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Preparation and Evaluation of Wastelage Using Wet Rice Straw and Cow Dung for Ruminant Feed

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ABSTRACT

Preparation of wastelage by ensiling wet rice straw treated with cow dung (CD) and molasses was performed to improve the nutritional value as a quality feed for ruminants. Three different treatments were used as T_0 (10% cow dung and 85% wet rice straw), T_1 (20% cow dung and 75% wet rice straw), T_2 (30% cow dung and 65% wet rice straw), and T_3 (40% cow dung and 55% wet rice straw) with 5% molasses based on DM in each treatment to explore physical quality, chemical composition, *in-vitro* organic matter digestibility (OMD) and metabolizable energy (ME) contents at five different ensiling periods of 0, 30, 45, 60 and 90 days. The use of cow dung and molasses in wet rice straw improved the physical quality, nutritive value, and preservation quality of wastelage. The highest DM, CF, and EE were observed as 41.83%, 18.51%, and 2.88% respectively in T_0 and CP was highest as 10.55% in T_3 followed by T_1 and T_2. After ensiling, DM, ash, CF and EE were declined in all of the treatments but the increase of CP content was observed significantly ($P<0.05$) with increasing the ensiling period from 0 to 90 days. The OMD and ME contents were improved in T_1, T_2, and T_3 compared to T_0. The highest OMD and ME values were observed in treatment T_3 which were 48.46% and 8.78 MJ/Kg DM, respectively and the lowest values were in (T_0) were 38.31% and 7.57MJ/Kg DM respectively. Therefore, proper ensiling of rice straw with CD and molasses can provide an inexpensive, quality of feed and also reduce the waste hazards in our environment.

Introduction

Livestock is an integral part of the farming system in Bangladesh to provide not only a source of meat but also a major contribution to on-farm power as well as employment. The sub-sectors of livestock contribute about 20% full employment and 50% part-time employment of the total population (Begum *et al.,* 2011). In Bangladesh, the total livestock population has been estimated as 242.38, 35.37, 262.67, 14.86 lakh cattle, sheep, goat, and buffaloes, respectively (Bangladesh Economic Survey, 2018-2019). The livestock is beset with innumerable problems such as inadequate feed supply, undernourishment, improper management, high incidence of diseases, and poor genetic makeup. Moreover, a large number of animals are deprived of feeds both in quality and quantity. The available roughage and concentrate for feeding livestock can meet only 50% and 10%, respectively of the requirement (Haque *et al.*, 2007). Sometimes, available feeds are fed without consideration of their quality or the requirements of the animals. Due to a high rate of population growth, rapid urbanization, and industrialization, pressure on the available land in Bangladesh has been increasing rapidly. So, it causes scarcity of land for human food production, and is not possible to spare land exclusively for the production of livestock feed.

Rice straw is the vegetative part of the rice plant used as a versatile by-product after rice cultivation. In the livestock sector, it is used as fodder for livestock. Rice straw is being utilized by the cattle and buffaloes as a sole feed, in the rural regions of Bangladesh (Akbar *et al*., 1995). But it has a lack of very essential nutrients, crude protein, and metabolizable energy (Islam *et al.*, 2018) because of cell walls, comprised of cellulose, hemicellulose, and lignin, which causes low digestibility of it.

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The combination of low intake, low degradability, low nitrogen content, and an imbalanced mineral composition mean that rice straw alone may not even meet the animal's maintenance needs. But farmers depend on rice straw as basal feed for livestock especially in the absence of adequate grazing and limited space for fodder production. Moreover, agro-industrial wastes e.g., cow dung, poultry droppings, slaughterhouse byproducts, biogas slurry, etc. have drawn the nutritionist's attention for their nutritional and economical potentialities as animal feeds, in recent years (Waste concern, 2005). Cow dung production in the country is about 81.3 million tons per year (AIS, 2014) according to the census of agriculture (BBS, 2003). The huge amount of cow dung is not properly used and this is the cause of environmental pollution. The utilization of cow dung may be a valuable resource of nutrients and substrate for microbial protein synthesis (Cook *et al.*, 2011; Ritz *et al*., 2004). Cow dung can be used in animal feed with other feed ingredients having high palatability and during the fermentation process, there may be the production of microbial proteins and several simple molecules in the usable form (Sikka, 2008).

