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Preparation of Wastelage using Poultry Droppings and Wet Rice Straw as a Cattle Feed

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Abstract

An experiment was conducted with wet rice straw (WRS) treated with poultry droppings (PD) and molasses to increase the nutritional and preservation quality by ensiling. Five different combination was prepared as T_0 (100% WRS), T_1 (5% Molasses + 95% WRS), T_2 (5% PD+ 5% Molasses+ 90% WRS), T_3 (10% PD + 5% Molasses+ 85% WRS) and T_4 (15% PD+ 5% Molasses+ 80% WRS). The mixed ingredients were preserved in plastic containers under airtight condition at room temperature. Physical quality, chemical composition, *in-vitro* organic matter digestibility (IVOMD) and Metabolizable Energy (ME) content at 0, 30, 45, 60 and 90 days were measured and calculated. The physical quality (color, smell, and hardness) of straw improved in PD added treatments till 90 days of ensiling except in T_4 where some pungent smell was found after 60 days. The pH value was decreased (P<0.05) with the increasing of droppings and ensiling time as expected. The significantly (P<0.05) highest average crude protein (CP) and lowest average ether extract (EE) and crude fiber (CF) content was found in T_4 indicating greater fermentation rate with greater proportion of poultry droppings. Dry matter, EE and CF content were found highest in T_0 which indicate poor fermentation. The CP increased (P<0.05) and DM, EE and CF decreased (P<0.05) with the increasing of ensiling time from 0 to 90 days. The ash content decreased (P<0.05) significantly with the increase of PD and ensiling time. The Organic Matter Digestibility (OMD) and Metabolizable Energy (ME) content increased (P<0.05) with the PD level. The highest OMD and ME content were found to be 56.46% and 6.98 MJ/Kg DM in T_4 and the lowest OMD and ME content were found to be 53.31% and 4.88 MJ/Kg DM in T_0, respectively. Considering all the physical and chemical properties among all the treatments T_3 (10% PD + 5% Molasses+ 85% WRS) can be marked acceptable for preparing ensilage as the dark chocolate color, pungent odor and presence of fungus in later stage of T_4 may result in rejection by cattle. Proper ensiling of WRS with PD will not only reduce waste disposal hazards and environment pollution problem but also provide inexpensive feed components for ruminants.

Introduction

Livestock contributes 1.53% of the gross domestic products and 13.46% of the agricultural domestic products of Bangladesh (Bangladesh Economic Review, 2019). But a large number of animals are suffering from shortage of feeds both in quality and quantity. The roughage and concentrate available for feeding livestock can meet only 50% and 10% respectively of the requirement (Haque *et al.,* 2007). Low productivity of animal is observed due to scarcity, poor quality, and poor digestibility of the forage. As like many other developing countries in the world, pressure on the available land in Bangladesh is increasing rapidly, due to a high rate of population growth, industrialization and rapid urbanization.

Bangladesh is the fourth largest rice producer of the world. Rice straw is the main feed for cattle and buffalo here. But, Straw contains very low amount of metabolizable energy, crude protein and almost lack of any essential mineral elements (Islam *et al.,* 2018). The cellulose of straw is highly indigestible. So, straw alone cannot maintain an animal because of its deficiency in nutrient (Weston, 1982). Moreover, during the monsoon

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season the straw is being spoiled due to heavy rainfall. As much as 75 to 80% of the straw can be lost, sometimes all, if the rain is particularly heavy. It has been estimated that about 7.7 million tons of rice straw dry matter is being rotten during monsoon (July to August), (Chowdhury and Haque, 1996).

