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Preparation of Wastelage with Poultry Droppings and Oat Forage (*Avena sativa*) as a Feed for Cattle

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Abstract: In this experiment, wastelage was prepared by ensiling Oat forage (*Avena sativa*) with fresh caged layer excreta (CLE) at varying proportions to investigate the feeding values of wastelage for cattle and protect environment from poultry droppings. Oat forage was mixed with 0, 20, 40 and 60% CLE and 5% molasses in each treatment on dry matter (DM) basis and ensiled in air tight plastic container under room temperature. After 56 days, ensiled mixtures were opened. All the wastelages had desirable aroma, yellowish green color, soft texture and were mould free. The pH, DM, crude protein (CP), crude fiber (CF), ether extract (EE), ash, nitrogen free extract (NFE), in vitro organic matter digestibility and metabolizable energy were significantly influenced by levels of CLE. The percentages of DM, CP and Ash (37.34, 18.95 and 14.45, respectively) were highest in wastelage with 60% CLE ($p<0.05$) followed by 40 and 20% CLE. The pH, CF and NFE were decreased linearly ($p<0.05$) from 4.5 to 3.90, 19.91 to 17.81% and 52.34 to 44.71%, respectively as the level of CLE increased from 0 to 60%. In all treatments, the EE content was not significantly influenced by the different level of CLE. The in vitro organic matter digestibility and metabolizable energy also increased significantly ($p<0.05$) with the increase of CLE and maximum value (65.5% and 9.10 MJ/kg DM, respectively) was obtained in wastelage with 40% CLE, which was statistically identical with 60% CLE. The results suggest that ensiling Oat forage with up to 60% CLE improve the feeding value of wastelage.

Key words: Layer Droppings, Oat Forage, OM Digestibility, Wastelage

Introduction

The problem of feed inadequacy is a major concern among livestock industry players. Native and naturally grown grasses, crop residues and cereal by-products, which are poor in nutrient content and nutritional value, are common feedstuffs for ruminants. In recent years, agro-industrial wastes e.g. poultry droppings, cow dung, slaughter house by-products, biogas slurry etc., have attracted the attention of nutritionists for their economical and nutritional potentialities in the feeding of animals (Kumar *et al.*, 1983; Reddy and Reddy, 1986).

Commercial poultry industry is growing rapidly in Bangladesh and annual growth rate of chicken population is 5.3 percent (GOB., 2010). Layer hens produce 100-150g waste products per bird per day, with a 25% dry matter content (Taiganides, 1977). Poultry wastes are higher in nutritional value and can be a valuable feed for ruminants (Fontenot *et al.*, 1971). It contains about 28-30% crude protein out of which 36-50% is true protein (Bhattacharya and Taylor, 1975). Due to the lack of proper disposal system, a large amount of poultry manure and litters (feaces with bedding materials) are creating environmental and health problem hazards and foul smell near and adjoining areas of the poultry farms. Proper disposal of poultry droppings to minimize the environmental pollution is a new challenge for poultry farmers. Most effective and easy solution of these problems is to use the excreta for feeding animals either by drying or ensiling with poor quality forages. Poultry wastes can be rendered free of pathogens by ensiling (Hadjipanayiotou, 1982; Daniels *et al*,. 1983) and deep stacking (Strickler, 1977). Drying or ensiling poultry waste either alone or with green or dried roughage has been the most feasible and effective way of destroying pathogens (Chaudhry *et al.*, 1993).

Oat forage is widely supplied as silage or haylage to ruminants. Adding caged layer excreta to oat forage at ensiling time increases the crude protein in silage, disposing poultry waste and reducing feed cost for ruminant. Thus, the objective of the study were to determine the optimum proportion of CLE that will improve the nutritive value and keeping quality of oat forage with an ultimate view to find out a convenient option of proper disposing of poultry droppings as well as to prepare a low cost feed for ruminants.

Materials and methods

Collection of experimental materials

Caged layer excreta and oat forage were collected from Poultry Farm and field of Goat and Sheep Farm, respectively, Bangladesh Agricultural University, Mymensingh. For collection layer droppings, polyethylene sheet was placed under the cage of birds. During collection enough care was taken so that the droppings would be free from feather, sand or other materials. Molasses and air tight plastic containers were purchased from local market.

