Effect of supplemental nutrition around lambing on hair sheep ewes and lambs during the dry and wet seasons in the U.S. Virgin Islands[1]

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ABSTRACT: Pregnant St. Croix White and Barbados Blackbelly hair sheep ewes were used to evaluate the effect of supplemental nutrition around the time of lambing on ewe and lamb performance during the dry and wet seasons on St. Croix. Beginning 14 d before expected day of lambing (d 0) and for 21 d postpartum, one group of ewes was fed a pelleted supplement in addition to grazing guinea grass pasture (FEED). Other ewes in the flock grazed pasture only (CONTROL). This study was conducted during the dry season (June through September; FEED n = 14 and CONTROL n = 15) and during the wet season the next year (October through January; FEED n = 11 and CONTROL n = 12). The 24-h milk production of each ewe was measured on d 7, 21, 35, 49, and 63. Ewes were exposed to sterile rams equipped with marking harnesses to detect estrus during the postpartum period. The FEED ewes lost less weight postpartum during both seasons ($P < 0.0001$) and had higher milk production ($P < 0.009$) than CONTROL ewes during the dry season. During the dry season, the time to the first postpartum estrus did not differ ($P > 0.10$) between FEED and CONTROL ewes (46.9 ± 2.7 vs 52.9 ± 2.6 d, respectively). During the wet season, the time to first postpartum estrus was less ($P < 0.07$) in FEED than in CONTROL ewes (33.0 ± 3.1 vs 41.1 ± 2.9 d, respectively). The FEED ewes had higher lamb birth weight ($P < 0.04$) and weaning weight ($P < 0.05$) than CONTROL ewes (3.2 ± 0.1 and 12.2 ± 0.5 vs 2.9 ± 0.1 and 10.9 ± 0.5 kg, respectively) during the dry season. In the wet season, lamb birth weight and weaning weight were similar ($P > 0.10$) between FEED and CONTROL (3.2 ± 0.1 and 15.5 ± 0.7 vs 3.1 ± 0.1 and 15.3 ± 0.6 kg, respectively). Lambs born during the wet season had higher ($P < 0.0001$) ADG than lambs born during the dry season (194.4 ± 5.9 vs 127.7 ± 4.7 g/d, respectively). Strategic nutritional supplementation of hair sheep ewes may provide a method for increasing the weight of lambs produced during the dry season in the tropics, but it does not seem to be beneficial during the wet season.

Key Words: Forage, Lamb, Milk Production, Nutrition, Sheep, Tropics

J. Anim. Sci. 2003. 81:587–593

Introduction

In the U.S. Virgin Islands (**USVI**) livestock farmers rely on native forages for nutritional management of their animals. The environment on St. Croix can be described as semi-arid with an average annual rainfall of 1,098 mm (Godfrey and Hansen, 1996). The majority of the rainfall occurs during the months of September through December; during the months of January through August, the rainfall is markedly less (Godfrey and Hansen, 1996). This seasonal pattern of rainfall leads to a seasonal pattern of forage production, with maximal production during the rainy season. Because all the livestock production in the USVI is based on a system that relies on forages as the major source of nutrients, the rainfall and forage availability fluctuations throughout the year are of great concern to livestock producers.

Many sheep producers in the Caribbean do not manage their flocks with defined breeding and lambing seasons. This is due to the fact that sheep in this area do not exhibit a true seasonal pattern of reproductive cycles (Evans et al., 1991; Swartz and Hunte, 1991). Because of the year-round breeding program, ewes within a flock can be at many different stages of the production cycle at any given time. This makes meeting the nutritional requirements of individual ewes very difficult. The intensive level of production and year-round breeding that is imposed on the ewes requires that the entire flock have adequate nutrition at most times of the year.

By identifying specific periods in the reproductive cycle of the ewe when additional feed is necessary or

[1]The authors thank J. Bultman, W. Gonzales, and R. Redo for assistance with animal care and management. This project was funded by USDA-TSTAR-Caribbean Grant 98-U6519/99-U8026/00-U9668.

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Received June 24, 2002.
Accepted October 21, 2001.

beneficial, it would be possible to minimize nutritional stress imposed on the ewe by the limited forage availability during the dry season. This study was conducted to determine whether providing supplemental nutrition to hair sheep ewes grazing native pasture during late gestation and lactation in the dry and wet seasons of the year would enhance ewe and lamb performance.

