

Utilization of Soybean Milk Residue as Additive of Para Grass Silage

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Abstract

The objective of this study was to determine nutrients and ruminal digestibility of Para grass silage added with dried soybean milk residue (DSMR). The experimental design was completely randomized design with 4 treatments and 3 replications. The treatments were DSMR addition to Para grass at 0, 5, 10, and 15% fresh weight. The ensiling period was 30 days. The samples were collected and analyzed for nutrients and digestibility in rumen with batch culture for 24 h. The results showed that the increasing of DSMR (0, 5, 10 and 15) significantly increased dry matter (19.54, 23.23, 25.53 and 28.80%, respectively), crude protein (7.14, 13.71, 17.76 and 20.04 %DM, respectively), dry matter digestibility (32.54, 43.40, 55.53 and 63.52%, respectively), organic matter digestibility (30.12, 40.30, 53.44 and 61.81%, respectively) and crude protein digestibility (45.11, 73.79, 83.04 and 89.12%, respectively) of Para grass silages. Dry matter loss of the silages added with DSMR at 5-15% were not significantly different (8.18-11.78%) but significantly decreased when compared to the control (16.12%). Para grass silage added with 15% DSMR had higher organic matter content ($P<0.05$; 92.31 %DM) than the silage added with 0, 10 and 15% DSMR (90.16, 91.72 and 91.89%DM, respectively). In conclusion, Para grass silage added with 15% DSMR had the highest nutrients and ruminal digestibility.

Keywords: Para grass silage; soybean milk residue; nutrient; digestibility; rumen; batch culture.

1. Introduction

Silage production is an alternative way to preserve fresh forage crops, such as maize, grasses and legumes for feeding ruminants during dry season. In many countries, ensiled forages are highly valued as animal feed. In European countries, such as The Netherlands, Germany and Denmark, more than 90% of the forages produced are stored as silage. Even in

countries with generally good weather conditions for hay making, such as France and Italy, about half of the forages are ensiled [1]. In Thailand, no data reported regarding the amount of forage production and percentage of forage production that produced and stored as silage. However, silage production is still not extensively produced. Consequently dairy

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farmers often experience a shortage of roughage for the cows.

Para grass (*Brachiaria mutica*) is common forage in Thailand. It is a perennial grass which grows well in many soil types ranging from sandy loam to clay. It responds well to the fertility of soil and water and withstands flooding for a long time. It yields about 1.4 to 3.7 tons dry matter per rai per year and contains approximately 6-10 percent protein [2]. Since Para grass is abundant in Thailand during rainy season, it should be preserved as silage for feeding dairy cows during dry season.

Soybean milk residue, waste from soybean milk industry is high in moisture and spoil very quickly in room temperature. Its dry matter contains high nutrients with 31.5% crude protein, 8.9% crude fat and 12.1% crude fiber [3]. Several reports had shown the utilization of soybean residue as animal feed [3-5]. However, no data report utilization of soybean milk residue as additive for grass silage. The objective of this study was to determine nutrients and ruminal digestibility of Para grass silage added with dried soybean milk residue (DSMR). The result data from this experiment would be beneficial for soybean milk industry for having alternative way to add the value of its waste. It also benefit for dairy industry to have alternative way to produce high quality roughage for dairy cows during dry season.

2. Materials and Methods

The experiment was conducted with Completely Randomized Design. There were 4 treatments (3 replications) of dried soybean

milk residue (DSMR) addition to Para grass at 0 (control), 5, 10, and 15% fresh weight. Para grass were cut at 10 cm above ground and chopped to a length of 1 inch average. DSMR was then added to the chopped grass. Ensiling was carried out in double lined polyethylene plastic bags holding 10 kg each. They were kept indoors at room temperature. After 30 d of ensiling, dry matter losses were measured using dry matter weights before and after ensiling. The dry matter was determined in hot air oven at 60 °C for 72 h. The dried samples were ground through 1mm screen and then analyzed for organic matter, crude protein and pH [6]. *In vitro* ruminal digestibilities in 24 h of incubation Batch culture were determined following the methods described by [7]. In brief, rumen fluid was obtained from a dairy cattle previously fitted with rumen fistula. Rumen fluid was strained through 4 layers of cheese cloth, mixed 1:3 with McDougall's buffer and placed in glass culture flasks containing 3 grams of sample. Flasks were purged with CO₂ and then incubated in incubator shaker at 39°C. Samples were collected at 24 h. Samples were used to determine crude protein, dry matter and organic matter [6] and then calculated for the digestibilities. The result data were analyzed using Proc GLM and a comparison of the Least Square means [8].