Preparation of wastelage

Wastelage was prepared in the Goat and Sheep farm, Department of Animal Science, Bangladesh Agricultural University, Mymensingh during the period from 10th January to 15th March 2012. Oat fodder was harvested at the milk stage and 3 hours wilting to increase the dry matter content up to 35 percent. After wilting, fodders were chopped by 5 to 7 cm long. Then wastelage was prepared by mixing previously chopped fodder with fresh poultry droppings in varying ratios; 95: 0, 75: 20, 55: 40, 35: 60 and 5% molasses in each treatment. For proper mixing, first caged layer excreta and molasses were mixed then finally mixed with fodder. When fodders were properly mixed with caged layer excreta 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 (25 to 28°C) for 56 days (8 weeks) for successful ensiling.

Chemical analysis

pH of wastelage was determined by digital pH meter after putting 2g sample in 50 ml distill water. Dry matter was determined by drying the wastelage at 65°C for 48 h. Crude Protein (CP) was measured using Kjeldahl method (N × 6.25) while other proximate constituents, ether extract (EE), ash, crude fiber (CF) and nitrogen free extract (NFE) according to procedures described by AOAC (2004). In vitro organic matter digestibility (IVOMD) and metabolizable energy (ME) content of wastelage were done following the method described by Menke *et al.* (1979).

Statistical analysis

All data were analyzed using 'MSTAT' and 'SPSS' computer package program for a Completely Randomized Design, and differences among the treatment means were determined by Duncan's Multiple Range Test (DMRT).

Results and discussion

Physical properties and P^H of wastelage

The Physical properties of the wastelage are shown in Table 1. All wastelages had pleasant aroma, desirable yellowish green colour, soft texture and no mould growth was observed any of the wastelage, indicating optimum fermentation. A pleasing aroma and good colour were obtained when poultry litter was ensiled with forage maize (Harmon *et al.*, 1975), citrus pulp or weeds (Hadjipanayiotou, 1982).

Table 1. Physical properties of wastelage at different level of caged layer excreta

Parameters	Wastelage with different percentage of Caged Layer Excreta			
	0% (control)	**20%**	**40%**	**60%**
Colour	Light green	Light yellowish green	Yellowish green	Yellowish green
Aroma	Very good	Very good	good	good
Texture	soft	soft	Very soft	Very soft
Mould	Absent	Absent	Absent	Absent

0% = wastelage with Oat forage and 5% molasses, 20% = wastelage with Oat forage, 20% caged layer excreta and 5% molasses, 40% = wastelage with Oat forage, 40% caged layer excreta and 5% molasses, 60% = wastelage with Oat forage, 60% caged layer excreta and 5% molasses.

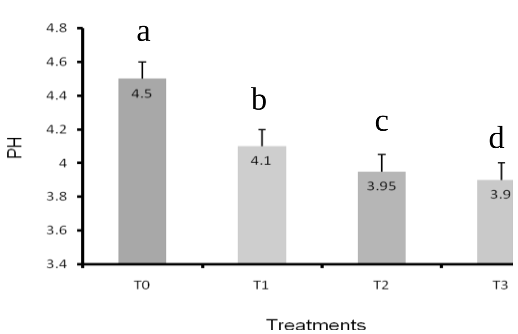

Figure 1. pH of wastelage with Oat forage and 5% molasses (T_0), Oat forage with 20% caged layer excreta and 5% molasses (T_1), Oat forage with 40% caged layer excreta and 5% molasses (T_2), Oat forage with 60% caged layer excreta and 5% molasses (T_3). Bar represents mean ± SD. $^{a, b, c, d}$ values with different superscripts differ significantly (p<0.05) among treatments.

The pH of wastelage was shown in figure 1. Significant differences (p<0.05) were observed among the treatments with regard to pH. The highest pH value was found in control followed by 20%, 40% and 60% caged layer excereta. Wastelage with 40% caged layer excreta was statistically identical to wastelage with 60% caged layer excreta.

