

## Forage-based feeding of hair sheep

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Presented at the 2006 Tennessee Nutrition Conference

Sponsored by Department of Animal Science and UT Extension, The University of Tennessee.

Interest in hair sheep production in the U.S. has been increasing with a decline on return for wool, an increased acceptance of smaller carcasses in non-traditional markets, and a shift towards forage-based production (Notter, 2000). Hair sheep are generally smaller in size and have lower growth rates than more traditional wool sheep, but are reputed to be more tolerant to gastrointestinal parasites, to have an increased ability to breed out-of-season, and to be better able to utilize low to moderate quality forages than the traditional breeds (Wildeus, 1997). Weight and size requirements of lambs destined for ethnic markets are lower than for lambs produced for the traditional markets, and hair sheep have the potential to achieve these weights under forage-based production systems.

There are currently four hair sheep breeds in the U.S. that can be loosely grouped into original (Barbados Blackbelly and St. Croix) and improved types (Dorper and Katahdin). The latter type was developed through crossbreeding of hair breeds (Blackhead Persian and St. Croix, respectively) with wool breeds to improve growth rate and carcass conformation, while retaining a hair coat. A large volume of information is available on grazing behavior, digestive function and growth performance of wool sheep breeds under varying production conditions, while comparatively little information is available on hair sheep breeds, especially in the U.S.

Due to their appearance and size traditional hair sheep breeds such as the Barbados Blackbelly and St. Croix are often confused with goats by the lay persons. Inter- and intraspecies differences in forage feeding behavior and digestive function in wool (Targhee x Dorset), hair sheep (St. Croix) and dairy goats were evaluated by Quick and Dehority (1986) who found differences between the three types in dry matter intake (3.17%, 2.66% and 2.23% of body weight, respectively). Water intake was also greater for wool sheep and similar between sheep and goats. However, there was no difference in DM and fiber fraction digestibility between the animal types and the composition of the selected diet was also similar. However, the confinement conditions of this experiment may have masked differences expressed during grazing. When co-grazing mixed species on pasture, hair sheep (Katahdin) had a higher preference for grass and lower preference for forbs than goats (Animut et al., 2005b). In the same study hair sheep spend more time eating and ruminating, and less time idling than goats, but distance traveled and time spend grazing was similar for the two species (Animut et al., 2005a).

Most comparisons of wool and hair sheep breeds have been conducted under feedlot conditions using high concentrate finishing diets (Table 1). In studies using St. Croix lambs, purebred lambs had 35 to 40% slower growth rates than wool breeds in Ohio (McClure et al., 1991), 27 to 42% slower growth rates in Utah (Foote, 1983; Bunch et al., 2004), and 20% slower growth rates in Oklahoma (Philips et al., 1995). St. Croix x wool crossbred lambs generally achieved similar daily gains to those of purebred wool or wool x wool crossbreds (Table 1). Still more pronounced were differences between Barbados Blackbelly and wool breeds fed high energy diets (Table 1), with growth rates reduced by 44% (Horton and Burgher, 1992) and 51% (Ockerman et al., 1987). Growth rates of Barbados Blackbelly x Rambouillet crosses were 31% slower than those of Blackface x Rambouillet crosses (Shelton, 1983).

Improved hair sheep breed types have been used mostly as sire breeds of lambs in feedlot and dry lot studies that were evaluated (Table 1). There were no differences in drylot growth between Dorper and Dorset-sired lambs in Virginia, though growth rates were low (Notter et al., 2004). In Utah, Dorper-sired crossbred lambs had the same growth rate as St. Croix-sired crossbred lambs, but both hair sheep cross lambs grew slower than wool x wool crossbred lambs (Bunch et al., 2004). Katahdin-sired crossbred lambs from Rambouillet cross ewes in Kansas had similar or slightly higher drylot gains than lambs derived from Rambouillet, Tunis and Romanov sires (Schwulst and Martin, 1995). There is only one study reporting growth rates of purebred Katahdin lambs fed finishing diets which were slower than those in St. Croix lambs (Burke et al., 2003).

