Sugarcane bagasse silage treated with different levels of urea for improvement sheep production.
II. Body weight changes and ewes` reproductive performance.

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Abstract

This study was carried out on 179 of 3/4 Chios x 1/4 Ossimi sheep. Animals were divided into four treatment groups, a control group (26 animals) fed concentrates with wheat straw and three silage fed groups, T_0 (25 animals), $T_{1.5}$ (26 animals) and T_3 (26 animals) receiving silage containing 0, 1.5 and 3 % urea, respectively with concentrates. The animals fed 60 % of their nutrition requirements as concentrate mixture while roughage (silage or wheat straw) were given ad libitum. This study was carried out to investigate the influence of sugarcane bagasse silage treated with different levels of urea on body weight and ewes reproductive performance. The experiment was lasted for 10 months and consisted of 4 periods, premating (1 month), mating (1 month), pregnancy (5 months) and lactation (3 months). Body weight, estrus, number of service per conception and fertility,% were recorded. Data were statistically analyzed using GLM of SAS. During premating period, silage or urea had no significant effect on body weight or body weight changes, whereas the increase in feed intake was significant ($P< 0.05$). During pregnancy, T0, T1.5 and T3 had higher body weight and body weight changes ($P< 0.05$) and feed intake ($P< 0.01$) compared with control group. Whereas, during lactation, T1.5 and T3 groups had higher body weight than that of T0 fed group.

Number of ewes exhibited estrus or lambed were lower in urea fed groups (T1.5 & T3) than control and silage fed groups. Number of service per conception (S/C) was adversely affected by urea treatment particularly 3 % urea. Silage fed groups had higher body weight at lambing and their lambs had higher average and total birth weight and weaning weight than control group. Long term feeding of urea had adverse effect on fertility of treated ewes as compared with fertility before treatment. About 18 % (8 from 45 ewes) of urea fed-groups had estrus length more than 48 hours compared with about 4 % (2 from 49 ewes) for both control and silage (T0) fed groups. In conclusion, feeding sugarcane bagasse silage with or without urea may improve growth performance, whereas feeding urea particularly long term feeding and high level (3 %), may be had a negative effect on reproductive performance of ewes.

Key words: Sheep, sugarcane bagasse, urea, body weight, estrus, service per conception, fertility, and %.

Introduction

In Egypt, about 4.71 million ton of bagasse is generated in sugarcane factories (FAO, 2002). However due to its low nitrogen content, urea or ammonia may be used to raise the crude protein of bagasse. However dietary protein may interacts with reproductive performance of ruminants (Ferguson and Chalupa, 1989). Therefore, the purpose of this study is to investigate the effects of sugarcane bagasse silage supplemented with different levels (1.5 and 3 % of DM) of urea on body weight and fertility.

Materials and methods

The present study was carried out at Mallawi Animal Production Research Station on 103 mature 3/4 Chios x 1/4 Ossimi ewes and 76 newborn lambs. The aim of the study was to determine the effect of feeding sugarcane bagasse silage treated with different levels of urea on body weight changes and reproductive performance of ewe's in different stages of production. Ewes were treated for internal and external parasites with Ivomec – super at start of experiment, also all animals were subjected to the routine vaccination programs for infectious diseases (FMD, rift valley fever, pox etc.). Animals were in a good health conditions through the experiment and there were no apparent digestive troubles.

The experimental animals were allocated to one of four treatment groups which were balanced for age and initial live weight, control group (C, 26 animals) fed wheat straw and three treatment groups (T_0, $T_{1.5}$ and T_3) fed sugarcane bagasse silage treated with different levels of urea, 0, 1.5 and 3 %, as dry matter basis, respectively. All animals were fed 60% of their nutritional requirements (according to NRC, 1985) as a concentrate mixture (in a single ration at 8:00 a.m.) while roughages were given ad libitum either wheat straw or treated sugarcane bagasse silage. Fresh food was weighted and offered at 8:30 a.m. sufficient silage and wheat straw were offered daily to provide 110% of the intake of the previous day and refusal were weighted and discarded. Silage and wheat straw consumptions were determined daily by difference between the quantity of feed offered and refused. Dry matter intake was estimated after adjusting the material offered and refused for dry matter content. Samples were dried in an oven at 65º C. Animals were weighted every other week in the morning before feeding and weight gain was calculated. Mineral mixture blocks were used to cover the animal's requirements. Animals were allowed to drink water ad libtum for 3 times daily.

