Cornell University

Management and Nutrition for Milking Sheep in Short and Frequent Lactations

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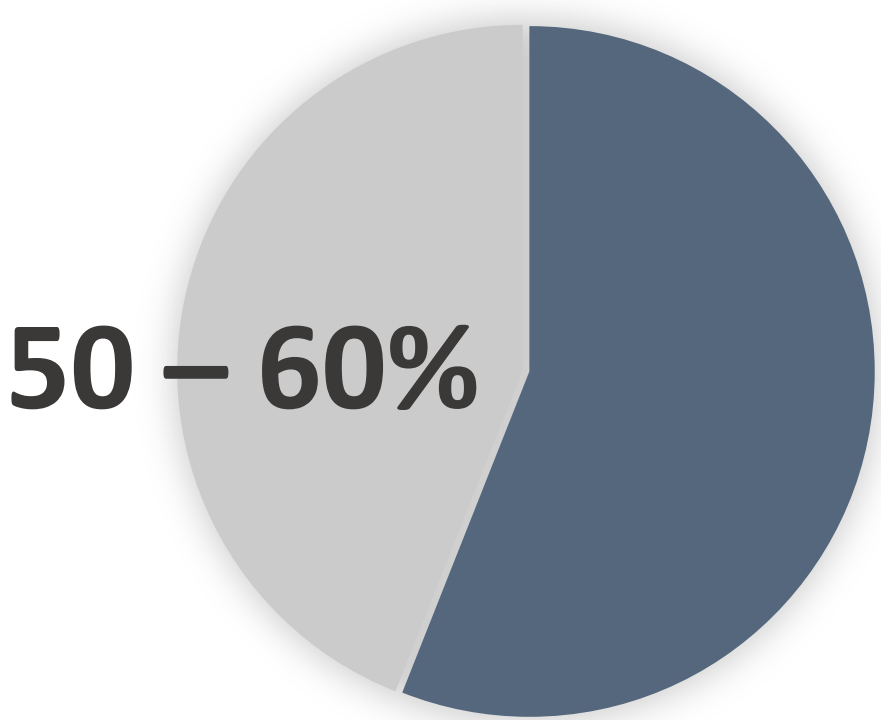
Introduction



- Unknown number of sheep dairies in US
- Small scale, artisanal production
- Processing on site
- Sales at local farmer’s markets, food co-ops and CSA-shares

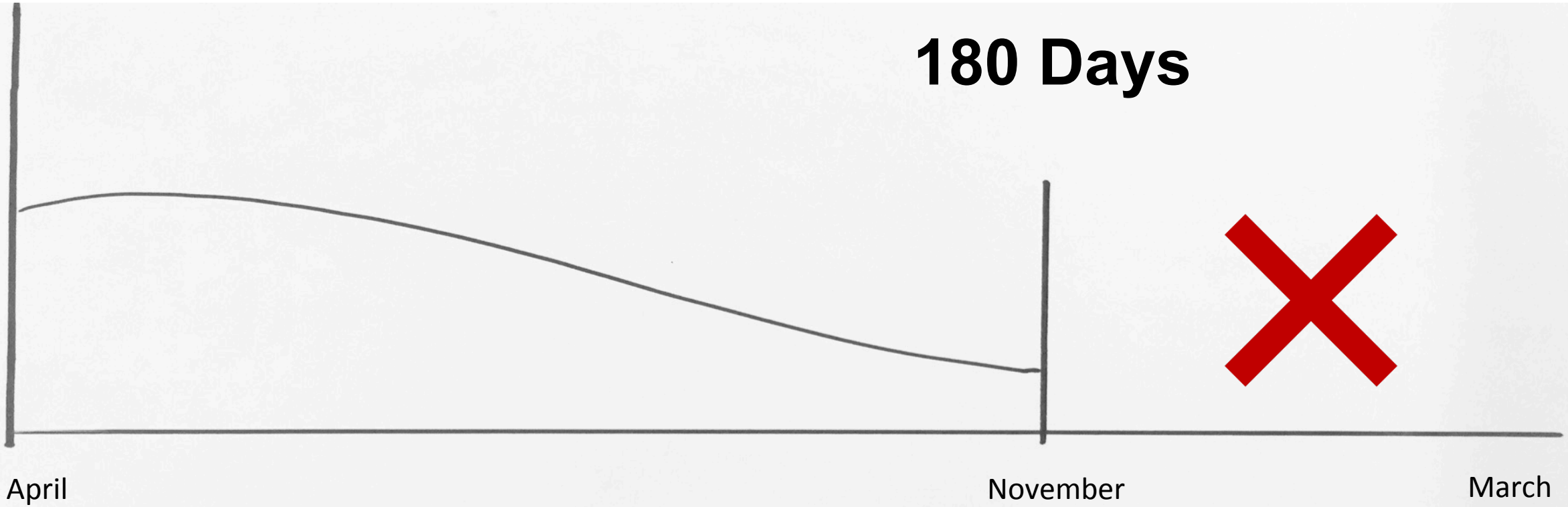
Introduction

	Sheep	Goat	Cow
Water (%)	82.5	87.0	87.5
Total solids (%)	**17.5**	**13.0**	**12.5**
Fat (%)	6.5	3.5	3.5
TN (%)	5.5	3.5	3.2
Casein (%)	4.5	2.8	2.6
Lactose (%)	4.8	4.8	4.7
Minerals (%)	0.92	0.80	0.72
Ca (mg/l)	193	134	119
Energy (kcal/l)	1,050	650	700
pH	6.65	6.60	6.50

(Pulina et al. 2004)