In recent years, agro-industrial waste e.g. poultry droppings, cow dung, slaughter house by products, biogas slurry etc. have attracted the attention of nutritionist for their economical and nutritional potentialities in animal feeding. There are about 42 million chicken, producing around 3079 metric tons of poultry manure daily in Bangladesh (Waste concern, 2005). Poultry droppings contain higher level of feed nutrients, especially crude protein. Combining poultry droppings with maize, sorghum, potatoes prior to ensiling has been shown to increase energy and protein digestibility of the resultant silage when fed to cattle (Daniels *et al.,* 1983). Griffith (1993) observed that ensiled broiler chicken litter manure can be used to replace half the concentrate feed in fattening lambs without significantly influencing growth rate. Smith and Wheeler (1979) reported daily gains were 1.07 and 1.10 Kg, respectively, for control and experimental cattle fed caged layer waste. Arave *et al*. (1990) reported that there is no adverse effect of feeding up to 17% processed poultry litter to dairy cows on milk flavor. Heat processing of animal waste reliably kills bacterial pathogens, but its use is limited by expense and other factors. Deep-stacking and ensiling are commonly used by farmers to process animal wastes, but the maximal temperatures achieved in stacked poultry litter are typically in the range of 43 to 60°C (110 to 140°F), below the inactivation temperatures of pathogenic salmonella and *Escherichia coli* species (Eric *et al.,* 1997).

Silages made of poultry excreta with forage, grain or other agricultural residues may offer other advantages such as enhancing the nutritive value of conventional or unconventional feedstuff, reducing effluent losses, dustiness and improving palatability (Islam and Hossain, 1990). The objective of the study is to introduce alternative feed use along with basal feed as rice straw to reduce the shortage of nutritive animal feed in Bangladesh.

Materials and Methods

The experiment was conducted in two phases: The first phase was the preparation of wastelage and second phase was laboratory analysis. Preparation of wastelage and related activities were carried out in the goat and sheep farm, Department of Animal Science, Bangladesh Agricultural University, Mymensingh. The laboratory analysis of wastelage was completed in both Animal Science laboratory and Animal Nutrition laboratory, Bangladesh Agricultural University, Myemnsingh. Poultry droppings and wet rice straw were collected from poultry farm, and goat and sheep farm, Bangladesh Agricultural University, Myemnsingh. The poultry droppings was collected carefully so that it remains free from feather, sand or other materials. Washed, cleaned and properly dried plastic containers were used for different treatments.

Preparation of samples for chemical analysis

The straw was chopped into small pieces manually and then caged layer excreta and chopped straw were subjected for determining dry matter (DM) content. At the same time, another portion of poultry droppings and wet rice straw were dried in the sun and then ground to pass through 40 mm mesh sieve. After grinding, the samples were subjected to chemical analysis for DM, organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash following the procedure of AOAC (AOAC, 2004).

Experimental treatments

The experiment was laid out in a Complete Randomized Design (CRD) with 3 replicate in each treatment. The treatments under the study were as follows:

T_0 = 0% Poultry droppings + 0% molasses + 100% wet rice straw

T_1 = 0% Poultry droppings + 5% molasses + 95% wet rice straw

T_2 = 5% Poultry droppings + 5% molasses + 90% wet rice straw

T_3 = 10% Poultry droppings + 5% molasses + 85% wet rice straw

T_4 = 15% Poultry droppings + 5% molasses + 80% wet rice straw

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

Preparation of ensilage

After collecting wet rice straw were chopped about 3-4 cm size by chopper. The collected poultry droppings were sun dried for several days until became suitable enough for grinding. Grounded poultry droppings was first mixed with molasses and then with the wet rice straw for homogenous mixing. The mixtures were then 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.

Physico organoleptic test and chemical analysis

Ensilage samples were collected at 0, 30, 45, 60 and 90 days. Aroma, color, texture and fungal growth was observed on every sampling days. Two samples from each treatment were taken, one for DM and pH determination and another one was dried in oven at 55°C for 72 hours for chemical analysis. pH determination was done by using a laboratory pH meter (ino Lab, Germany). Proximate analysis for dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash were performed following the methods of AOAC (AOAC, 2004).

Determination of in vitro organic matter digestibility and metabolizable energy content

In vitro organic matter digestibility (IVOMD) and metabolizable energy (ME) content of ensilage were determined following the method described by Menke *et al.* (1979). Fermentations are conducted in large (100 ml) calibrated glass syringes containing the feedstuff and a buffered rumen fluid. In this system, gas production in 24 hours observed on incubation of 200 mg feed dry matter. The volume of gas produced in 24 hours was used together with the concentration of other chemical constituents to predict IVOMD and ME suggested by Menke and Steingass (1988).

$$IVOMD = 16.49+0.9024\,GP+0.0492CP+0.0387TA$$
$$ME = 2.20+0.1357GP+0.0057CP+0.0002859EE2$$

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

Data were statistically analyzed using SAS Statistical Discovery Software, NC, USA for Complete Randomized Design.