The grazing performance of hair, wool, and hair x wool crossbred lambs was evaluated in Oklahoma (Brown and Mayeux, 2005). St. Croix lambs had slower growth rates (120 g/d) on wheat pasture than Dorset lambs (160 g/d) with reciprocal crosses being intermediate. The growth performance of Katahdin and Suffolk lambs grazing bermudagrass pasture in summer was similar (120 g/d), while contemporary Katahdin lambs in drylot grew significantly slower (150 g/d) than Suffolk lambs (220 g/d). Reciprocal crosses performed similar to the Suffolk in the drylot, but exceeded performance of the parent breeds on pasture.

Information on dry matter intake and feed to gain ratio of hair sheep fed forage-based rations is limited in the U.S., and more data are available for their tropical and semi-tropical areas (Table 2). In Pelibuey in Mexico, daily gain decreased by 30% as the forage component of the diet increased from 0 to 30%, while dry matter intake increased by 48%, and feed to gain ratio doubled (Fimbres et al., 2002). Differences in dry matter intake were observed for fresh vs. dried pangola grass fed to Barbados Blackbelly rams in the Caribbean. Conflicting results have been reported for differences in forage dry matter intake between hair and wool breed types (Table 2). Quick and Dehority (1986) reported a higher dry matter intake in wool (Targhee x Dorset) than hair (St. Croix sheep) fed alfalfa and brome grass hay (15% CP). In contrast, Mann et al. (1987) found a higher forage intake in hair (Barbados Blackbelly) than wool lambs (Dorset) fed orchard grass hay, and no difference when coastal bermuda grass pellets were fed. In Brazil, intake of Santa Inês hair sheep fed Bermuda grass and concentrate was higher than in Ile de France wool sheep.

**Table 1: Comparative growth of hair, hair x wool, and wool breed types fed feedlot diets in the U.S.**

Breed type	n	ADG, g/d	Location	Reference
St. Croix	12	222	Ohio	Ockerman et al., 1982
Barbados Blackbelly	12	172		
Florida Native	10	259		
Suffolk x Whiteface cross	12	349		
St. Croix cross	57	270	Ohio	McClure & Parker, 1991
St. Croix cross x Rambouillet cross	50	310		
St. Croix cross x Hampshire	49	370		
St. Croix	12	200	Ohio	McClure et al., 1991
Targhee	12	330		
St. Croix		187	Oklahoma	Philips et al., 1995
Romanov x St. Croix		227		
Texel x St. Croix		238		
Romanov x Polypay		239		
Texel x Polypay		232		
Barbados Blackbelly x Rambouillet	20	176	Texas	Shelton, 1983
Blackface x Rambouillet	20	254		
Rambouillet	14	251		
St. Croix	13	259	Utah	Foote, 1983
St. Croix x Rambouillet	12	292		
Rambouillet	7	355		
Dorper x Whiteface cross	126	142	Virginia	Notter et al., 2004
Dorset x Whiteface cross	164	148		
St. Croix	6	210	Utah	Bunch et al., 2004
St. Croix x wool	6	290		
Dorper x St. Croix	6	260		
Dorper x wool	6	290		
Wool x wool	6	360		
Dorper x St. Croix	7	247	Arkansas	Burke et al., 2003
Dorper x Romanov/St. Croix cross	9	226		
St. Croix	8	205		
Katahdin	15	181		
Katahdin x Rambouillet cross	132	279	Kansas	Schwulst & Martin, 1995
Rambouillet x Rambouillet cross	96	277		
Tunis x Rambouillet cross	130	265		
Romanov x Rambouillet cross	135	264		