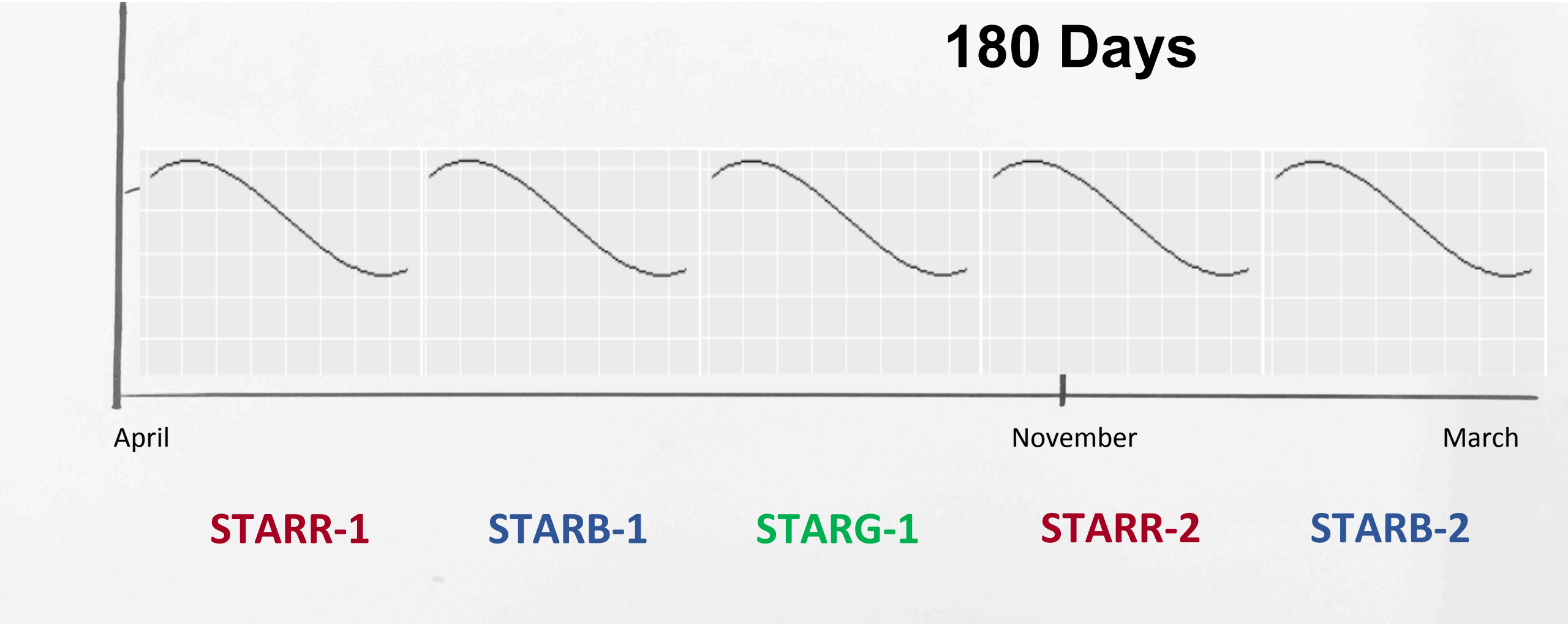
123 million kg

Traditional Sheep Dairy production



- East-Frisian, Lacaune => seasonal breeding
- One, 180-day lactation per year
- Breeding in Fall, parturition in Spring (5 months gestation)
- 30-day or mixed lamb rearing systems
- No stable buyers market of fresh milk due to seasonal production
- Challenges marketing fresh products (e.g. yogurt)

STAR Accelerated Lambing System

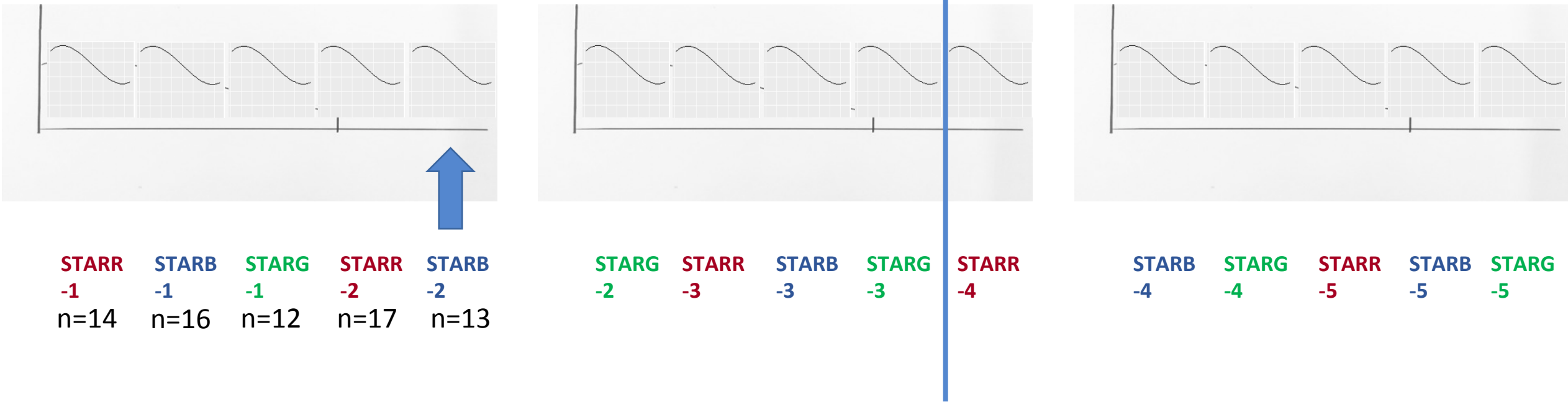


(Lewis et al. 1996)

STAR Accelerated Lambing System

- Five, 73 – 103 day lactations/ year/ flock
- 5 lactations/ 3 years/ ewe
- 1.67 lactations/ year/ ewe
- Re-breeding on day 73 of each lactation
- 219 day lambing interval

(Lewis et al. 1996)