Results and Discussion

Physical properties and pH of ensilage

The physical properties of ensilage of different treatments (T_0, T_1, T_2, T_3 and T_4) at different ensiling time (0, 30, 45, 60 and 90 days) are shown in Table 1. After 90 days of ensiling period, the color of different treatments (T_0, T_1, T_2, T_3 and T_4) were brown, brown, dark brown, light chocolate and chocolate respectively. Among all the treatments, T_1, T_2 and T_3 had good smell at 90 days of ensiling but T_4 had pungent smell which was not acceptable by cattle. These findings matches with Harmon *et al.* (1975) who found pleasing aroma and good color when poultry droppings were ensiled with wet rice straw and citrus pulp or weeds, respectively. Another statement support our findings that properly ensiled silage give good color and smell (Schroeder, 2004). Fungus propagation was not observed in poultry droppings treated straw but some were seen in controlled treatment. Kayongo *et al.* (1986) also found ensilage that ensiled with cage-layer waste (nitrogen source) results gold brown color, pleasant aroma and no mold growth. The color of ensilage became deeper with the increasing level of poultry droppings may be due to more efficient fermentation and the richness of organic matter. Silages with excessive acetic acid will have a yellowish hue, while those with high butyrate will have a slimy, greenish color. Brown to black silage usually indicates heating from fermentation and moisture damage. The pungent odor in T_0 could be due to less number of lactic acid producing bacteria resulting in inefficient fermentation. The possible reason behind pungent smell in T_4 could be the conversion of lactic acid and plant sugars into butyric and acetic acid. This usually happens when the silage contains a lot of soil or manure. Among all the treatments, T_1, T_2 and T_3 was found soft at 90 days of ensiling but T_4 was softer which indicate moisture damage. 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, T_3 and T_4. The lower pH of ensilage indicates good fermentation quality which was due to presence of higher lactic acid production (Yunus *et al.,* 2000). Roothaert and Matthewman (1992) indicated that ensiled materials should reach a pH of less than 5 in order to destroy Salmonella and other pathogens. In the present studies, pH values lower than 5 were attained in all ensilage. Lower pH level helps to facilitate faster fermentation and preservation of the silage and in turn retain more nutrients in the silage (Schroeder, 2004).

Chemical composition of ensilage

Dry matter

The dry matter content of ensilage of different treatments and different ensiling time is shown in Table 2. It was observed that dry matter (DM) content (g/100g) of ensilage differ significantly ($p<0.05$). The highest DM was obtained in T_0 followed by T_1, T_2, T_3 and T_4. The DM at different treatments T_0, T_1, T_2, T_3 and T_4 were found 32.32, 31.02, 30.37, 29.65 and 28.75% respectively. Man and Wiktorsson (2007) observed increase of DM from 26.7% to 27.7% in cassava silage ensiled with 0% and 9% molasses which is in contrast to the present finding. The reason of decreasing the DM content in the study may be due to decomposition and fermentation of ensiling materials. The DM at ensiling time 0, 30, 45, 60 and 90 days was found 32.3, 30.85, 30.39, 29.92 and 28.87% respectively. It was observed that DM content was decreased significantly ($p<0.05$) with the ensiling time from 32.3 to 28.87% with the increase of duration from 0 to 90 days. DM was decreased from 28.0 to 26.4%, with increased ensiling time from 2 to 4 months (Man and Wiktorsson, 2007) supports the present finding. Losses