Preparation of silage

Sugarcane bagasse (SCB) as poor quality agriculture waste was collected through different periods of experiments from sugarcane mills that produced molasses, which are spread in Mallawi town. SCB was spread in a clean place in thin layer and subjected to sun dried for 2 – 3 days with continuous toppled. After drying, SCB was chaffed by mechanically operated chaff cutter machine to the particle size varying from 0.5 to 2.0 cm. During ensiling process, the water was added to the chopped SCB to decrease the dry matter content to 40 %.

Groups of under ground trenches were used for ensiling of SCB. The holes were padded with plastic sheets and filled with chopped SCB in layers. Molasses and / or urea were added (after diluting in equivalent amount of water) to the chopped SCB. Molasses was added as 5 % of dry mater and urea was added in 0, 1.5 and 3 % for making T_0 (SCBS without urea supplement), $T_{1.5}$ (SCBS with 1.5 % urea) and T_3 (SCBS with 3 % urea). After filling of the trench with SCBS, it was covered with plastic sheets and thick layer (20 – 40 cm) of soil. After a period of 45 days, trenches were opened from one side and silage was offered daily to the experimental animals.

Experimental procedure

Ewes were in similar average body weight (39.1 to 39.4 kg) and reproductive history. The experimental period was lasted for 10 months and consisted of 4 periods, premating or flushing (1 month), mating (1 month), pregnancy (5 months) and lactation (3 months). The live weight of sheep was recorded at beginning of the experiment and every other week and body weight changes were calculated. At autumn mating season, ewes were monitored for sign of estrus using well trained ram two times per day (at 8:0 and 15:0 h) for 30 days (mating season). The ewes in estrus were mated using 3/4 Chios x 1/4 Ossimi rams. Four mature rams, had nearly the same age and weight, were used for bred ewes. Each ram was assigned to copulated ewes from all treated group to delete any effect of rams on results obtained. Thus, each treatment group had the same opportunity to be mated by four different rams. Date, weight and number of ewes exhibited estrus were recorded. Day of mating was considered to be day 0 of pregnancy. All ewes lambed in February. Animals were subjected to fertility test 2 years after treatment. After lambing, ewes housed in individual pens measuring 2 x 1 m for 3 days to ensure that no difficulties or troubles in udder or milk secreted and the placenta was let down. After that they return to their previous housing system.

Suckling lamb management

Suckling milk is the main source of lamb feeding during the first 6 weeks of age. After that lambs was degraded on starter ration (83 % yellow corn, 15 % soy bean, 1 % calcium carbonate and 1 % Nacl). They isolated far away from their mothers and were fed as a group feeding once daily. The isolation period increased gradually from 1 hour at fifth week of age and reached to the whole day (from morning till afternoon) at eighth week of age. Body weight of lambs was recorded and daily gain was calculated. Milk intake was measured using milk-suckling technique.

Statistical analysis

All results were subjected to an analysis of variance procedure using general linear model procedure (PROC GLM) of the statistical analysis system Institute (SAS, 1989).

Results and discussion

a) Ewe's body weight and body weight changes

1) During pre and post mating

Silage fed groups either with or without urea had higher body weight, body weight changes and intake than those of control group the effect was more pronounced in post mating period (Table 2). This effect of silage feeding on live weight and live weight changes may be attributed to high ($P< 0.01$) intake of silage as compared with control diet (Tables 1 & 2). This high intake may be due to the following: 1) good preservation quality of the silage. O`Doherty et al. (1997) pointed that the fermentation pattern of silage had a positive effect on intake, 2) higher palatability of silage (Mohamed, 1998) and 3) higher digestibility of silage than control diet (Table 6). Similarly, Elliott (1967) found positive relationship between digestibility and intake. The rate of increase in body weight, its changes and intake were higher ($P< 0.01$) in urea-supplemented animals; particularly those fed high level of urea. Urea addition to silage increased N content, which subsequently will affect intake (Castro and Machado, 1990). Also, Aston et al (1979) found adverse effect of low pH and acetic acid content of silage on voluntary intake. They also showed an improvement in intake with using urea supplement and owing these results to the partial neutralization of silage. Body weight of ewes and its changes were increased gradually from start of experiment (6 weeks pre- mating, Table 2) and reached its maximum level at 20 weeks post mating (Tables 1 & 2). The changes in live weight gain values were almost constant till the last 4 weeks of pregnancy where it showed a sharp increase in its value, this reflects the rapid growth of the fetus and its attachments during the last 4 weeks of pregnancy.