Nutrition

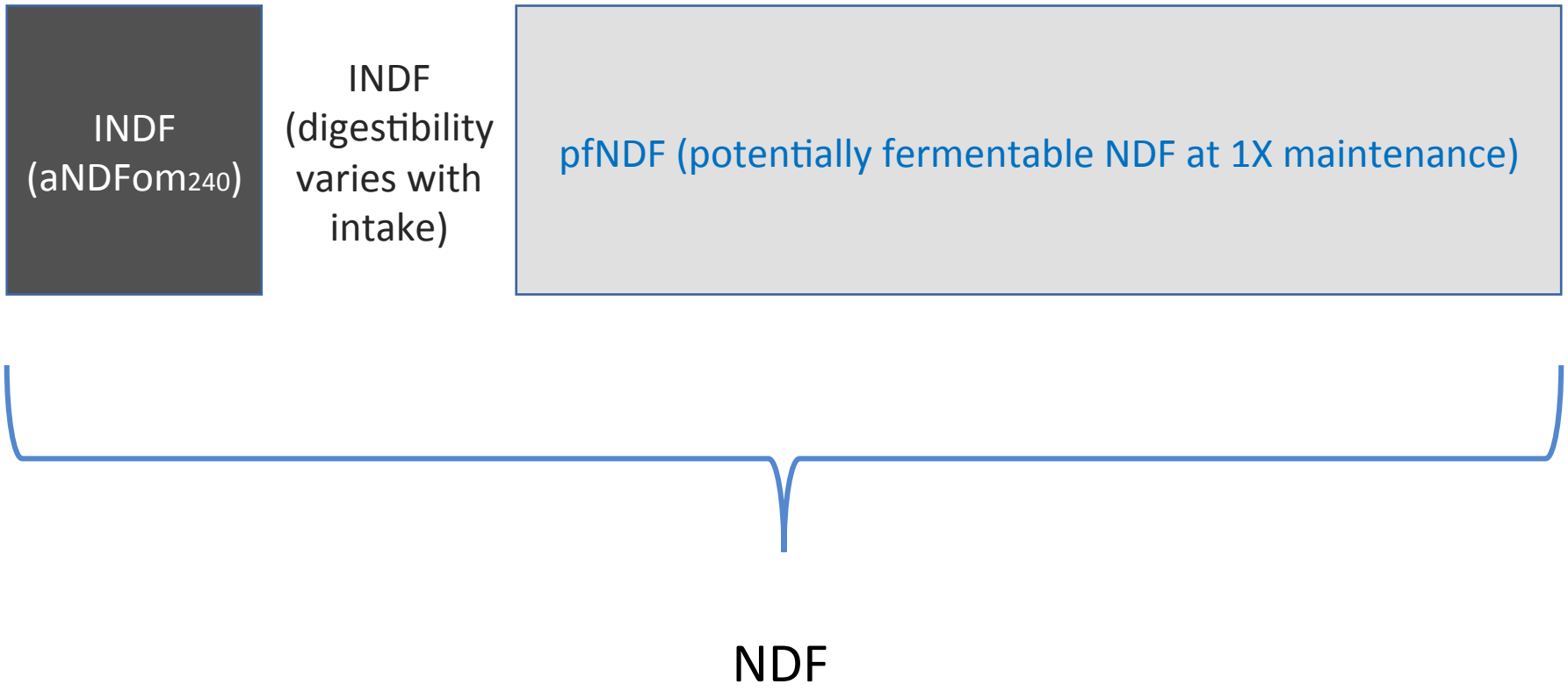
Aseasonal breeding ability

	G	H	I	J	K	
	Diet	Date	Day	Lambing	DIM	Time	Milklbs	
	35	6/5/2017	3	6/2/2017		3 PM	3.00	
2 A	35	6/11/2017	9	6/8/2017		3 PM	2.30	1.
2 A	35	6/11/2017	9	6/8/2017		3 PM	1.50	0.68
2 A	35	6/10/2017	8	6/7/2017		3 PM	3.00	1.36
2 B	40	6/20/2017	18	6/17/2017		3 PM	1.70	0.77
2 B	40	6/14/2017	12	6/11/2017		3 PM	2.00	0.91
2 B	40	6/16/2017	14	6/13/2017		3 PM	2.60	1.18
2 B	40	6/13/2017	11	6/10/2017		3 PM	1.80	0.82
2 B	40	6/22/2017	20	6/19/2017		3 PM	1.10	0.50
2 B	40	6/19/2017	17	6/16/2017		3 PM	1.80	0.82
2 C	30	6/12/2017	10	6/9/2017		3 PM	0.90	0.41
2 C	30	6/9/2017	7	6/6/2017		3 PM	2.50	1.13
2 C	30	6/22/2017	20	6/19/2017		3 PM	0.70	0.32
2 C	30	6/20/2017	18	6/17/2017		3 PM	2.20	1.00
2 C	30	6/19/2017	17	6/16/2017		3 PM	2.30	1.0
C	30	6/15/2017	13	6/12/2017		3 PM	2.90	
	35	6/9/2017	7	6/5/2017		4 PM	3.40	
	35	6/6/2017	4	6/2/2017		4 PM		
	35	6/12/2017	10	6/8/2017		4 PM		
		/2017	10	6/8/2017				

