Proceedings of the

25th Annual

Dairy Sheep Association of North America

Dairy Sheep Symposium

November 7-10, 2019

Idaho Falls, Idaho

Ms. J and Co.™
Innovation • ASSAF • Genetics

Meadowood Farms
Established 1910
meadowoodfarms.com
315.655.0623
Cazenovia, New York

Head Honchos

Premier 1
Premier1Supplies.com

The Scharine Group Inc.

Green Dirt Farm

P&P

Hamby dairy supply

Assaf
SHEEP USA™

- High Milk Production

- Adaptable to all Climates

- High Quality Genetic Semen Imported from Spain

Available from Ms. J and Co.™

Email: mariana@msjandco.com
www.msjandco.com

Proceedings of the

25th Annual

Dairy Sheep Association of North America

Dairy Sheep Symposium

November 7-10, 2019

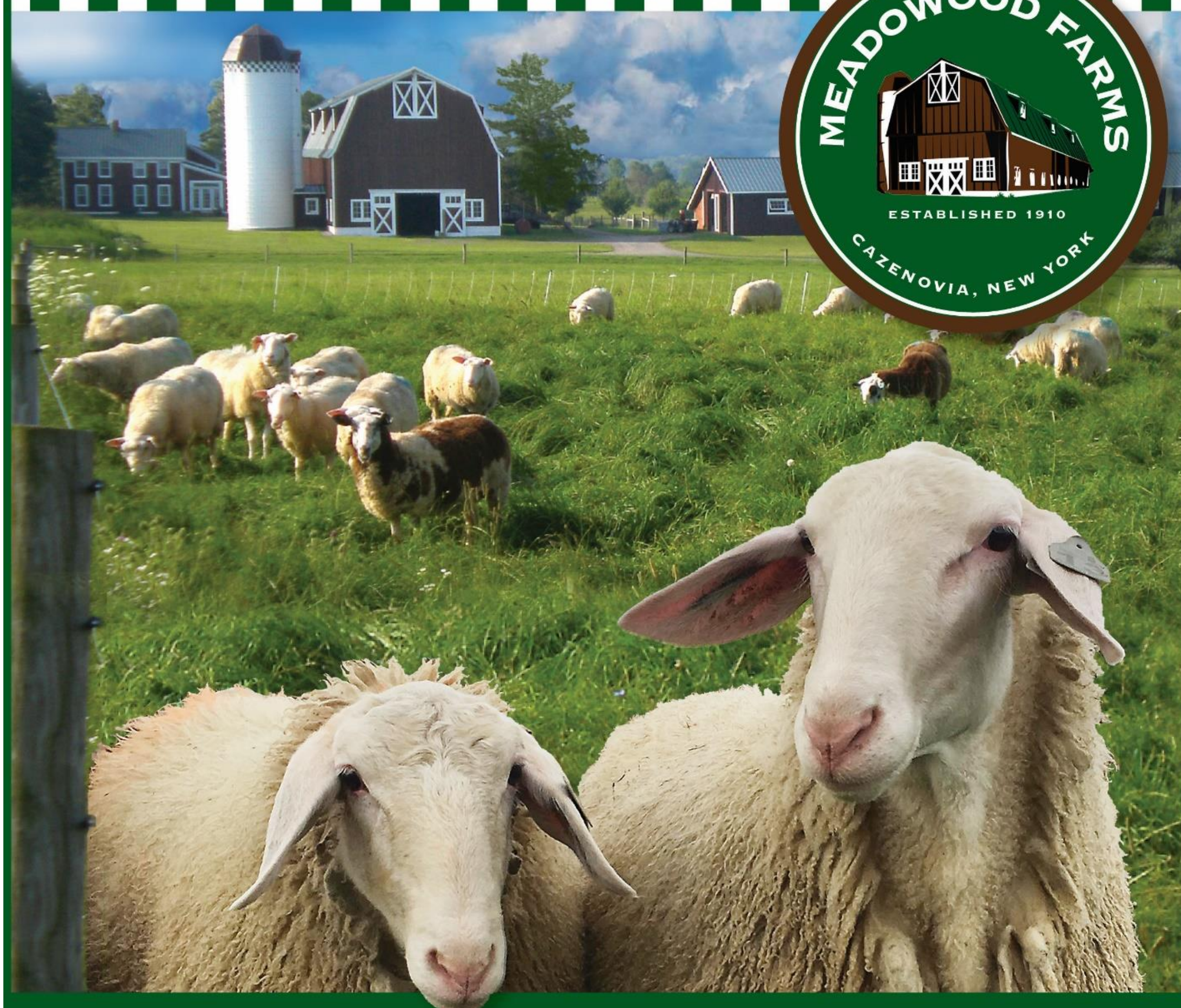
DSANA

Dairy Sheep Association

of North America

MEADOWOOD FARMS

Exceptional Genetics For The Dairy Sheep Industry



ADVANCED SELECTION
FOR MILK PRODUCTION AND UDDER CONFORMATION

AWARD-WINNING CHEESES
STRAWBRIDGE ACS 2019
LEDYARD
RIPPLETON

PROUD STEWARDSHIP
OF A PASTURE-BASED LIVESTOCK ECOSYSTEM

MEADOWOODFARMS.COM 315.655.0623

Table of Contents

The Sponsors who have helped make the 2019 Symposium possible:

Platinum

Ms J & Co
Meadowood Farms

Gold

Head Honchos LLC
Premier1 Supplies

Silver

Green Dirt Farm
The Scharine Group

Bronze

Page & Pedersen
Hamby Dairy Supply

Our 2019 sponsors have been generous in their support of our 2019 Dairy Sheep Symposium, and the Dairy Sheep Association of North America. The Symposium would not be possible without their financial support. Please thank these sponsors as you enquire about their products, equipment, supplies, and services for your dairy sheep farm or sheep-milk processing facility.

Program of Events

Wednesday, November 6, 2018.

6:00 - 8:00 pm. DSANA Board Meeting

8:00 pm - 9:30 pm. **Open Session Q&A for Production Improvement Program**: Understanding the EBV results, how to enroll, how to participate. Laurel Kieffer, PIP Project Manager. In the Hilton Garden Hotel Lobby.

Thursday, November 8, 2018

8:30 – 8:45. Attendee introductions.

Morning session sponsored by Ms. J and Co.

9:15 – 10:00. **PIP User Panel.** *Producers enrolled in the Production Improvement Program show how they are making use of the EBVs from their flocks' production and component data.* Producer Panel discussion with Rebecca King, Garden Variety Cheese, CA; Eliza Spertus, Green Dirt Farm, MO; Quincy Wool Parker, Meadowood Farms, NY.

10:00 – 10:45. **Analyzing sheep milk for components and SCC at Rocky Mountain DHI.** *Virtual tour of RMDHI lab; what you can learn from testing.* Chris Tucker, Rocky Mtn DHIA, Logan, Utah

10:45 - 11:00 Networking break

11:00 - 12:15 **Climate-resilient agriculture.** *Agricultural adaptation to climate change.* Dr Joshua Faulkner, Center for Sustainable Agriculture, University of Vermont Extension.

12:15 - 1:45. Lunch, Genetic Improvement Committee meeting

Afternoon session sponsored by Meadowood Farms

2:00 - 2:30. **Production of F1 Lacaune-semen-sired yearling daughters.** *Analysis of Lacaune-semen-sired vs domestic-ram-sired yearling ewes.* Laurel Keiffer, PIP Project Manager; and Tom Clark, DSANA Genetic Improvement Committee Chair.

2:30 - 3:30. **Metabolic and nutritional needs of high-producing dairy animals**. Butch Cargile, DVM, Progressive Dairy Solutions.

3:30 - 3:45 – Networking break

3:45 - 4:45. **Tools to monitor flock nutritional status and udder health**. Lynn Van Wieringen DVM, and Fred Mueller DVM, AgHealth Labs

4:45 - 5:30. **Bottling sheep milk for consumer purchase.** Producer Panel discussion with Jim Ashmore, Sheep Mountain Creamery, MT; Bill Simmerman, Misty Meadow Farm, NJ; Debbie Webster, Whispering Pines Farm, SC.

6:30 – Cheese and Wine Reception

Friday, November 8, 2019

Morning session sponsored by Premier 1 Supplies

8:45 - 10:00 – Using the H2-A program for seasonal sheep dairy farm workers. *One farm's experience in its first year with H-2A employees.* Bee Tolman, Meadowood Farms, NY. *An overview of the H-2A program.* Todd Miller, Head Honchos, LLC, Helotes, TX.

10:00 – 10:15 Networking break

10:15 - 11:15. Forages and Flavor: the influence of pasture species on cheese flavor profiles. Tom Pyne, Twenty Paces Farm & Creamery, VA

11:15 – 12:00. Comparing European vs Domestic Sheep-milk cheeses: A cheesemonger's perspective. Greg Hessel, Cowbell Cheesemonger; and Dorota Siejek-Hendershot, Boise Co-op

12:00 - 1:30. Lunch. DSANA AGM, Attendee Brainstorming Session.

Afternoon session sponsored by Head Honchos LLC

1:45 – 2:30. Setting prices for artisan sheep-milk cheeses. Panel discussion with Alissa Shethar, Fairy Tale Farm, VT; Lynn Swanson, Glendale Shepherd, WA; Brad Gregory, Black Sheep Creamery, WA.

2:30- 3:15. Positioning and pricing of domestically-produced sheep-milk cheeses. A cheesemonger's perspective. Greg Hessel, Cowbell Cheesemonger; and Dorota Siejek-Hendershot, Boise Co-op

3:15 – 3:30. Networking break

3:30 - 4:45. The relationship between sheep-milk buyers and their supplying producers. *Milk quality standards and supplier agreements.* Marie-Chantal Houde, Fromagerie Nouvelle France, QC; Sarah Hoffmann, Green Dirt Farm, MO.

4:45 - 5:15. Starting a new sheep dairy in Southern Idaho. *A slideshow tour.* Butch Cargile, Shepherd's Creek Dairy, ID

7:00pm – Banquet. Awards. Entertainment: Terry and Amber Rekow, Cowboy Poets

Saturday, November 9, 2019. 9:00 - 5:00. Tour and lunch at Lark's Meadow Farms in Rexburg, ID. Bus leaves hotel at 9:00 sharp. Bagged lunch provided.

Discussion of the adapted 12-hr-suckling system *for rearing lambs to 30 days, while milking the ewes 2x/d*. Kendall Russell, Lark's Meadow Farms, ID; and Quincy Wool Parker, Meadowood Farms, NY.

Sunday, November 10, 2019. – Cheese-making workshop *at Lark's Meadow Farms, Rexburg, ID*. Cheese types, coagulation of milk, rennet types, cheese culture selection, the importance of understanding pH and three no-fail cheese recipes.