In Bangladesh, it has been estimated that about 7.7 million tons of rice straw dry matter are being rotten during monsoon (July to August), (Chowdhury and Huque, 1996). It has been reported that overall, 24% of rice straw are lost due to spoilage as a result of faulty storage and heavy rainfall in Bangladesh. Ensiling wet rice straw with cow dung and molasses will increase crude protein and other nutritive value of the diet lowering the pH value and produce lactic acid-producing bacteria which will facilitate natural preservation (Premier Molasses, 2006). So, ensiling of wet rice straw along with cow dung and molasses may produce a good quality ensilage for feeding ruminant having desire palatability, nutrient content, and digestibility and also reduce the environmental pollution. Several studies have reported the physical, chemical characterization, and utilization of rice straw as ruminant feed (Islam *et al*., 2018; Panna *et al*., 2019; Sharmin *et al*., 2020). Therefore, the objective of this experiment is to utilize cow dung and rice straw as animal feed and also to reduce environmental pollution.

Materials and Methods

The experiment was performed in the Goat and Sheep farm, Department of Animal Science, Bangladesh Agricultural University, Mymensingh during the period from 21th May to 25th August 2018. The laboratory analysis was conducted in the Animal Science and Animal Nutrition laboratory of the Department of Animal Science and Animal Nutrition, respectively, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Preparation of experimental materials

Fresh cow dung and wet rice straw were collected from Sheep and Goat farm, Bangladesh Agricultural University (BAU), Mymensingh. During collection, enough care was taken to avoid extra silica or other foreign substances. Molasses and air-tight plastic containers (30 L size) were purchased from the local market. After purchasing, the plastic containers were washed, cleaned, and dried properly. Plastic containers were labeled for different treatments.

Preparation of samples for chemical analysis

The wet rice straw was chopped into small pieces manually. Cow dung and chopped wet straw were subjected to determining the dry matter (DM) content of fresh samples. At the same time, another portion of fresh samples of both cow dung and wet rice straw were dried in the sun and then ground to pass through a 40 mm mesh sieve. After grinding, the samples were subjected to chemical analysis for organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE), and total ash (TA) following the procedure of AOAC (2004). The following treatments were used in this experiment:

T_0 = 10% cow dung + 5% molasses + 85% wet rice straw
T_1 = 20% cow dung + 5% molasses + 75% wet rice straw
T_2 = 30% cow dung + 5% molasses + 65% wet rice straw
T_3 = 40% cow dung + 5% molasses + 55% wet rice straw

The amounts of all of the above ingredients were measured on a DM basis.

Preparation of ensilage

Rice straw was collected just after harvesting. After collecting, wet rice straws were chopped about 3-4 cm long by chopper. Then ensilage was prepared by mixing chopped straw with fresh cow dung and molasses according to the above treatment. For proper mixing, cow dung and molasses were mixed first and then finally mixed with straw. When straw was properly mixed with cow dung and molasses, these were placed into air-tight plastic containers which were previously marked according to the treatment. Finally, plastic containers were kept in a room for 90 days for successful ensiling.

Organoleptic test and proximate analysis of ensilage

Ensilage samples were collected at 0, 30, 45, 60, and 90 days to observe how many days need to get a good ensilage. Finally, they were opened at 90 days. All the ensilage had a desirable pleasant aroma, yellowish in color, soft texture, and no mold growth observed on the top of any ensilage, indicating optimum fermentation. Acceptability of ensilages by cattle was also tested to test the palatability.