Materials and Methods

Pregnant St. Croix White and Barbados Blackbelly ewes that lambed in July (dry season) or November (wet season) were used. During the dry season, 13 Barbados Blackbelly and 16 St. Croix White ewes were used. During the wet season, 13 Barbados Blackbelly and 10 St. Croix White ewes were used. The dry season evaluation period lasted from June 9 (first day of supplemental feeding) through September 27, 1999 (last lamb weaned), and the wet season evaluation period lasted from October 27, 2000 (first day of supplemental feeding) through February 4, 2001 (last lamb weaned). Lambing dates were estimated based on dates of estrus and non-return to estrus during the previous breeding season. All ewes were kept in eight guineagrass (*Panicum maximum*) pastures (0.8 ha) throughout the duration of the project in a rotational grazing system with ad libitum access to water and mineralized salt. During the dry season, the ewes grazed each pasture for 21 to 27 d, and during the wet season, ewes grazed each pasture for 7 d. At 2 wk before expected lambing dates, ewes were assigned to treatment groups based on breed, age, BW, parity, and number of lambs expected (determined previously using ultrasound). In both seasons, one group of ewes (n = 14 and n = 11, respectively; FEED) was fed a pelleted sheep feed (PMI, Mulberry, FL) beginning 14 d before lambing (d 0) and for 21 d postpartum while grazing native pasture (Table 1). The amount of feed provided for the late-gestation and early-lactating ewes grazing tropical pastures was based on the guidelines put forth by Kawas and Huston (1990) and was determined individually for ewes within the FEED group based on BW measured weekly. This resulted in the ewes being fed 2.3% of BW/d during the last 14 d of gestation and 3.8% of BW/d during the first 21 d of lactation. The standard practice for the sheep flock at the University of the Virgin Islands is to feed adult, nonlactating, nonpregnant ewes in confinement a maintenance ration of 2% of BW/d. The remaining group of ewes in the dry and wet seasons (n = 15 and n = 12, respectively; CONTROL) grazed guineagrass pasture only. Within season, both groups of ewes were kept in the same pastures during the study. The FEED ewes were sorted off in a drylot pen for the daily feeding as a group for 2 to 3 h/d. All FEED ewes were observed consuming the feed within the time period allotted each day. The CONTROL ewes were kept in an adjacent drylot pen during this time as well. Ewes were weighed weekly through the study. On the day of parturition, ewes and lambs were weighed. Lambs were weaned at 63 d of age and both the ewe and lambs were weighed at this time.

Immediately after lambing, ewes in each treatment were exposed to two sterile rams equipped with marking harnesses to determine the postpartum interval to estrus. Ten days after estrus, a jugular blood sample was collected. Plasma was harvested and stored at –20°C until assayed for progesterone concentration by a commercial ELISA kit (OVUCHECK, Biovet Inc., Quebec, Canada) that had been previously validated in our laboratory (Godfrey et al., 1997a). Inter- and intraassay CV were 5.7 and 10.1%, respectively.

Milk production was measured on d 7, 21, 35, 49, and 63 using procedures previously described (Godfrey et al., 1997b). On the days of milking, lambs were separated from ewes in the morning and placed in a holding pen with access to shade and water. Each ewe was given 1 IU of oxytocin (i.v.) and milked by hand. Four hours later, each ewe was milked again after a second injection of 1 IU oxytocin (i.v.). The weight of the second collection of milk was recorded and used to determine 24-h milk production. Lambs were returned to ewes after the second milking. Total milk production for each ewe was calculated as the sum of milk produced on each day of milking.

Herbage mass, an estimate of the total weight of forage per unit area of pasture, was measured at the start of the grazing period in each pasture. Six randomly selected, 0.5-m^2 plots were harvested to a stubble height of 75 mm in each pasture and dried at 60°C for 48 h to determine DM expressed as 1,000 kg/ha (Mg/ha). Daily precipitation was recorded during each season of the study. Samples of forage and concentrate feed were sent to a commercial laboratory for analysis of nutrient quantity (Dairy One Cooperative, Inc., Ithaca, NY).

