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Ensiling Buffalo Manure with Bagasse as a Diet Supplement for Sheep

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THIS study included three different wastelages in which increasing amounts of buffalo manure were added. Each wastelage was included in the ration of sheep at two levels on dry matter basis (separate experiment for each of the three wastelages). Six mature fat tailed Ossimi male sheep were used in each experiment of two animals in each treatment (two 3 × 3 latin square design). Food and water intake along with nutrients digestibility and introgen balance were determined for the tested rations.

The results indicated a variation in crude protein and ash content of the different wastelages. Dry matter intake (gm/kg 0.75/day) decreased significantly with increasing level of wastelage in the rations and decreased also as the level of manure in the silage increased. Water intake increased significantly with an increased proportion of wastelage in the diet.

Digestibility of almost all nutrients decreased as increased level of wastelage substitution. Highest digestibility values for almost all nutrients were recorded for animals given the third wastelage compared with the other two wastelages. All animals in all treatments of the three experiments showed a positive nitrogen balance. However, highest values were recorded for animals given the third wastelage.

Animal manure which is mainly used as a fertilizer is considered a potential source of some nutrients for ruminants. Recently, there has been growing interest in the use, as a feed of cattle manure. This interest has been sparked by a number of developments, not least of which is the increasing demand for animal protein and the particular burden this places on providing adequate feed.

Processing of animal manure can be beneficial for increasing nutrients, pathogen destruction and odour control. The drying of manure is one possibility of using manure in ruminant rations (Soliman, 1983). Hence, the problems associated with use of high temperature, energy costs and losses led to the ensiling methods for recycling of manure (El-Serafy, *et al.*, 1979). The ensiling of mixtures of cattle manure and other feedstuffs (termed wastelage by Anthony, 1968) appears to be a technologically simple and practical method of processing. The safe use of silage prepared from cattle manure necessitates its evaluation to determine its nutritive value and the limits of its use in feeding ruminants.

The objectives of the present study were ; to test different methods of making wastelages (silage prepared from manure), chemical evaluation of the prepared wastelages and to determine the nutritive value by mature sheep of the prepared wastelages using different feeding levels.

Material and Methods

Waste materials and their processing as wastelage

Three experiments were carried out to test three wastelage mixtures. The wastelages consisted of different proportions of buffalo manure and sugar cane bagasse with 5% cane molasses. Pure buffalo manure was collected fresh from the experimental farm station of the milk replacer research centre, Faculty of Agriculture, Ain-Shams University, Cairo, Egypt. The manure collected comprised a mixture of fattening male and dairy buffaloes manure. These animals were maintained on dry rations consisting of co-op-feed concentrate mixture, berseem hay and rice straw. Samples from lactating and fattening buffalo manure were taken for chemical analysis. Both sources were nearly similar in their chemical composition. Fresh sugar cane bagasse was collected from sugar cane juice shops and sun-dried by speading bagasse on plastic sheets in layers of 5 to 10 cm thickness for about 10 days to reach approximately 90% dry matter content (during the sun-drying period, bagasse was shuffled up side-down daily).

Samples from sugar cane bagasse were taken for chemical analysis. Three wastelage mixtures were prepared. They contained 32, 47.5 and 63% buffalo manure and 63, 47.5 and 32% sugar cane bagasse, respectively for wastelages, I, 2 and 3. The three wastelages were prepared by mixing chopped bagasse with fresh buffalo manure. Cane molasses at a level of 5% of the mixture weight was dissolved in a proper volume of water (about 15 lit.) then sprayed over each mixture. Average moisture content of the prepared mixture was about 65-70% at time of ensiling. The mixtures were ensiled in silos with a capacity of about one ton each. The silos were usually fitted with a hole at the bottom.

Rations

The experimental rations were formulated to cover the maintenance protein and energy requirements for fat tailed male Ossimi sheep according to Hassan, (1970). For the all three experiments, the control ration consisted of rice straw, co-op-feed concentrate mixture and cane molasses, while the experimental rations contained two levels of the wastelages. In experiments I, 2 and 3 ; 15.3 and 31.3 ; 12.6 and 24.4 ; 14.8 and 26% of the dietary dry matter was replaced by the first, second and the third wastelage, respectively. The composition of the experimental rations is presented in Table 1. Chemical composition of the buffalo manure, bagasse, co-op-feed, rice straw and the different wastelages is presented in Table 2.

TABLE 1. Composition of the experimental rations (on dry matter basis).