Ensilage samples were taken and mixed thoroughly, to check DM in an air-dry oven at 105°C and pH by pH meter. To determine the nutritive value of the ensilage, respective dry samples were subjected to proximate analysis for crude protein (CP), crude fiber (CF), ether extract (EE), and Ash, following the methods of AOAC (2004) at Animal Science laboratory, Bangladesh Agricultural University, Mymensingh.

Determination of in vitro organic matter digestibility and metabolizable energy of ensilage

In vitro, organic matter digestibility (OMD) and metabolizable energy (ME) content of ensilage were done following the method described by Menke *et al*., (1979). Digestibility of organic matter (%) and metabolizable energy (MJ/kg DM) content were calculated according to the following equations by Menke and Steingass (1988).

IVDOM = 16.49+0.9024 GP+0.0492CP+0.0387TA
ME = 2.20+0.1357GP+0.0057CP+0.0002859EE2

Where, IVOMD = *In vitro* organic matter digestibility (%), ME = Metabolizable energy (MJ/kg DM), GP = Gas production expressed in ml per 200 mg DM, CP = Crude protein (g/kg DM), TA = Total ash (g/kg DM), EE = Ether extract (g/Kg DM)

Statistical analysis

A 4 ×5 factorial design with three replicates was used in the experiment. Data were statistically analyzed using SAS Statistical Discovery Software, NC, USA, and differences among the treatment means were determined by Duncan's Multiple Range Test (DMRT)

Results

Physical properties and pH of ensilage

The physical properties of ensilage of different treatments (T_0, T_1, T_2, and T_3) at the different ensiling times (0, 30, 45, 60, and 90 days) were shown in Table 1. After 90 days of the ensiling period, the colors of different treatments (T_0, T_1, T_2, and T_3) were brown, dark brown, light chocolate, and chocolate. The color of the ensilage became deeper with the increasing level of cow dung. All the treatments had good color. Among all of the treatments, T_1 and T_2 had a good smell at 90 days of ensiling but T_3 had a pungent smell which was not acceptable by an animal. Controlled treated ensilage remained hard at 45 days of ensiling but T_1, T_2 became soft and had a pleasing aroma and good color and T_3 became very soft after 90 days of ensiling. Fungus propagation was not observed in cow dung treated straw but some were seen in controlled treatment. All ensilage had a pleasant aroma, desirable light brown color, soft texture, and no mold growth in ensilage of wet rice straw with biogas slurry and molasses (Sarkar *et al*., 2018). 30% caged layer excreta treated rice straw had a pungent smell and not acceptable by cattle (Islam *et al*., 2018). Fungus propagation was not observed while maize stover was treated with caged layer excreta (Jamee *et al*., 2020). Ensilage of Napier grass became hard while no poultry droppings were used (Panna *et al*., 2019).

The pH is shown in Figure 1. Significant differences ($p<0.05$) were observed among the treatments. After ensiling, the highest pH value was observed by treatment T_0 followed by T_1, T_2, and T_3. It was observed that the pH value decreased with the increased level of cow dung. The pH value of wet rice straw ensilage was decreased with the increase of biogas slurry (Sarkar *et al*., 2018). The pH value was decreased significantly ($p<0.05$) from 0 to 90 days. In the present studies, pH values lower than 5 were attained in all ensilage indicated that they are highly fermented and lactic acid production is higher which will help to conserve more nutrients in the ensilage. The pH value was decreased with the increase of caged layer excreta in rice straw ensilage (Islam *et al*., 2018). The pH value of maize stover ensilage was decreased with the increase of caged layer excreta (Jamee *et al*., 2020). pH value of Napier grass ensilage with poultry droppings was decreased from 0 to 75 days ($P<0.05$) of the ensiling period (Panna *et al*., 2019)

Effect of different treatments and ensiling time on the chemical composition of ensilage of wet rice straw

Dry matter (DM)

