Management and Nutrition for Milking Sheep in Short and Frequent Lactations

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ABSTRACT

This ongoing research (October, 2016 – September, 2018) aims to determine if milking sheep able to breed out of season on the STAR Accelerated Lambing System can achieve equal or higher milk yields year-round in 365 days than possible with one annual 180-day dairy sheep lactation. The Cornell University Dorset, and Dorset X Finnsheep flock is managed in three STAR groups (STAR-R, STAR-B, STAR-G) that each are either lactating, in early gestation and dry or in late gestation and dry. The STAR groups undergo consecutive lactations, with each group lambing and lactating 3 times in this 2-year research project. Applying the STAR Accelerated Lambing System to dairy production with lambs taken away after 12 h and ewes being milked for the first time on DIM 1 leads to short and frequent lactations. The ewes in each STAR management group will lactate for 73 to 103 days, with breeding on day 73 of lactation, leading to ~219-day lambing intervals. Higher litter sizes of traditional meat ewes as well as the ability to lamb up to 1.67 times per year on the STAR management system will lead to a higher lamb crop, to more product sold and subsequently to higher profits. To be able to uphold high productivity, fecundity, and fertility while maintaining optimal health and body condition, elevated levels of nutrients need to be made available by the diet fed.

BACKGROUND

- Traditional meat sheep express high peak lactation yields up to 3,744 g/d (8.25 lb) (Ramsey et al., 1998).
- Lactation persistency ranges between 155 and 161 days for East-Friesian and Lacaune dairy sheep (Thomas, 2014) and is significantly longer than for meat sheep.
- Dairy sheep are seasonal polyestrous and have low conception rates with out of season breeding (Thomas, 2014), while some meat sheep are able to lamb year round.
- The Cornell Finnsheep X Dorset meat sheep flock has been successfully bred on the STAR system for several decades (Lewis, 1998).
- The seasonality of dairy sheep farming has a variety of detrimental impacts on small farming communities, including a lack of financial viability due to seasonal sales of product and high cost for equipment that can't be used year-round.
- China and Europe currently are the biggest producers of sheep milk (Balthazar, 2017); however, the US imports 50-60% of the annual world exports in sheep milk cheese (Thomas, 2014), which amounted to ~53 million lb in 2014 (FAO statistics) or 270 million lb raw milk equivalent with 18-25% cheese yield.
- The estimated millions of idle forage acreage in New York State and the Northeast may be utilized for grazing and provide possibilities for new low input farming systems of interest for emerging farming communities or small scale cow dairy farms that were forced out of business

OBJECTIVES

- Determine optimal dietary levels of fermentable fiber (pfNDF) for maximum milk production, optimal ewe body condition, fertility, and health.
- Record prolificacy and lamb survival under the STAR accelerated system in a milking sheep environment.
- Compare published values for 190-day, yearly lactations of traditionally-milked dairy-breed ewes with yield and components of Finnsheep x Dorset ewes milked in 73- to 103-day lactations.

METHODS

42 ewes were divided into 3 STAR groups and milked in consecutive short and frequent lactations (73-103 days); the dairy operates year-round. Lambs are taken away from their dams 12 h after birth and reared artificially on free-choice cold milk. Milking ewes and lambs are weighed weekly.

Table 1. Pelleted diet composition, % of DM

Ingredient	30% pfNDF	35% pfNDF	40% pfNDF
Soy hulls	34.4	42.4	50.9
Corn	31.5	24.1	16.2
Wheat midds	20.1	20.1	20.1
Soybean meal	8.9	8.6	8.2
Molasses	1.67	1.68	1.68
Calcium carbonate	1.34	1.12	0.89
Cornell premix	1.06	1.06	1.06
Ammonium chloride	0.78	0.78	0.78
Pellet binder	0.27	0.27	0.27

Each STAR group is divided and receives 3 experimental diets containing 30, 35, or 40% potentially fermentable fiber (pfNDF, Table 1). Amounts fed and refused are recorded daily and sampled weekly to determine digestibility with acid insoluble ash and aNDFom methods. Milk yields are recorded every day for individual ewes at milking at 7 am and 5 pm.

In collaboration with Dr. Dave Barbano, Cornell University, Department of Food Science, weekly milk samples are collected and analyzed for milk components.
Rumen fluid and fecal samples are collected at 3 timepoints throughout lactation. Rumen pH is measured and VFA composition and concentration will be determined. Blood samples are drawn prenatally and on DIMs 1, 7, 40 to determine energy balance via blood NEFA.