Milk response

Lamb crop

Results

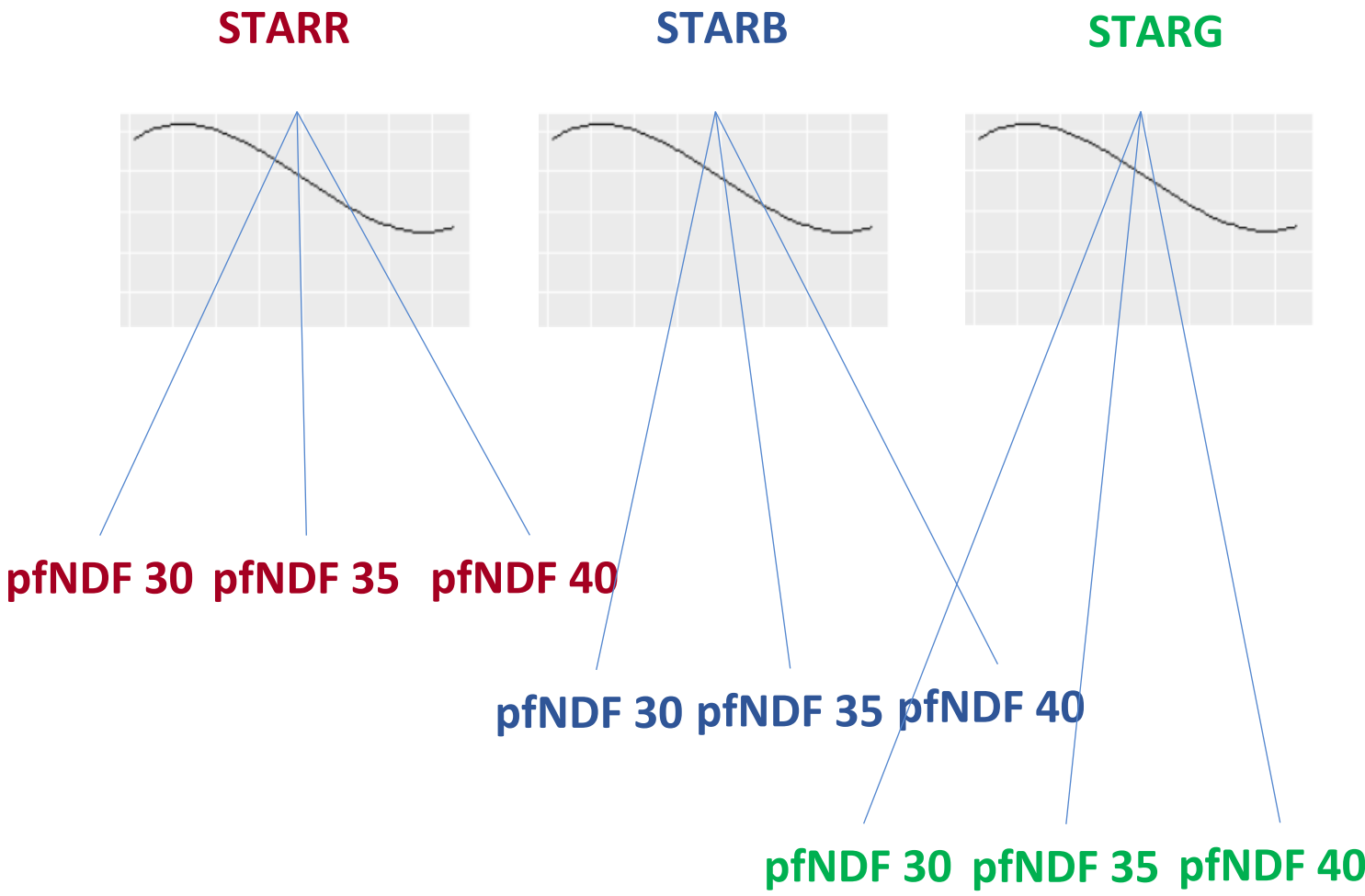


(Schotthofer, Thonney, and Hogue 2007)
(Thonney 2017)