Table 1. Effect of different treatment on physical quality of ensilage

Characteristics	Observation	Treatment				
		T_0	T_1	T_2	T_3	T_4
Color	0 Day	Straw color	Straw color	Light Brown	Light Brown	Brown
	30 Days	Light Brown	Light Brown	Brown	Brown	Brown
	45 Days	Light Brown	Brown	Brown	Brown	Brown
	60 Days	Brown	Brown	Dark Brown	Dark Brown	Dark Brown
	90 Days	Brown	Brown	Dark Brown	Light Chocolate	Chocolate
Smell	0 Day	Straw	Straw	Bad odor	Bad odor	Bad odor
	30 Days	Straw	Straw	Good	Good	Bad odor
	45 Days	Straw	Good smell	Good smell	Acceptable smell	Bad odor
	60 Days	Good smell	Good smell	Acceptable smell	Molasses smell	Pungent smell
	90 Days	Pungent odor	Pleasant smell	Pleasant smell	Molasses smell	Pungent smell
Softness	0 Day	Hard	Hard	Hard	Hard	Hard
	30 Days	Hard	Hard	Moderate Soft	Moderate Soft	Soft
	45 Days	Hard	Moderate soft	Moderate soft	Soft	Soft
	60 Days	Moderate soft	Moderate soft	Soft	Soft	Very Soft
	90 Days	Moderate soft	Soft	Soft	Soft	Very Soft
Fungus	0 Day	Absent	Absent	Absent	Absent	Absent
	30 Days	Absent	Absent	Absent	Absent	Absent
	45 Days	Absent	Absent	Absent	Absent	Absent
	60 Days	Absent	Absent	Absent	Absent	Present
	90 Days	Present	Absent	Absent	Absent	Present

To=100% WRS, $T_{1=}$ 5% molasses + 95% WRS, T_2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

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

Ensiling (days)	Dry matter content (%)					Mean	SEM
	T_0	T_1	T_2	T_3	T_4		
0	35.18	34.25	31.14	30.88	30.01	32.3^a	0.034
30	34.22	31.78	30.25	29.51	28.24	30.85^b	0.039
45	32.09	31.88	30.07	29.75	28.09	30.39^c	0.045
60	30.92	29.44	28.13	27.91	26.80	29.92^d	0.051
90	29.22	27.71	27.46	27.02	26.36	28.87^e	0.059
Mean	32.32^a	31.02^b	30.37^c	29.65^d	28.75^e		
SEM	0.52	0.047	0.044	0.051	0.044		

*Means with different superscripts within row and column are significantly different (P<0.05); T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

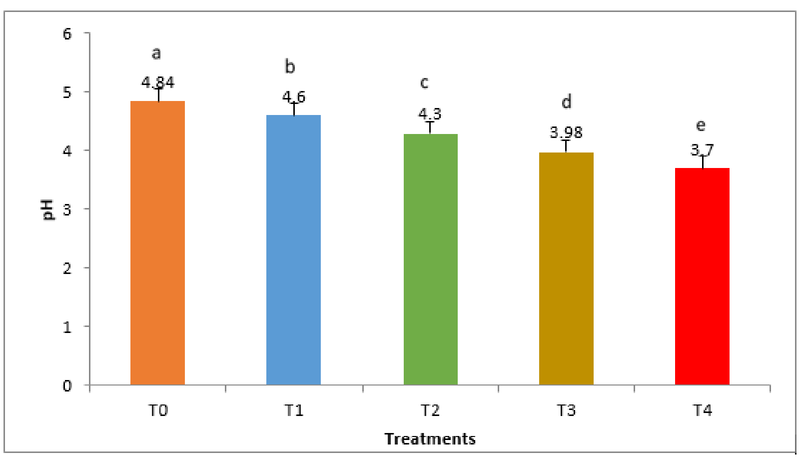

Figure 1. pH values of ensilage of different treatment. T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

of DM may come from run off, oxidation and loss of volatile organic compounds (Kung, 2010). A combination of run off, oxidation and loss of volatile organic acid with the progress of ensiling time may have resulted in reduced DM in the present study too.