Item	Level of dry matter(DM) substitution								
	Expt.I			Expt.II			Expt.III		
	Control	15.3%	31.3%	Control	12.6%	24.4%	Control	14.8%	26%
Co-op-feed mix.*	39.5	34.8	28.7	40.5	30.3	20.4	38.8	30.0	20.6
Rice straw	42.0	33.7	27.9	42.0	39.9	38.6	44.4	36.9	32.4
Molasses	18.5	16.5	12.4	17.5	17.2	16.6	16.8	18.3	21.0
Buffalo - wastelage	----	15.3	31.3	----	12.6	24.4	----	14.8	26.0

* Consists of ; 40% undecortecoted cotton seed meal, 26% wheat bran, 20% ground maize, 7% molasses, 4% rice bran, 2% lime stone and 1% salt.

Table 2 . Chemical composition of the experimental buffalo manure, wastelages, ingredients and feedstuffs(on DM basis).

Item	Dry matter, %	Organic matter, %	Ash %	Crude protein, %	Crude fiber, %	Ether extract, %	Nitrogen free extract, %	PH values
Buffalo manure,	16.2	82.7	17.3	9.5	27.9	0.6	44.7	
Bagasse,	93.5	95.6	4.4	3.4	39.0	3.8	49.4	
Wastelage I ,	42.0	88.0	12.0	6.5	36.0	2.7	42.8	6.0
Wastelage II,	40.0	75.2	25.0	11.8	30.4	2.8	30.0	5.8
Wastelage III,	36.0	81.6	18.4	13.8	24.0	1.1	42.7	4.8
Co-op-feed mix.	90.8	93.4	6.6	21.0	15.5	6.3	50.6	
Rice straw ,	93.3	81.4	18.6	3.2	36.0	1.4	40.8	
Molasses,	62.5	88.5	11.5	2.4	----	---	86.1	

Animals and their management

For each of the three experiments, six mature Ossimi rams (fat-tailed) of about 51 kg live body weight were used. In each of the three experiments, animals were randomly assigned to the three experimental treatments using a latin square design with two replicates (two animals for each treatment). The animals were confined to wooden metabolic crates with 3 days of exercise in pens between periods. The digestion trial consisted of a preliminary period of 14-days to permit full adaptation to the tested rations followed by a 7-day collection period. During the collection period, faeces and urine were quantitatively collected. Animals were offered their ration twice daily in equal parts at 8.00 and 17.00 hr. Water was offered ad lib. Total water intake and residues of feed if any were recorded.

Analysis

Proximate analysis for buffalo manure, wastelages, ration ingredients, feed residues (if any), faeces and urine were carried out according to A.O.A.C. (1970) procedures. The pH values of seepage samples taken from each silo were measured using a combination electrode pH meter (EIL-7010).

Data were statistically analyzed according to Snedecor and Cochran, (1967). A double latin square design followed by LSD test for testing the significancy between means was used.

Results and Discussion

Chemical composition

Chemical composition data of the different experimental materials (Table 2) show that ash content of the buffalo manure (17.3%) was lower than those reported by El-Serafy, *et al.*, (1981) and Soliman, (1983) on buffalo manure (20.4-23.1%), while it was higher than the values found by Hammond, (1944), Anthony, (1971), Smith, *et al.*, (1971), Lucos, *et al.*, (1975), Malossini, *et al.*, (1978) and Cornman, *et al.*, (1981) on cattle manure (11-16%). Differences in ash content may have been related to differences in the methods of handling and processing of the manure (Day, *et al.*, 1980) along with possible contamination with dust and soil (Johnson, 1972). The crude protein content of the present buffalo manure (9.5%) was in general lower than the values (12.4-14.1%) reported by El-Serafy, *et al.*, (1981) on buffalo manure and Tinnimit, *et al.*, (1972) and Ward and Muscato (1976) on cattle manure, but it was very close to the value of 9.9% reported by Soliman, (1983) on buffalo manure. Differences in crude protein content may have been influenced by the original ration fed to the animals producing the manure, principally the ratio of rice straw in the ration (Johnson, 1979). Crude fiber content of the present buffalo manure (27.9%) was found to be lower than that reported by Smith, *et al.*, (1971) on cattle manure (37.0%) while it was higher than those of El-Serafy, *et al.*, (1981) and Soliman, (1983) on buffalo manure (19.5 and 22.6%). Ash content of wastelages showed no constant trend. The highest value was recorded for wastelage II, while the lowest value was noticed for wastelage I. It was expected that ash content of wastelage increased by increasing the level of manure (Harpester, *et al.*, 1975). A noticeable increase in the crude protein (CP) content of the wastelage was found as the level of buffalo manure increased. In contrast, crude fiber (CF) content decreased as the level of manure increased. This is a result of the chemical composition of the ingredients used in wastelage making. The values given for nitrogen free extract (NFE) were almost similar for both wastelages, I and II. Ash contents as well as fiber contents of the different wastelages were probably responsible for the differences in NFE contents.