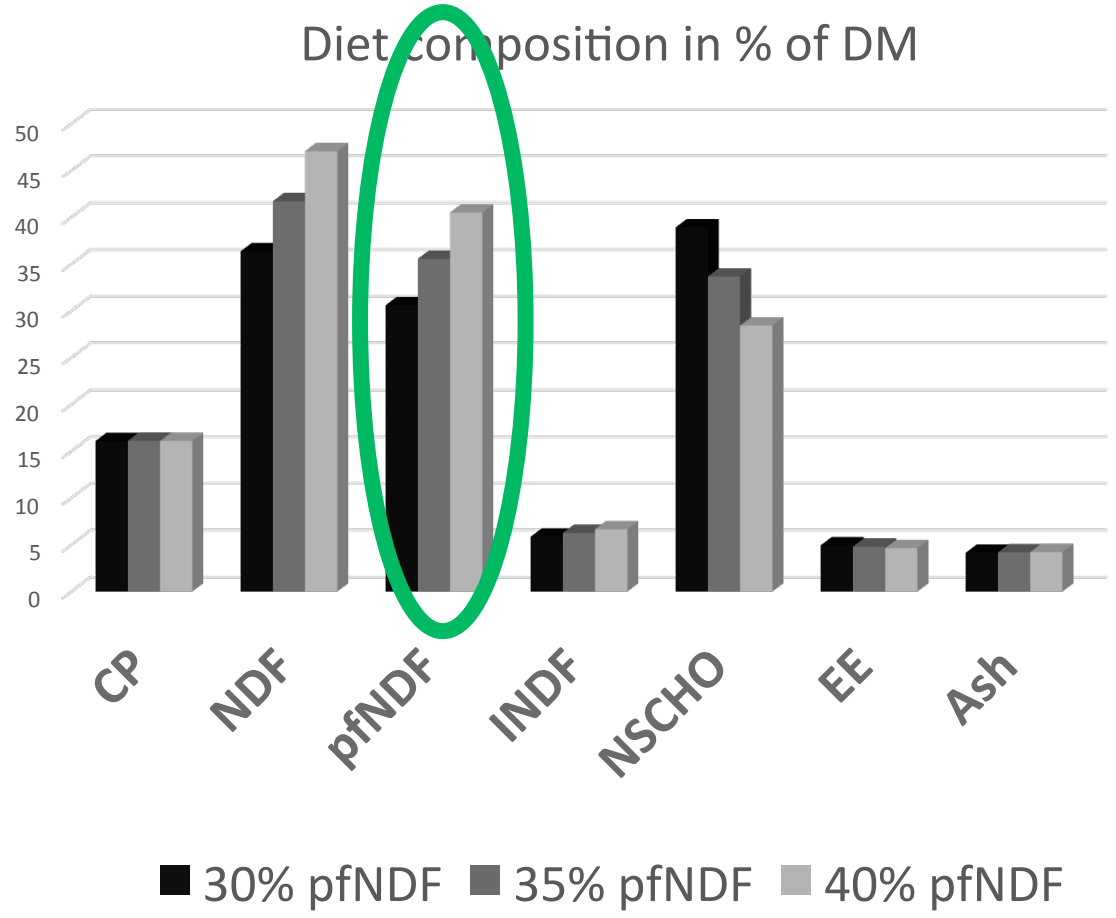
Results

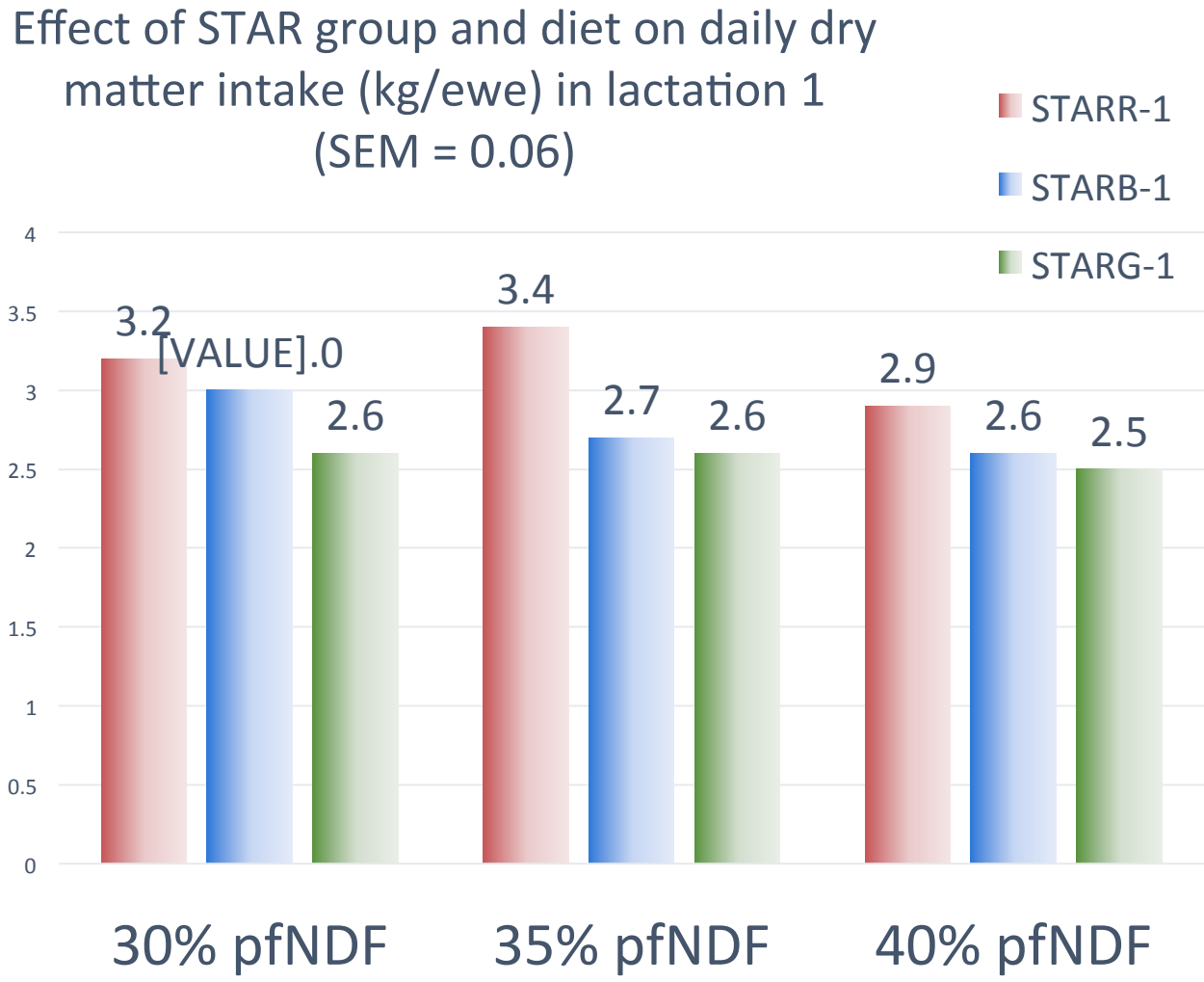
Pelleted diet composition, % of DM

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



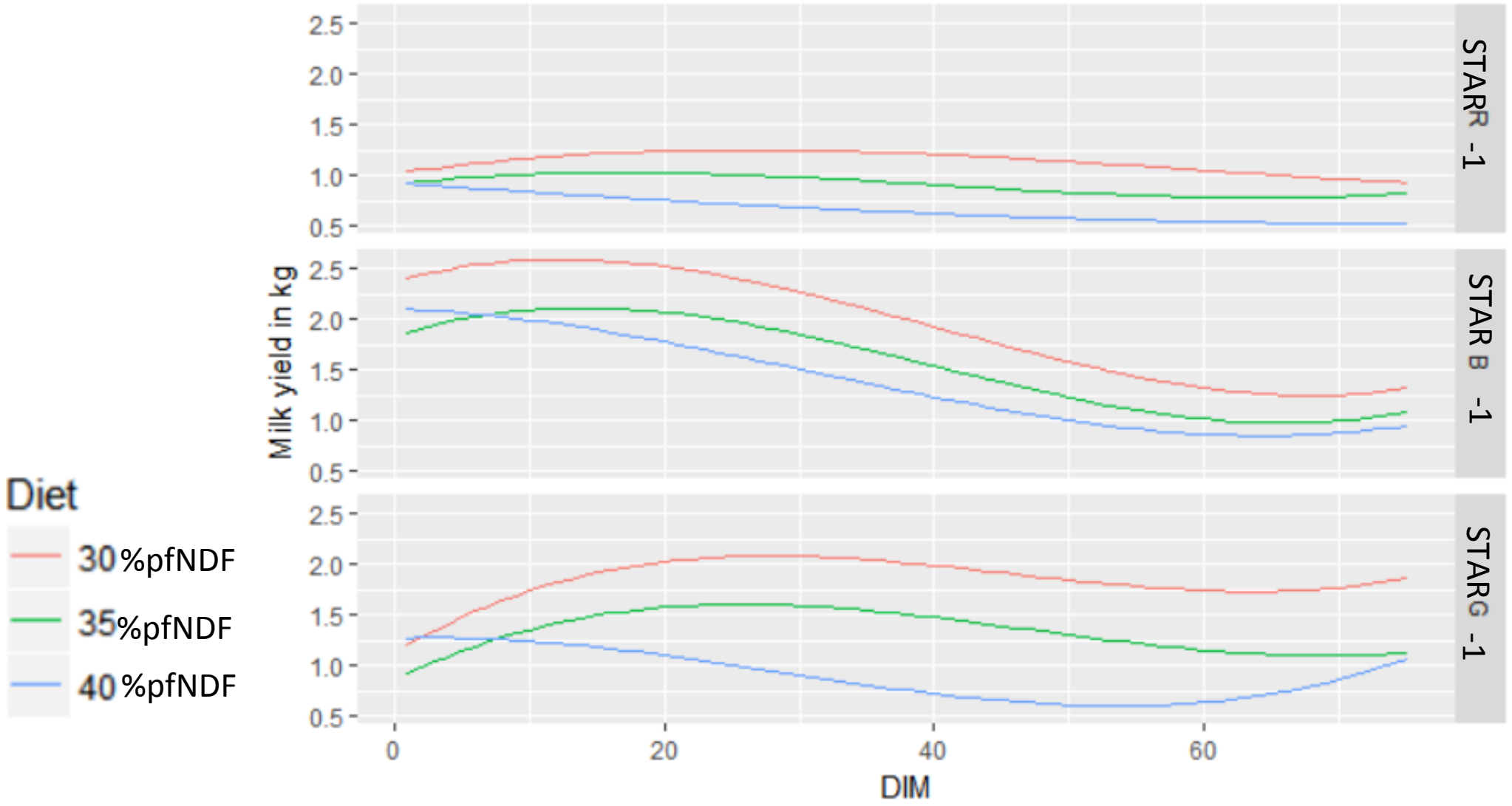
Results


Diet composition in % of DM
50
45
40
35
30
25
20
15
10
5
0
CP
NDF
pfNDF