3. Results and Discussion

Dry matter, crude protein, organic matter and crude fat of DSMR were 92.96, 19.99, 96.23 and 5.61%, respectively (Table 1). Dry matter losses of Para grass silages with DSMR 5-15% were not significantly

different ($P>0.05$) ranging from 8.18 to 11.78%. However, the DSMR addition significantly decreased dry matter loss when compared to the control (16.12%) (Table 2). [9] suggested that one of the most critical factors affecting silage dry matter losses is the moisture present in the crop prior to ensiling. Ensiling high moisture forage can increase dry matter loss. The data from this experiment indicated that the decrease in dry matter loss in Para grass silage with DSMR was due to the lower moisture content of Para grass and DSMR mixtures prior to the ensiling.

As shown in Table 1, pH of Para grass silages with DSMR 10-15% were not significantly different (4.96-5.01; $P>0.05$). When the percentage of DSMR addition decreased from 15 to 5 and 0, the pH significantly decreased (4.94 and 4.80, respectively). The higher pH as the amount of DSMR increased might be due to the increased ammonia from protein degradation of DSMR during the ensiling. [10] suggested that a low quality silage had pH higher than 5.1. Therefore, the obtained data reflected DSMR addition at 5 to 15% kept a good fermentation to produce high quality silages.

Dry matter of the silages significantly increased when DSMR increased ($P>0.05$; Table 2). [11] and [12] reported that a good quality of grass silage should contain 25-35% dry matter. High dry matter grass would result a problem of difficulty in air elimination prior to the ensiling. Low dry matter grass would result the problem of effluent. However, the data from this research indicated that DSMR

addition made a better quality of Para grass silage.

Para grass silage without DSMR contained less organic matter (90.16%; $P<0.05$) than those with 5-15% DSMR. Organic matter was highest in the silage with 15% DSMR (92.31%) followed by those with 10 and 5% DSMR (91.89 and 91.72%, respectively). Since the organic matter of DSMR was 96.23% as mentioned above, the increase of organic matter in the silage with DSMR was due to the increase amount of DSMR in the silage.

As DSMR increased, crude protein of the silage significantly increased ($P<0.05$; Table 2). As mentioned above, we found that DSMR contained 19.99% crude protein. The increased content of crude protein in the silage with DSMR was due to increased amount of DSMR. However, the obtained data reflected that the addition of 5-15% DSMR produced a better source of roughage for ruminants which had higher crude protein content than the requirement of ruminant for maintenance (8-10%) as mentioned by [13] and had higher crude protein content than the requirement for the activity of microorganisms in rumen (7%) as mentioned by [14].

Dry matter digestibility and organic matter digestibility increased as DSMR in the silages increased (Table 2). The data indicated that the addition of DSMR did not only increase crude protein content in the silages but also increased their dry matter digestibility and organic matter digestibility. These silages would enhance growth and production when fed to ruminants.

Crude protein digestibility significantly increased as DSMR in the silages increased (Table 2). [15] reported a high degradable protein of soybean meal in rumen (58-69%). The increased in crude protein digestibility in the silages with DSMR was due to the degradability of DSMR. The silages with DSMR would be a good source for ruminants that fed with concentrate containing readily fermentable carbohydrate such as cassava chips and molasses.

4. Conclusion

Addition of DSMR improved quality of Para grass silage. Para grass silage with 15% DSMR was the highest quality with the lowest dry matter loss and the highest nutrients and ruminal digestibility which would enhance growth and production when fed to ruminants. The data from this experiment supported an alternative way for dairy industry to produce high quality roughage for dairy cows during dry season.

Table1. Dry matter and nutrients of dried soybean milk residue (DSMR).

	DSMR
Dry matter (%)	92.96
Crude protein (%DM)	19.99
Organic matter (%DM)	96.23
Crude fat (%DM)	5.61

Table 2. Dry matter loss, pH, nutrients and digestibility in rumen of Para grass silages with dried soybean milk residue (DSMR) additive.

	DSMR (%)				CV
	0	5	10	15	
Dry matter loss (%)	16.12 ^a	10.84 ^b	11.78 ^b	8.18 ^b	12.36
Dry matter (%)	19.54 ^d	23.23 ^c	25.53 ^b	28.80 ^a	1.67
pH	4.80 ^c	4.94 ^b	4.96 ^{ab}	5.01 ^a	0.67
Nutrient (%DM)					
Organic matter	90.16 ^c	91.72 ^b	91.89 ^b	92.31 ^a	0.07
Crude protein	7.14 ^d	13.71 ^c	17.76 ^b	20.04 ^a	7.62
Digestibility (%)					
Dry matter digestibility	32.54 ^d	43.44 ^c	55.53 ^b	63.52 ^a	5.97
Organic matter digestibility	30.12 ^d	40.30 ^c	53.44 ^b	61.81 ^a	5.49
Crude protein digestibility	45.11 ^d	73.79 ^c	83.04 ^b	89.12 ^a	3.37

^{abcd} Superscript with different letters within row differed (P<0.05).

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