2019 Dairy Sheep Symposium Organizing Committee

Terry Felda, Tin Willows Farm, OR
Sarah Hoffmann, Green Dirt Farm, MO
Nancy Clark, Old Chatham Farm, NY
Mary Rose Livingston, Northland Farm, NY
Kendall Russell, Lark's Meadow Farms, ID
Debbie Webster, Whispering Pines Farm, SC
Carrie Abels, Willow Pond Sheep Farm, NY
Bee Tolman, Meadowood Farms, NY

Proceedings Editing and Compilation

Bee Tolman, Meadowood Farms, NY

Photographs on the Cover

Provided by Lark's Meadow Farms, Rexburg, ID

Celebrating 25 YEARS of getting dairy sheep information out to the North American dairy sheep industry!

DSANA

Dairy Sheep Association of North America

Page & Pedersen International, Ltd.

P&P

Using DSANA's Production Improvement Program (PIP & EBVs) at Green Dirt Farm

Green Dirt Farm, Weston, MO
Eliza Spertus

Overview of Green Dirt Farm

GDF is a 150-acre dairy in Weston, MO. Our dairy is pasture based. Our sheep spend all of their time outdoors on pasture; in fact, we are just this year building a barn for sheep housing. We had 80 ewes on the milk line in 2019, and we are working on increasing our numbers to milking 150 ewes year-round.

Our sheep are predominantly East Friesian and Lacaune crosses. We had several AI (Lacaune) lambs born in 2018, but they were not milked this year. They will be on the line next year in addition to some daughters of AI ram lambs.

Our milk is used for cheesemaking by the Green Dirt Farm cheese kitchen.

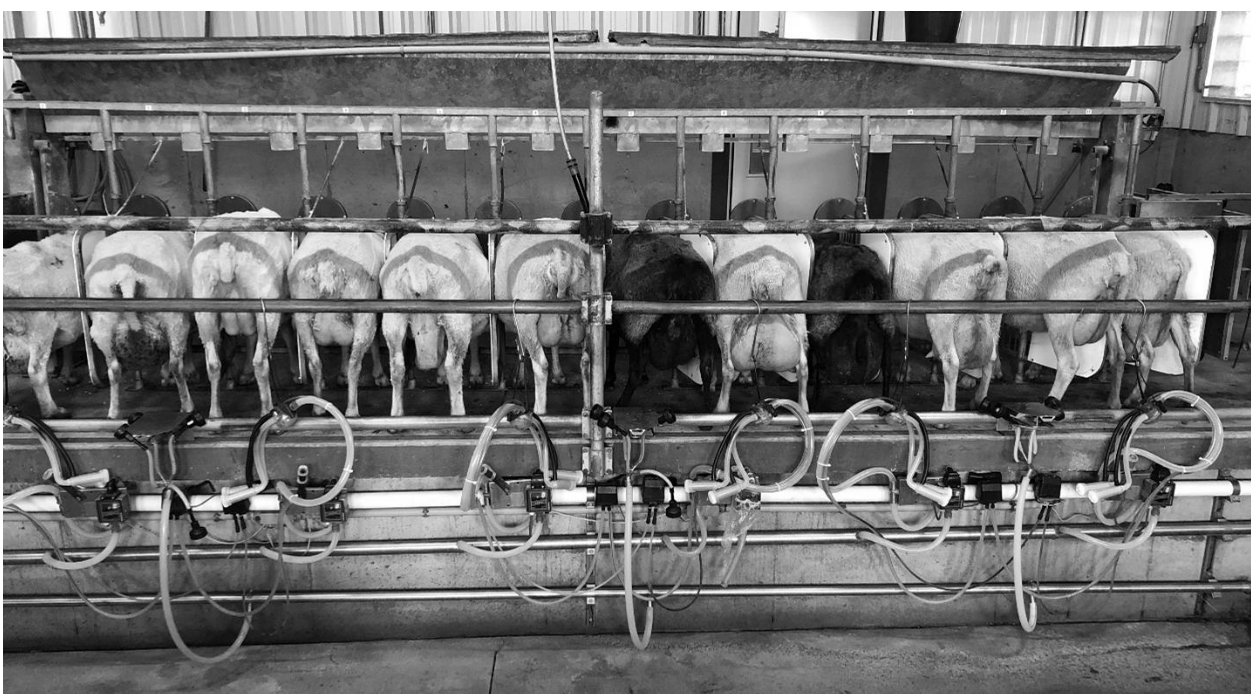
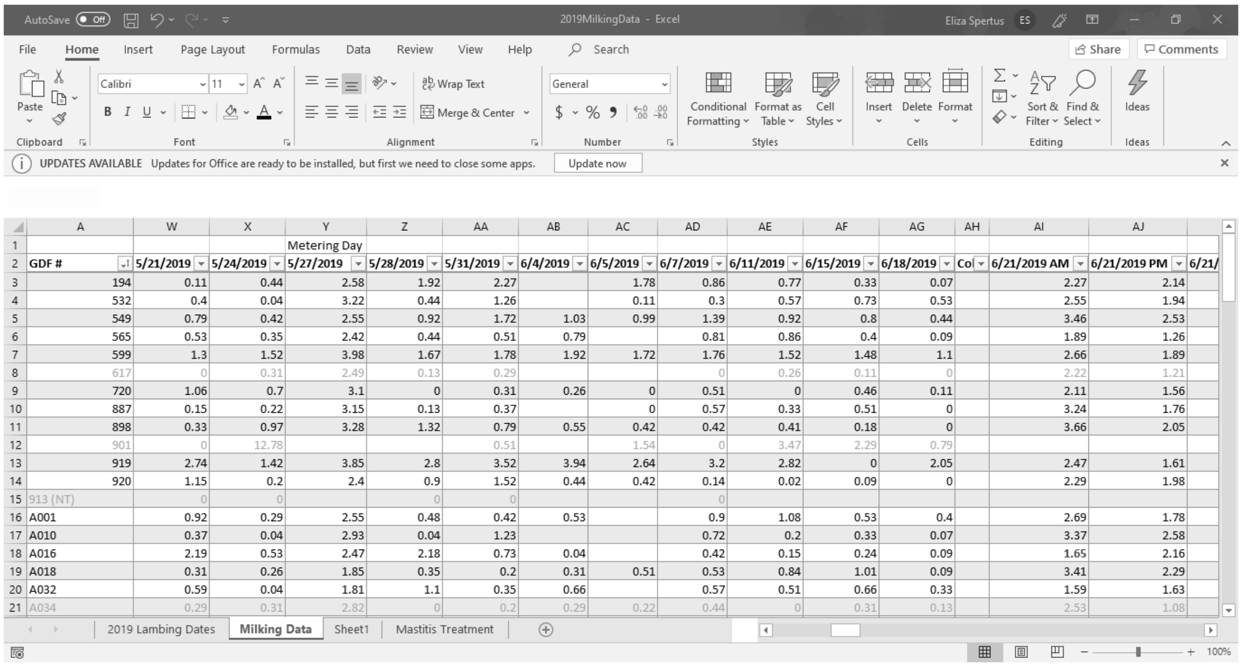


Figure 1: 2019 GDF milk line with ewes directly prior to lambing. You can see the in-line milk meters.

Previous recording system:

At GDF, we have in line milk meters which makes collecting milk weights very easy and, as a result, we have been doing so since we began milking; however, those weights were rarely used. When I first took over and started working on flock improvement, we collected milk weights and I compiled them into an excel spreadsheet. We did not have any component data at this point. I didn't really use milk production to rank my ewes and focused instead on other measures.



	A	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1				Metering Day											
2	GDF #	5/21/2019	5/24/2019	5/27/2019	5/28/2019	5/31/2019	6/4/2019	6/5/2019	6/7/2019	6/11/2019	6/15/2019	6/18/2019	Co	6/21/2019 AM	6/21/2019 PM
3	194	0.11	0.44	2.58	1.92	2.27		1.78	0.86	0.77	0.33	0.07		2.27	2.14
4	532	0.4	0.04	3.22	0.44	1.26		0.11	0.3	0.57	0.73	0.53		2.55	1.94
5	549	0.79	0.42	2.55	0.92	1.72	1.03	0.99	1.39	0.92	0.8	0.44		3.46	2.53
6	565	0.53	0.35	2.42	0.44	0.51	0.79		0.81	0.86	0.4	0.09		1.89	1.26
7	599	1.3	1.52	3.98	1.67	1.78	1.92	1.72	1.76	1.52	1.48	1.1		2.66	1.89
8	617	0	0.31	2.49	0.13	0.29			0	0.26	0.11	0		2.22	1.21
9	720	1.06	0.7	3.1	0	0.31	0.26	0	0.51	0	0.46	0.11		2.11	1.56
10	887	0.15	0.22	3.15	0.13	0.37		0	0.57	0.33	0.51	0		3.24	1.76
11	898	0.33	0.97	3.28	1.32	0.79	0.55	0.42	0.42	0.41	0.18	0		3.66	2.05
12	901	0	12.78			0.51		1.54	0	3.47	2.29	0.79			
13	919	2.74	1.42	3.85	2.8	3.52	3.94	2.64	3.2	2.82	0	2.05		2.47	1.61
14	920	1.15	0.2	2.4	0.9	1.52	0.44	0.42	0.14	0.02	0.09	0		2.29	1.98
15	913 (NT)	0	0		0	0			0						
16	A001	0.92	0.29	2.55	0.48	0.42	0.53		0.9	1.08	0.53	0.4		2.69	1.78
17	A010	0.37	0.04	2.93	0.04	1.23			0.72	0.2	0.33	0.07		3.37	2.58
18	A016	2.19	0.53	2.47	2.18	0.73	0.04		0.42	0.15	0.24	0.09		1.65	2.16
19	A018	0.31	0.26	1.85	0.35	0.2	0.31	0.51	0.53	0.84	1.01	0.09		3.41	2.29
20	A032	0.59	0.04	1.81	1.1	0.35	0.66		0.57	0.51	0.66	0.33		1.59	1.63
21	A034	0.29	0.31	2.82	0	0.2	0.29	0.22	0.44	0	0.31	0.13		2.53	1.08

Figure 2: A screenshot of my milk weight spreadsheet. This one is from this year; I continue to use these spreadsheets to record twice weekly milk weights.

Weaknesses of this system:

Recording milk weights alone is useful, but it can't tell you a ewe's full performance. When you have protein, fat and especially SCC data you can make a more balanced judgement of your ewes. As an example, some ewes may produce a lot of milk, but their udder conformation might not be great, and as a result they might be more highly susceptible to high SCC numbers. When you have the SCC numbers from throughout the year, you can see that clearly.

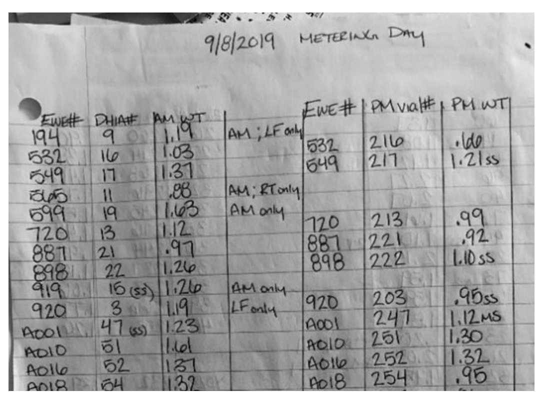
How do you measure individual milk production and/or components for the PIP?

