

Fattening Sheep on Diets of Broiler Litter Ensiled With Green Berseem (*Trifolium Alexandrinum* L.)

1. Nutritional Evaluation of the Fattening Sheep Diets.

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SIXTEEN yearling male-lambs were allocated to four groups and offered different proportions of broiler litter-green berseem silage (BLS) to investigate the nutritive value and the best suitable level of silage for fattening sheep. The control conventional diet (1st group) consisted of a commercial concentrate mixture, berseem hay and wheat straw. In the other three groups, the BLS replaced 33, 66 and 100% of the control diet on TDN basis. Dry matter intake increased approximately 13% in the 33% silage group compared to those fed the control diet. All apparent digestibility coefficients decreased with increasing proportions of BLS in diets up to 66%, except EE. Both TDN and DCP intakes declined with increasing levels of BLS above 33% in the diet; the intake of TDN ($\text{g/kg}^{0.75}$) from the 33% diet was 5.2% more than that of the control group. All animals had a positive nitrogen balance. Nitrogen retained by sheep decreased progressively from 356 mg/day/kg body weight on conventional diet to 17 mg/day/kg body weight on the whole BLS diet. Total water intake of sheep on high levels of BLS was greater than those fed the control diet.

Keywords: Fattening sheep, broiler litter silage, digestibility, nitrogen utilization.

Disposal of animal excreta under intensive livestock production can contribute to the hazards of environmental pollution in absence of good management. Utilization of recycled animal waste in ruminants feeding seems to be quite meaningful and en-

couraging as an avenue for solving the problem of environmental pollution as well as being a new promising untraditional feedstuffs. Animal excreta must be processed to enhance animal acceptability, destroy pathogens and reduce unfavourable odors (Arndt *et al.*, 1979). Ensiling animal wastes, particularly poultry excreta, with other feed ingredients is the most economically advantageous method of controlled processing of manure for feed (Fontenot, 1979; Kamra, *et al.*, 1989 and Reddy and Reddy, 1989). Ensiling of poultry excreta has the added advantage of destroying pathogens and parasites (Mckaskey and Anthony, 1979; Jakhmola, *et al.*, 1986 and Gupta and Kamra, 1987).

This study was designed to explore the potential of feeding different levels of broiler litter ensiled with green berseem as fattening diets for growing sheep, in terms of intake, digestibility and nitrogen utilization.

Material and Methods

This study was conducted at Maryout Research Station, Desert Research Center, 35 km south of Alexandria. The broiler litter-green berseem silage (BLS) was made as equal parts (on DM basis) of chopped green berseem (3rd cut) and air-dried broiler litter; in addition to 4% molasses and 1% mineral mixture. The broiler litter contained primarily, broiler droppings and chopped wheat straw (approximately 2.5 cm length) as bedding material. Green berseem (*Trifolium alexandrinum* L., IFN, 2-01-348) was wilted for 24 hr then chopped (2-5 cm length). Sugar cane molasses (IFN 4-04-695) was added, as a source of energy, to initiate fermentation in the silo. The mixture of these ingredients, in addition to 1% mineral mixture were mixed thoroughly and placed carefully in a stone-built trench for 2 months. Three replications were made at the same time. Dry matter in silage was determined by oven drying at 80°C for 18 hr (Barnett, 1954). The pH of the silage was tested (Barnett, 1954), and some physical characteristics, such as texture, color and odor were also recorded.

Sixteen Barki x Merino crossbred yearling (aged nearly 10 months) male-lambs (averaged 28.9 ± 0.177 kg body weight) were allocated into four groups of 4 animals each according to body weight. These groups were assigned at random to receive one of the four dietary treatments. The control ration consisted of a commercial concentrate mixture, between hay (*Trifolium alexandrinum* L., 4 cut, IFN, 1-27-5160) and wheat straw, IFN, 1-05-175). Proportions of the BLS were replaced 33, 66 and 100% of the control diet. Allowances were presumed to satisfy the requirements for

maintenance, wool growth and to allow for 150 g daily gain (ARC, 1965).

The yearling lambs were fed in groups for a period of which was required for voluntary feed intake to be stabilized (El Shaer, *et al.*, 1990). Thereafter, the animals were housed individually in metabolism cages for a 10-day preliminary period followed by a 5-day collection period. Feed offered and refusals, and free water intake were recorded every day. Daily feces and urine (with 5% of HCL) were measured, recorded, sampled and composited for chemical analysis. Dried samples of offered feeds, refusals, and feces were analysed according to the methods of the A.O.A.C. (1975). Chemical composition of representative samples of the control, silage rations and their ingredients (on DM basis) is summarized in Table (1). Nitrogen in urine samples was determined by kjeldahl method. Nitrogen free extract (NFE) was

TABLE 1. Chemical composition of experimental rations (% on dry basis).