Data were analyzed using GLM procedures of SAS (SAS Inst., Inc., Cary, NC). Feed and forage laboratory analysis results were analyzed using season as the main effect. Lamb birth weight, weaning weight, ewe total milk production, and postpartum interval to estrus were compared using the main effects of treatment, season, and their interaction in the model. Breed was not included in the model because ewe numbers were balanced within breeds across treatments. Weight ratio of ewes on days after the start of the study was calculated as the ratio of ewe BW to ewe BW at 14 d before lambing. Changes in ewe BW and milk production over time were analyzed using repeated measures procedures as described by SAS. Specifically, ANOVA consistent with a split-plot experimental design was used. Terms included in the whole plot were treatment and season and the treatment × season interaction. The error term was ewe within treatment × season. Factors included in the subplot were days relative to lambing as a measure of time along with the interactions with season and treatment using the residual as the error term. Mean separation, or preplanned comparisons, was conducted using the PDIFF option. All values are reported as least squares means and standard errors.

Table 1. Composition of concentrate feed and guineagrass forage fed to hair sheep ewes during two periods of the year[a]

	Dry season[b]		Wet season[b]	
Item	Forage	Concentrate[c]	Forage	Concentrate[c]
CP, %	3.6 ± 0.3	16.8 ± 0.5	3.1 ± 0.2	16.3 ± 0.5
TDN, %	24.5 ± 1.3[d]	69.0 ± 1.8	17.5 ± 0.9[e]	67.0 ± 1.8
ADF, %	15.3 ± 0.6[d]	23.5 ± 0.09	11.2 ± 0.4[e]	22.2 ± 0.9
NDF, %	27.4 ± 1.7[d]	31.8 ± 2.4	18.4 ± 1.2[e]	32.5 ± 2.4
NE_m, Mcal/kg	0.49 ± 0.03[d]	1.65 ± 0.04	0.35 ± 0.02[e]	1.61 ± 0.04
NE_g, Mcal/kg	0.26 ± 0.02[d]	1.08 ± 0.03	0.19 ± 0.02[e]	1.06 ± 0.03
NE_l, Mcal/kg	0.46 ± 0.05[d]	1.61 ± 0.08	0.32 ± 0.04[e]	1.58 ± 0.08
DM, %	45.2 ± 2.8[f]	90.6 ± 2.9	30.6 ± 1.5[g]	88.8 ± 2.9
Total forage, Mg/ha	13.8 ± 2.9[f]		5.3 ± 0.5[g]	
Forage DM, Mg/ha	5.9 ± 0.3[f]		1.4 ± 0.1[g]	

[a]Values for CP, TDN, ADF, NDF, NE_m, NE_g, and NE_l are reported on an as-fed basis. The Feed ewes were provided with a pelleted feed for 14 d before and 21 d after lambing and the Control ewes grazed guineagrass pasture only.

[b]The dry season lasted from June 9 (first day of supplemental feeding) through September 27, 1999 (last lamb weaned), and the wet season lasted from October 27, 2000 (first day of supplemental feeding) through February 4, 2001 (last lamb weaned).

[c]Feed ingredients as listed on the feed tag from the manufacturer were as follows: ground corn, alfalfa meal, cottonseed meal, ground peanut hulls, wheat middlings, soybean meal, ammonium chloride, cane molasses, bentonite, vitamin A, dicalcium phosphate, salt, sodium selenite, sodium molybdate, calcium iodate, ferrous carbonate, manganous oxide, cobalt carbonate, calcium carbonate, and zinc oxide.

[d,e]Values in a row and forage with different superscripts differ ($P < 0.05$).

[f,g]Values in a row and forage with different superscripts differ ($P < 0.0003$).

Results

The total rainfall for the year in which the study was conducted during the dry season was 1,406 mm, and 842 mm for the year in which the study was conducted during the wet season. The rainfall for 90 d before the start of the feeding treatment through the date when the last lamb was weaned in each flock for the dry and wet seasons within each year is shown in Figure 1. The total accumulation of rainfall was 560 mm for the portion of the study conducted during the dry season (Figure 1a) and 566 mm for the portion conducted during the wet season (Figure 1b).

Results of the laboratory analysis of the feed and forage samples are presented in Table 1. The nutritional content of the concentrate feed was similar between the dry and wet seasons. The forage had higher ($P < 0.05$) percentages of DM and TDN during the dry season than during the wet season. The amount of total forage and forage DM was lower ($P < 0.05$) during the wet season than in the dry season.

