Wisconsin Dairy Sheep Research

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Location - Spooner Station

Spooner Agricultural Research Station

University of Wisconsin-Madison campus

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Sheep Research Unit, Spooner Agricultural Research Station, University of Wisconsin-Madison

The only dairy sheep research farm in North America.

Dairy Sheep at Spooner Station

- Construction of double-12 pit parlor started in 1995.
- First East Friesian-cross ewes milked in 1996.

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Former Students

Dr. Maristela Rovai

Dr. Brett McKusick

Dr. Claire Mikolayunas

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Dorset-Cross vs. EF-Cross (≤ 50%)

Table 1. Lactation performance[1] of one- and two-year-old East Friesian-cross and Dorset-cross ewes

Trait	Breeding of ewe	
	Dorset-cross	East Friesian-cross
Number of lactations	76	246
Lactation length, d	92.7[a]	126.2[b]
Milk yield, kg	56.9[a]	109.1[b]
Fat, %	5.5[a]	5.02[b]
Fat yield, kg	3.3[a]	5.5[b]
Protein, %	5.42[a]	4.97[b]
Protein, kg	3.2[a]	5.4[b]
Somatic cell count, $\log_{10}$	4.99	5.02

[1]Ewes were milked starting approx. 30 days after parturition.
[a,b]$P < 0.05$.

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East Friesian vs. Lacaune

- The Spooner Station imported the first Lacaune genetics into the U.S. in 1998.
- Purebred East Friesian genetics also became available after 1995.

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East Friesian vs. Lacaune

Expected performance of pure East Friesian and Lacaune 3-year-old ewes.

Trait	Breed	
	East Friesian	Lacaune
Lactation length, d	188.6	180.3
Milk yield, kg	359.3	345.1
Fat yield, kg	20.9	22.1
Fat, %	6.3[a]	6.5[b]
Protein yield, kg	18.0	18.2
Protein, %	5.2[a]	5.3[b]
Litter size, no.	1.97[a]	1.84[b]

[a,b]$P < 0.05$.

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Weaning Systems

- 1998 - first dairy sheep production trial
- Three weaning systems compared
  - DY1 – Lambs raised on milk replacer from 24-36 hours to 30 days, ewes milked twice per day for entire lactation, lambs weaned to dry diets at 30 days.
  - MIX – First 30 days: lambs separated from ewes overnight, ewes milked once per day in the morning, ewes returned to their lambs for the day. Lambs weaned to dry diets at 30 days, ewes milked twice per day for remainder of lactation.
  - DY30 – Ewes raised their lambs for 30 days, lambs weaned to dry diets at 30 days, and ewes milked twice per day from 30 days to end of lactation.

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Weaning Systems

Ewe lactation traits for three weaning systems.

Trait	Weaning system DY1	MIX	DY30
Machine milking period, d	182.4[a]	178.2[a]	152.3[b]
Commercial milk yield, kg	260.1[a]	235.8[b]	171.7[c]
Fat yield, kg	13.2[a]	10.9[b]	8.4[c]
Fat, %	5.1[a]	4.5[b]	4.8[a,b]
30-d fat, %	4.8[a]	2.8[b]	-
Protein yield, kg	13.7[a]	12.1[b]	9.0[c]
Protein, %	5.3	5.1	5.2

[a,b,c]$P < 0.05$.

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Weaning Systems

- Subsequent detailed studies with MIX and DY1 ewes showed that the low fat of MIX ewes was due to the failure of oxytocin release and milk let down during the milking period.
- During milking of MIX ewes, cisternal milk was captured, but milk in the alveoli, which is higher in fat, was not captured.
- MIX ewes had oxytocin release and milk let down when reunited with their lambs after milking.
- Another study fed 91 g of Megalac/ewe/day to MIX and DY1 ewes
- Milk fat increased by 1.9 percentage units in DY1 ewes but had no effect on MIX ewes

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Weaning Systems

Lamb mortality and growth of three weaning systems.