2) During lactation period

Silage and urea feeding had a significant effect ($P < 0.01$) on silage intake during lactation period (Table 3), although the effect on body weight and body weight changes was not significant. This is a normal physiological response due to the increase of milk production in silage fed groups as compared with control one. During the physiological stress of milk production particularly during the peak of lactation, ewes tended to have no increase or may loss of body weight. (Dapoza et al. , 1999 and Olsson et al., 1999).

Silage fed groups (T_0 and to some extent $T_{1.5}$) showed negative body weight changes although they had higher ($P < 0.01$) silage intakes than the control one. This may be related to the higher milk production of silage fed groups than those fed control diet. This reflects a higher utilization of significant amount of body reserves during lactation and subsequently loss more weight of silage fed groups (Banchero et al., 2003). Also, Sanh et al. (2002) reported no increase in body weight of lactating cows although they had high silage intake.

b) Ewe's reproductive performance

1) Conception rate (CR)

The effect of feeding sugarcane bagasse silage and different levels of urea on CR is presented in Tables (4 & 5). Results showed insignificant effect of feeding silage (T_0) on CR. Average CR was about 84, 83, 78 and 82 (as a percent of ewes mated) and about 81, 80, 69 and 69 (as a percent of ewes subjected to be mated) in control and silage fed groups (T_0, $T_{1.5}$ and T_3), respectively (Table 4). This result may suggest that urea supplementation had a negative effect on fertility of ewes. Such adverse effect of urea supplementation on CR still and more pronounced after treatment (Table 5), in which we followed the fertility of ewes for two years after the end of urea supplementation.

The mechanism whereby feeding high protein diets to ruminants compromises reproductive performance is not known (Fahey et al., 2001). In the present study, the negative effect of urea supplements on fertility or CR may be attributed to: 1) Feeding excess urea resulted in an increase of urea concentration in the circulating blood and tissues especially uterine and reproductive tract which changes the suitable environment for sperm or fertilized ova (gametes) and resulting in early lose of embryos and the animal return to be mated (Fahey et al., 2001, Kenny et al., 2001 and Jordan and Swanson, 1979a), 2) Urea addition lowered serum progesterone concentrations (which is responsible in maintenance of pregnancy). Accordingly, dietary protein supplementation decreased concentration, excretion and/ or metabolism of progesterone (McEvoy et al., 1997; O`Doherty and Crosby 1996). In this respect, Stock and Fortune (1993) demonstrated that low progesterone level was associated with low fertility due to oocyte deterioration.

Feeding urea for a long time (about 9 months) may be a cause of decreased fertility during and after the end of urea supplementation (Tables 4 & 5). Also, this adverse effect on fertility may be due to the increase in urea level at tissue especially reproductive organs, resulted in cellular damage through the body resulting in a tolerate, but not optimal, uterine or ovarian environment and thereby reducing fertility (Jordan and Swanson, 1979a). In this field, Putnam et al. (1999) reported that dairy cows had chronically elevated N concentrations postpartum as a result of feeding high protein level in the prepartum period. Also, Daghash et al. (1994) found that infertile Chios and Ossimi ewes had higher ($P < 0.01$) levels of blood urea by 31.43 % than fertile ewes.

2) Estrus duration length

About 63 % of total ewes had an estrus period less than 36 hours (Table 6). This result is similar to the normal estrus period pointed by Jainudeen et al. (2000) and Bearden and Fuquay (1984). About 11 % of ewes exhibited their estrus period in 48 hours and more. Ewes fed SCBS ($T_{1.5}$ & T_3) represented about 80 % (8 from 10 ewes) of the total number that showed the highest estrus period length (48 hours and more, Table 6). No remarkable effect of SCBS without urea (group, T_0) on estrus period was found. The long estrus period in animals fed 1.5 ($T_{1.5}$) and 3 % (T_3) urea may be related to the effect of urea. High feed intake and/ or dietary urea had a negative effect on circulating progesterone (Yaakub et al., 1999 and Jordan and Swanson, 1979b). Low progesterone level means activation of GnRH (Jordan and Swanson, 1979b) and estrus behavior (Bearden and Fuquay,1984).