Ingredient	Dry matter	Ash	Crude protein	Crude fiber	Ether extract	Nitrogen Free extract
Control ration						
Conc. mixture*	91.3	7.94	22.1	7.75	2.41	59.8
Berseem hay	87.4	12.6	12.2	29.3	1.69	44.21
Wheat straw	92.1	13.9	2.01	38.6	1.15	44.34
Silage ingredients						
Green berseem	17.0	13.5	15.7	25.9	3.22	41.68
Broiler litter	85.8	22.6	20.3	15.0	5.32	36.78
Molasses	7.0	12.1	3.61	5.02	0.12	79.15
BLS**	32.8	25.9	16.2	12.0	8.35	37.55

* Commercial concentrate mixture (based on undecorticated cotton - seed cake, corn grains, wheat bran, rice polishnig and additives 25, 20, 30, 20 and 5% respectively).

** Broiler litter - green berseem silage.

calculated by difference.

The data obtained were analysed according to a completely randomized design

(Snedecor and Cochran, 1980). Duncan multiple range test was also used (Duncan, 1955) to test significance among means.

Results and discussion

The pH of the silage (BLS) in the three trenches ranged from 3.8 to 4.1. The silage was golden yellow in color with a pleasant aroma, soft texture and moist, indicating optimum fermentation. After approximately four weeks of feeding, animals consumed constant amounts of BLS and showed stabilized voluntary intake without any metabolic disorders, which confirms the previous findings of El Shaer *et al.*, (1990).

Dry matter intake (DMI) from diets varied significantly ($P < 0.05$) among the experimental animal groups (Table 2). Proportional inclusion of BLS in the diets seemed to improve the total consumption of the whole ration. It increased considerably when BLS constituted up to 66% replacement (76.5 and 73.2 vs. 67.7 g/day/kg $w_{0.75}$ for the control diet). The lowest consumption was observed for animals fed the silage solely (100% level). Such observations are in agreement with those obtained by Muller (1980) and El Houseiny (1984). In previous study, El Shaer *et al.*, (1990) found that mature rams consumed amounts of BLS that were comparable to those obtained in this study.

The pattern of apparent digestion coefficients of nutrients was significantly influenced by feeding different levels of BLS. It was of interest to observe that higher digestion of CF and CP by animals fed the whole silage diet (100% level) over those in 66% level group. Sheep fed the sole BLS diet, also, showed the highest ether extract (EE) digestion coefficient (70.9%) which was nearly similar to that reported earlier (70.3%) by Mohsen and El Santiel, (1983). The sheep fed either the control diet or the 33% BLS tended to exhibit similar digestion of all nutrients, except CP (Table 2). These results are in agreement with the previous results (Parthasarathy and Pradhan, 1985) which showed that digestibility of most nutrients were not significantly affected when the broiler litter, based on wheat straw, replaced 30% of the control diet. However, higher level of broiler litter replacement in diets could decrease CP digestibility as has been reported by Abu-Izzedin and Bhattacharya (1969) and Fontenot and Webb (1974). Digestibility of OM was significantly ($P < 0.05$) reduced when replacement reached 66 or 100%. Such reduction might influence microbial protein synthesis in the rumen (despite of higher NPN).
Egypt. J. Anim. Prod., 29, No. 1 (1992)

TABLE 2 . Dry matter intake, digestibility and nutritive value of diets containing different proportions of BLS .

Attributes	Dietary broiler litter silage (%)				± S.E.	F - test
	0	33	66	100		
Number of animal	4	4	4	4		
Initial live weight (kg)	29.8	29.6	28.3	27.9	0.177	ns
Total DMI, (g/day)	862.8 ab	971.1 a	989.0 ab	747.6 c	30.85	*
(g/kg ^{0.75})	67.7 c	76.5 a	73.2 ab	61.6 d	0.910	*
Digestibility (%)						
DM	67.8 a	67.7 a	58.9 b	61.9 b	0.974	*
OM	69.2 a	68.9 a	60.7 b	59.3 b	0.887	**
CF	64.3 a	61.7 a	52.3 b	63.4 a	0.965	*
CP	76.7 a	69.7 b	55.4 d	60.9 c	1.465	**
EE	50.7 c	48.4 c	59.9 b	70.9 a	1.605	**
NFE	72.7 a	74.8 a	65.9 b	55.1 c	1.480	**
Nutritive value (%)						
TDN	67.9 a	63.3 b	54.0 c	48.2 d	2.157	**
DCP	16.2 a	12.6 b	10.0 c	11.7 bc	0.688	**
Digested intake (g/day)						
TDN, (g/day)	586.1 a	614.5 a	484.8 b	360.4 c	29.5	**
(g/kg ^{0.75})	46.0 a	48.4 a	39.5 b	24.7 c	1.15	**
DCP, (g/day)	140.2 a	122.0 a	90.0 b	87.3 b	6.85	**
(g/kg ^{0.75})	11.0 a	9.61 a	7.33 b	7.19 b	0.87	**

Values in the same row with different superscripts differ significantly ($P < 0.01$) .
 ns = not significant ; * = $P < 0.05$, ** = $P < 0.01$.