Trait	Weaning system DY1	MIX	DY30
Lamb growth and survival:			
Mortality, birth-30 days, %	5.8	8.2	1.3
30-day weight, kg	15.4	14.5	15.0
Mortality, 30-120 days, %	6.2	6.0	5.2
120-day weight, kg	43.7[f]	45.9[e]	47.3[d]
Mortality, birth-120 days, %	11.6	13.7	6.4

[d,e,f]$P < 0.10$.

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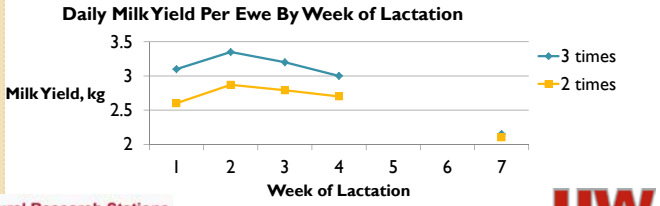
3-Times Per Day Milking

- 125 DY1 ewes, 53-3X (6 am, noon, 6 pm), 72-2X (6:30 am, 5:30 pm)
- Treatments applied for the first 30 days of lactation, 2X daily milking of all ewes from 30 days to end of lactation
- Total yield first 30 days: 3X = 95 kg, 2X = 83 kg, 15% increase for 3X
- No effect after 30 days



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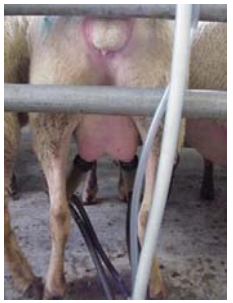
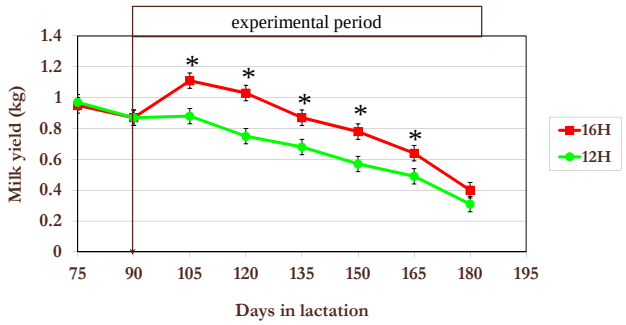
12- vs. 16-Hour Milking Interval

(Milking 2 times per day or 3 times in 2 days)

- 3rd parity East Friesian crossbred ewes
- Similar udder morphology, milk yield, and stage of lactation (90 d)
- Milking Treatments
  - 12H:6AM and 6PM (n = 24)
  - 16H:6AM, 10PM, and 2PM (n = 24)
- From day 90 to 180 of lactation
  - 12H = 180 milkings
  - 16H = 135 milkings

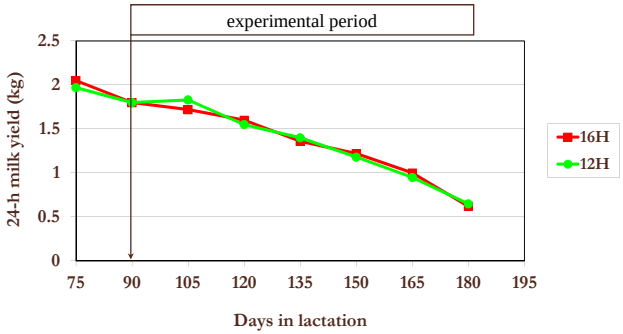


Morning Milk Yield (6 AM)



* $P < 0.05$

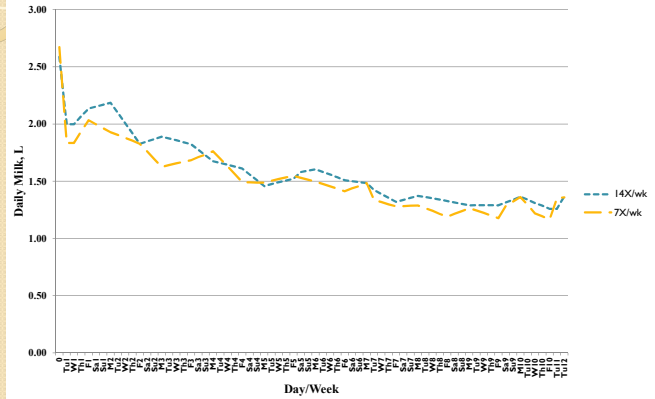
24-hour Milk Yield



12- vs. 24-Hour Milking Interval
(Milking twice-daily or once-daily)