Ewes receiving feed lost less ($P < 0.0001$) of their prelambing weight during the time that feed was provided (d 14 through 21) in both the dry and wet seasons (Figure 2). In the wet season, the FEED ewes were able to maintain a greater proportion of their prelambing weight than the CONTROL ewes even after the period of supplementation ended. Milk production was higher ($P < 0.009$) in FEED ewes than CONTROL ewes during the 63-d lactation in the dry season (Figure 3), but the interaction of treatment × day was not significant ($P > 0.10$). There was a significant interaction ($P < 0.006$) of treatment × season for total milk production. Total milk production was higher ($P < 0.004$) for the FEED ewes than for the CONTROL ewes during the dry season, but there was no difference ($P > 0.10$) in total milk production between groups during the wet season (Table 2). The postpartum interval to estrus was shorter ($P < 0.001$) during the wet season than in the dry season (37.1 ± 2.2 vs 49.9 ± 1.9 d, respectively). In the wet season, the FEED ewes had a postpartum interval that was 8 d shorter ($P < 0.07$) than CONTROL ewes (Table 2). There was a 6-d difference in postpartum interval between the groups during the dry season, which was not significant ($P > 0.10$). There was no difference ($P > 0.10$) in progesterone concentration 10 d after estrus between the FEED and CONTROL ewes in either the dry or wet season (Table 2).

Lamb birth weight was not different ($P > 0.10$) between the dry and wet seasons (3.1 ± 0.1 vs 3.2 ± 0.1 kg, respectively). During the dry season, the lambs born to FEED ewes had higher ($P < 0.04$) birth weights than lambs born to CONTROL ewes (Table 3). Weaning weight of lambs was higher ($P < 0.0001$) during the wet season than during the dry season (15.4 ± 0.4 vs 11.5 ± 0.3 kg, respectively). During the dry season, lambs raised by FEED ewes had higher ($P < 0.05$) weaning weights than lambs raised by CONTROL ewes (Table 3), but there was no difference during the wet season. Lamb ADG was higher ($P < 0.0001$) during the wet season than the dry season (194.4 ± 5.9 vs 127.7 ± 4.7 g/d, respectively). During the dry season, lambs raised by FEED ewes had higher ($P < 0.06$) ADG than lambs raised by CONTROL ewes (Table 3), but there was no difference during the wet season.

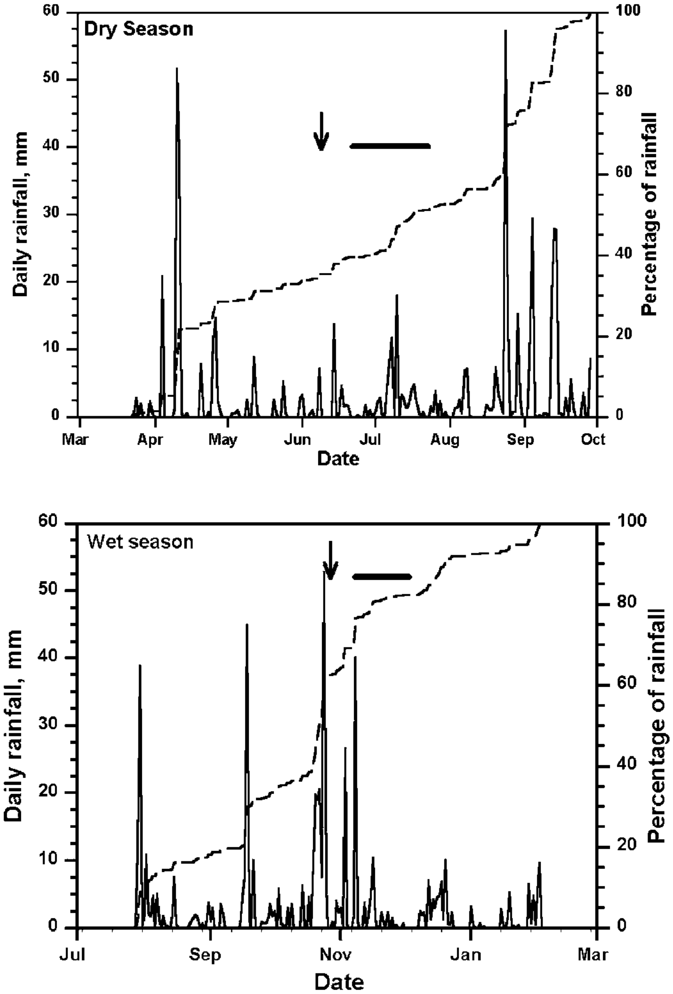

Figure 1. The daily rainfall (solid line) and percentage of total rainfall (dashed line) during the dry and wet seasons on St. Croix. The arrow indicates the start of the prepartum feeding, and the black bar represents the duration of the lambing period.