3) Gestation length

Mean of gestation length in different treatment groups are presented in Table (4). Mean gestation length was similar (151 days) for control, T_0 and $T_{1.5}$ groups while it was 152 days for T_3 group, respectively. These values are within the normal range reported by (Jainudeen et al., 2000 and Bearden and Fuquay, 1984). Statistical analysis for the effect of feeding silage or urea on gestation period showed no significant effect, although it was tended to be longer in animals fed 3 % urea (Table 4). This was consistent with the results of Sibbald and Davidson (1998) and Mohamed (1986).

4) Twining rate

Twining rate calculated as number of lambs produced per ewes lambed is shown in Table (4). Values approximately the same and ranged from 1.10 to 1.17 for percentage of total lambs born per ewe lambed and from 0.95 to 1.11 as percentage of alive lamb at birth. These results indicated no significant effect of either silage or urea feeding on twining rate, although urea supplemented group (T_3) tended to have the highest number of lambs alive at birth (1.11 lamb/ewe) as compared with other groups (0.94 - 0.95 lamb/ewe, Table 4). This was in consistent with those reported by Fahey et al. (2001) and Kenny et al. (2001) on ewes supplemented with higher level of dietary protein or urea. Also, Yaakub et al. (1999) reported no significant effect of silage feeding on mean number of follicles or the proportion of embryos that developed to the blastocyst.

5) Number of service per conception (S/C)

As shown in Table (4), the percent of ewes mated was higher in control (96.15 %) and non-supplemented silage (96 %) fed groups than urea treated groups, being 88.46 and 84.62 % for $T_{1.5}$ and T_3-groups, respectively. This effect may be mediated through a change in the pH of the uterine and oviduct environments due to urea supplementation during early embryo development. The reduction of uterine pH may increase the incidence of embryonic mortality (Jainudeen et al., 2000). Similarly, urea supplementation had a negative effect on early embryo developments in ewes (Fahey et al., 2001) and heifers (Kenny et al., 2001).

Ewes fed silage with 3 % urea level had higher ($P< 0.05$) S/C (1.32) than control and silage fed groups (1.08 and 1.04, respectively, Table 4). The group fed silage with 1.5 % level of urea showed an intermediate value (1.17), indicating the increase of S/C with increasing urea level. This adverse effect of urea supplementation may be due to: 1) Urea addition resulted in increasing follicular and uterine concentration of ammonia and urea, decreasing in uterine pH and systemic concentration of progesterone which could adversely affect either gametes formation and/ or early embryonic development (Sibbald and Davidson, 1998 and Jordan and

Swanson, 1979a), 2) Urea supplementation increased serum albumin which is inversely related to S/C required per conception (Rowlands et al., 1977), 3) Urea may had a debilitating effect on the oocyte which resulted in a compromise in early embryo viability (Fahey et al. (2001) and 4) Urea treated ewes produced embryos with lower cell numbers than untreated ewes and their subsequent rate of development in vitro culture was poor. All of the previous points may result in early embryonic mortality and subsequently increase S/C. Similar positive correlation between urea supplementation and S/C reported by Jordan and Swanson (1979a).

6) Performance of produced lambs.

I - Birth weight

Average birth weights are presented in Table (4). Treatment had a significant effect ($P < 0.05$) on birth weight (Table 4). Silage fed groups revealed higher ($P < 0.05$) average and total birth weight of their lambs. Ewes supplemented with higher level of urea (3 %) showed higher values of average and total birth weight as compared with other groups (Table 4). This was in consistent with the results of Sibbald and Davidson (1998) who pointed that lambs born to ewes offered silage supplemented with protein source had higher ($P < 0.05$) birth weight than lambs born to ewes fed silage only. This positive effect on birth weight in urea treated group may be due to, 1) higher twining rate (1.11-lamb born/ewe, Table 4). Similarly, Al-Haboby et al. (1999) reported that twining rate calculated using lambed or joined ewes tended to be greater in the urea supplemented group (27 %) than non supplemented one (12 %), 2) higher body weight and intake of treated ewes during pregnancy than control group (Table 2). Yaakub et al. (1999) reported the variability in embryo development rates in vitro might be influenced by dietary intake of donor cattle prior to oocyte recovery.

II- Growth performance of suckling lambs.