- 72 multi-parous ewes
- Milking Treatments
  - Twice-daily (14X/wk)
  - Once-daily (7X/wk)
  - Once-daily but not on Sunday (6X/wk)
- From day 100 to 167 of lactation
  - 14X/wk = 134 milkings
  - 7X/wk = 67 milkings
  - 6X/wk = 60 milkings

12- vs. 24-Hour Milking Interval
(Milking twice-daily or once-daily)



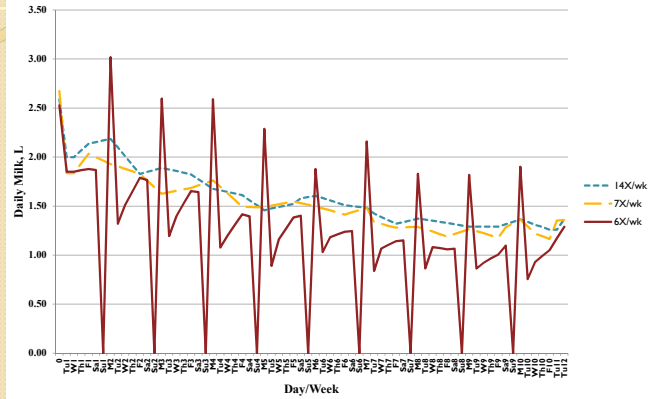
12- vs. 24-Hour Milking Interval
(Milking twice-daily or once-daily)

Lactation performance of ewes milked twice-daily (14X/wk) or once-daily (7X/wk) from mid- to late-lactation (67 days).

Treatment	Milk yield, kg	Fat, %	Protein, %	SCC, log_{10}
14X/wk	109.6	5.61[d]	4.98[d]	5.30
7X/wk	105.2	6.37[c]	5.26[c]	5.25

[c,d]P < 0.01.

12- vs. 24-Hour Milking Interval
(Milking twice-daily or once-daily)



12- vs. 24-Hour Milking Interval

(Milking twice-daily or once-daily)

Lactation performance of ewes milked twice-daily (14X/wk), once-daily (7X/wk), or once-daily except not on Sunday (6X/wk) from mid- to late-lactation (67 days).

Treatment	Milk yield, kg	Fat, %	Protein, %	SCC, log_{10}	Plasma lactose, nmol/µL
14X/wk	109.6[a]	5.61[d]	4.98[d]	5.30	3.40[b]
7X/wk	105.2[a]	6.37[c]	5.26[c]	5.25	2.00[b]
6X/wk	86.0[b]	6.64[c]	5.34[c]	5.28	4.90[a]

[a,b]P < 0.05.
[c,d]P < 0.01.

Grazing Research

- Starting in mid-lactation in 1998, 49 ewes grazed during the day on kura clover/orchard grass pasture, 48 ewes remained in drylot on alfalfa hay.
- Pastured ewes produced 10.5% more milk.
- Since 1998, all ewes have been pastured.

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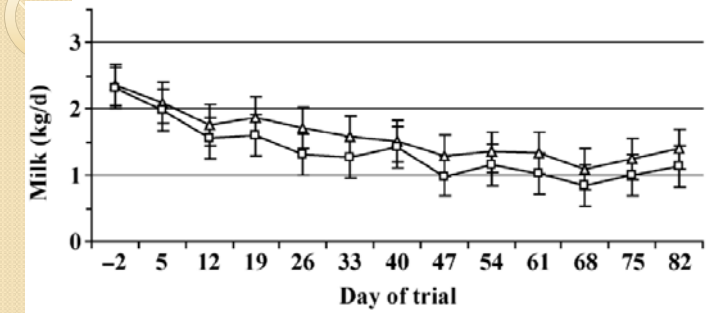
Pasture Supplementation Research

Milk yield of ewes receiving 0.00 (□) or 0.91 (Δ) kg corn-soybean meal (16% CP) supplement



Supplemented ewes produced an average of 0.23 kg/d more milk than unsupplemented ewes (1.59 vs. 1.36 kg/d, respectively).