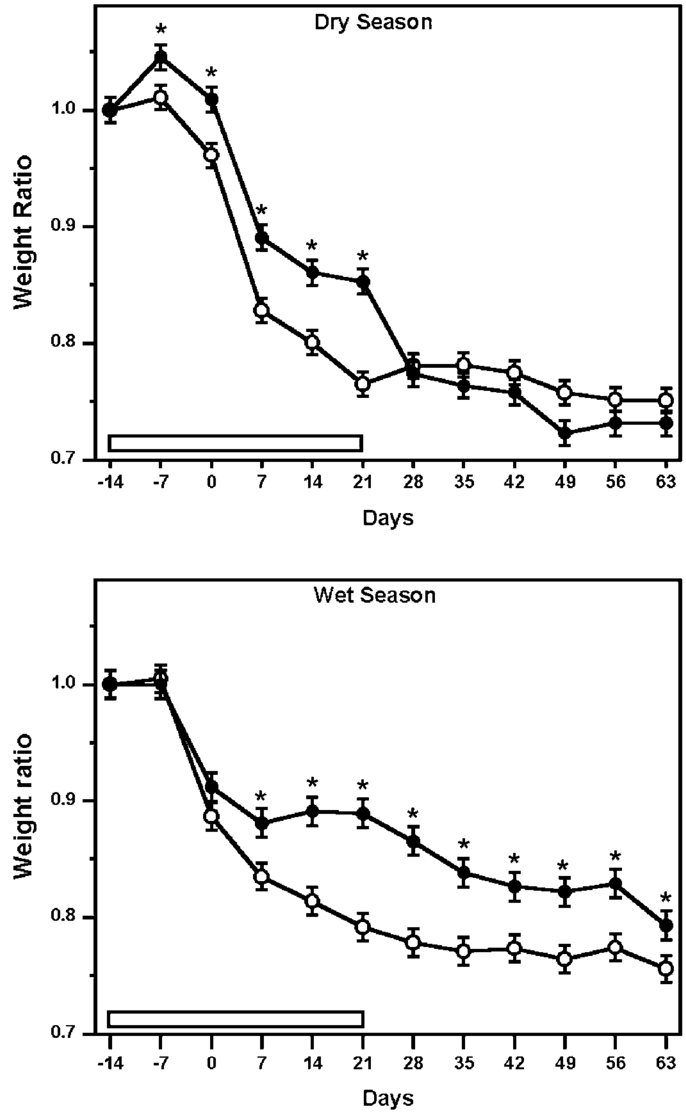

Figure 2. The relative weight change of the CONTROL ewes (open circles) and FEED ewes (solid circles) during the dry and wet seasons. Relative weight change was evaluated as the ratio of ewe BW on a given day to ewe BW at 14 d before lambing. The FEED ewes were fed concentrate for 14 d before and 21 d after lambing (indicated by the open bar above the x-axis) in addition to grazing guineagrass pasture, and the CONTROL ewes grazed guineagrass pasture only. $^*P < 0.03$.

Discussion

The total rainfall for the year in which the study was conducted during the dry season (1,406 mm) was above the annual average of 1,098 mm reported by Godfrey and Hansen (1996) and below average for the year in which the study was conducted during the wet season (842 mm). Even though rainfall during the study period within each year was similar, there may have been residual effects. During the dry season, 25% of the total accumulated rainfall occurred after September 1, which is considered to be the start of the wet season. By this point in the study, there were only four ewes that were still lactating, and only three that had not exhibited estrus. Before this point during the dry season, rainfall accumulation was consistent with the amounts received during the dry season in previous years (Godfrey and Hansen, 1996). During the dry season, slightly less than 40% of the total rainfall had accumulated by the start of the study, but during the wet season, over 60% of the total rainfall had accumulated by the start of the study. The lower forage and DM quantities in the pastures during the wet season may have been due to the lower total rainfall during that year. It may have also been caused by the higher frequency of grazing rotation in these pastures than during the dry season. With a shorter duration (7 vs 21 d) during the wet season, the forage did not have as long a rest period and did not have time to grow back.

