38	4.13	4.15	4.21	4.17[a]			
	average	4.27	4.20	4.23	4.25				
Acetic acid	control	0	0.50	0.06	0.35	0.23	0.09	0.60	0.01
	LAB	0	0	0.97	0.22	0.30			
	average	0[a]	0.25[ab]	0.51[b]	0.28[ab]				
Butyric acid	control	0	0	0	0	0	0.41	0.33	0.41
	LAB	0.003	0	0	0	0.0006			
	average	0.001	0	0	0				
Propionic acid	control	0.03	0.01	0.06	0.03	0.03	0.04	0.42	0.03
	LAB	0.01	0.04	0.03	0.04	0.03			
	average	0.02[a]	0.03[ab]	0.05[b]	0.03[ab]				
Lactic acid	control	2.10	1.58	2.61	1.31	1.90[a]	<0.01	0.03	0.03
	LAB	4.07	1.20	2.12	1.37	2.19[b]			
	average	3.09[b]	1.39[a]	2.37[b]	1.34[a]				
Chemical composition									
DM	control	22.18	23.74	20.48	21.34	22.04[b]	0.67	0.01	0.23
	LAB	18.94	18.88	20.17	19.85	19.73[a]			
	average	20.56	21.31	20.33	20.59				
OM	control	81.75	82.85	81.82	82.22	81.91	0.07	0.27	0.74
	LAB	81.51	83.78	83.54	82.22	82.47			
	average	81.10	83.32	82.68	82.22				
CP	control	8.36	7.96	7.96	7.67	7.98[a]	<0.01	<0.01	0.18
	LAB	8.70	8.57	8.31	8.14	8.57[b]			
	average	8.52[c]	8.26[b]	8.14[b]	7.91[a]				
EE	control	2.33	2.26	2.73	2.72	2.50[a]	<0.01	<0.01	0.09
	LAB	2.53	2.44	2.84	2.78	2.31[b]			
	average	2.43[a]	2.35[a]	2.79[b]	2.75[b]				
CF	control	28.74	28.18	30.67	28.71	28.66[a]	0.20	0.03	0.80
	LAB	31.28	29.31	30.64	31.03	30.28[b]			
	average	30.01	28.74	30.65	29.87				
NDF	control	60.03	57.61	58.30	58.89	59.22	0.08	0.43	<0.01
	LAB	58.04	61.92	56.82	58.34	58.76			
	average	59.03	59.77	57.56	58.61				
ADF	control	40.67	39.17	35.67	40.38	39.27	<0.01	0.47	0.15
	LAB	43.93	43.01	35.57	37.05	39.99			
	average	40.43[c]	41.09[bc]	35.62[a]	38.72[ab]				
ADL	control	7.11	6.64	7.18	7.74	7.19	0.23	0.49	0.56
	LAB	7.67	7.19	6.89	7.52	7.34			
	average	7.39	6.92	7.03	7.63				

[a,b] Means in the same row with different superscripts differ significant ($P<0.01$),
DM loss = Dry matter loss, LAB = Lactic acid bacteria, T*L =Time × Lactic acid bacteria

The result of this research claimed that the addition of LAB stimulated the early growth of LAB and caused a more rapid decline in silage pH and also enhances aerobic deterioration of silages and inhibit the growth of fungi. Indeed, acetic acid is known to play an important role in the aerobic stability of silages. The simultaneous production of lactic acid and acetic acid by the LAB maintain the aerobic stability in silages (Ashbell et al., 2002).

Conclusions and Outlook

It can be concluded that LAB supplementation increase fermentation of Napier Pakchong 1 silage and decrease the nutrient deterioration of Napier Pakchong 1 silage

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