INDF
NSCHO
EE
Ash
30% pfNDF
35% pfNDF
40% pfNDF

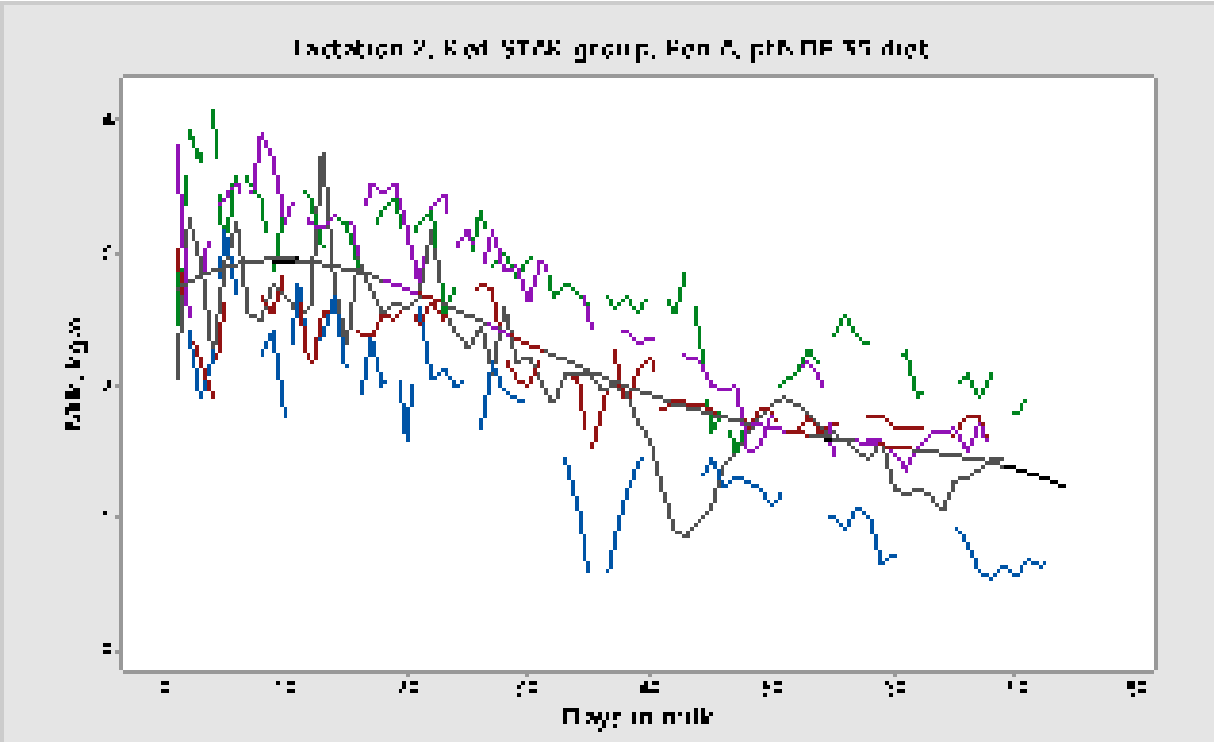

Effect of STAR group and diet on daily dry matter intake (kg/ewe) in lactation 1 (SEM = 0.06)
STARR-1
STARB-1
STARG-1
4
3.5
3
2.5
2
1.5
1
0.5
0
3.2
[VALUE].0
2.6
3.4
2.7
2.6
2.9
2.6
2.5
30% pfNDF
35% pfNDF
40% pfNDF