Our milking system at GDF is from DeLaval and we have in line flow-through milk meters with samplers that attach to the meters. The samplers in our system have to be put on and removed after each milking as they do not clean with the CIP but our meters stay in place. You can see a clear picture of the meters alone in Figure 1.

Figure 3: This is one of our DeLaval samplers. The sampler connects directly to the milk meter.

We/I milk out each ewe and record the weight from the meter and then collect the sample from the sampler jar and put it into the containers sent by RMDHIA. This process is pretty simple, but it is time consuming. Personally, I prefer to do it myself as it limits the possibility of mistakes being made. On our system, if you restart a milk meter you lose the milk weight, so doing it by myself really limits the likelihood that this will happen.

One thing to note: Be conscious about how you record the numbers. Because we take milk weights more regularly than just when we sample, I have a system in place for recording weights. When we sample, I continue to follow my existing system, but add in the sampling, the only thing that makes this difficult is ewe identification (another reason why I prefer to do this myself). Our sheep have 2 different numbers that come into play during sampling, RMDHIA only wants a ewe's DHIA #, this number cannot have any letters. So our girls are given a number based on when they come onto the milk line (when we started the PIP program we made our oldest ewe by age #1 and we are now on #96). This number doesn't correlate with their ear tag # which has a letter in front to indicate the year they were born (A=2016, B=2017, C=2018, D=2019). I always have a sheet with me going into sampling day with all the ewe's numbers, so that I can ensure that I mark the correct sheep with the correct sample.



9/8/2019 METERING DAY

EWE#	DHIA#	AM WT		EWE#	PM vial#	PM WT
194	9	1.19	AM; LF only			
532	16	1.03		532	216	.66
549	17	1.37		549	217	1.21ss
565	11	.88	AM; RT only			
599	19	1.63	AM only			
720	13	1.12		720	213	.99
887	21	.97		887	221	.92
898	22	1.26		898	222	1.10ss
919	15 (ss)	1.26	AM only			
920	3	1.19	LF only	920	203	.95ss
A001	47 (ss)	1.23		A001	247	1.12MS
A010	51	1.61		A010	251	1.30
A016	52	1.37		A016	252	1.32
A018	54	1.32		A018	254	.95

Figure 4: This is what one of my recording sheet's looks like on metering day.

Difficulties or shortcomings of PIP?

One issue that I struggled with this year came from my own system. I had issues this year with my milk samplers that caused some problems for me. I would suggest knowing how your samplers work, and ideally seeing someone else use them if you can. Sadly, my main issues are design related and DeLaval isn't the most helpful when it comes to small ruminants.

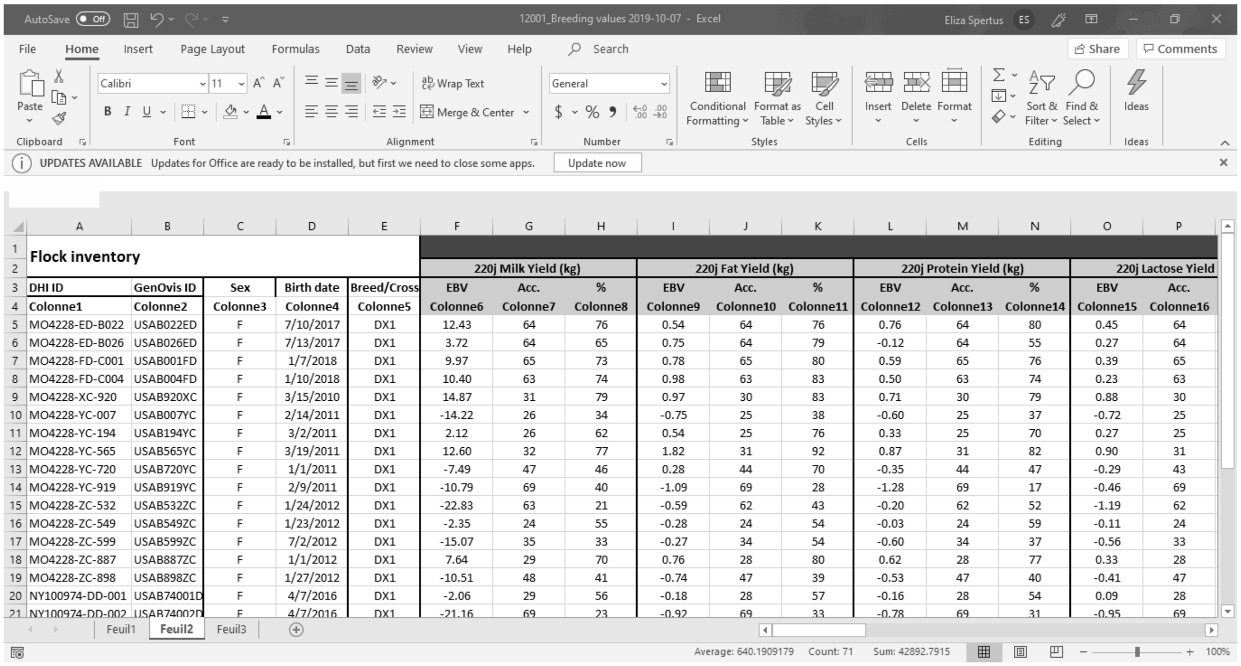
The bigger issue that I've had was time. It takes a lot of time to enter data and I had a feeling that entering all of my milking data into the proper format so it can get to Genovis would take a huge amount of time and as a result I put off sending in my data. The truth is I was able to send out my data in one day for all 6 meterings I did this year. It took me 6 hours to do, but that's because I waited and did it all in one day. In the future, I intend to spend the hour it will take me to enter the data the day I get it back. Especially since I know it will make my life easier and it will help the folks at Genovis to have my data sooner and not all at once. The other big data set we have to send off is animal enrollment data. As I get more accustomed to sending in this data, this process has gone a lot faster, and I think it will continue to get faster.

The other thing is we, as American producers, do have access to Genovis' online database. Dairy sheep producers can't get EBV's through the online system, but I believe having access to the database will help us ensure our flock information is correct and will help dispose of and add sheep more efficiently. I intend to use this moving forward.

Use of EBV results

My 2018 data was a bit wonky, so this is actually the first year that I really used my EBV results. It's been an interesting process getting a handle on how to use them. I am using them this year as an additional data point for my culling and breeding decisions. I use it in conjunction with what I know about a ewe's overall performance, health, udder conformation, lambing ability, and behavior to help me make decisions. I have been surprised at times to see the difference in my own thoughts about an animal and what the EBVs say. I have used it to help balance my totally subjective thoughts on certain animals.

One of the biggest benefits of this program is the fact that participating in the PIP program requires you to have really good record keeping, which in turn supports a good breeding and improvement program.



Flock inventory					220j Milk Yield (kg)			220j Fat Yield (kg)			220j Protein Yield (kg)			220j Lactose Yield	
DHI ID	GenOvis ID	Sex	Birth date	Breed/Cross	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.
Colonne1	Colonne2	Colonne3	Colonne4	Colonne5	Colonne6	Colonne7	Colonne8	Colonne9	Colonne10	Colonne11	Colonne12	Colonne13	Colonne14	Colonne15	Colonne16
MO4228-ED-B022	USAB022ED	F	7/10/2017	DX1	12.43	64	76	0.54	64	76	0.76	64	80	0.45	64
MO4228-ED-B026	USAB026ED	F	7/13/2017	DX1	3.72	64	65	0.75	64	79	-0.12	64	55	0.27	64
MO4228-FD-C001	USAB001FD	F	1/7/2018	DX1	9.97	65	73	0.78	65	80	0.59	65	76	0.39	65
MO4228-FD-C004	USAB004FD	F	1/10/2018	DX1	10.40	63	74	0.98	63	83	0.50	63	74	0.23	63
MO4228-XC-920	USAB920XC	F	3/15/2010	DX1	14.87	31	79	0.97	30	83	0.71	30	79	0.88	30
MO4228-YC-007	USAB007YC	F	2/14/2011	DX1	-14.22	26	34	-0.75	25	38	-0.60	25	37	-0.72	25
MO4228-YC-194	USAB194YC	F	3/2/2011	DX1	2.12	26	62	0.54	25	76	0.33	25	70	0.27	25
MO4228-YC-565	USAB565YC	F	3/19/2011	DX1	12.60	32	77	1.82	31	92	0.87	31	82	0.90	31
MO4228-YC-720	USAB720YC	F	1/1/2011	DX1	-7.49	47	46	0.28	44	70	-0.35	44	47	-0.29	43
MO4228-YC-919	USAB919YC	F	2/9/2011	DX1	-10.79	69	40	-1.09	69	28	-1.28	69	17	-0.46	69
MO4228-ZC-532	USAB532ZC	F	1/24/2012	DX1	-22.83	63	21	-0.59	62	43	-0.20	62	52	-1.19	62
MO4228-ZC-549	USAB549ZC	F	1/23/2012	DX1	-2.35	24	55	-0.28	24	54	-0.03	24	59	-0.11	24
MO4228-ZC-599	USAB599ZC	F	7/2/2012	DX1	-15.07	35	33	-0.27	34	54	-0.60	34	37	-0.56	33
MO4228-ZC-887	USAB887ZC	F	1/1/2012	DX1	7.64	29	70	0.76	28	80	0.62	28	77	0.33	28
MO4228-ZC-898	USAB898ZC	F	1/27/2012	DX1	-10.51	48	41	-0.74	47	39	-0.53	47	40	-0.41	47
NY100974-DD-001	USAB74001D	F	4/7/2016	DX1	-2.06	29	56	-0.18	28	57	-0.16	28	54	0.09	28
NY100974-DD-002	USAB74002D	F	4/7/2016	DX1	-21.16	69	23	-0.92	69	33	-0.78	69	31	-0.95	69

Figure 5: A screenshot of some EBVs from the GDF ewes.

<u>Future Use</u>

I am really excited about the EBV's and Genovis program moving forward. 2018 was a strange year for us, and while I participated in the program and in fact sampled 5 times that year my data is very unreliable. Due in part to drought, in part to how lambs were raised and in part to the way we chose to milk. As a result, I am focusing on this year as my starting point for the program. And I am really looking forward to comparing the next few years and making sure I am making improvements in my flock the way I'd like to.

Overall, I think this program is going to be super useful for making decisions about the quality of certain animals, and how those animals' traits are passed down. I am looking forward to continuing to use this program and to be able to track this information in a solid, data driven way.

If you have any questions about this presentation or about how Green Dirt Farm has used the PIP and EBVs, please send me an email at eliza@greendirtfarm.com.

Eliza Spertus
Farm Manager, Green Dirt Farm
eliza@greendirtfarm.com
816-204-7234

GREEN DIRT FARM®

Using EBVs for Our Breeding, Selection, and Culling Decisions

Meadowood Farms, Cazenovia NY
Quincy Wool Parker

In early August we make breeding decisions for the fall, because any ewes that are going to be AI'd have to be kept as a separate management group starting 30 days before AI breeding.