The dry matter content of ensilage of different treatments and different ensiling times is shown in Table 2. It was observed that dry matter content (g/100g) of ensilage differed significantly ($p<0.05$). The highest DM was obtained in T_0 followed by T_1, T_2, and T_3. The DM at different treatments T_0, T_1, T_2, and T_3 were found 41.83, 40.69, 39.40, 38.84% respectively. The reason for decreasing the DM content in the study may be due to decomposition and fermentation. The highest DM of wet rice straw ensilage was observed when no biogas slurry and molasses were used (Sarkar *et al*., 2018). The DM content was decreased ($P<0.05$) with the increase of caged layer excreta in rice straw ensilage from 0 to 30% (Islam *et al*., 2018). It was observed that DM content was decreased significantly ($p<0.05$) with the ensiling time from 42.60 to 37.71% with the increase of duration from 0 to 90 days. The reason for decreasing of DM in maize stover ensilage was the fermentation of a high level of caged layer excreta (Jamee *et al*., 2020). The DM content of Napier grass ensilage treated with poultry droppings was decreased with the increase of ensiling period from 0 to 75 days ($P<0.05$) (Panna *et al*., 2019). The lowest DM was observed in 15% poultry droppings, 5% molasses, and 80% wet rice straw ensilage (Sharmin *et al*., 2020).

Table1. Effect of different treatments on physical quality of ensilage

Characteristics	Observation	Treatments			
		T0	T1	T2	T3
Color	0 Day	Straw color	Straw color	Light brown	Brown
	30 Days	Light brown	Light brown	Brown	Brown
	45 Days	Light brown	Brown	Brown	Brown
	60 Days	Brown	Brown	Dark brown	Dark Brown
	90 Days	Brown	Brown	Dark Brown	Chocolate
Smell	0 Day	Straw	Straw	Pleasant smell	Good
	30 Days	Straw	Straw	Good	Bad odor
	45 Days	Straw	Good smell	Good smell	Bad odor
	60 Days	Good smell	Good smell	Acceptable smell	Pungent smell
	90 Days	Pungent odor	Pleasant smell	Pleasant smell	Pungent smell
Softness	0 Day	Hard	Hard	Hard	Hard
	30 Days	Hard	Hard	Moderate soft	Soft
	45 Days	Hard	Moderate soft	Moderate soft	Soft
	60 Days	Moderate soft	Moderate soft	Soft	Very Soft
	90 Days	Moderate soft	Soft	Soft	Very Soft
Fungus	0 Day	Absent	Absent	Absent	Absent
	30 Days	Absent	Absent	Absent	Absent
	45 Days	Absent	Absent	Absent	Absent
	60 Days	Absent	Absent	Absent	Present
	90 Days	Present	Absent	Absent	Present

T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

Table 2. Effect of treatments and ensiling time on dry matter of ensilage

Ensiling (days)	Treatments				Mean	SEM
	T0	T1	T2	T3		
0	45.51	43.45	41.33	40.13	42.605a	0.52
30	44.4	41.56	40.34	40.47	41.69b	0.64
45	41.34	41.37	39.52	38.61	40.21c	0.58
60	39.5	39.4	38.42	37.73	38.76d	0.61
90	38.43	37.7	37.41	37.3	37.71e	0.58
Mean	41.836a	40.696b	39.404c	38.848d		
SEM	0.54	0.52	0.58	0.6		

*Means with different superscripts within row and column are significantly different (P<0.05); T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

Table 3. Effect of treatments and ensiling time on crude protein of ensilage

Ensiling (days)	Treatments				Mean	SEM
	T0	T1	T2	T3		
0	6.26	9.54	9.67	10.12	8.89e	0.54
30	7.54	9.64	9.84	10.18	9.30d	0.66
45	7.83	9.99	10.28	10.54	9.66c	0.52
60	8.95	10.54	10.72	10.72	10.23b	0.51
90	9.72	10.64	10.84	11.21	10.60a	0.48
Mean	8.06d	10.07c	10.27b	10.55a		
SEM	0.57	0.54	0.56	0.62		

*Means with different superscripts within row and column are significantly different (P<0.05); T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