It is worthnoting that the pH value of the three experimental wastelages tended to show more acidic value by increasing manure level, *i.e.* 6.0, 5.8 and 4.6 for wastelages, I, 2 and 3, respectively. For the third one, it is clear that it contained the highest proportion of buffalo manure and showed the highest values of NFE and CP and the lowest value of CF content. These results indicate that wastelage quality improved with an increased proportion of buffalo manure. The present results are in harmony with those reported by Cornman, *et al.*, (1981) who ensiled cattle excreta with rye straw in 30:70, 40:60, 50:50, 60:40 and 70:30% ratios. They found that water soluble carbohydrate content increased as the level of cattle waste in the silage increased.

Feed and water intake

Data concerning feed intakes in term of dry matter gm/kg$^{0.75}$ which are presented in Table 3 indicate decreasing values with increasing level of buffalo manure in the silage. However, it is worthnoting that within every particular experiment, feed intakes decreased significantly ($P < 0.05$) by increasing the proportion of wastelage in the diet. This may be attributed to the higher ash content and the lower CP content of the wastelage containing rations than those of the control (Van Souest and Jones, 1968. Kempton and Leng, 1979, Shoukry, 1982 and Soliman, 1983). The high ash content of the present wastelage demonstrate clearly that feed intake could be much better expressive if considered in terms of organic matter (OM) than dry matter (DM).

Table 3 : Mean values of feed and water intakes of animals fed the experimental rations.

Item	Level of dry matter substitution								
	Expt. I			Expt. II			Expt. III		
	Control	15.3%	31.3%	Control	12.6%	24.4%	Control	14.8%	26%
Dry matter feed intake :									
gm/day,	1034	922.7	835.8	944.3	884.5	762.7	1000.6	779.3	702.0
gm/kg$^{0.75}$,	52.2^a	47.0^b	41.8^c	49.6^a	46.6^b	40.8^c	51.4^a	40.4^b	36.5^b
Water intake:									
ml/day,	2446.2	2243.0	2738.5	3261.1	3427.5	3451.4	2865.0	2712.0	2935.0
ml/gm DMI*,	2.4^a	2.4^a	3.3^b	3.4^a	3.9^b	4.5^c	2.8^a	3.5^b	4.2^c

* DMI : Dry matter intake.

a , b , c , values of each separate experiment of the same row with different superscripts are significantly different ($P < 0.05$).

In general, water intakes as absolute ml/head/day or ml/gm DM intake, increased as the level of wastelage in diets increased in the three experiments. Soliman, (1983), obtained similar results by using sun-dried buffalo manure. The excessive higher water intake was probably necessary for removing the extra minerals intakes (Pierce, 1957, Potter, 1961, and Wilson, 1966).

Nutrients digestibility and nitrogen-balance

In general, it has been shown in all experiments (Table 4) that DM, OM, CF and NFE digestibilities were lower for wastelage containing rations than those of the control. These results may be probably related to the corresponding lower intakes of these nutrients. Such results are in accordance with those of Harpester, (1975 and 1978), Newton, *et al.*, (1977), El-Serafy, *et al.*, (1979) and Cornman, *et al.*, (1981) on cattle wastelage and Soliman, (1983) on sun-dried-buffalo manure. The higher value of CF digestibility of the group fed the higher level of wastelage than the control in Expt. I, may be possible attributed to the corresponding higher intake of CF (El-Shazly, *et al.*, 1961, Baile and Forbes, 1974 and Orskov, (1975). Protein digestibility tended to decrease in the wastelage containing rations (Table 4). The reduction in protein digestibility was probably related to reduction in CP intake (Table 3) along with differences in protein quality. Such results support the findings of El-Serafy, *et al.*, (1979) and Soliman, (1983).

Nitrogen balance values in the all three experiments were positive. However, the all recorded values were nearly similar except that of the Expt. 3, which showed highest values. This may be due to the highest CP digestibility values obtained in this experiment. Similar results were obtained by Smith, *et al.*, (1971), El-Serafy, *et al.*, (1979) and Soliman, (1983), who found that although animals given rations containing cattle or buffalo manure were in positive nitrogen-balance, yet nitrogen from manure was used less efficiently than that from the control diet.