We breed 150 ewes, and aim to milk 140 through the season. We plan to keep ~ 40-60 replacement ewe lambs every year. Thus:

- 85 total mature ewes and ewe lambs bred to produce replacements via AI & clean-up dairy ram.
- 65 total mature ewes and ewe lambs bred to terminal sires (Dorper & Tunis, respectively).
- Sell ~ 50 excess ewes. We have selected and culled stringently for the last few years, and our per-ewe milk production has reflected that. Also, in 2019 we milked our first F1 daughters from the imported Lacaune semen, and we are now seeing another huge jump in production. As a result, ewes or yearlings that we would have retained a year or two ago have moved into the surplus category.

We have 3 main "buckets" that we need to assign ewes to:

1. Breed AI and clean-up with dairy ram – should be our highest-genetic value ewes, from whom we want replacement daughters, and some replacement ram lambs
2. Breed to terminal sire – solid ewes that we want to milk, and who may move to the AI bucket next year, but from whom we don't need/want replacement daughters
3. Sell as excess breedable ewes – solid ewes who have been genetically surpassed by others

(4^{th} bucket) – cull ewes whose production or udder conformation make her unfit for milking

We meter ewes every two weeks until all ewes are through their first 60 days in milk, after which we meter 1x/mo. We take individual milk samples 1x/mo, for five months of the lactation season. Samples are sent to Rocky Mountain DHI for analysis of components.

We have recorded our flock's milk weights in our own Excel sheet since 1999 (we bought Waikato meters in 1998, and have used the same 12 meters ever since).

What a process!

The 140 ewes that we milked through to August 1st ranged in production from 185 lb produced to 1,466 lb produced.

Below in Table 1, as an example, is a segment from our own Excel spreadsheet for the 2019 milking season to August 1st. The show the three ewes that produced at the absolute middle of the 140 ewes.

We have condensed the table, but for each you can see:

- Lambing date
- Lb/d milked at each metering date
- Mtr sum to 8/1 – total milk collected to August 1st
- Add'l prod'n if suckling – we added 100 lbs to her production if she raised twins for the 1st 30 days (in this case, 1345 suckled twins)
- Mtr sum to 8/1 w age – total productin to August 1st, adjusted for the ewe's age. We used U of Wisc's age factor to equalize production of young ewes and mature ewes
- DIM at Aug 1 – how many days they had been producing at August 1
- Avg lb/DIM
- Avg lb/DIM w age factor – average lb milk produced per day, adjusted by ewe's age

Table 1.

Ewe#	Lamb'g Dt	2/18	3/5	3/18	4/1	4/16	5/2	5/16	5/30	6/21	7/9	7/30	Mtr sum to 8/1	Add'l prod'n if suckling	Mtr sum w suckling	Mtr sum to 8/1w age	DIM at Aug 1	Avg lb/DIM	Avg lb/DIM w age fact
1205	3-Feb	5.6	5.5	4.2	3.7	3.7	3.4	3.1	4.4	3.1	3.1	2.9	695	0	695	695	178	3.9	3.9
1345	8-Apr					3.1	4.2	8.8	8.4	6.6	6.6	5.1	700	100	800	800	114	6.2	6.2
1883	3-Apr					6.4	6.6	6.4	6.6	5.5	5.3	4.6	702	0	702	1,011	119	5.9	8.6

Selection decisions clearly have to take into account:

- Total production
- Lambing date (Days in Milk, DIM)
- Suckling lambs – some ewes suckled twins from D1 – D30 on the 12-hr suckling system
- Age – ranged from yearlings to 7-yr-olds
- Persistency – some were still powering on, some were slowing down

What we have used to help compare apples to apples is the summary number:

- Average lb/DIM, adjusted for age ("*Avg lb/DIM w age factor*" on the table)

But we also have to take into account:

- Production history of their dams, their sisters, their daughters – each over multiple years
- Udder conformation (and udder conformation of their dams, daughters, sisters)

It's a dizzying process.

Using EBVs in 2019

This year we had EBVs to help us. They are the results of submitting production data (from metering) and component analysis data (from individual milk samples analyzed by RMDHI) to Genovis in Quebec.

We really are only starting to understand the numbers we are getting, but this is what we think we know:

Parity 2 – the ewe's predicted mature performance. These numbers are based on her own performance data, the performance data of all of her female relatives and her flockmates, Genovis' understanding of typical milk production curves in dairy ewes, and the genetic links between different performance traits.

EBV – the estimate of a ewe's direct genetic effect on a trait such as milk yield or fat %.

Acc. – the accuracy or reliability of the EBV. Higher is better. Accuracy improves with more data from the ewe, from her relatives, and from other similarly managed animals.

% -- where this ewe places on a 0-100 scale, as her ranking amongst all dairy ewes in the Genovis system.

We are paying most attention to 220-day milk yield, but also starting to watch component % as well.

Below in Table 2 are examples from the 140 ewes we milked this year. In this case we sorted the ewes by % ranking within the North American dairy flock (so look at the column for 220-day Milk Yield, %)

- Our two highest-ranking ewes
- Two of our average ewes
- Our two bottom-ranking ewes

Table 2.

	Parity 2														
	220j Milk Yield (kg)			Ave. Daily Fat %			Ave. Daily Protein %			Ave. Daily Lactose %			Persistency		
Ewe #	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%
1529	142	76	99	0.19	70	89	0.16	70	92	0.10	70	96	0.37	76	53
1638	135	76	99	-0.65	69	0	-0.31	69	0	-0.36	69	0	0.27	76	3
1427	10	76	51	0.10	71	78	-0.02	71	37	-0.07	71	5	0.29	76	7
1820	7	3	49	0.00	3	57	0.04	3	61	0.03	3	73	0.38	3	68
1533	-54	70	5	-0.21	63	18	-0.08	63	19	0.07	63	91	0.39	70	81
1232	-65	72	3	0.48	64	97	0.21	64	95	0.01	64	59	0.45	72	98

It's easy to see that the bottom two (whose progeny will actually decrease the average production of the flock!) should not be bred to a dairy ram to produce replacement ewe lambs!

But what's interesting is to find a ewe like 1529, who not only increases the flock's average production by a lot, but who also increases the average component %! We should be using her not only for producing daughters, but also for producing ram lambs!

Another way we used the EBVs was to make final ram lamb selection decisions. For example, we had to decide which ram lamb would be used to be the clean-up ram on our group of AI ewes. Below in Table 3 were our top two choices. In the end, we chose the son of 1707, because of her better EBV and the relatively-high accuracy.

Table 3.

	Parity 2														
	220j Milk Yield (kg)			Ave. Daily Fat %			Ave. Daily Protein %			Ave. Daily Lactose %			Persistency		
Ewe #	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%
1434	80	74	91	-0.02	64	53	0.12	64	89	0.02	64	67	0.29	74	5
1707	102	75	96	-0.03	65	50	0.04	65	58	0.10	65	96	0.40	75	83

Sorting out the middle

Where we really used the EBVs the most was in all the middle ewes – ewes that could reasonably be in either the AI/replacement group, the terminal sire group, or the excess ewe group.

Below in Table 4 and Table 5 are 11 ewes, most of whom ranged between 700 – 850 lb of milk at August 1st, and so were above the median of 700lb for the total flock.

Table 4 is our own Excel spreadsheet. The usual dizzying array of numbers.

Table 4.

Ewe#	Lamb'g Dt	12-hr	2/18	3/5	3/18	4/1	4/16	5/2	5/16	5/30	6/21	7/9	8/30	Mtr sum to 8/1	Add'l prod'n if suckling	Mtr sum w suckling	Mtr sum to 8/1 w age	DIM at Aug 1	Avg lb/DIM	Avg lb/DIM w age fact
1400	21-Mar					7.3	6.2	6.2	6.8	5.7	5.1	3.7	3.7	734	0	734	734	132	5.60	5.60
1427	20-Mar					5.7	7.0	6.6	5.7	5.9	5.9	4.4	3.5	746	0	746	746	133	5.65	5.65
1436	23-Mar					7.3	7.3	6.9	7.3	7.0	6.6	4.8	4.6	838	0	838	838	130	6.49	6.49
1521	20-Mar					7.5	7.9	8.6	8.4	7.7	8.6	7.5	4.4	1,015	0	1,015	1,015	133	7.69	7.69
1531	24-Feb			6.4	5.5	4.2	4.8	4.6	5.0	5.3	4.4	4.0	3.3	741	0	741	741	157	4.75	4.75
1609	5-Apr	2					4.4	4.8	8.1	9.9	6.8	7.0	4.0	761	100	861	973	117	6.56	7.41
1623	12-Apr	2					4.6	3.5	10.1	8.4	7.3	7.7	5.3	752	100	852	962	110	6.90	7.79
1644	23-Mar					5.7	5.5	5.5	4.8	5.5	4.8	5.1	4.4	670	0	670	757	130	5.19	5.87
1733	2-Mar			3.7	3.5	3.4	3.7	3.7	2.9	3.1	3.1	2.0	1.8	459	0	459	570	151	3.06	3.80
1734	22-Feb			4.8	4.4	4.4	4.4	5.3	4.4	5.7	4.4	3.7	3.3	714	0	714	885	159	4.52	5.60
1737	5-Feb		8.1	7.9	6.8	6.3	7.0	5.9	5.7	5.5	6.6	6.2	6.2	1,154	0	1,154	1,431	176	6.59	8.18

Table 5 is the EBVs for each of those 11 ewes.

Points that can be noted:

- 5-yr-olds. Pretty similar performance in the season (same lambing dates, similar total production). But their EBVs take their past milking records into account, and those of daughters etc, and you can see that their EBVs are vastly different EBVs. 1400 and 1427 were sold; 1436 was bred to a terminal sire.
- 4-yr-olds. Clearly a difference between the two, but notice that although 1521 produced much more milk than 1436 *this season*, her EBV was actually below 1436.
- 3-yr-olds. Two of them had lower early metering numbers, due to suckling twins. But 1623's EBVs showed that she clearly should be in AI group.
- 2-yr-olds. Thankfully, we don't have to milk these many more years to see how their genetics will impact the flock! 1737 went in the AI group. 1733 & 1734, twin sisters (and daughters of one of our top ewes a few years ago, or so we thought … !), went into the excess ewe group.

Table 5.