Crude protein

The Crude Protein (CP) content of different treatments (T_0, T_1, T_2, T_3 and T_4) of ensilage was 4.17, 5.87, 6.85, 6.94 and 7.57%, respectively which is shown in Table 3. The highest (7.57%) CP content was found in T_4 and the lowest (4.17%) CP content was found in T_0. The CP content differ with the addition of poultry droppings ($p<0.05$). The crude protein of sorghum forages ensiled with broiler litter increased with increased proportion of poultry litter (Al-Rokayan *et al.,* 1988; Flachowsky and Henning, 1990) matches with the present finding. The reason for increasing CP with the addition of poultry droppings is that poultry droppings contains around 28% CP whereas rice straw contains only 3.4% CP (Sen *et al.,* 2003). The CP content of ensilage in different ensiling time (0, 30, 45, 60 and 90 days) was 4.68, 5.17, 6.17, 6.77 and 7.07% respectively. It was observed that CP content was increased with the ensiling time from 4.68 to 7.07% ($p<0.05$). Similar result has been reported by Daniels *et al.* (1983). The reason for increased CP content with time could be the extended fermentation. CP degradation in silage via proteolysis increase after 10 months of ensiling (Newbold *et al.,* 2006).

Crude fiber

The Crude Fiber (CF) content of ensilage of different treatments and different ensiling time is shown in Table 4. The CF content of different treatments (T_0, T_1, T_2, T_3 and T_4) of ensilage was 22.11, 21.09, 20.96, 20.67, and 20.19%, respectively. In the present experiment the value of CF was higher (22.11%) in controlled T_0 than treated (T_1, T_2, T_3 and T_4) wet rice straw but the differences between T_2 and T_3 were not statistically significant ($p>0.05$). Rasool *et al.* (1996) also observed a similar trend in rice straw ensiled with biogas slurry. CF decreased with the level of caged layer waste (nitrogenous source) in the maize stover (Kayongo *et al.,* 1986). The reason of CF decrease may be due to addition of poultry droppings which contain lower CF than rice straw and also indicated the higher decomposition of wet rice straw ensiling with the addition of poultry droppings (Skultety *et al.,* 1991). The CF content of ensilage in different ensiling time (0, 30, 45, 60 and 90 days) was 21.75, 21.64, 21.35, 21.06 and 19.36%, respectively. It was observed that CF was decreased from 21.75 to 19.36% with the time of 0 to 90 days but not statistically significant difference ($p>0.05$) between the values of 0 to 60 days. The findings of this experiment is supported by many authors (Rajeev *et al.,* 1997; Khan *et al.,* 1999; Malek, 2001; Man and Wiktorsson, 2007) who observed that decrease of CF content with increasing of ensiling time. The reason behind this could be the degradation of CF cell wall by cellulose and hemicellulose enzymes in acidic conditions with the progress of time (Islam *et al.,* 2018).

Ether extract

The ether extract (EE) content of ensilage of different treatments and different ensiling time is shown in Table 5. The EE content of different treatments (T_0, T_1, T_2, T_3 and T_4) of ensilage was 4.96, 4.55, 4.39, 4.05 and 3.53%, respectively. It was observed that EE was decreased with the addition of poultry droppings but the differences between T_2, T_3 and T_4 were not statistically significant ($p>0.05$). The EE content of ensilage in different ensiling time (0, 30, 45, 60 and 90 days) was 4.84, 4.35, 3.47, 3.51 and 2.82%, respectively. It was observed that EE was decreased significantly ($p<0.05$) from 4.84 to 2.82% with the time of 0 to 90 days. It might be due to the lower EE content of poultry droppings and higher decomposition of wet rice straw. The result of this study is similar to Baba *et al.* (2010) who reported, when Kyasuwa hay (*Pennisetum pedicellatum*) ensiled with poultry litter, EE declines. This decrement could be due to an increase in the activity of plant enzymes and lipolysis and extensive fermentation (Van Ranst *et al.,* 2009).

Ash

The ash content of ensilage of different treatments and different ensiling time is shown in Table 6. The Ash content of different treatments (T_0, T_1, T_2, T_3 and T_4) of ensilage was 6.28, 5.37, 4.57, 4.36, 3.86%, respectively. The Ash content was decreased significantly ($p<0.05$) with the increase of droppings. The ash content of ensilage in different ensiling time (0, 30, 45, 60 and 90 days) was 6.28, 4.71, 4.63, 4.54 and 4.47%, respectively. It was observed that the ash content was decreased from 6.28 to 4.47% with the increase of ensiling period from 0 to 90 days but not statistically significant ($p>0.05$) between the values of 30 and 60 days. The ash content was decreased with the ensiling period might be due to utilization of ash for the microbial growth during the ensiling period. This result is supported by Al-Rokayan *et al.* (1988); Flachowsky and Hennig (1990) who observed a linear decrease in ash with increased proportion of broiler litter. The finding is in contrary with Jalc *et al.* (2009) who reported bacterial inoculation during ensiling did not affect ash content of grass and corn silages. Declining of ash content with the increasing amount of poultry droppings may be due to greater fermentation as well as greater utilization of ash for microbial growth.