Results

Effect of STAR group and Diet (P<0.001) on milk yield in lactation 1

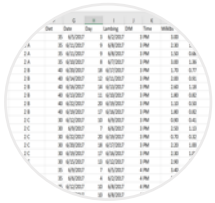


Results

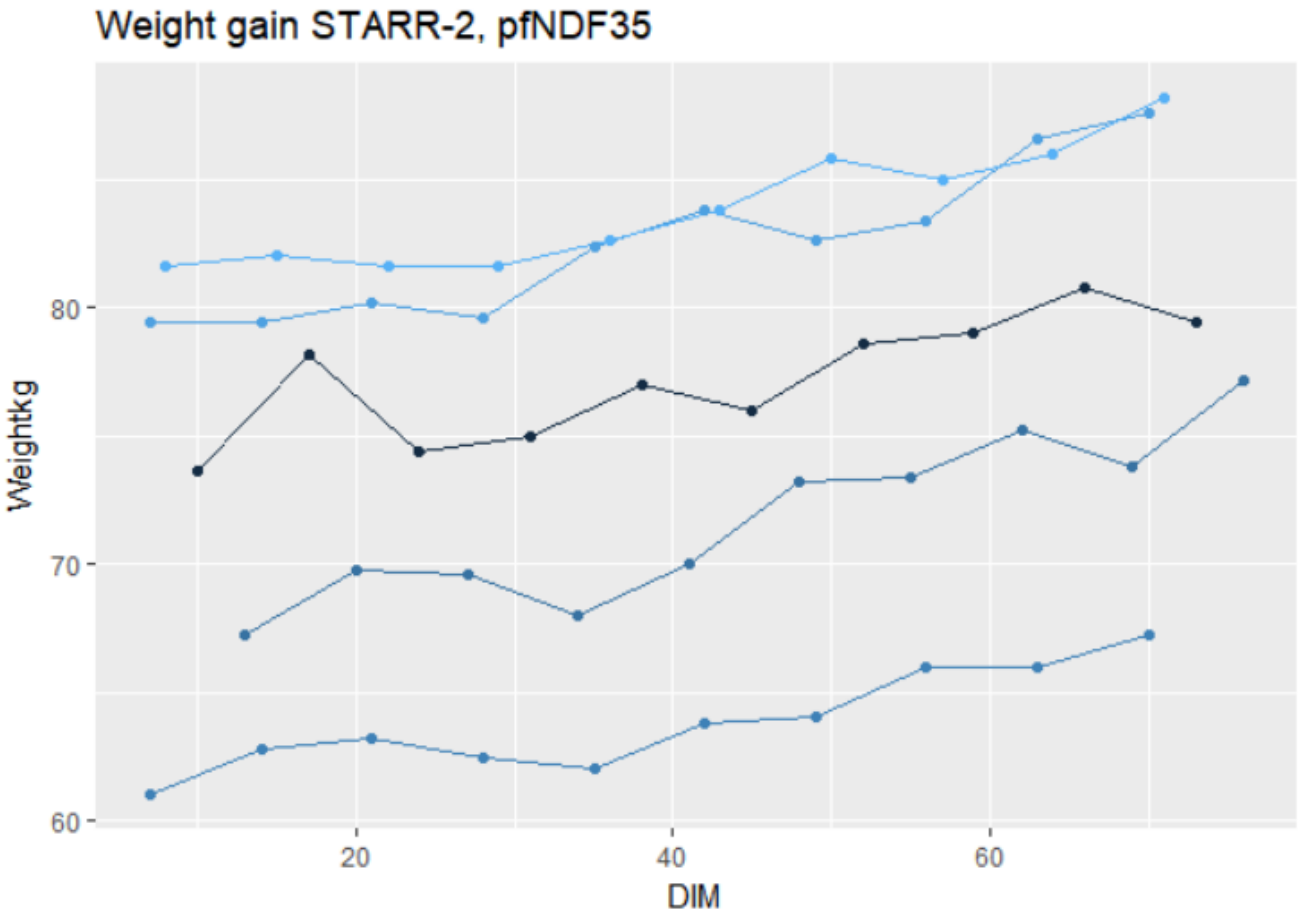


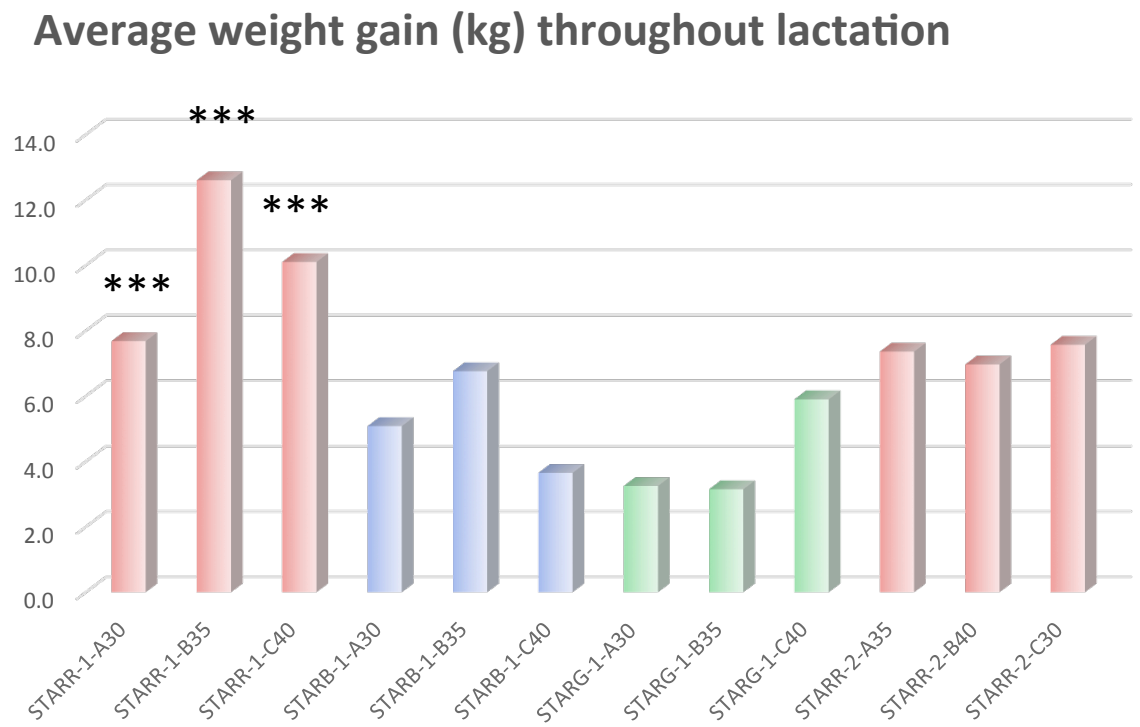
Sheep breeds	Lactation length d/ year	Milk yield kg/year	Literature
East Friesian	189	359	(Thomas, 2014)
Lacaune	180	345	(Thomas, 2014)
Finnsheep x Dorset Diet 30	125	225	Current experiment
Finnsheep x Dorset High 30	115	246	Current experiment

East Frisian: 1.89 kg/day
Finnsheep x Dorset: 2.14 kg/day



Results


Weight gain STARR-2, pfNDF35
Weightkg
80
70
60
20
40
60
DIM


Average weight gain (kg) throughout lactation
***
***
***
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
STARR-1-A30
STARR-1-B35
STARR-1-C40
STARB-1-A30
STARB-1-B35
STARB-1-C40
STARG-1-A30
STARG-1-B35
STARG-1-C40
STARR-2-A35
STARR-2-B40
STARR-2-C30