The nutritive values, in terms of total digestible energy (TDN) and digestible crude protein (DCP), varied significantly ($P < 0.01$) among the four dietary treatments (Table 2). The energy value (TDN%) significantly decreased progressively as the proportion of the BLS increased in the diets. Similar results were obtained by Muller (1980, 1982). The highest DCP values were recorded for animals fed the control diet (16.2%), followed by those in the 33% BLS group (12.6%). The apparent decrease in both TDN and DCP intake (g/day or g/kg^{0.75}) could be due to lower utilization of most nutrients, i.e., OM, CF, CP and NFE in addition to a decrease in DMI as the BLS replaced more than 33% of the control diet, as reported earlier by Abu-Izzedin and Bhattachary (1969), Muller, (1982) and Hanafy (1985). Values of TDN and DCP intake (g/kg^{0.75}) for sheep fed 100% BLS diet were 55 and 53% of the conventional diet, respectively. Moreover, TDN intake from the 33% diet was approximately 5% more than that of the control group. The differences were not significant ($P > 0.05$).

Nitrogen utilization data (Table 3) showed that all animals in the different groups were in positive nitrogen balance but retained different amounts of nitrogen. These results, also, depicted a trend in which nitrogen balance decreased progressively ($P < 0.01$) from 356 mg/kg body weight/day for sheep in the control group to 16.5 mg/kg body weight/day for those fed the whole BLS diet. Such results are consistent with several data reported elsewhere (Fontenot and Webb, 1974; Kishan *et al.*, 1984 and Reddy and Reddy, 1989). Sheep given the control and 33% BLS

TABLE 3. Nitrogen balance in fattening lambs fed diets containing different proportions of BLS.

mg N/day/kg BW	Dietary broiler litter silage (%)				± S.E.	F - test
	0	33	66	100		
N - intake	968 a	918 a	862 b	774 c	23.2	*
faecal - N	224 c	278 b	378 a	302 b	19.6	**
Digested - N	744 a	640 b	484 c	471 c	38.2	**
Urinary - N	388 b	321 c	315 c	455 a	19.8	*
N - balance	356 a	319 a	169 b	17.0 c	38.2	**
DN retained (%)	47.8 a	49.8 a	34.9 b	3.50 c	4.26	**

Values in the same row with different superscripts differ significantly ($P < 0.01$).

* = $P < 0.05$; ** = $P < 0.01$.

Egypt. J. Anim. Prod., 29, No. 1 (1992)

diets recorded similar values, in terms of nitrogen balance and digested nitrogen retained (DN retained), as the apparent differences were not significant, which is a reflection of availability of energy.

Information on water utilization by fattening yearling lambs is presented in Table (4). The total water intake, in terms of ml/day or ml/g DMI, increased gradually as the proportions of BLS increased form 33 to 100%. In general, total water in-

TABLE 4 . Water intake and excretion by fattening lambs fed diets containing different proportions of BLS .

ml water/day	Dietary broiler litter silage (%)				±S.E.	F - test
	0	33	66	100		
Water intake						
Free water	2017 a	1444 c	1798 b	1542 c	69.8	**
Feed water	79 c	788 b	1469 a	1401 a	153.1	**
Metabolic water ^{1/}	348 a	369 a	291 b	216 c	17.7	**
Total	2445 c	2601 c	3557 a	3160 b	123.3	**
Water excretion						
Faecal	253 b	311 ab	406 a	282 b	21.9	*
Urine	1059 bc	718 c	1616 ab	1879 a	155.5	*
Total	1312 b	1029 b	2022 a	2161 a	217.0	*
Insensible water loss	1132	1571	1536	999	110.0	ns
Water intake (ml/g DMI)						
Free water	2.34 a	1.49 b	2.00 a	2.06 a	0.111	**
Total water	2.83 b	2.68 b	3.96 a	4.23 a	0.204	**

Values in the same row with different superscripts differ significantly (P < 0.01) .

ns = not significant ; * = P < 0.05; ** = P < 0.01

1/ Farid *et al.* (1985).