Results of nutrients digestibility and nitrogen balance showed clearly that values obtained from the Expt. 3, at the two levels of wastelages were higher than those of the other two ex-

Table 4 Apparent digestibility and nitrogen balance for the experimental rations

Item	Level of dry matter substitution								
	Expt. I			Expt. II			Expt. III		
	Control,	15.3%,	31.3%,	Control,	12.6%,	24.4%,	Control,	14.8%,	26%,
Dry matter,%	59.3^{a}	56.8^{b}	55.2^{b}	62.9^{a}	57.9^{b}	49.7^{c}	73.1^{a}	70.1^{a}	64.2^{b}
Organic matter,%	64.6^{a}	63.1^{a}	67.3^{b}	67.7^{a}	63.2^{a}	56.0^{b}	77.2^{a}	74.4^{a}	69.6^{b}
Crude protein,%	55.7^{a}	55.9^{a}	55.3^{a}	54.7^{a}	53.0^{a}	39.6^{b}	70.5^{a}	72.4^{a}	65.3^{b}
Crude fiber,%	56.6^{a}	53.6^{a}	64.5^{b}	50.3^{a}	49.6^{a}	45.9^{b}	71.5^{a}	67.2^{a}	61.6^{b}
Ether extract,%	72.5^{a}	68.1^{b}	70.2^{b}	67.6^{a}	63.3^{a}	55.7^{b}	73.5^{a}	76.8^{a}	67.8^{b}
Nitrogen- free-extract,%	70.2^{a}	67.8^{b}	70.2^{a}	77.7^{a}	71.1^{b}	64.7^{c}	80.7^{a}	76.5^{b}	73.7^{b}
Nitrogen balance,gm.	+3.9^{a}	+4.0^{a}	+3.1^{b}	+3.4^{a}	+3.6^{a}	+0.3^{b}	+8.2^{a}	+7.5^{a}	+5.2^{b}

a , b , c , values of each separate experiment of the same row with different superscripts are significantly different($P < 0.05$)

periments. Many reasons may have been responsible for the superiority of nutrients digestibility of this group which comprised the highest rate of buffalo manure and the lowest rate of bagasses. Differences in chemical composition in particular CF fractions along with silage quality and its ingredients were probably the reasons for increasing nutrients digestibility of the wastelage 3. Bagasses may contain higher lignin than buffalo manure and this may have reduced CF digestibility of wastelage containing higher amounts of bagasse (I and 2). Moreover, type of lignocellulose bonds may be different between bagasses and buffalo manure. Therefore, the present results support the conclusion of Soliman, (1983) that fractionation of the CF content of the different wastelages should be coupled with their gross chemical composition in future studies if successful use of waste material in rations for ruminants is to be achieved.

From the above mentioned results, it may be recommended to use buffalo manure wastelage in rations for sheep up to 12% of the whole ration on dry matter basis.

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سيلاج روث الجاموس ومصاصة قصب السكر كاضافات غذائية للاغنام

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قسم الانتاج الحيوانى كلية الزراعة جامعة عين شمس – شبرا الخيمة ومعمل تغذية الحيوان والدواجن بالمركز القومى للبحوث – الدقى – القاهرة .

اجريت هذه التجربة بهدف دراسة امكانية استخدام سيلاج روث الجاموس مع مصاصة القصب فى علائق الاغنام كاستبدال جزئى من المادة الجافة . استخدم فى هذه التجربة ثلاثة أنواع من سيلاج روث الجاموس مع مصاصة القصب تختلف فيما بينها فى نسبة روث الجاموس بها حيث كانت ٣٢ ، ٥ر٤٧ ، ٦٣٪ وتكمل الى ١٠٠٪ بواسطة مصاصة قصب السكر . وكل نوع من هذه الأنواع الثلاثة تم استخدامه بثلاثة مستويات فى علائق الاغنام حيث استخدم ٦ أغنام أوسيمى ذكور بالغة لاجراء تجارب الهضم وميزان الآزوت .

أوضحت النتائج ما يأتى :

١ – اوضحت النتائج وجود اختلافات بين أنواع السيلاج المختلفة بالنسبة للبروتين والرماد الخام .

٢ – المادة الجافة المأكولة (جم لكل كيلو جرام مرفوع للأس ثلاثة أرباع فى اليوم) انخفضت معنويا بزيادة مستوى السيلاج فى العلائق وكذلك بزيادة مستوى روث الجاموس فى السيلاج .

٣ – زاد الماء المتناول معنويا بزيادة مستوى سيلاج الفضلات فى العليقة .

٤ – معاملات هضم معظم العناصر الغذائية انخفضت بزيادة مستوى السيلاج فى العليقة وكانت معاملات هضم النوع الثالث من سيلاج الفضلات هى افضل الانواع الثلاثة .

٥ – كل انواع السيلاج وكل مستوياتها فى العليقة أظهرت ميزان ازوت سالب وأحسنها كان للنوع الثالث من سيلاج الفضلات .