	Parity 2														
	220j Milk Yield (kg)			Ave. Daily Fat %			Ave. Daily Protein %			Ave. Daily Lactose %			Persistency		
Ewe #	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%	EBV	Acc.	%
1400	-19	76	20	0.01	71	59	-0.03	71	33	0.03	71	71	0.35	76	36
1427	10	76	51	0.10	71	78	-0.02	71	37	-0.07	71	5	0.29	76	7
1436	55	72	83	-0.03	64	51	0.07	64	79	-0.08	64	4	0.29	72	5
1521	49	76	81	-0.07	70	42	0.08	70	82	0.03	70	72	0.28	76	4
1531	4	74	47	0.40	65	96	0.15	65	91	0.14	65	99	0.34	74	26
1609	25	72	64	0.26	65	92	0.14	65	90	0.02	65	68	0.23	72	0
1623	80	70	92	-0.13	64	29	0.16	64	92	0.03	64	70	0.31	70	10
1644	43	75	78	-0.25	68	14	-0.01	68	39	0.08	68	93	0.37	75	66
1733	-38	73	10	-0.07	64	43	-0.10	64	15	0.13	64	98	0.32	73	16
1734	2	73	45	0.12	64	82	-0.04	64	29	0.09	64	95	0.34	73	33
1737	110	76	97	-0.17	68	23	0.11	68	87	0.03	68	71	0.40	76	84

p.s. udders don't tell you much

1436 as a 4-yr-old in May 2018

1521 as a 3-yr-old in May 2018

Using 2019 EBVs for 2020 ram lamb decisions

We select our ram lambs, both to keep and to sell, in mid-winter, before lambing starts. We do this because any non-selected rams will be castrated at Day 1, and go off to a baby lamb buyer. (We keep more than we anticipate needing, so that if any physical weaknesses emerge as the ram lambs grow, we can still cull them.)

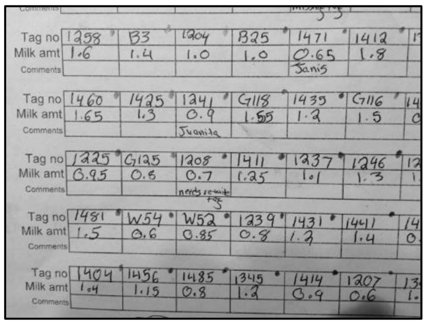
But we need to identify the ewes from whom we want to keep ram lambs. We will use EBV's to make these decisions. We will send in our metering and component data for the last three months of the season, and in January we'll use the EBV's to select the dams to keep ram lambs from.

Addendum: our process for milk recording and sampling for component analysis

Metering/sampling steps:

1. Take a bulk tank sample before milking
2. Milk ewes as normal with Waikato meters
3. Record ear tag #s
4. Record milk weights from meters
5. Collect sample from each meter
6. Write ewe # on top of sample vial
7. Take bulk tank sample after milking
8. Refrigerate samples until mailing
9. Include a copy of parlor recording sheet in box of vials
10. Mail to RMDHIA

Ready for metering

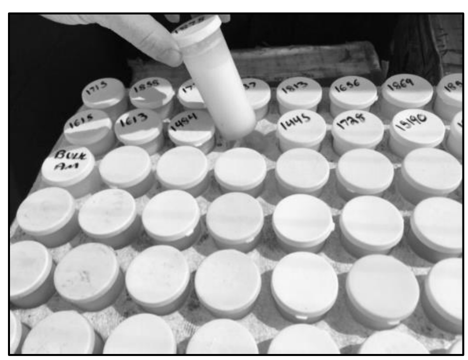


Tag no	1258	B3	1204	B25	1471	1412
Milk amt	1.6	1.4	1.0	1.0	0.65	1.8
Comments					Janis	
Tag no	1460	1425	1241	G118	1435	G116
Milk amt	1.65	1.3	0.9	1.55	1.2	1.5
Comments			Juanita			
Tag no	1225	G125	1208	1411	1237	1246
Milk amt	0.95	0.8	0.7	1.25	1.1	1.3
Comments			needs re-write tag			
Tag no	1481	W54	W52	1239	1431	1441
Milk amt	1.5	0.6	0.85	0.8	1.2	1.4
Comments						
Tag no	1404	1456	1485	1345	1414	1207
Milk amt	1.4	1.15	0.8	1.2	0.9	0.6
Comments						

Ewes milked, ready to record on our parlor recording sheet

Finished metering, meters washing with the CIP system after milking

Taking individual samples for component testing

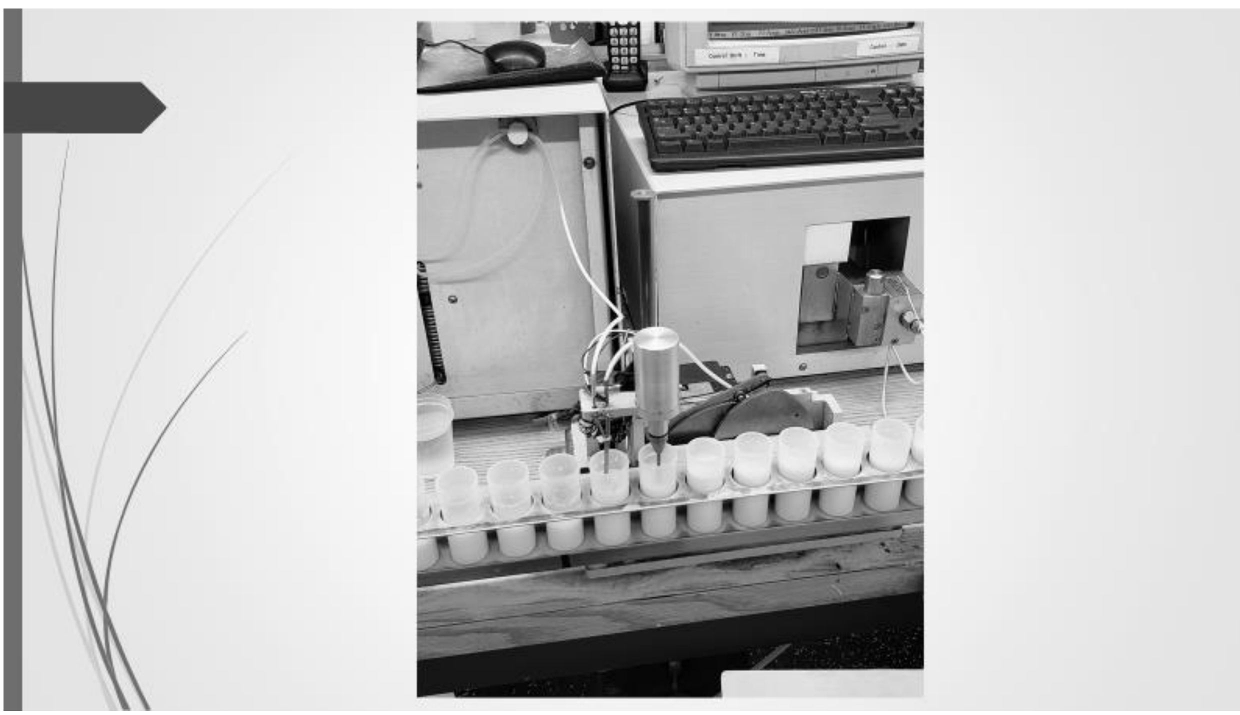


Individual samples put in foam shipping box to go to RMDHI (shipping boxes supplied by RMDHI

What Can Testing Do For You?

Rocky Mountain DHIA, Logan, Utah
Chris Tucker, General Manager RMDHI


DHIA



CMT and SCC, what is the difference?

- California Mastitis Test (CMT) test only for mastitis and does a pretty dang good job.
- Somatic Cell Count (SCC) looks at the present immune system to see if it has been triggered.
- What can trigger the immune system?
- Mastitis
- Open wounds
- Fevers, Viruses, Hidden Infections
- Weather Stress
- Moving Stress
- Lambing and Drying off
- Feed/Water Stress
- Environmental Stresses (Cleanliness, Stray Voltage, Comfort, Feeling Safe)
- Milking System (Inflations, Pulsations, Stable Vacuum)

Why should I test?

- Flock Management
- "How can you manage when you don't measure"
- Which ewes are REALLY your good ewes?
- Genetic Evaluation
- Looking at the ram
- Healthy daughters
- Milk production
- Lambing ease
- Low SCC
- Longevity
- Hoofs, Hips, Teats, etc.

Reading Reports

Chris's Sheep Dairy
123 Sheep Lane
Logan, UT 84321

Test Averages by String

P-String	T-String	Fat	Pro	Total Solids	SC	MUN	# Samples	Milk	% Inverted
0	1	5.91	5.10	17.00	970		133	3.31	12%

SCC Contribution to Bulk Tank

This report is for those ewes with a SCC of 400,000 and over

Sorted by Percentage to tank

# of samples this test: *133* *# of samples 400,000 and* *64* *% of samples 400,000 and* *48%*

CTL	Perm String	Temp String	Milk	SCC	% to Tank	Running Sum	CTL	Perm String	Temp String	Milk	SCC	% to Tank	Running Sum
92	0	1	4.2	4021	4.25%	4.25%	24	0	1	1.5	4118	1.55%	60.57%
25	0	1	3.2	4388	3.53%	7.78%	73	0	1	3.3	1614	1.34%	61.91%
90	0	1	3	4426	3.34%	11.12%	3	0	1	1.9	2798	1.34%	63.25%
45	0	1	3.4	3778	3.23%	14.35%	30	0	1	2.2	2403	1.33%	64.58%
37	0	1	3	4276	3.23%	17.57%	71	0	1	3.4	1494	1.28%	65.86%
20	0	1	2.9	4422	3.22%	20.80%	77	0	1	4.1	1188	1.22%	67.08%
99	0	1	2.9	4266	3.11%	23.91%	65	0	1	3.7	1232	1.15%	68.23%
93	0	1	3.3	3649	3.03%	26.94%	85	0	1	4.8	926	1.12%	69.34%
19	0	1	3.1	3748	2.92%	29.86%	12	0	1	3	1434	1.08%	70.43%
46	0	1	3.2	3552	2.86%	32.72%	42	0	1	3.3	1298	1.08%	71.50%
103	0	1	3	3360	2.54%	35.25%	39	0	1	2.2	1944	1.08%	72.58%
70	0	1	3	3274	2.47%	37.72%	109	0	1	3.7	1138	1.06%	73.64%
75	0	1	3.3	2874	2.39%	40.11%	53	0	1	3.5	1154	1.02%	74.66%
86	0	1	2.2	4232	2.34%	42.45%	78	0	1	2.5	1408	0.89%	75.54%
14	0	1	3.3	2742	2.28%	44.73%	132	0	1	2.2	1564	0.87%	76.41%
44	0	1	4.4	1761	1.95%	46.67%	124	0	1	5.5	602	0.83%	77.24%
36	0	1	3.7	2042	1.90%	48.57%	123	0	1	3.3	996	0.83%	78.07%
13	0	1	4.6	1580	1.83%	50.40%	57	0	1	2.6	1198	0.78%	78.85%
62	0	1	2.9	2494	1.82%	52.22%	33	0	1	3.6	858	0.78%	79.63%
41	0	1	2.9	2444	1.78%	54.00%	63	0	1	3.4	876	0.75%	80.37%
76	0	1	3.4	2046	1.75%	55.75%	40	0	1	3	949	0.72%	81.09%
67	0	1	2.5	2711	1.70%	57.46%	128	0	1	3.9	728	0.71%	81.80%
7	0	1	4.4	1411	1.56%	59.02%	54	0	1	3	920	0.69%	82.50%

Saturday, October 26, 2019 *87000000* *Page 1 of 2*

Butterfat/Protein Ewes List

Only ewes with inversions will be on this report.