Results

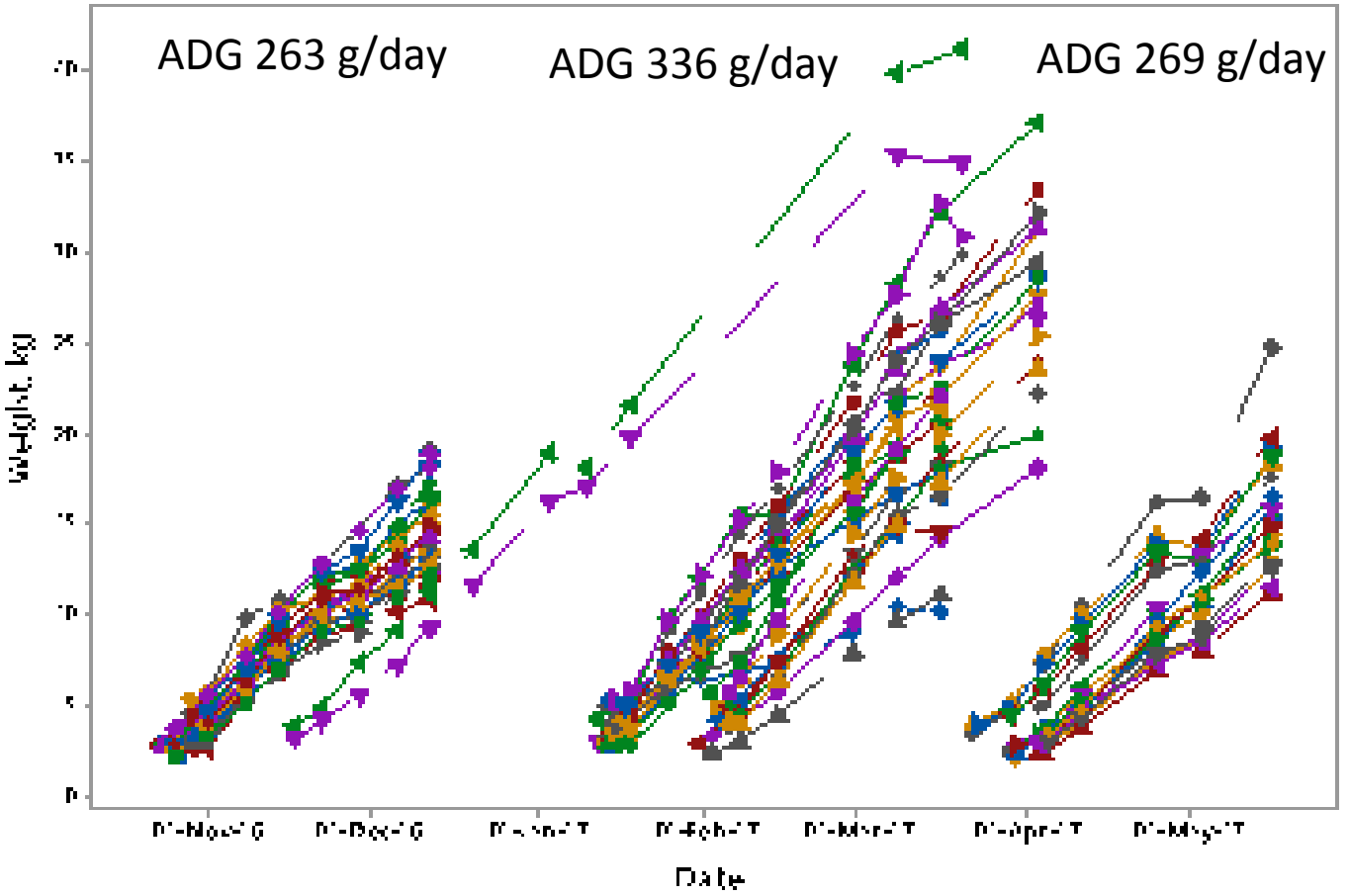
Group and lactation	Ewes	Breeding start	Method	Scanned positive	Lambed	Parturition in first half of lambing period
Red STAR-1	18	6 Jun 2016	Teaser rams, CIDRs	14 (78%)	14	13 (93%)
Blue STAR-1	16	20 Aug 2016	Teaser rams, sponges	16 (100%)	16	11 (69%)
Green STAR-1	16	30 Oct 2016	Teaser rams	12 (75%)	12	11 (92%)
Red STAR-2	18	11 Jan 2017	Natural	17 (94%)	17	13 (76%)
Blue STAR-2	17	25 Mar 2017	Teaser rams, CIDRs in 13	13 (76%)	13	11 (85%)
Green STAR-2	18	6 June 2017	Teaser rams, CIDRs	17 (94%)	Lambing in October	

Results

- Lambs taken away after 12 h
- Colostrum by their dams
- Reared artificially

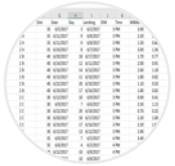
Production data	Sheep
Number of ewes lambing	46
Number of lambings	72
Lambings per ewe/year	1.56
Lambs delivered per ewe lambing/year	3.4
Lambs born alive	145
Stillborn loss	9.5%
Lambs born alive per ewe lambing/year	3.15
Lambs born alive that died	2
Live lamb loss	1.4%

Gain (kg) of lambs born in STARR;B;G-1



Conclusions

- Feed intake increased with increased NSCHO levels
- Minimal levels of pfNDF are required to maintain healthy rumen function, however, production increased with increased NSCHO levels

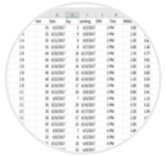


- Proof of concept of sheep dairy production on STAR accelerated lambing system accomplished
- Equal or even higher milk yields possible

- Breeding periods can be limited to 1 cycle
- Breeding during lactation doesn’t compromise breeding ability

Future directions

- Ideal levels of carbohydrates and protein during breeding
- Protein metabolism and protein efficiency
- Carry-over effects, nutritional levels of protein and carbohydrates during breeding seem to have impact on milk production in subsequent lactation



- Ideal body condition for high level production
- Where is the limit?
- How do these diets influence milk quality?

- Ideal dry periods, and ideal in-between-lambing periods, for intensive year-round systems
- Crossbreeding with EF dairy sheep genetics to increase persistency

- How influential are dietary levels of protein and carbohydrates during breeding on lamb crop, weight gains, etc?

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