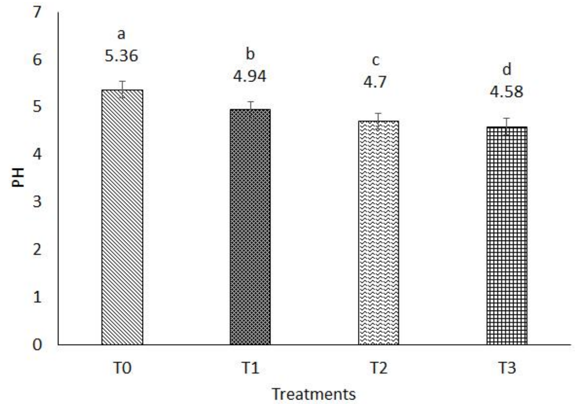

Figure 1. pH values of different ensilage prepared under different treatment

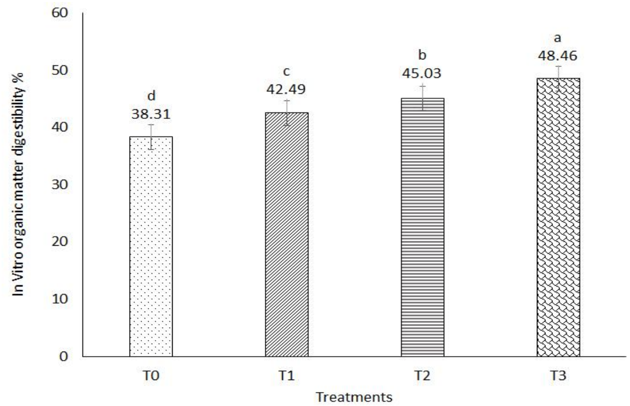

Figure 2. *In vitro* organic matter digestibility (%) of ensilage at different level of cow dung

Crude protein (CP)

The Crude protein content of different treatments (T_0, T_1, T_2, and T_3) of ensilage is shown in Table 3. The highest (10.55%) CP content was found in T_3 and the lowest (8.06%) CP content was found in T_0. The CP content differed with the differences of cow dung ($p<0.05$). The CP contents were increased with the increase of biogas slurry used in wet rice straw ensilage (Sarkar *et al*., 2018). It was observed that CP content was increased by 8.89 to 10.60% with the increase of ensiling time from 0 days to 90days, respectively ($p<0.05$). The CP contents were increased ($P<0.05$) in rice straw ensilage with the increase of caged layer excreta (Islam *et al*., 2018). The highest CP content was found in maize stover ensilage when 60% of caged layer excreta was used (Jamee *et al*., 2020). The CP contents of Napier grass differed with the different levels of poultry droppings (Panna *et al*., 2019). The CP was highest in 15% poultry droppings, 5% molasses, and 80% wet rice straw ensilage (Sharmin *et al*., 2020).

Crude fiber (CF)

The crude fiber content of ensilage of different treatments and different ensiling times is shown in Table 4. In the present experiment, the value of CF was higher (18.51%) in controlled T_0 than treated (T_1, T_2, and T_3) wet rice. The CF content was decreased from 18.51 to 17.34% with the addition of cow dung (10 to 40%). The CF content was reduced with the increase of biogas slurry of wet rice straw ensilage with molasses (Sarkar *et al*., 2018). The CF content of ensilage in different ensiling time (0, 30, 45, 60 and 90 days) was 19.95, 18.81, 16.66, 16.19 and 15.78% respectively. The CF contents of rice straw ensilage were declined with the ensiling period from 0 to 90 days (Islam *et al*., 2018). CF content was decreased with the ensiling period ($p<0.01$) but again increased in 90 days while maize stover was treated with caged layer excreta (Jamee *et al*., 2020). CF amounts were decreased in Napier grass ensilage with poultry droppings with the increase of ensiling period from 0 to 75 days ($P<0.05$) (Panna *et al*., 2019).