Average body weight, gain and milk intake of suckling lambs from birth till weaning at 10 th week of age are presented in Tables (4 & 7). The effect of treatment on average body weight and intake was significant ($P < 0.05$, Table 7). Sugarcane fed groups had higher ($P < 0.05$) average birth weight and milk intake than control group (Tables 4 and 7). Urea treated- silage fed group (T_3) exhibited higher response in average ($P < 0.01$) and total ($P < 0.05$) birth weight than control group. However, no significant effect for urea treatment or levels on initial or final body weight, gain and milk intake were observed as compared with silage only (T_0, Table 24). Similarly, weaning weight was higher ($P < 0.05$) in treated groups being 13.34, 13.25 and 13.53 kg for T_0, $T_{1.5}$ and T_3, respectively than that of control group (12.36 kg) (Table 7). The highest total weaning weight/ ewes was recorded in T_3 (15.33 kg/ewe) followed by T_0 (14.91 kg/ewe) and $T_{1.5}$ (14.78 kg/ewe), while the lowest value was in control group (13.89 kg/ewe). Kenny et al. (2001) and Sibbald and Davidson (1998) reported similar results. Brande et al. (1992) found that forage treated with urea resulted in improved its utilization and resulted in satisfactory ewe live weight and lamb growth rate.

This variability in growth performance may be partially due to 1) higher intake of silage fed ewes (T_0, $T_{1.5}$ and T_3) during lactation period (Table 3). Sibbald and Davidson (1998) reported that ewes with lower intake during lactation would reduce the live weight gains of their lambs. 2) High average and total birth weight in suckling lambs of treated groups as compared with control one (Table 4). In this respect, Hayder (1996) reported that heavier lambs at birth were capable of drawing more milk. Also, Sibbald and Davidson (1998) and Abd El-Rehim (1997) found that level of intake during gestation and lactation was shown to have a significant effect on lamb birth weight and subsequent growth rate. 3) Higher milk production of dams and subsequently milk intake of their suckling lambs in silage fed groups as compared with control (Table 7). Abd El-Rehim (1997) cited that milk production was the major consideration in determining the body weight of lambs, and 4) higher digestive system capacity and development of silage fed groups as compared with control one. Sibbald and Davidson (1998) reported that ewes with higher intake during pregnancy and lactation produce lambs with higher rumen, abomasum and liver weights when adjusted for empty body weight as compared with that produced from ewes fed on lower level of intake. Also they stated that the lambs from higher intake ewes had significantly longer and wider rumen villi at weaning than did lambs from lower intake ewes. In addition, pregnant ewes with lower intake may had high level of serum cortisol and low level of serum triiodothyronine, consequently, lambs may born with reduced metabolic rates, lower vigor and possibly lower chances of survival (Quigley and Drewry, 1998).

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Table (1). Body weight (kg), body weight change (g/day) and silage intake (g/day) of ewes during premating periods as influenced by sugarcane bagasse silage treated with different levels of urea.

		Feeding groups*			
	LSM	Control	SCBS		
Item	± SE		T_0	$T_{1.5}$	T_3
Body weight (kg)					
*Initial***		39.40	39.41	39.13	39.11
		1.32	1.36	1.39	1.39
*Final****		40.87	40.92	41.30	41.63
		1.32	1.36	1.39	1.39
Change (kg)		1.47	1.52	2.17	2.53
		0.56	0.57	0.59	0.59
Daily change (g/day)		35.03	36.07	51.63	60.15
		13.36	13.69	14.04	14.04
Silage intake (g/day)		512.87 ^{a}	543.38 ^{c}	554.66 ^{bc}	633.29 ^{d}
		10.08	10.08	10.08	10.08

Values are least square means (LSM) ± standard error of LSM (SE)
SCBS= Sugarcane bagasse silage. T_0 = SCBS with 0 % urea supplement.

$T_{1.5}$= SCBS with 1.5 % of DM urea supplement. T_3= SCBS with 3 % of DM urea supplement.

** Weight at 6 weeks before mating ***Weight at mating day

Values with different letters in the same raw are different (P< 0.01) except a,c (P< 0.05).

Table (2). Body weight (kg), daily body weight changes (g/day) and silage intake (g/day) during pregnancy in ewes fed sugarcane bagasse silage treated with different levels of urea

Item	LSM ± SE	Feeding groups* Control	SCBS T_0	$T_{1.5}$	T_3
Body weight (kg)					
*Initial***		40.87 [A]	40.92 [A]	41.30 [A]	41.63 [A]
		1.53	1.57	1.61	1.61
*Final****		48.55 [B]	51.63 [B]	53.18 [B]	55.95 [B]
		1.53	1.57	1.61	1.61
Change (kg)		7.68 [d]	10.73 [ab]	11.88 [a]	14.32 [c]
		0.84	0.86	0.88	0.88
Daily change (g/day)		54.86 [d]	76.64 [ab]	84.89 [a]	102.26 [c]
		5.97	6.11	6.27	6.27
Silage intake (g/day)		494.51 [a]	538.12 [b]	547.73 [b]	564.38 [d]
		± 4.46	± 4.46	± 4.46	± 4.46

* Values are least square means (LSM) ± standard error of LSM (SE)

SCBS= Sugarcane bagasse silage. T_0 = SCBS with 0 % urea supplement.