Milk urea nitrogen (MUN) mg/dl = 25 for both treatments; indication of poor protein utilization

Pasture Supplementation – Corn Only

Lactation performance of grazing ewes unsupplemented or supplemented with corn.

Trait	Whole corn supplementation, kg/ewe/day 0.0	.45	.91	1.36
Test day milk yield, kg	1.30[a]	1.32[a]	1.41[b]	1.44[b]
Milk fat, %	6.26[b]	6.40[b]	6.09[b]	5.89[a]
Milk protein, %	5.29	5.41	5.37	5.39
Milk urea nitrogen, mg/dL	18.9[a]	17.1[b]	13.6[c]	13.6[c]

[a,b,c]($P < 0.05$).

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Effect of alfalfa and orchardgrass on performance of dairy ewes

Cut-and-Carry Trial

Alfalfa/Orchardgrass: 0/100, 25/75, 50/50, 75/25

Grazing Trial – Alfalfa/Orchardgrass: 0/100, 25/75, 50/50

Effect of alfalfa and orchardgrass on performance of dairy ewes

Lactation performance of ewes fed or grazing forage of varying proportions of alfalfa.

	% alfalfa in forage			
Trait	0	25	50	75
Cut-and-carry trial:				
Milk yield, kg/d	1.74[g]	1.85[f]	1.94[e]	1.95[e]
Fat yield, kg/d	0.12	0.12	0.12	0.13
Protein yield, kg/d	0.09[a]	0.09[a]	0.10[b]	0.10[b]
Milk urea nitrogen, mg/dL	10.9[d]	12.7[c]	14.3[b]	16.8[a]
Grazing trial:				
Milk yield, kg/d	1.55[g]	1.78[f]	1.87[e]	
Fat yield, kg/d	0.10	0.11	0.11	
Protein yield, kg/d	0.08[a]	0.09[a,b]	0.10[b]	
Milk urea nitrogen, mg/dL	15.0[b]	19.8[a]	22.1[a]	

[a,b,c,d] ($P < 0.05$), [e,f,g] ($P < 0.10$).

Effect of rumen undegraded protein on lactation performance of dairy ewes

Lactation performance of ewes supplemented with rumen undegraded protein (RUP) and fed or grazing forage of varying proportions of alfalfa.

	Supplement	
Trait	No RUP	RUP[1,2]
Cut-and-carry trial[1]:		
Milk yield, lb./d	3.94[f]	4.29[e]
Fat yield, lb./d	0.27	0.27
Protein yield, lb./d	0.20	0.21
Milk urea nitrogen, mg/dL	12.3[b]	15.1[a]
Grazing trial[2]:		
Milk yield, lb./d	3.63	4.00
Fat yield, lb./d	0.23	0.25
Protein yield, lb./d	0.19	0.21
Milk urea nitrogen, mg/dL	18.2	19.8

[a,b] ($P < 0.05$), [e,f] ($P < 0.10$).

[1] RUP = 0.3 kg/hd/d Soy Pass, [2] RUP = 0.3 kg/hd/d SoyPlus

Prepartum Photoperiod Effects on Milk Production of Dairy Ewes

Ewes: 22 four-yr-old dairy ewes

Treatments – Livestock Lab on campus:

long day photoperiod (LDPP) = 16 h light, 8 h darkness, n = 11.

short day photoperiod (SDPP) = 8 h light, 16 h darkness, n = 11.

Treatments started Dec. 20, 2005 and were applied for 44 to 78 days prior to lambing.