P-String	T-	CTL	BF	Pro	Muns	P-String	T-	CTL	BF	Pro	Muns
0	1	6	5.14	5.38							
0	1	91	4.43	4.72							
0	1	101	4.50	4.73							
0	1	22	4.71	5.05							
0	1	100	5.05	5.07							
0	1	89	4.65	5.25							
0	1	26	4.19	4.47							
0	1	127	4.85	5.30							
0	1	14	5.89	6.01							
0	1	34	5.09	5.47							
0	1	5	5.44	5.58							
0	1	97	5.19	5.59							
0	1	45	4.89	5.67							
0	1	36	5.75	5.83							
0	1	44	5.71	5.94							
0	1	12	5.04	5.26							

High Average SCC Ewe List

This report is for those ewes with an average SCC of 250,000 and over for the last 3 test

Sorted by Avg SCC

Number of Ewes: **84**

CTL	Present P-String	Present T-String	Test Date	Fat	Pro	SCC	Milk
99	0	1					
			5/1/2019	4.87	5.10	4223	1.95
			6/1/2019	5.87	5.06	182	1.10
			8/1/2019	6.06	4.96	4266	2.90
					Avg Scc	2890	
67	0	1					
			5/1/2019	5.28	5.27	3295	1.35
			6/1/2019	5.80	5.00	2054	2.30
			8/1/2019	6.60	5.25	2711	2.50
					Avg Scc	2687	
85	0	1					
			5/1/2019	4.28	5.17	4982	1.30
			6/1/2019	5.75	4.89	1542	1.40
			8/1/2019	6.25	5.34	926	4.80
					Avg Scc	2483	
45	0	1					
			5/1/2019	6.10	4.56	1243	1.20
			6/1/2019	5.90	5.32	2165	2.30
			8/1/2019	4.89	5.67	3779	3.40
					Avg Scc	2395	
46	0	1					
			5/1/2019	5.72	5.06	3404	1.40
			6/1/2019	5.25	5.14	52	2.80
			8/1/2019	6.75	6.42	3553	3.20

Saturday, October 26, 2019 *87000000* *Page 1 of 10*

The Higher The SCC The Lower The Milk Quality.

- Lower shelf life
- Products don't turn out as desired
- State Regulations
- Export Regulations
- Lower milk yield

2018-2019 Sheep milk testing program

	2018	2019	Difference	Percentage
Butter Fat	5.60	6.49	0.89	15.8%
Protein	4.92	5.21	0.29	5.9%
Total Solids	10.96	17.76	6.81	62.1%
SCC	1052	574	-478	-45.5%
Milk Weights	1.58	1.83	0.24	15.4%

Test Day Check List

- Boxes with pills in them. Check a week in advance
- All materials needed. Markers (Staples Blue Permanent), Rags, Notebook, Pen
- Meters have gone through prewash and rinse
- Check vacuum, adjust if needed
- Proper agitation of milk in meter, 5-10 seconds, before sample is taken
- Post wash and rinse of meters
- **REMEMBER TO SET VACUUM BACK IF IT WAS CHANGED**
- Invert boxes of samples periodically to assure the pill is mixed
- Store samples in cooler before shipping. DO NOT ship over the weekend
- Please make sure samples match your paperwork
- If possible, please email the test day Excel spreadsheet to the lab. Also, let us know when the samples were shipped and with whom.
- Always place paperwork sent with the samples in a plastic bag.

Things I would like to share

- Consistency
- C***on***Sistency
- c***on****Sist***en**cY
- This applies to both managing your flock, and testing
- Make changes from the advice of trusted sources
- EVERYTHING ON THE INTERNET IS NOT ALWAYS TRUE
- Develop a good dry off program
- The first 48 hours of life is the most critical
- Use your test information
- "How can you manage if you don't measure."

ROCKY MOUNTAIN DHIA

Effective Dairy Management

Thank You

Chris Tucker, General Manager Rocky Mountain DHIA

Dairy Sheep Symposium, November 7, 2019

Agricultural Adaptation to Climate Change: Improving Resilience in Dairy Systems

Joshua Faulkner, PhD
Research Assistant Professor
Farming and Climate Change Program Coordinator
Center for Sustainable Agriculture, University of Vermont Extension

Climate change and climate variability pose great risks to agricultural production and farm livelihoods, and producers will need to adapt to a changing climate that is expected to be significantly more variable in order to meet these challenges. Dairy producers have a long record of successful adaptation to a host of internal and external pressures and have made remarkable strides in the face of these pressures. Yet the threat, and indeed, the reality of a changing climate puts our nation's food and fiber resources in peril. Recent years have demonstrated the vulnerability of our production systems to a changing climate and weather extremes. Indeed, 2012 was one of the most expensive years on record for crop damage ($15.7 billion) and weather-related disasters. The historic drought that gripped much of the Midwest and Eastern U.S. caused extensive crop damage and resulted in the largest ever government crop insurance payout. 2011 had a record-breaking 12 climate-related disasters that exceeded $1 billion each. Thus, it is increasingly recognized that our production systems will need to exhibit even greater flexibility to remain viable. Figure 1 shows the historical yield increases our production systems are exhibiting and the impact of climate variability and extremes on yields.

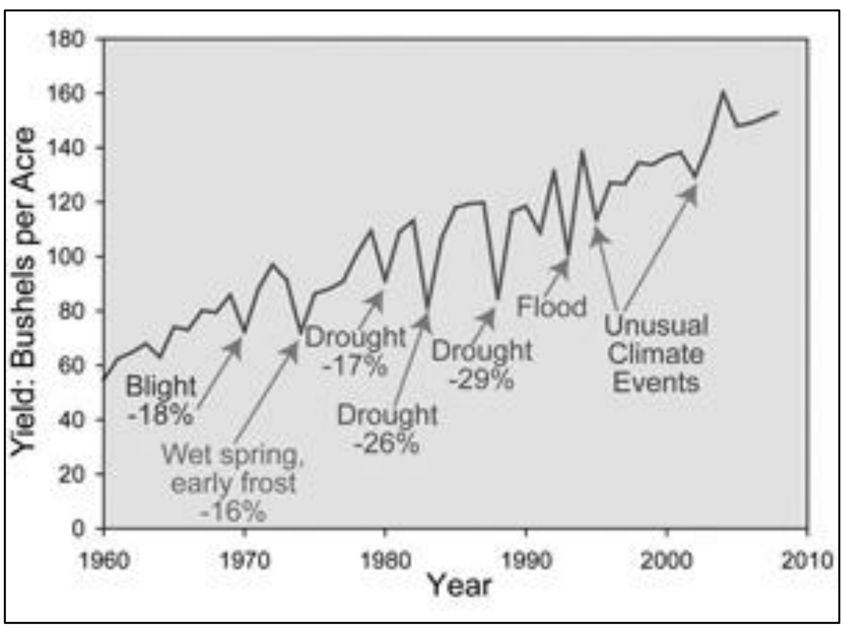


Figure 1. Extreme weather events have caused significant yield reductions in some years. The unusual event in 1993 was destructive flooding of the Mississippi River; in 2003 the unusual event was a persistent heat wave.

Source: U.S. Global Change Research Program, 2009.

Climate Change and Its Consequences

Certain activities create greenhouse gases (GHGs), which capture heat and energy in the atmosphere and alter long-term climate cycles. This phenomenon is called the greenhouse effect. The Earth's greenhouse effect is, in fact, a natural phenomenon that helps regulate the temperature of the planet. When the sun heats the Earth, some of this heat escapes back into space. The rest of the heat, also known as infrared radiation, is trapped in the atmosphere by clouds and GHGs, such as water vapor and carbon dioxide (CO_2). If all of these GHGs did not exist, the planet would be approximately 60 degrees (Fahrenheit) colder than it is today.

The primary GHGs emitted by human activities (fig. 2) are CO_2, methane (CH_4) and nitrous oxide (N_2O) which trap heat in the atmosphere and steadily increase the temperature of the Earth above natural levels. The resulting effects of this are commonly known as climate change.

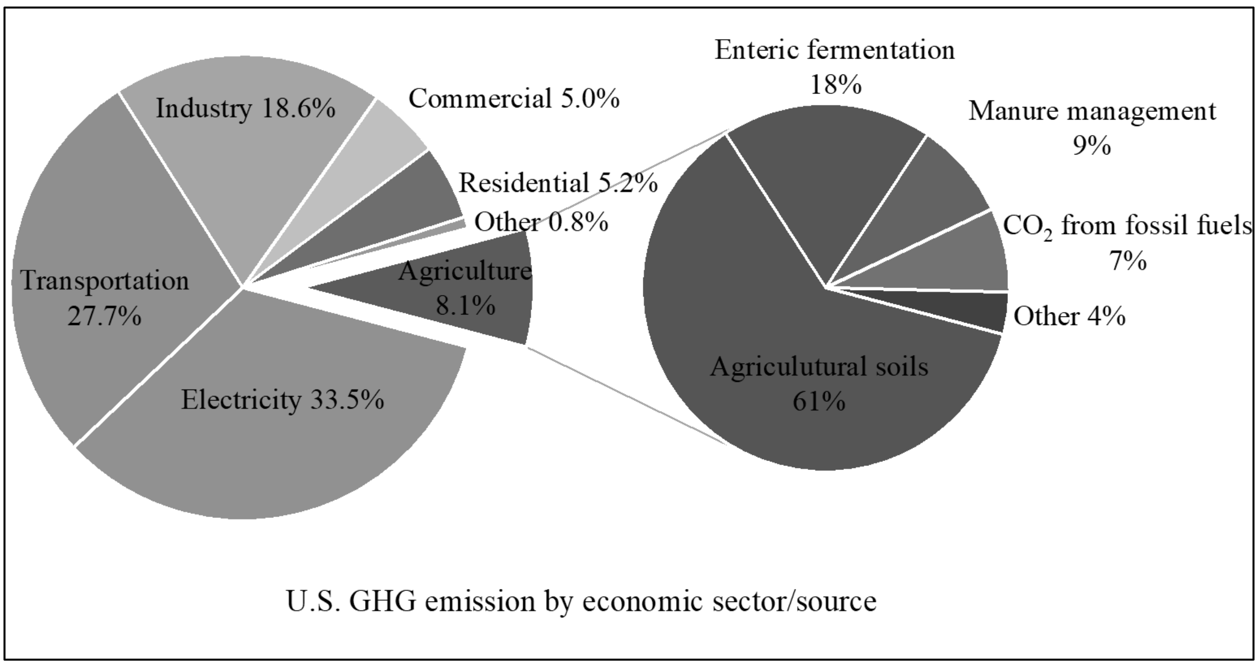


Figure 2. Contribution of agriculture to total U.S. greenhouse gas emissions and the breakdown of agricultural GHG emissions by source.

Source: Adapted from U.S. Environmental Protection Agency, 2011.

The different GHGs have different potencies in the atmosphere. The potency of a GHG is referred to as its global warming potential and is commonly expressed as a carbon dioxide equivalent or CO_2e. Two common GHGs — methane and nitrous oxide — are 21 and 310 times more potent than CO_2, respectively; that is, their presence in the atmosphere traps considerably more heat than CO_2.