$T_{1.5}$= SCBS with 1.5 % of DM urea supplement. T_3= SCBS with 3 % of DM urea supplement.

** Weight at mating day ***Weight at 20 weeks after mating

Values with different letters in the same raw (small letters) or the same column (capital letters) are different (P< 0.01) except a,c (P< 0.05).

Table (3). Body weight (kg), daily body weight changes (g/day) and roughage intake (g/day) during lactation in ewes fed sugarcane bagasse silage treated with different levels of urea.

Item	LSM ± SE	Feeding groups* Control	SCBS T_0	$T_{1.5}$	T_3
Body weight (kg)					
*Initial***		43.69	46.44	47.14	47.24
		1.74	1.74	1.68	1.59
*Final****		41.91	42.13	44.97	46.37
		1.74	1.74	1.68	1.59
Change		-1.78 [c]	-4.31 [a]	-2.44	-0.87 [bc]
		0.90	0.90	0.87	0.83
Daily change(g/day)		-25.45 [c]	-61.61 [a]	-34.87	-12.41 [bc]
		12.68	12.68	12.47	11.80
Silage intake (g/day)		524.59 [a]	639.06 [b]	631.77 [b]	636.51 [b]
		0.01	0.01	0.01	0.01

* Values are least square means (LSM) ± standard error of LSM (SE)

SCBS= Sugarcane bagasse silage. T_0 = SCBS with 0 % urea supplement.

$T_{1.5}$= SCBS with 1.5 % of DM urea supplement. T_3= SCBS with 3 % of DM urea supplement.

** Weight at lambing ***Weight at the end of lactation period (10 weeks)

Values with different letters in the same raw are different ($P< 0.01$), except a,c ($P< 0.05$).

Table (4). Some reproductive parameters of ewes fed sugarcane bagasse silage treated with different levels of urea.

Item (LSM ± SE)	Treatment: Control	T0	$T_{1.5}$	T_3
No of ewes	26	25	26	26
Body weight at mating	40.87 1.32	40.92 1.36	41.30 1.39	41.63 1.39
No of ewes exhibited estrus	25/26	24/25	23/26	22/26
ewes exhibited estrus, %	96.15	96.00	88.46	84.62
No of service/conception	1.08 c 0.07	1.04 bc 0.07	1.17 0.07	1.32 a 0.07
No of ewes lambed	21/25	20/24	18/23	18/22
Fertility as % from mated ewes	84.00	83.33	78.26	81.82
Fertility as % from total ewes	80.77	80.00	69.23	69.23
Gestation period, days	150.9 0.39	151.15 0.40	150.56 0.42	151.61 0.42
Body weight at lambing	43.69 1.74	46.44 1.74	47.41 1.68	47.24 1.59
No of lambs (total)	23	22	20	21
No of lambs (alive)	20	19	17	20
No of total lambs produced/ewe lambed	1.10 0.07	1.10 0.07	1.11 0.08	1.17 0.08
No of lambs produced (alive)/ewe lambed	0.95 0.11	0.95 0.11	0.94 0.12	1.11 0.12
Total birth weight/ewe*	3.80 a 0.28	4.40 0.30	4.41 0.30	4.62 c 0.28
Average birth weight	3.51 a 0.14	3.94 c 0.14	3.93 c 0.15	4.03 bc 0.14
No of lambs weaned/ewe lambed (alive)	1.00 0.11	1.12 0.11	1.00 0.12	0.94 0.11
No of lambs weaned/ewe lambed	0.90 0.12	0.95 0.12	0.83 0.13	0.89 0.13
Weaning weight/ewe*	13.89 1.05	14.91 1.02	14.78 1.12	15.33 1.12
Average weaning weight	12.48 0.64	13.56 0.62	13.34 0.69	13.56 0.69

Most values are least square means ± standard error

Control= Animals fed wheat straw

SCBS= Sugarcane bagasse silage. T_0 = SCBS with 0 % urea supplement.