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

Ensiling (days)	Crude protein (%)					Mean	SEM
	T_0	T_1	T_2	T_3	T_4		
0	3.02	3.78	4.97	5.55	6.09	4.68e	0.033
30	3.45	3.41	5.57	6.21	6.55	5.17d	0.039
45	4.55	5.17	6.57	6.76	7.81	6.17c	0.037
60	4.87	4.89	7.29	7.81	8.42	6.77b	0.039
90	4.96	5.22	6.96	7.98	9.02	7.07a	0.031
Mean	4.17e	5.87d	6.85c	6.94b	7.57a		
SEM	0.044	0.032	0.029	0.031	0.033		

*Means with different superscripts within row and column are significantly different (P<0.05); T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

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

Ensiling (days)	Crude fiber (%)					Mean	SEM
	T_0	T_1	T_2	T_3	T_4		
0	23.25	22.72	19.08	20.14	21.67	21.75a	0.045
30	23.03	22.85	21.25	20.65	20.05	21.64a	0.053
45	22.56	21.08	20.34	20.54	21.06	21.35b	0.038
60	21.55	21.44	20.25	19.76	20.47	21.06b	0.041
90	20.11	19.38	18.59	18.87	19.34	19.36c	0.046
Mean	22.11a	21.09b	20.96c	20.67c	20.19d		
SEM	0.044	0.045	0.047	0.049	0.037		

*Means with different superscripts within row and column are significantly different (P<0.05); T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

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

Ensiling (days)	Ether extract (%)					Mean	SEM
	T_0	T_1	T_2	T_3	T_4		
0	5.18	5.24	4.79	4.82	4.92	4.84a	0.032
30	5.79	5.66	4.11	4.08	4.09	4.35b	0.027
45	4.82	4.44	3.21	3.23	3.17	3.47c	0.023
60	4.58	4.26	2.73	2.49	2.00	3.51d	0.033
90	4.89	3.36	2.98	2.06	1.67	2.82e	0.038
Mean	4.96a	4.55b	4.39c	4.05c	3.53c		
SEM	0.042	0.034	0.017	0.048	0.023		

*Means with different superscripts within row and column are significantly different (P<0.05); T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

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

Ensiling (days)	Ash content (%)					Mean	SEM
	T_0	T_1	T_2	T_3	T_4		
0	11.35	12.28	4.69	3.69	3.20	6.28a	0.043
30	6.38	4.45	4.56	3.60	3.57	4.71b	0.042
45	5.4	4.63	4.29	4.76	4.57	4.63b	0.035
60	4.72	4.88	4.58	4.80	4.90	4.54b	0.046
90	4.43	5.64	4.75	4.96	3.55	4.47c	0.045
Mean	6.28a	5.37b	4.57c	4.36d	3.86e		
SEM	0.037	0.045	0.040	0.038	0.048		

*Means with different superscripts within row and column are significantly different (P<0.05); T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

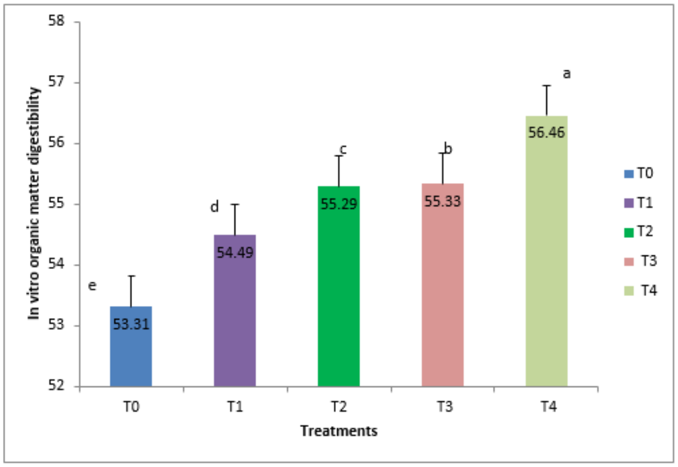

Figure 2. In vitro organic matter digestibility (%) of ensilage at different combination of poultry litter. T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