In general, ewes maintained in good body condition throughout the year are able to perform at or near their production potential (West et al., 1991). In semi-arid

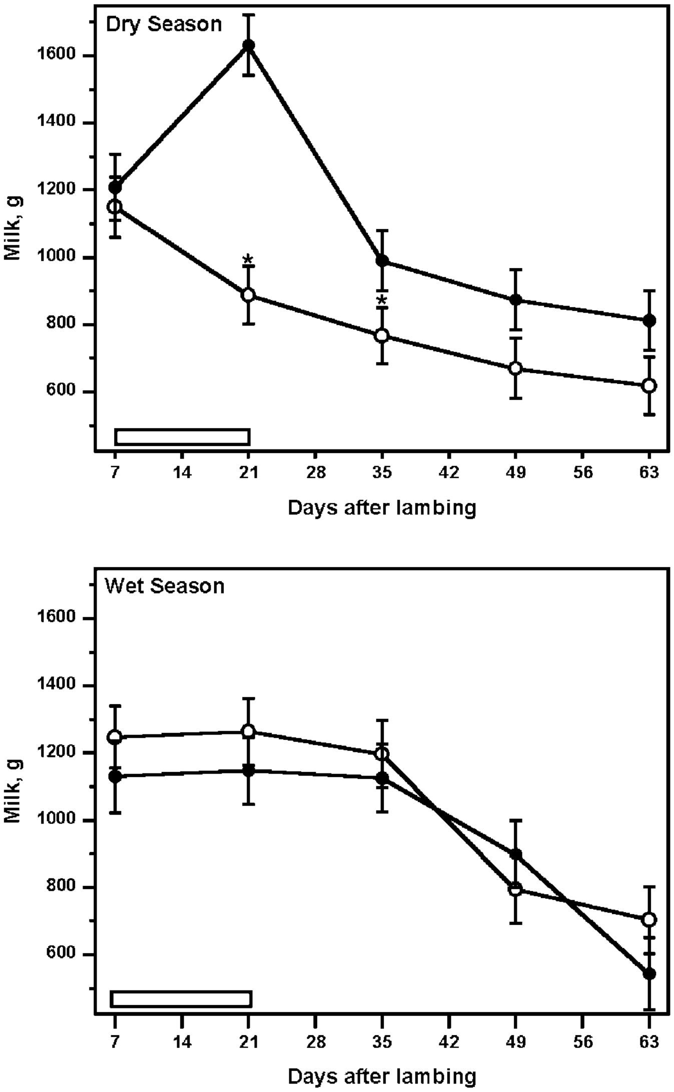

Figure 3. Milk production of the FEED (solid circles) and CONTROL (open circles). Milk production was higher for FEED than for CONTROL ewes at d 21 (*; $P < 0.001$) and d 35 (*; $P < 0.07$) in the dry season, but there was no difference between treatments in the wet season ($P > 0.10$). The FEED ewes were fed concentrate for 14 d before and 21 d after lambing in addition to grazing guineagrass pasture, and the CONTROL ewes grazed guineagrass pasture only. Milk production consisted of oxytocin-induced hand milking before and after 4 h of lamb separation. The open bar above the x-axis indicates when supplemental feed was provided during the days postpartum after milking began on d 7.

areas with long periods of little or no precipitation, tropical grasses can be low in energy and protein content (Johnson et al., 1990). To maintain body condition during these dry periods, it becomes necessary to provide supplemental feed to livestock with high nutrient needs that cannot be met by the forage available in the pasture. Growing lambs and ewes in late gestation or early lactation require increased levels of nutrients and would be susceptible to undernutrition during periods of low forage quality or quantity (Johnson et al., 1990). Ewes in the present study lost 25% of their prelambing weight during lactation in the dry season, regardless of whether they received supplemental feed. During the wet season the loss was 20% for the FEED ewes and 25% for the CONTROL ewes. This indicates that even with supplemental nutrition during the dry season, the native forage is not sufficient to prevent weight loss in lactating ewes. The predominant grass in the pastures, guineagrass, has a reported CP content of 8% (on a DM basis), which is adequate for maintenance, but may not be sufficient for lactating ewes (Wildeus et al., 1988). In the present study, CP content was lower at 3.1 and 3.6%, on an as-fed basis, during the wet and dry seasons, respectively, which corresponds to approximately 10.1 and 7.9% on a DM basis. The legume leucaena (*Leucaena leucocephala*) has been reported to have a CP content of 28% (Wildeus et al., 1988), but based on subjective evaluation, it accounted for less than 20% of the forage available in the pastures. Because the forage during the wet season had lower DM, energy, and TDN, the smaller percentage of weight lost by the FEED ewes during the wet season was most likely due to the concentrate they received.