The comparison means of pH of ensiled oat forage at different levels of CLE revealed that pH significantly decreased when the levels of CLE increased and this is in agreement with the results reported by Reddy and Reddy (1989). The lower pH of wastelage indicates good fermentation quality which was due to presence of molasses and higher water soluble carbohydrates in fodder that enhanced lactic acid production (Yunus *et al.*, 2000). Roothaert *et al.* (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 wastelages.

Chemical composition of wastelage

DM contents of different wastelages are presented in Table 2. Ensiling with caged layer excreta significantly ($p<0.05$) increased the dry matter (DM) content of wastelages among the treatments. DM increased linearly from 34.81 to 37.34% with increased level of caged layer excreta from 0 to 60% of the total dry matter. This is supported by the report of Al-Rokayan *et al.* (1988) when broiler litter was ensiled with sorghum forage in the proportions of 0: 100, 25: 75, 35: 65 and 45: 55. Similar result was reported by Flachowsky and Hennig (1990).

Crude protein composition of the silage was increased with increased proportion of CLE. Crude protein increased steadily with adding CLE from 14.11% in wastelage with 20% caged layer excreta to 18.95% in wastelage with 60% caged layer excreta. Wastelage with 60% caged layer excreta was superior ($p<0.05$) than other treatments (Table 2). Ngele *et a.* (2006) treated rice straw with poultry litter at different ratios and recorded highest crude protein in ratio 50:50. The crude protein of sorghum forages ensiled with broiler litter increased with increased proportion of poultry litter (Al-Rokayan *et al.,* 1988; Flachowsky and Hennig, 1990). In contrast to the foregoing trend, crude fiber declined with increased proportion of poultry droppings from 19.91 to 17.81% (Table 2). Rasool *et al.* (1998) observed a decline in NDF,

Table 2. Chemical composition of wastelage at different level of caged layer excreta

Parameters (%) DM basis	Wastelage with different percentage of Caged Layer Excreta			
	0% (control)	20%	40 %	60 %
Dry matter (Fresh basis)	34.81^{d} ± .02	35.03^{c} ± .02	36.46^{b} ± .03	37.34^{a} ± .03
Crude protein	13.90^{d} ± .01	14.11^{c} ± .02	17.07^{b} ± .04	18.95^{a} ± .12
Crude fibre	19.91^{a} ± .02	19.75^{b} ± .03	18.06^{c} ± .03	17.81^{d} ± .02
Ether extract	3.11 ± .01	3.09 ± .01	3.08 ± .01	3.05 ± .01
Ash	10.75^{d} ± .04	11.12^{c} ± .02	12.97^{b} ± .03	14.45^{a} ± .03
Nitrogen free extract	52.34^{a} ± .04	51.92^{b} ± .04	47.94^{c} ± .04	44.71^{d} ± .07

0% = wastelage with Oat forage and 5% molasses, 20% = wastelage with Oat forage, 20% caged layer excreta and 5% molasses, 40% = wastelage with Oat forage, 40% caged layer excreta and 5% molasses, 60% = wastelage with Oat forage, 60% caged layer excreta and 5% molasses. [a, b, c, d] values in the same row with different superscripts differ significantly ($p<0.05$).

hemicelluloses and cellulose (fiber component) in sudax fodder ensiled with broiler litter and molasses. Magar and Fontenot (1988) and Rasool *et al.* (1996) also observed a similar trend. The decline in crude fiber might be due to hydrolysis of uric acid available in poultry litter to ammonia which can effectively break down the lignin bond in roughage (Ngele *et al.,* 2006).

Ether extact components of wastlages were not significantly ($p<0.05$) different among the treatment groups (Table 2). The highest EE was obtained in control followed by 20%, 40% and 60% caged layer excreta with Oat forage. The result of this study similar to Baba *et al.* (2010) who reported, when Kyasuwa hay (*Pennisetum pedicellatum*) ensiled with poultry litter, EE declined with increased proportion of poultry litter.