**Table 2: Growth, intake and feed efficiency of hair, wool and hair x wool crossbred lambs feed forage-based diets**

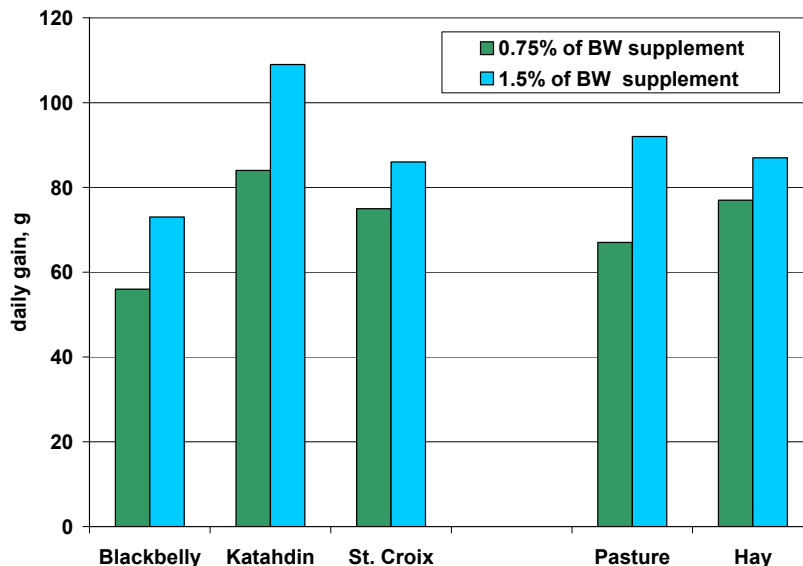
Diet; Location	Breed type	ADG, g/d	Intake, g/d/BW <sup>0.75</sup>	Feed/gain	Reference
Alfalfa and brome grass hay, 15% CP; Ohio <sup>#</sup>	St. Croix Wool cross (Dairy goat)		67 86 (58)		Quick & Dehority, 1986
Pelleted bermudagrass, 8.9% CP; North Carolina	Blackbelly BB x DO Dorset	48 48 37	95 101 100		Mann et al., 1987
Orchard grass-alfalfa hay, 12.7% CP; North Carolina	Blackbelly BB x DO Dorset		92 84 77		Mann et al., 1987
Concentrate (94%) and guinea grass (6%); Mexico	Pelibuey-♂ Pelibuey-♀ Wool x PE-♂ Wool x PE-♀	182 102 239 182	95 85 136 142	5.50 7.94 5.33 6.85	Pineda et al. 1998
Pangola grass hay, 9% CP; West Indies	Blackbelly dried: fresh:		53 61		Archimede et al. 1999
Klein grass and concentrate, 15% CP; Mexico <sup>#</sup>	Pelibuey 0% forage 10% forage 20% forage 30% forage	250 207 203 174	89 111 127 132	4.9 7.1 7.6 10.3	Fimbres et al., 2002
Bermuda grass hay and concentrate, 10-16% CP; Brazil	Santa Ines Ile de France X		101 86		Silva et al., 2004
Alfalfa hay, 16.7% CP; Virginia	Blackbelly Katahdin St. Croix	87 131 117	109 107 107	10.53 9.11 8.73	Wildeus et al., 2006

<sup>#</sup>intake re-calculated from data presented in reference

Research at Virginia State University has evaluated the growth performance of lambs from three hair sheep breeds (Barbados Blackbelly, Katahdin and St. Croix) on forage-based rations. In comparative trials with meat goats, mixed breed groups of hair sheep lambs that were pen-fed grass hay diets and corn/soybean meal based concentrate supplement at 2% of body weight had higher daily gains (145 to 147 g/d) than mixed breed groups of meat goats (Boer cross, Spanish, Myotonic; 88 to 107 g/d). In doing so, the hair sheep lambs consumed more forage dry matter than the goat kids (1.49 vs. 1.36% of body weight). Growth rates for both species increased as hay quality (alfalfa) improved (182 and 123 g/d, respectively), but the species differences were maintained.

In these hay-based feeding trials differences between hair sheep breeds were not consistent. In an initial trial with moderate quality forage and supplementation at 2% body weight, growth of Katahdin was faster (129 g/d) than of St. Croix (85 g/d) and Barbados Blackbelly. In a second trial with higher quality forage, growth in Katahdin lambs was not significantly different (171 g/d) from St. Croix (165 g/d) and Barbados Blackbelly (158 g/d), though Katahdin lambs were heavier at the onset of the feeding trial.