Ether extract (EE)

The ether extract content of ensilage of different treatments and different ensiling times is shown in Table 5. It was observed that EE was decreased with the addition of cow dung. The highest EE was obtained by treatment T_0 followed by T_1, T_2, and T_3. EE was decreased significantly ($p<0.05$) from 2.88 to 2.36% with a time of 0 to 90 days. It might be due to the lower EE content of cow dung and higher decomposition of wet rice straw. There were no significant differences in EE among different treatments of caged layer excreta in rice straw ensilage (Islam *et al*., 2018). The EE amounts of wet rice straw ensilage with molasses were not significantly different in different treatments of biogas slurry (Sarkar *et al*., 2018). EE contents were similar with the increase of ensiling period from 0 to 90 days while maize stover was treated with caged layer excreta (Jamee *et al*., 2020). The highest ether extract was found in Napier grass while no poultry droppings were used (Panna *et al*., 2019). The EE extract was decreased with the increase of poultry droppings in wet rice straw ensilage with 5% molasses (Sharmin *et al*., 2020).

Ash

The Ash content of the ensilage of different treatments and different ensiling times is shown in Table 6. The Ash content was decreased significantly ($p<0.05$) with the increase of cow dung. It was observed that the ash content was decreased from 6.01 to 4.60% with the increase of ensiling period from 0 to 90 days but not statistically significant ($p>0.05$) between the values of 30 to 60 days. In the present study, the ash content was decreased with the ensiling period might be due to the utilization of ash for the microbial growth during the ensiling period. The ash content of wet rice straw with molasses ensilage was decreased significantly with the increased proportion of biogas slurry (Sarkar *et al.*, 2018). The ash contents of maize stover ensilage with caged layer excreta were decreased with the increase of ensiling period from 30 to 90 days (Jamee *et al*., 2020). The highest ash content was found in Napier grass ensilage while 45% of poultry droppings were used (Panna *et al*., 2019). The ash amount of rice straw was decreased with the improvement of caged layer excreta (Islam *et al*., 2018). The ash content was decreased in poultry droppings treated wet rice ensilage with 5% molasses with the increase of ensiling period from 0 to 90 days (Sharmin *et al*., 2020).

In vitro organic matter digestibility

The organic matter digestibility (OMD) of ensilage of different treatments and different ensiling times is shown in Figure 2. It showed that the highest *in vitro* OMD was observed in T_3 and the lowest was in T_0. The *in vitro* organic matter digestibility (OMD) in different treatments differed significantly (P<0.05) due to different levels of cow dung. In vitro, organic matter digestibility was different in different proportions of biogas slurry while wet rice straw was treated with molasses (Sarkar *et al*., 2018). OMD was increased in maize stover ensilage with the increase of caged layer excreta (P<0.01) (Jamee *et al*., 2020). When 45% of poultry droppings were used in Napier grass ensilage, OMD was the highest (Panna *et al*., 2019). With 10% caged layer excreta in rice straw ensilage showed the best OMD (Islam *et al*., 2018). The OMD was increased with the increase of poultry dropping (P<0.05) in wet rice straw ensilage with 5% molasses (Sharmin *et al*., 2020).

Table 4. Effect of treatments and ensiling time on crude fiber of ensilage

Ensiling (days)	Treatments				Mean	SEM
	T0	T1	T2	T3		
0	20.18	21.28	20.36	18.00	19.95a	0.57
30	19.16	18.88	18.95	18.26	18.81b	0.61
45	17.20	16.58	16.70	16.17	16.66c	0.54
60	16.31	16.37	16.36	15.73	16.19d	0.59
90	14.73	15.02	14.82	18.58	15.78e	0.54
Mean	18.51a	17.62b	17.43c	17.34d		
SEM	0.56	0.58	0.54	0.57		

*Means with different superscripts within row and column are significantly different (P<0.05); T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