Scientists have concluded that increased temperatures are and will continue to significantly alter climate patterns, but the interactions are complex and a range of possibilities exists. According to the U.S. Environmental Protection Agency, certain regions of the U.S. will be more prone to extreme weather, such as tornados, drought, and flooding. Specifically, the Eastern U.S. is expected to experience more intense precipitation and longer periods of drought, also referred to as climate extremes or variability. This may appear contradictory, but in the Eastern U.S., the area affected by drought has increased steadily since the mid-1970s despite an overall annual increase in precipitation across the area.

Potential consequences of a changing climate include decreasing agricultural yields because of the rise in temperature and changes in precipitation, and the displacement of traditional crops northward, forcing producers to change the crops they can grow in order to adapt to the new climate. Increasing temperatures is also expected to increase the incidence of heat stress for livestock. Heat stress in dairy animals can decrease feed intake, milk production, and also potentially disrupt reproductive cycles, interfering with lactation. These temperatures will also likely intensify the water cycle. Increasing evapotranspiration will make more water available in the atmosphere for storms but will contribute to drying over some other areas. As a result, storm-affected areas are likely to experience increases in precipitation and increased intensity, which can cause flooding, the loss of valuable topsoil, and crop damage. Areas located far away from storm tracks are likely to experience less precipitation and increased risk of drought. In the U.S., climate change is expected to cause a northward shift in storm tracks, resulting in decreases in precipitation in areas such as the Southwest U.S. but increases in many areas to the north and east. However, these changes will vary by season and will depend on regional weather patterns (e.g., El Nino, La Nina).

In a warming climate, extreme events like floods and droughts are likely to become more frequent. More frequent floods and droughts will affect water quality and availability. For example, increases in drought in some areas may increase the frequency of water shortages and lead to more restrictions on water usage, such as for irrigation. An overall increase in precipitation may increase water availability in some regions but also create greater flood potential and water-logged soils, which can reduce crop and forage production. Rising temperatures will also warm surface waters, causing them to be more susceptible to algae growth and making the control of nonpoint source pollution more critical.

Increased temperatures have several direct impacts on crop and forage production as well.

1. Higher temperatures will cause more evapotranspiration, drying soils more rapidly and raising the humidity of the atmosphere, which can decrease crop water uptake. The implications of decreased crop water uptake and variable soil moisture level are not generally well-understood, but crops rely on water uptake to supply essential nutrients, so anything that decreases water uptake will need to be considered for its consequences on crop productivity.

2. Increased temperatures will reduce organic carbon levels in the soil via oxidation, which can further reduce soil moisture levels and subsequently impact crop productivity.

3. Increased temperatures may impact germination and senescence of some crops.

4. Reduced frost risk and warmer winters in many regions could allow earlier planting but could also expand the range of various agricultural pests and diseases.

Increased atmospheric CO_2 levels have the potential to increase crop productivity for two reasons.

1. Warmer temperatures may make many crops grow more quickly but could also consequently reduce yields of some crops. Crops tend to grow faster in warmer conditions, but for some crops, such as grains, rapid growth reduces the seed maturity and nutrition, and can ultimately reduce yields.

2. Greater CO_2 concentrations increase plant respiration rates. As part of the carbon cycle, plants use energy from the sun to photosynthesize carbohydrate from CO_2, and greater CO_2 concentrations can result in greater carbohydrate production. A small amount of warming coupled with increasing CO_2 could benefit certain crops, although the impact on crops depends also on the availability of water and nutrients.

Overall, scientists and policymakers generally agree that rapid climate change will have far more negative consequences on our production systems than positive outcomes. The supply and cost of dairy products may change as farmers and the food industry adapt to new climate patterns. For warming of more than a few degrees, the effects are expected to become increasingly negative, especially for farms located near the warm end of their suitable temperature range.

Adapting to Climate Change

Adaptation covers many strategies that can reduce or mitigate the impacts of climate change and climate variability. Broadly, the term "adaptation" covers those practices that improve resistance to climate change, those that increase resilience to climate change, and those that transform production systems in the face of climate change. Some examples of these strategies include:

- Transitioning to sod-based rotations and grass-based systems
- Using drought-resistant or excess-moisture-resistant species (or varieties like drought-resistant wheat, corn, cotton, etc.) to reduce (resist) the impact from droughts and floods.
- Modifying crop rotations to include cover crops that help build resilience to climate change and climate variability.

Practices that Adapt to and/or Mitigate Climate Change

Following are several practices that can help producers adapt to or mitigate the impacts of climate change.

Improved Soil Health for Water Management

Improved soil health increases the amount of rain that infiltrates into the soil and the soil water-holding capacity or available water content can reduce the impacts of both drought and extreme rainfall events. As more water infiltrates, more can be stored in the soil and less runs off, which also reduces the probability of nutrient and sediment loss. One way to increase soil health, and water-holding capacity, is to increase the amount of soil organic matter in the soil profile. Soil organic matter can be increased by incorporating residue management practices, using organic fertility sources, planting cover crops, improved grazing management, and by practicing conservation tillage.

Conservation Tillage

Conservation tillage reduces soil compaction and erosion, and increases soil organic matter and infiltration capacity — all of which reduce runoff and increase drought resilience. Tilling the field exposes soil organic matter/carbon to oxidation and makes the soil more susceptible to erosion, both of which result in carbon depletion and, as a consequence, less productive soils. Advances in seed technology, pest control, and farm machinery are making no-till and reduced-till practices more acceptable to producers.

Barn Ventilation and Shade Structures

Designing new barns to account for increasing temperatures can help reduce heat stress, as well as investing in improved ventilation in existing barns. For grazing animals, additions of shade structures can also be beneficial in pastures that do not have natural shade.

Cover Crops/Crop Rotations

Cropping sequences that include a fallow period tend to reduce soil carbon levels as compared to continuous cropping, which tends to increase soil carbon levels. Cover crops and nitrogen-fixing legumes are often recommended to both enhance fertility and increase the soil organic matter content. Cover crops also help ensure that soil is protected during intense rainfall events by absorbing raindrop impact, which reduces erosion and nutrient runoff; they also protect the soil during periods of drought, when wind erosion can remove topsoil. A greater number of rotations in any given crop rotation cycle (e.g., 5-year rotation versus 2-yearrotation) can also help to reduce pest pressure, thus enhancing a field's productive capacity.

Rotational Grazing

Rotational grazing can improve forage yield and animal productivity per acre. It also promotes soil health and carbon sequestration. Managing plant communities through rotational stocking can improve forage root structure and depth. These also translate to improved soil health, and it associated benefits (i.e., water infiltration and drought resilience).

Irrigation Efficiency

Many regions already rely on irrigation during some portions of the growing season, and it is expected that the reliance on irrigation will increase substantially — both in traditionally irrigated crops and in those that will need to be irrigated due to increased temperature stress. This coupled with increasing per capita water demand will result in even greater stress on water resources. Thus, increasing irrigation efficiency will enable producers to irrigate more land with fewer resources. Practices such as regular system maintenance, frequent system audits, using recycled water, using drip or subsurface-drip irrigation systems, and incorporating soil moisture sensor networks to refine timing and target regions of a field are some common ways to improve irrigation water use efficiency.

Nitrogen Use Efficiency

Excessive rainfall can result in leaching of valuable nitrogen from the crop root zone. If nitrogen applications are optimized based on actual crop need, and — to the extent possible — applied when there is a low potential for leaching, yields and profits can be increased. Nutrient management tools that improve the timing, method and amount of nitrogen applied should be used when possible. Some examples of these tools include nitrogen-content-sensing fertilizer applicators (e.g., GreenSeeker® and many others), incorporating short- and long-term meteorological forecasts into fertilizer scheduling (e.g., evolving software tools such as Adapt-N), and utilizing soil moisture sensor networks to optimize timing. These strategies also decrease the amount of nitrogen that is lost to the environment.

Conservation Buffers (riparian, filter strips, etc.)

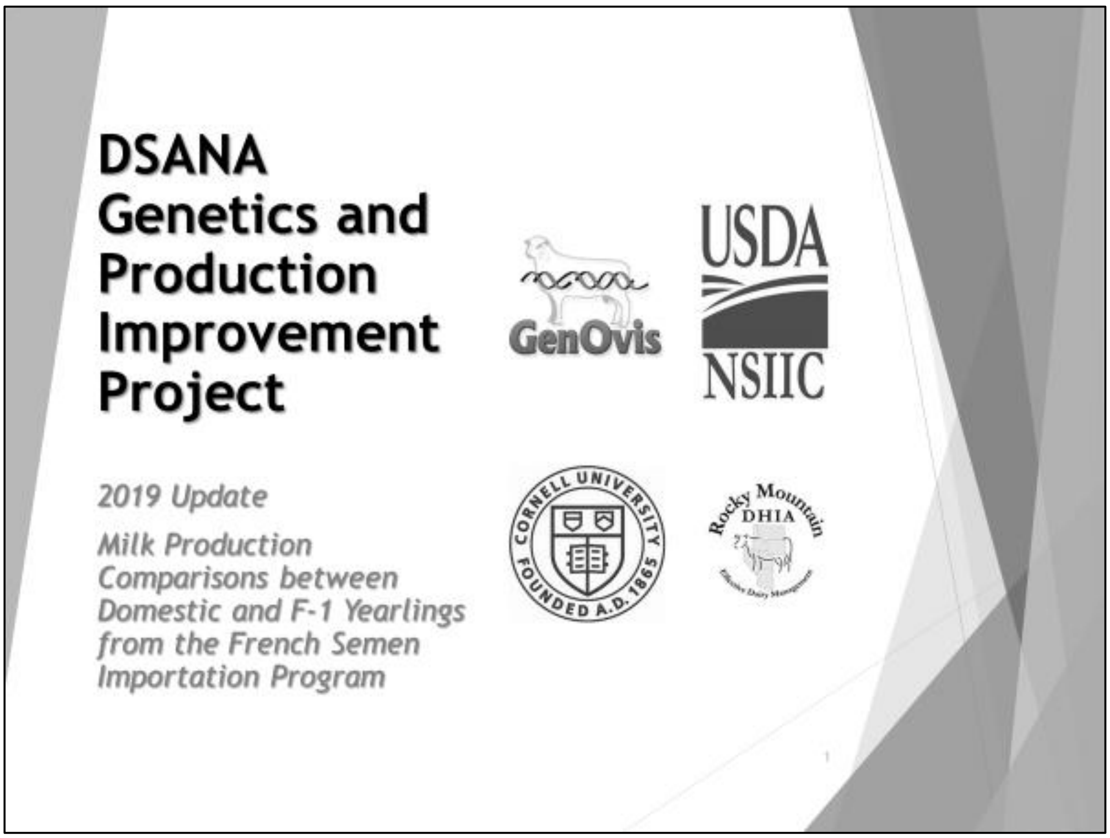
Conservation buffers, whether forested or grassed, increase the resilience of agricultural operations to weather extremes in multiple ways. Forested buffers along waterways can reduce streambank erosion and farmland loss during flood events. Grass strips within and surrounding fields help capture eroded soil and nutrients and can slow down runoff and prevent gully formation. Windbreaks help reduce soil loss from exposed ground during windy drought conditions. In addition, buffers increase carbon storage and provide habitat for valuable crop pollinators essential for some crops.