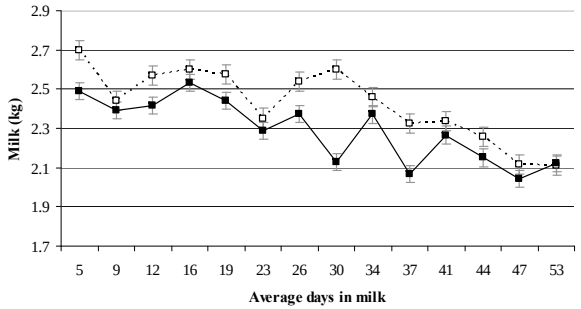
Milking period:

Ewes milked twice per day for approx. 180 days.

After lambing, all ewes exposed to 12 h light for 34 to 63 days in Livestock Lab on Campus.

Moved to Spooner Station April 10, 2006 under ambient light.

Mean test day milk production of SDPP (□) and LDPP (■) treatments during the milking period on campus.



Mean Daily Milk Production and Milk Composition During the Period on Campus, average of 53 d

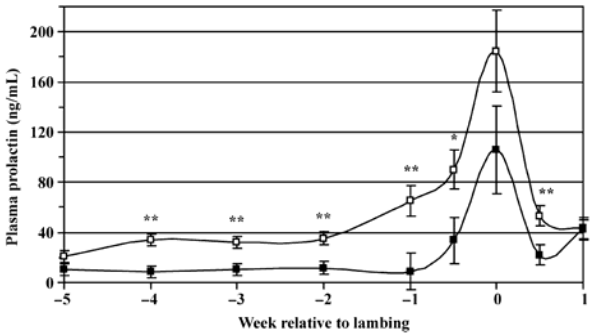
	SDPP	LDPP	*P* <
Milk, kg/d	2.43	2.29	0.05
Fat, %	6.04	5.51	0.01
Protein, %	4.61	4.54	0.45

Mean Daily Milk Production and Milk Composition During the Period on Campus and At Spooner, average of 180 d

	SDPP	LDPP	*P* <
Milk, kg/d	2.17	2.02	0.01
Fat, %	6.38	6.15	0.04
Protein, %	5.01	4.95	0.30

Mean plasma prolactin levels of SDPP (■) and LDPP (□) treatments prior to and immediately after lambing.

Week	−5	−4	−3	−2	−1	−0.5	0	0.5	1
SDPP, n	10	10	10	10	7	7	7	10	10
LDPP, n	10	10	10	10	10	10	8	10	9

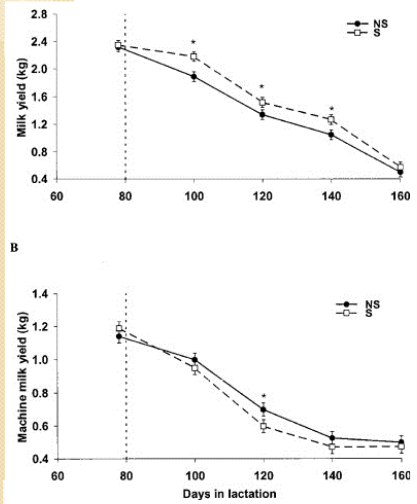


Economics?

SDPP ewes produced 0.15 kg more milk per day x 180 day lactation x $1.65/kg milk = $44.55 increased milk income per ewe over LDPP ewes

Practical Implications?

Will ewes that have late gestation during short days (December/January for January/February lambing) be expected to produce more milk than ewes that have late gestation in longer days (April/May for May/June lambing)?



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Machine Stripping

- 48 East Friesian crossbred ewes: 24 machine stripped, 24 no stripping
- From day 80 to end of lactation
- Stripped ewes produced 14% more milk than non-stripped ewes (+0.44 lb./day)

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Machine Stripping Simulation

(Group of 12 ewes in a double-12 parlor)

	Stripping treatment/number of milkers			
Factor	Stripping/1	Stripping/2	No-Stripping/1	No-Stripping/2
Parlor entry time, s	45	45	45	45
Milking procedure time, s	344	237	207	186
Parlor exit time, s	30	30	30	30
Parlor time, min	6.98	5.20	4.70	4.35
Parlor throughput, ewes/h	103	138	153	166
Ewes overmilked, no.	11/12	4/12	0/12	0/12

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