Previous work done in our laboratory (unpublished data) has shown that ewes given supplemental feed (3.5% of BW/d) for 63 d postpartum maintained their weight compared to ewes that grazed guineagrass pasture only. In the present study, the ewes ended up being fed 2.3% of BW/d during the last 14 d of gestation and 3.8% of BW/d during the first 21 d of lactation. The fact that the ewes in the present study were fed at a similar level to those of the previous study only for the first 21 d of lactation may explain why they lost weight compared with the ewes that were fed during the entire 63-d lactation.

Jaime and Purroy (1995) reported that ewes provided with 110% of CP requirements during lactation produced more milk than ewes receiving 90% of CP requirements. The ewes in the present study were fed to receive 150% of their nutritional requirements based on the data of Kawas and Huston (1990), but there was only a difference in milk production between FEED and CONTROL ewes during the dry season. Godfrey et al. (1997b) reported that the peak of the lactation of hair sheep ewes on St. Croix maintained on guineagrass pastures occurred within the first 14 d of lactation. These ewes were maintained on guineagrass pastures during the first 36 d of lactation, after which supplemental feed (3% of BW/d) and hay were provided for the remainder of the 63-d lactation due to drought conditions. There was no evidence of an increase in the level of milk production of these ewes after they were given supplemental feed. In fact, the level of milk production was declining and continued to decline after d 36, when supplemental feed was provided (Godfrey et al., 1997b). In the current study, where supplementation began 14 d prepartum, the FEED ewes exhibited

Table 2. Performance of hair sheep ewes lambing during the dry or wet season on St. Croix while receiving supplemental feed or forage only[a]

	Dry season[b]		Wet season[b]	
	Control	Feed	Control	Feed
Number of ewes	16	15	12	11
Postpartum interval, d[c]	52.9 ± 2.6	46.9 ± 2.7	41.1 ± 2.9^{e}	33.0 ± 3.1^{f}
Progesterone 10 d after estrus, ng/mL	8.8 ± 0.5	9.9 ± 0.6	9.1 ± 0.7	9.5 ± 0.7
Total milk, g[d]	4,031 ± 287^{g}	5,298 ± 298^{h}	5,359 ± 322	4,824 ± 336

[a]The Feed ewes were provided with a pelleted feed for 14 d before and 21 d after lambing and the Control ewes grazed guineagrass pasture only.

[b]The dry season lasted from June 9 (first day of supplemental feeding) through September 27, 1999 (last lamb weaned), and the wet season lasted from October 27, 2000 (first day of supplemental feeding) through February 4, 2001 (last lamb weaned).

[c]Postpartum interval to estrus was determined with the aid of a sterile ram equipped with a marking harness.

[d]The interaction of treatment × day was not significant ($P > 01.0$), so milk production was pooled across days. Milk production was determined on d 7, 21, 35, 49, and 63.

^{e,f}Values in a season with different superscripts differ ($P < 0.07$).

^{g,h}Values in a season with different superscripts differ ($P < 0.004$).

an increase in milk production by d 21 compared with the CONTROL ewes during the dry season, but not during the wet season. It may be possible that supplemental feeding during the early stages of lactation in the dry season allowed the ewes to produce more milk throughout the entire lactation by establishing a higher level of milk production initially. Milk production of ewes in the present study declined after d 35, which is similar to the lactation curves reported by Godfrey et al. (1997b). In addition, Godfrey et al. (1997b) reported that the BW of ewes began to increase after d 35, demonstrating an inverse relationship between ewe BW and milk production. This inverse relationship between milk production and BW was not evident in the present study, where all ewes were still loosing weight after d 35, regardless of season or treatment.