The ash contents of all treatments were virtually higher ($p<0.05$) than the control. Table 2 showed that wastelage with 60% caged layer excreta gave the highest ash content, followed by 40% and 20% caged layer excreta. The lowest ash content was obtained in control. This result contrast with the findings of Al-Rokayan *et al.* (1988) and Flachowsky and Hennig (1990) who observed a linear increase in ash with increased proportion of broiler litter. This was occurred due to higher proportion of ash in caged layer exreta. The nitrogen free extract (NFE) content of wastelage was decreased ($p<0.05$) from 52.34 to 44.71% due to increase the level of CLE from 0 to 60% (Table 2). This was occurred due to lower proportion of fibre in caged layer exreta. Similar result was reported by Cruz and Viado (1981) who recorded a decrease in NFE of Para grass silage treated with poultry litter.

In vitro organic matter digestibility of wastelage

The in vitro organic matter digestibility (OMD) differed significantly ($p<0.05$) due to different levels of CLE (Figure 2). The highest in vitro OMD was produced by wastelage with 40% caged layer excreta which was statistically identical to wastelage with 60% caged layer excreta while the lowest value was recorded in the control. In vitro organic matter digestibility of ensiled poultry manure and crop residue was increased with increased the level of poultry manure (Saylor and Long, 1972).

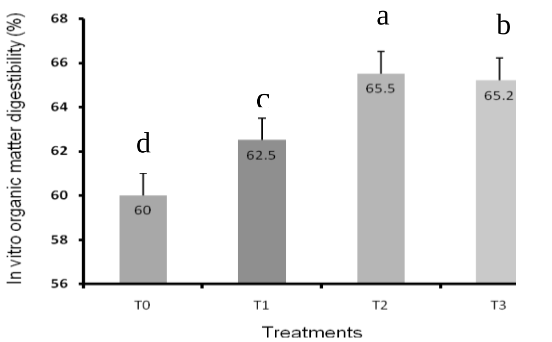

Figure 2. In vitro organic matter digestibility (%) of wastelage with Oat forage and 5% molasses (T_0), Oat forage with 20% caged layer excreta and 5% molasses (T_1), Oat forage with 40% caged layer excreta and 5% molasses (T_2), Oat forage with 60% caged layer excreta and 5% molasses (T_3). Bar represents mean ± SD. [a, b, c, d] values with different superscripts differ significantly ($p<0.05$) among treatments.

Metabolizable energy content of wastelage

Metabolizable energy content of wastelage is shown in Figure 3. The values for metabolizable energy (ME) content (MJ/Kg DM) of wastelage differed significantly ($p<0.05$) among the treatments. The highest ME was produced by wastelage with 40% caged layer excreta which was statistically identical to wastelage with 60% caged layer excreta. The lowest ME was produced by the control. Simillar trend was also reported by Ali *et al.* (1994), who indicated that in vitro DM digestibility and ME were increased in treated compared with untreated stover after ensiling.

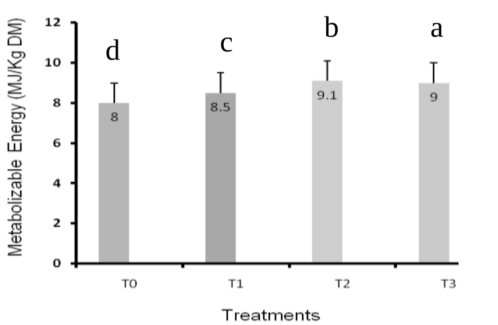

Figure 3. Metabolizable energy content (MJ/kg DM) of wastelage with Oat forage and 5% molasses (T_0), Oat forage with 20% caged layer excreta and 5% molasses (T_1), Oat forage with 40% caged layer excreta and 5% molasses (T_2), Oat forage with 60% caged layer excreta and 5% molasses (T_3). Bar represents mean ± SD. [a, b, c, d] values with different superscripts differ significantly ($p<0.05$) among treatments.

Implications

The results suggest that ensiling Oat forages with up to 60% caged layer excreta and 5% molasses significantly improves the nutritional values of wastelage and may be a feasible means of preserving and converting layer excreta, into a palatable and nutritious feed for cattle. In addition, this approach may also solve the disposal problem of poultry droppings in large poultry industries by utilizing it as an animal feed.

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