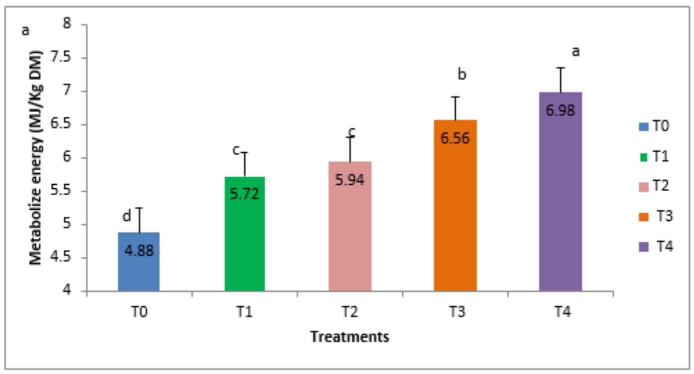

Figure 3. Metabolizable energy (MJ/kg DM) of ensilage at different combination of poultry litter. T_0=100% WRS, T1= 5% molasses + 95% WRS, T^2 =5% molasses + 5% PD +90% WRS, T_3 = 5% molasses + 10% PD + 85%WRS, T_4 = 5% molasses + 15% PD + 80% WRS

Organic matter digestibility

The organic matter digestibility (OMD) of ensilage of different treatments is shown figure 2. The OMD content of different treatments (T_0, T_1, T_2, T_3 and T_4) of ensilage was 53.31, 54.49, 55.29, 55.33 and 56.46%, respectively. It showed that the highest *in vitro* OMD was observed in T_4 and the lowest was in T_0. The *in-vitro* organic matter digestibility (OMD) in different treatments differed significantly ($P<0.05$). The result of this study is similar to Reddy and Reddy (1989) who observed increase *in-vitro* organic matter digestibility of rice straw ensiled with animal excreta and rumen digesta. The reason for increased OMD with addition of poultry droppings may be due to the fact that the degradation was faster in lower pH and the OMD of poultry droppings is 69% (Flachowsky *et al.,* 1985) which is higher than the OMD of rice straw 37-44% (Rahman *et al.,* 2010).

Metabolizable energy

The values for metabolizable energy (ME) content (MJ/kg DM) of ensilage were differed significantly among the treatment is shown on figure 3. The highest ME (6.98 MJ/kg DM) was observed in T_4 which was higher than that of T_0, T_1, T_2, and T_3. The lowest ME (4.88 MJ/kg DM) was observed in control treatment (T_0). Similar trend was also reported by Ali *et al.* (1994) who indicated that ME increased in treated stover compared with untreated stover after ensiling. Bostami *et al.* (2009) also reported that ME content was increased in treated ensiled maize stover than untreated ensiled maize stover. The ME increased with addition of poultry droppings due to the fact that poultry droppings contains 6.7-9.1 MJ/Kg DM ME which is higher than the ME of rice straw 5.61-6.8 MJ/Kg DM (Rahman *et al.,* 2010).

Conclusion

Ensiling by-products is a simple and low-cost option, which can preserve feeds that are seasonally abundant for later feeding during periods of feed shortage. Ensiling can destroy pathogenic microorganism and render palatable feed to livestock by changing the chemical nature of some unusable materials. This result indicated that addition of poultry droppings and ensiling time helps to improve the nutritive value, physical quality and preservation capacity of wet rice straw. Poultry droppings treated wet rice straw showed better chemical composition and nutritive value. Although T_4 (15% Poultry droppings + 5% molasses + 80% wet rice straw) possess the best result in most of the parameters, bad odor from day 60 is prominent and there is a risk of rejection by the ruminants. Ensiled products of T_3 (10% Poultry droppings + 5% molasses + 85% wet rice straw) is more acceptable at 90th day of ensiling based on physical quality, nutritive value and chemical composition. Further investigation is needed to justify the present 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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