$T_{1.5}$= SCBS with 1.5 % of DM urea supplement. T_3= SCBS with 3 % of DM urea supplement.

Values with different letters in the same raw are different ($P< 0.01$), except a,c ($P< 0.05$).

* Total live weight (kg) produced from ewe either at birth or weaning.

Table (5). Long-term effect of feeding sugarcane bagasse silage and urea on fertility of experimental ewes.

Item	LSM ± SE	No of mating	No of lambing	Fertility, %	No of live lambs	No of dead lambs	Total no of lambs
Control	*Pre treatment*	53	36	67.92	37	1	38
	During treatment	26	21	80.77	20	3	23
	After treatment	50	33	66.00	35	2	37
T0	*Pre treatment*	59	37	62.71	40	1	41
	During treatment	25	20	80.77	19	3	22
	After treatment	45	30	66.67	35	0	35
T1.5	*Pre treatment*	63	37	58.73	41	2	43
	During treatment	26	18	69.23	17	3	20
	After treatment	63	27	42.86	30	2	32
T3	*Pre treatment*	56	38	67.86	42	1	43
	During treatment	26	18	69.23	20	1	21
	After treatment	75	32	42.67	36	3	38

-No of mating = number of ewes subjected to be mated by rams for 30 days period/ mating season.
-Fertility % was calculated from number of ewes subjected to be mated by rams for 30 days period/ mating season.
-Pre treatment= period before beginning of experiment
-After treatment= period after finishing experiment and all ewes subjected to normal feeding system in station.
Control= Animals fed wheat straw
SCBS= Sugarcane bagasse silage.
T_0 = SCBS with 0 % urea supplement.
$T_{1.5}$= SCBS with 1.5 % of DM urea supplement.
T_3= SCBS with 3 % of DM urea supplement.

Table (6). Effect of feeding ewes with sugarcane bagasse silage treated with different levels of urea on estrus duration length (hours).

Item	*Number of ewes*	Estrus duration length (hours)							
		12 hrs to less than 24 hrs		24 hrs to less than 36 hrs		36 hrs to less than 48 hrs		48 hrs and more	
		No	%	No	%	No	%	No	%
Control	25	7	*28*	9	*36*	8	*32*	1	*4*
T0	24	8	*33.33*	7	*29.17*	8	*33.33*	1	*4.17*
T1.5	23	8	*34.78*	7	*30.43*	5	*21.74*	3	*13.04*
T3	22	7	*31.82*	6	*27.27*	4	*18.18*	5	*22.73*
Average	*94*	30	*31.91*	29	*30.85*	25	*26.60*	10	*10.64*

Control= Animals fed wheat straw
SCBS= Sugarcane bagasse silage.
T_0 = SCBS with 0 % urea supplement.
$T_{1.5}$= SCBS with 1.5 % of DM urea supplement.
T_3= SCBS with 3 % of DM urea supplement.

Table (7). Body weight (kg), daily gain (g/day) and milk intake (g/day) of suckling lambs during suckling period.

Item	LSM ± SE	Feeding groups*			
		Control	SCBS		
			T_0	$T_{1.5}$	T_3
Body weight (kg)					
*Initial***	LSM	3.42	3.94	3.89	3.94
	SE	0.21	0.21	0.22	0.21
*Final****	LSM	12.36 [a]	13.34 [c]	13.25 [c]	13.53 [c]
	SE	0.22	0.21	0.24	0.21
Gain **(kg)**	LSM	8.98	9.40	9.28	9.49
	SE	0.54	0.53	0.60	0.58
Daily gain (g/day)	LSM	128.28	134.29	132.61	135.56
	SE	7.77	7.56	8.51	8.24
Milk intake (g/day)	LSM	634.95 [a]	699.95 [bc]	684.90 [c]	690.31 [bc]
	SE	15.54	15.74	17.32	16.06

* Values are least square means (LSM) ± standard error of LSM (SE)

Control= Animals fed wheat straw

SCBS= Sugarcane bagasse silage. **T_0** = SCBS with 0 % urea supplement.

$T_{1.5}$= SCBS with 1.5 % of DM urea supplement. **T_3**= SCBS with 3 % of DM urea supplement.

** Weight at birth ***Weight at weaning

Values with different letters in the same raw are different ($P< 0.01$) except a,c ($P< 0.05$).