Table 5. Effect of treatments and ensiling time on ether extract of ensilage

Ensiling (days)	Treatments				Mean	SEM
	T0	T1	T2	T3		
0	3.36	3.06	2.58	2.54	2.88a	0.55
30	2.76	2.26	2.37	2.38	2.44b	0.60
45	2.53	2.53	2.71	2.66	2.60c	0.54
60	2.26	2.14	2.24	2.11	2.18d	0.57
90	3.20	2.56	1.98	1.73	2.36e	0.55
Mean	2.88a	2.51b	2.37c	2.28c		
SEM	0.58	0.52	0.53	0.54		

*Means with different superscripts within row and column are significantly different (P<0.05); T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

Table 6. Effect of treatments and ensiling time on ash of ensilage

Ensiling (days)	Treatments				Mean	SEM
	T0	T1	T2	T3		
0	7.69	6.73	5.29	4.29	6.01a	0.54
30	4.62	4.11	4.23	4.81	4.44b	0.66
45	5.77	4.42	4.3	4.34	4.71c	0.52
60	5.41	4.54	4.49	4.49	4.73d	0.51
90	4.38	5.7	4.6	3.72	4.60e	0.48
Mean	5.57a	5.51b	4.58c	4.33d		
SEM	0.54	0.54	0.56	0.62		

*Means with different superscripts within row and column are significantly different (P<0.05); T0 = 10% cow dung + 5% molasses + 85% wet rice straw, T1 = 20% cow dung + 5% molasses + 75% wet rice straw, T2 = 30% cow dung + 5% molasses + 65% wet rice straw, T3 = 40% cow dung + 5% molasses + 55% wet rice straw

Metabolizable energy (ME)

The values for metabolizable energy content (MJ/kg DM) of ensilage differed significantly among the treatments in Figure 3. The highest ME (8.78) was observed in T_3 which was higher than that of T_0, T_1, and T_2 treatment. The lowest ME (7.57) was observed in the control treatment (T_0). But ME contents were increased with the increase of biogas slurry in wet rice straw ensilage with molasses (Sarkar *et al*., 2018). The highest ME content was found in maize stover ensilage with the use of 60% caged layer excreta (Jamee *et al*., 2020). The ME contents in Napier grass ensilage with poultry dropping were different with different percentages of poultry droppings but the highest ME was observed in 45% treatment of poultry droppings (Panna *et al*., 2019). In Rice straw ensilage, 10% caged layer excreta showed better ME (Islam *et al*., 2018). The highest ME was found in 10% of poultry dropping of 80 % wet rice straw with 5% molasses (Sharmin *et al*., 2020).

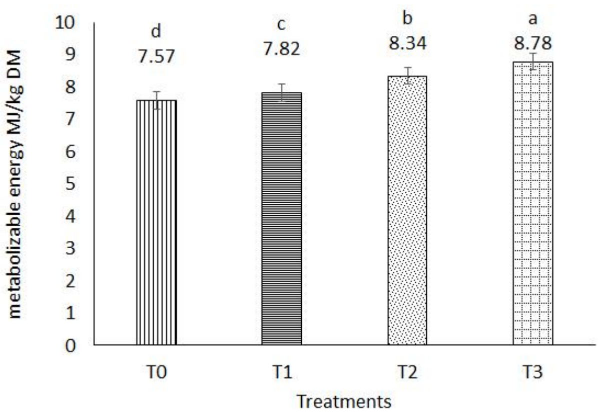

Figure 3. Metabolizable Energy (MJ/kg DM) of ensilage at different level of cow

Conclusion

Ensilage is a very versatile product and can be used as a basal diet or as a concentrate-type supplement to forage or other roughages. Therefore, the use of cow dung as a feed ingredient will not only reduce waste disposal and pollution problem but also provide inexpensive feed components for ruminants. Ensiling by-products is also a simple and low-cost option, which can preserve feeds that are seasonally abundant for later feeding. Therefore, the addition of cow dung and molasses in wet rice straw ensiling can improve the physical quality, nutritive value, preservation capacity. By comparing physical quality and nutritive value, the T2 (30% cow dung and 65% wet rice straw)) is better. Further investigation is required in-vivo feeding trial into T1 and T2 to justify the findings.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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