RESULTS

The following results are preliminary, encompass the first lactation period of all 3 STAR groups, and do not represent the final result of this research. The data model included the effect of STAR group, diet (confounded with pen), ewe within diet and STAR group, and days in milk as a linear and quadratic covariates for each diet.

Figure 1. Milk yields

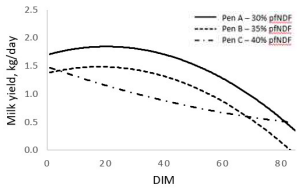


Figure 2. Feed intake

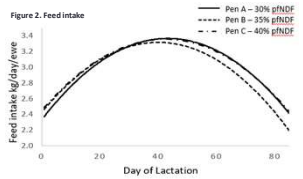
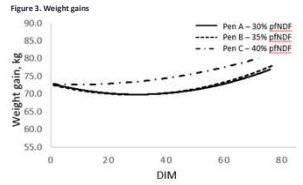


Figure 3. Weight gains



Diet was highly influential on milk production ($P < 0.001$, Figure 1). Ewes in pen A fed the 30% pfNDF diet achieved significantly higher milk yields than ewes in pen C receiving the 40% pfNDF diet. Milk yields for pens A & B dropped by ~ day 40, with feed intakes decreasing similarly (Figure 2), but weight gains increasing (Figure 3). There was a STAR group x Diet interaction ($P = 0.004$, not shown).

The experimental diets were offered free choice with a small amount of medium quality hay (~500 g per ewe). These preliminary results did not verify previous observations of a positive relationship between dietary percentage pfNDF with feed intake and milk production for ewes nursing triplets (Schotthofer, 2007).

The relationship of milk production and weight gain was inversely related. Ewes consuming the 40% pfNDF diet achieved the lowest milk yields and gained the most weight. Ewes consuming the 30% pfNDF diet achieved the highest milk yields and had the lowest rate of weight gain.

RESULTS

Table 2. Prolificacy

Group	Lact.	Ewes	Breeding	Method	Scanned positive		First cycle	
STAR-R	1	18	6/6/2016	Teaser, CIDR	14	78%	1 3	93%
STAR-B	1	16	8/20/2016	Teaser, Sponge	16	100%	1 1	69%
STAR-G	1	16	10/30/2016	Teaser	12	75%	1 1	92%
STAR-R	2	18	1/11/2017	Natural	17	94%	1 3	76%
STAR-B	2	17	3/3/2017	Teaser, CIDR (13)	13	76%	1 1	85%
STAR-G	2	18	6/6/2017	Teaser, CIDR	16	89%	1 2	75%
STAR-R	3	19	8/20/2017	Natural	17	89%	1 5	88%

Teaser rams in combination with CIDRS or sponges, only teaser rams, as well as completely natural breeding has been used to ensure a minimum number of ewes in each lactation (Table 2). Conception rates ranged between 75 and 100%. 69% to 93% have conceived and lambed within the first cycle (17 days).

Table 3. Lamb survival

Production data	Sheep
Number of ewes lambing	46
Lambings per ewe	1.56
Lambs delivered	158
Lambs delivered per lambing	2.19
Lambs delivered per ewe lambing	3.43
Lambs born alive	145
Stillborn loss	8.2%
Lambs born alive per ewe lambing	3.15
Lambs born alive that died	4
Live lamb loss	2.7%
Lambs sold or kept for replacement per ewe lambing	3.1

Lambs born in each STAR group are removed from their dams within 12h. They receive their mother's colostrum and then are raised artificially until weaning at ~25-30 days, depending on their weight. The lambs are raised on cold milk that is available to them free choice in lambars 24 h per day. Average daily gains range between 260 g/day and 330 g/day. Overall lamb vigor and health is high (Table 3).

CONCLUSIONS

- There was a high amount of variation in milk production among ewes within diets. With sound breeding decisions this variation may be decreased, higher producing ewes selected, and average milk yield increased.
- High achieving ewes milked 246 kg in 115 lactation days, compared to East-Friesian dairy sheep with 359 kg in 189 days. Combined with increased lamb production, this could be a significant advantage.
- With only 1/3 of the flock being milked at any given time of the year, grassland and pastures may be utilized by the dry animals, making a cheap and accessible feed source available.
- With 2.19 lambs delivered per lambing in this study and 1.67 lambings per year, meat ewes may produce 3.65 lambs per year, offering a major second income to a dairy flock.
- With the conclusion of this study in September 2018, the data will be used to improve a comprehensive economic model. It will be designed to be used by farmers to predict milk yields, lamb crop, feed cost and farm income.

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