In grazing trials spanning the forage growing season (April to October) growth rates were higher in Katahdin (78 g/d) and St. Croix (71 g/d) than Barbados Blackbelly (51 g/d) lambs when limited concentrate supplementation (0.75% of body weight) was provided (Figure 1). When concentrate supplementation was increased to 1.5% of body weight, Katahdin lambs had significantly higher growth rates (114 g/d) than both St. Croix (91 g/d) and Barbados Blackbelly (71 g/d). Contemporary lambs maintained in pens on grass hay-based diets had similar growth rates to the lambs grazing pasture, but higher growth rates when alfalfa hay was fed. All three hair sheep breeds responded similarly to this change in forage base.



**Figure 1: Growth in three breeds of hair lambs grazing pasture or pen-fed hay and provided with two levels of supplementation**

**Table 3: Body weight (BW), growth, feed intake and feed/gain ratio in three hair sheep breeds fed an all forage (alfalfa hay) diet**

	Breed		
	Blackbelly	Katahdin	St. Croix
Start BW, kg	23.8 <sup>a</sup>	36.5 <sup>c</sup>	29.1 <sup>b</sup>
Final BW, kg	29.2 <sup>a</sup>	44.7 <sup>c</sup>	36.5 <sup>b</sup>
ADG, g/d	87 <sup>a</sup>	131 <sup>b</sup>	117 <sup>b</sup>
DMI, % BW	3.31 <sup>b</sup>	2.93 <sup>a</sup>	3.10 <sup>ab</sup>
Feed/Gain	10.53	9.11	8.73

<sup>a,b,c</sup> values in same row with unlike superscripts differ significantly (P<0.05)

Forage intake and utilization was evaluated in Barbados Blackbelly, Katahdin and St. Croix lambs fed an alfalfa hay diet with no supplement. Daily gain was higher in Katahdin (131 g/d) and St. Croix (117 g/d) than in Barbados Blackbelly (87 g/d). Barbados Blackbelly had a higher dry matter intake (3.31% of body weight/d) compared to Katahdin (2.93%) with St. Croix intermediate (Table 3), while feed to gain ratio was not significantly different between the breeds. Apparent digestibility was higher in Katahdin than the other two breeds, especially for protein (Table 4). Katahdin lambs had higher absorber and retained nitrogen, appeared to utilize the nitrogen in the diet more efficiently than the other two breeds.

**Table 4: Apparent digestibility coefficients in three hair sheep breeds fed alfalfa hay**

Digestibility, %	Breed		
	Blackbelly	Katahdin	St. Croix
Dry matter (DM)	58.3 <sup>a</sup>	63.0 <sup>b</sup>	59.3 <sup>ab</sup>
Organic matter (OM)	58.6 <sup>a</sup>	63.4 <sup>b</sup>	59.7 <sup>ab</sup>
Nitrogen (N)	67.7 <sup>a</sup>	72.3 <sup>b</sup>	69.4 <sup>ab</sup>
NDF	41.8 <sup>a</sup>	49.0 <sup>b</sup>	43.6 <sup>ab</sup>
ADF	38.5 <sup>ab</sup>	44.0 <sup>b</sup>	36.5 <sup>a</sup>

<sup>a,b</sup> values with unlike superscripts in same column differ significantly (P<0.05)

Results are not consistent as to differences between hair and wool sheep in forage utilization. Under feedlot conditions with high concentrate finishing diets traditional hair sheep breeds (St. Croix and Barbados Blackbelly) grew considerably slower than wool breeds. Improved hair sheep breed types (Katahdin and Dorper) approach the production of some wool breeds under these conditions, as do wool x hair crosses. Under marginal production conditions differences between breed types have been more variable and tend to favor hair and hair x wool crosses. Production characteristics of hair sheep suggest their role to be more suited for the maternal aspects of production.

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