take of sheep fed high levels of BLS was greater ($P < 0.01$) than those obtained for sheep in control group, as a result of increased feed water intake (79, 788, 1469 and 1401 ml/day, for control, 33, 66 and 100% BLS groups, respectively). Such trends are mainly due to higher moisture content in the ingredients of BLS (67.2%) as compared to control diet (10.9, 8.21 and 9.71 % in berseem hay, wheat straw and a commercial concentrate mixture, respectively). Moreover, the greatest water intake (ml/g DMI) recorded for animals fed 100% BLs may be as a result of highest ash content in their diet (Miller, 1982 and El Shaer *et al.*, 1990). The excessively high water intake was probably necessary for removing the extra mineral intake (Pierce, 1951, and Wilson, 1966). Insensible water loss values were calculated as the difference between total water intake and excretions, assuming the animals were in a state of water equilibrium. It was observed that the insensible water loss increased as the animals were given the 33 and 66% BLS diet, whereas those on the whole BLS diet exhibited the lowest value. It could be a reflection of the greatest total water excretion achieved by these animals.

The results obtained herein indicate, quite clearly, that broiler litter-green berseem silage could successfully constitute approximately a third of the fattening diet of sheep as their DMI was higher than those fed the control diet. It was also reflected on the TDN and DCP intakes as $\text{g/kg}^{0.75}$, (i.e., 5.2% TDN intake more than the control group).

Further long term studies should be conducted to determine animal performance and the carcass characteristics of fattened yearling male Lambs fed the experimental silage.

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تسمين الأغنام على علائق مخلفات فرشاة الدواجن مع البرسيم المصرى
١- التقييم الغذائى لعلائق التسمين.

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أجرى هذا البحث لدراسة أمكانية أحلال العلائق التقليدية لتسمين الأغنام
بواسطة سيلاج مخلوط من مخلفات فرشاة الدواجن مع البرسيم المسقاوى.
فقد شملت الدراسة أربعة معاملات هم العليقة التقليدية (المقارنة - الكنترول)
والتي تكونت من علف مركز وتين قمح ودريس البرسيم المسقاوى والتي تم
أستبدالها بمعدل (٣٣ ، ٦٦ ، ١٠٠٪) بواسطة السيلاج من الثلاث معاملات
الأخرى والتي أشتملت كل معاملة من المعاملات الأربعة على (٤) حملان أغنام
خليطة (برقى - مارينو) تم تغذيتها لمدة أربعة اسابيع كفترة تمهيدية أعقبها
فترة الجمع الأساسى لدراسة التقييم الغذائى للعلائق المختلفة التى سوف
تستخدم فى التسمين .

وقد أوضحت نتائج هذه الدراسة أن كمية المادة الجافة المأكولة الكلية
للحيوانات التى قد تغذت على ٣٣٪ من السيلاج قد زادت بنسبة ١٣٪ عن ما
تم أستهلاكه فى مجموعة المقارنة (الكنترول) . كذلك أظهرت النتائج أن كل
معاملات فضم العناصر الغذائية تناقصت بشكل واضح عن زيادة نسبة
أحلال السيلاج أكثر ٦٦٪ من العليقة . وكذلك انخفضت كمية المأكول من
العناصر الكلية المهضومة والبروتين الخام المهضوم لزيادة مستويات السيلاج
أكثر من ٣٣٪ فى العليقة . وقد كانت كمية المأكول من العناصر الكلية
المهضومة فى مجموعة الـ ٣٣٪ سيلاج أكثر منها فى مجموعة المقارنة . وقد
أشارت أيضاً النتائج الى أن جميع الحيوانات كانت فى حالة اتزان
نيتروجينى موجب واحتجزت كميات متفاوتة من النتروجين والتي كانت ٣٥٦
ملحم / يوم / كجم وزن جسم فى مجموعة المقارنة وتناقصت بشدة الى ١٦
ملحم / يوم / كم وزن جسم فى مجموعة الحيوانات التى تغذت على عليقة
كلها سيلاج (مستوى ١٠٠٪ سيلاج) أما بالنسبة لأستهلاك الحيوانات من
مياه الشرب الكلية للأغنام التى تتغذى على علائق ١٠٠٪ سيلاج أكبر مما
سجلت فى المجموعات الأخرى .

ويمكن استخلاص أن سيلاج مخلفات الدواجن والبرسيم المسقاوى
الأخضر يعتبر عليقة جيدة يمكن إستخدامها فى التسمين وخاصة عندما يحل
محل ٣٣٪ من العليقة التقليدية للتسمين إلا أن هذه التجربة تحتاج لمزيد من
الدراسة لتقدير تأثير مثل هذه الأعلاف والتغذية على خصائص الذبيحة
وكفاءة تحويل الغذاء وتكاليفه .