Providing feed for ewes during lactation allows nursing lambs to consume a portion of the feed as well. Wildeus et al. (1990) creep-fed hair sheep lambs and was able to obtain an increase in ADG and weaning weight compared with control lambs. There was also a tendency for the dams of creep-fed lambs to have a shortened postpartum interval (Wildeus et al., 1990). In a study in our laboratory, ewes provided with feed during the postpartum period weaned lambs that were 1.4 kg heavier than the lambs of the control ewes (R. W. Godfrey, M. L. Gray, and J. R. Collins, unpublished data). The lambs of the fed ewes could have benefited from both the increased milk production by their dams and the feed they had access to themselves. In the current study, this advantage in lamb weaning weight was only apparent in the dry season, which could be due to the increase in milk production by FEED ewes during the dry season but not the wet season. The effect of season on lamb weaning weight was evidenced by the higher weaning weight of lambs during the wet season. This may be related to the milk production pattern of the ewes. During the wet season, the ewes were producing approximately 1,200 g/d through d 35 of lactation, whereas the CONTROL ewes during the dry season were producing approximately 900 g/d during this same time period, which contributed to the lower weaning

Table 3. Performance by lambs born during the wet or dry season on St. Croix to ewes receiving supplemental feed or guineagrass forage only

Dry[a]		Wet[a]		
Control[b]	Feed[b]	Control	Feed	
Number of lambs	26	28	19	14
Lamb birth weight, kg	2.9 ± 0.1^{d}	3.2 ± 0.1^{e}	3.1 ± 0.1	3.2 ± 0.1
Lamb weaning weight, kg	10.9 ± 0.5^{f}	12.2 ± 0.5^{g}	15.3 ± 0.6	15.5 ± 0.7
Lamb ADG, g/d[c]	118.8 ± 6.6^{h}	136.6 ± 6.6^{i}	192.4 ± 7.6	196.4 ± 9.1

[a]The dry season lasted from June 9 (first day of supplemental feeding) through September 27, 1999 (last lamb weaned) and the wet season lasted from October 27, 2000 (first day of supplemental feeding) through February 4, 2001 (last lamb weaned).

[b]The FEED ewes were provided with a pelleted feed for 14 d before and 21 d after lambing and the CONTROL ewes grazed guineagrass pasture only.

[c]Lamb ADG = (weaning weight − birth weight)/63.

^{d,e}Values in a season with different superscripts differ ($P < 0.04$).

^{f,g}Values in a season with different superscripts differ ($P < 0.05$).

^{h,i}Values in a season with different superscripts differ ($P < 0.06$).

weights of the lambs. These results are in agreement with those of Wildeus et al. (1988), in which hair sheep lambs on St. Croix were reported to have lower weaning weights when they were raised during the dry season of the year. Wildeus and Collins (1993) reported that lamb survival was lower during the rainy season on St. Croix, although this was not evident in the present study.

Parr et al. (1993) reported that feed intake influenced the metabolic clearance rate of progesterone in ewes. The authors hypothesized that an elevated level of nutrition increased the metabolic clearance rate of progesterone, but that the secretion rate of the corpus luteum was unable to change to match the clearance rate (Parr et al., 1993). This effect was not apparent in the present study where there was no difference in progesterone concentrations on d 10 after estrus between FEED and CONTROL ewes. One reason for this may be that the interval to first estrus in the present study was greater than 33 d; thus, d 10 would have been at 43 d postpartum, which was 22 d after the end of supplemental feeding. By the time the ewes exhibited estrus they were not receiving supplemental feed and may not have had an elevated metabolic clearance rate of progesterone as suggested by Parr et al. (1993).

Wildeus et al. (1990) reported that dams of creep-fed lambs exhibited a tendency to have a shorter postpartum interval to estrus. This agrees with the data from the present study for the wet season, where the FEED ewes had a postpartum interval that was 8 d shorter than that of the CONTROL ewes. The difference in postpartum interval between seasons in the present study is in contrast with a previous study (Godfrey et al., 1998) in which we reported that there was no difference in postpartum interval between ewes that lambed in July or November. There were differences in progesterone concentrations through d 63 postpartum between seasons in the previous study that were thought to reflect a response to the slight change in photoperiod on St. Croix (Godfrey et al., 1998). With only one blood sample collected from each ewe on d 10 for progesterone concentration in the present study, it was not possible to detect any differences between seasons or treatments.

Implications

Even though the increased milk production of the ewes given feed before and during lactation during the dry season was limited in duration, it had an effect on the weaning weight of lambs raised by these ewes. Supplementation of hair sheep ewes around parturition during the rainy season in the tropics did not seem to enhance ewe or lamb production traits. The feed costs for lactating ewes can be minimized if they are only provided with supplemental feed during periods of low forage availability (i.e., the dry season on St. Croix). Strategic timing of feed supplementation for hair sheep ewes may provide a method for increasing the weight of lambs weaned during periods of limited forage availability in the tropics.

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