The Bottom Line

While uncertainty remains, adapting to climate change will not necessarily require an abrupt and fundamental shift in our dairy systems. Although, if actions are not taken soon, these abrupt shifts will be one of the few options available. By investing in intelligent agricultural practices, a producer might be able to increase productivity and profitability while also reducing the short-term economic risk from climate change. Long-term resilience will likely require additional strategic planning and investment of resources. Use of selected conservation practices, namely improved soil health have tremendous potential for not only adapting to climate change, but also mitigating it.

Milk Production Comparisons: Domestic & F-1 Yearlings from the Imported French Semen

Laurel Keiffer, DSANA Production Improvement Project
Tom Clark, Chair, DSANA Genetic Improvement Committee
Mike Thonney, Professor of Animal Science, Cornell University



Production Improvement Program Goals

Develop	• Develop systematic approach to gathering sheep dairy production data
Develop	• Develop the means for developing estimated breeding values within and across sheep dairy flocks and across breeds
Develop	• Develop a means for producers to have a valid and accurate means for selection of replacement and sale stock
Track	• Track genetic improvements resulting from semen importation
Improve	• Improve sheep dairy production and components across North America

2

Presentation Goals

- Demonstrate comparative milk production results from the first **F1** ewes being milked in 2019
- Provide sheep dairy producers justification and incentive to participate in
  - Semen importation program
  - Production improvement program

3

Basis of Analysis

Survey of producers who imported semen

- 10 of 28 producers responded to the survey
- Straws used
  - 2017 - 86 by 4 producers
  - 2018 - 171 by 4 producers
- 2018: 51 F-1 ewes; 47 ram lambs
- 2019: 30 F-1 ewes; 37 ram lambs

- Of the producers that responded to the survey, none of the offspring were included in the 2019 milk production improvement program.

4

Milk Production Data Analysis

Participation in the comparative analysis required farm(s) that:

- Were milking F-1 ewes yearlings from semen importation program
- Were milking yearling ewes from own flock
- Were participating in the DSANA Production Improvement Program

Only one farm met all three criteria

5

Comparison Data Sets

- 26 yearling ewes from one domestic sire
- 24 yearling ewes from 7 different sires from the LaCaune semen importation program
- Days in milk (DIM) ranged from 89 to 128, adjusted to DIM 115
- One test-day reading was used for milk, fat, protein, lactose and SSC
- EBV's generated through the season were used.

6

Overview of Results: Statistically Significant Observations between Domestic and Imported Semen F-1 Yearling Ewes in Milk

Statistically significant differences

- Milk Production
- Estimated Breeding Values

- No statistically Significant differences
- Butterfat
- Protein
- Lactose
- SCC
- Persistency

7

Sire source	n	Milk/day, kg	Fat, %	Protein, %
French	24	2.1	5.80	4.70
Domestic	26	1.6	5.40	4.60
SEM		0.09	0.120	0.062
p-value		< 0.001	0.014	0.741
Litter size				
1	31	1.6	5.70	4.70
2	19	2.1	5.50	4.70
SEM		0.09	0.125	0.065
p-value		0.001	0.112	0.853

[1]Adjusted to average DIM 115 (range 89 to 128).

Yearling Production Comparisons: Single test day results

8

Sire source	220-day milk EBV, kg	Fat EBV, %	Protein EBV, %
French	20.0	0.09	0.02
Domestic	-29.7	-0.07	0.04
SEM	5.73	0.28	0.02
p-value	< 0.001	0.053	0.518
Litter size			
1	-7.5	-0.02	0.04
2	22.8	-0.03	0.03
SEM	6.16	0.03	0.02
p-value	0.005	0.825	0.601

Yearling Production Comparisons: EBV of Daughters

9

Item		Milk, kg			Fat, %		Protein, %
Sire ID	n	Mean	SEM	Difference[2]	Mean	SEM	Mean
FR17-A-40410	4	2.5	0.19	A	6.0	0.28	4.8
FR17-E-40524	1	1.7	0.37	AB	5.3	0.55	4.4
FR17-G-40171	7	1.9	0.14	AB	5.9	0.21	4.6
FR17-H-10013	2	2.2	0.26	AB	5.7	0.38	4.8
FR17-I-20208	5	2.2	0.16	A	6.0	0.24	4.9
FR17-J-30095	2	1.6	0.26	AB	5.7	0.39	4.8
FR17-L-10272	3	2.4	0.21	A	5.5	0.32	4.5
Domestic-X2920	26	1.6	0.08	B	5.4	0.12	4.7
p-value		< 0.001			0.267		0.431

[1]Adjusted to average DIM 115 (range 89 to 128).

[2]Means that do not share a letter are significantly different by the Tukey test.

Results: kg of milk, fat, protein

10

Item		220-day milk Ave Daughter's EBV, kg			Fat EBV, %		Protein, %	
Sire ID	n	Mean	SEM	Difference[2]	Mean	SEM	Mean	SEM
FR17-A-40410	4	51.2	12.30	A	0.06	0.068	0.01	0.039
FR17-E-40524	1	-21.3	23.60	AB	-0.11	0.130	-0.05	0.074
FR17-G-40171	7	8.1	8.98	A	0.06	0.049	0.00	0.028
FR17-H-10013	2	10.7	16.50	AB	0.03	0.091	0.08	0.052
FR17-I-20208	5	24.7	10.50	A	0.00	0.058	0.05	0.033
FR17-J-30095	2	-11.1	16.90	AB	-0.06	0.093	0.05	0.053
FR17-L-10272	3	26.6	13.70	A	-0.06	0.076	-0.01	0.043
Domestic-X2920	26	-27.7	5.14	B	-0.06	0.028	0.05	0.016
	p-value	< 0.001			0.402		0.527	

[1]Adjusted to average DIM 115 (range 89 to 128).

[2]Means that do not share a letter are significantly different by the Tukey test.

Results: EBV Comparisons

11

Conclusions

On this farm, assuming management practices are consistent across the milking flock:

- The F-1 yearling ewes produced statistically more milk than did the F-1 ewes from the domestic ram.
- There were no statistically significant differences for butterfat, protein, lactose, SCC, or persistency.

12

Limitations

- The small sample sizes for each of the imported rams may not be reflective of the true population of daughters from each ram.
- The domestic sample comes out of only one ram and is not necessarily representative of the domestic population.
- Because of the limitations on the linkages between related animals, the EBV estimates for the sires reflect averages from the daughters tested only.

13

Potential Impact for Your Sheep Dairy Operation

Again, realizing the limitations of the sample size, we can make some limited estimations.

- Scenario 1: Using the data from this sample, the LC F-1 daughters produced an ***average*** of approximately 4.5% more milk.
  - Hopefully, your yearling domestic ewe should produce about 550 pounds over a lactation of 150 days.
  - 550 pounds X 4.5% = 25 pounds estimated progressive difference
- Scenario 2: Using the kg of milk from the EBVs in this data set:
  - The daughters from ***highest LC ram*** had a +51.2 mean(+- 12.30 SEM) increase in milk. The domestic ram had a -27.7 (+- 5.14 SEM).
  - This is a predicted difference of 79 kg over a 220-day milking cycle. 79 kg X 2.2 = 179 pounds over the 220-day lactation between the daughters of the highest producing ram and the domestic ram.

14

What will your sheep dairying future look like?

You have opportunities and choices.

Improvements in production will require investments.

15

You can't judge a book by its cover.

You can't select a high-producing ewe by the size of her udder!

Next Steps

To determine the impact of the imported semen on the American Dairy Sheep industry the following steps are recommended:

- All flocks milking F-1 ewes make a commitment to participating in the DSANA Production Improvement Program (PIP)
- Producers purchasing F-1 rams or ewes expect production records to accompany those animals.
- Producers purchasing F-1 rams or ewes make a commitment to participating in the DSANA PIP
- Data continues to be collected and analyzed to track improvements.
- The sheep dairy industry experiences long-term improvements in milk production.

17

- Enrollment forms available
- $300 annual payment (U.S. $) for GenOvis services
- Producer pays for shipping and a per sample cost
- Enrollment and instructions available on the DSANA website
- One-on-one help available for:
  - Farm enrollments
  - Animal enrollments
  - Milk test day support
  - Interpreting and applying results

Status of the Production Improvement Program

Laurel Kieffer
Coordinator

18

Thank EWE!

Special thanks to Dr Mike Thonney of Cornell University for running the statistical analysis of the milk production data.

For more information:

- Semen Importation

  Tom Clark

  Clark@DubinClark.com

- Production Improvement Program

  Laurel Kieffer

  kieftl@tcc.coop

A BRIEF HISTORY OF ME

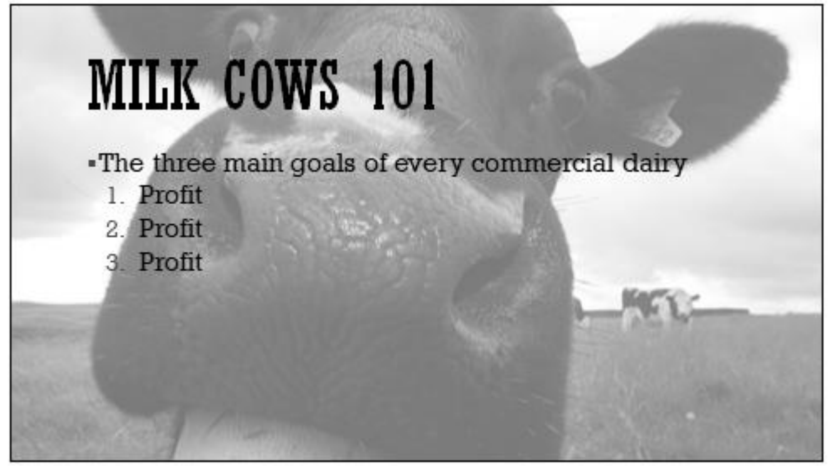
- Raised on a beef and row crop farm in Alabama
- Started marketing milk products at 14 from my Jersey cow Maybelle
- Dairy Science degree after high school
- Veterinary degree followed by a Masters in Dairy Production Medicine
- Palpated cows for 7 years in New Mexico
- Managed a 2400-cow sunset dairy for 2 years
- 12 years ago moved to Idaho and the front end of the cow

- Worked for a feed company from 2007-2012 consulting on dairy herds in Idaho and Texas
- 2012 joined Progressive Dairy Solutions (1/7th of the U.S. dairy herd). Consulted on cow and goat dairy herds in several countries
- 4 years ago started milking goats at Sage Valley in Southern Idaho
- 3 years ago started processing milk at Kimberly's Best Creamery
  - Goat milk products
  - A1-Free cow milk products
- 1 year ago started purchasing dairy sheep

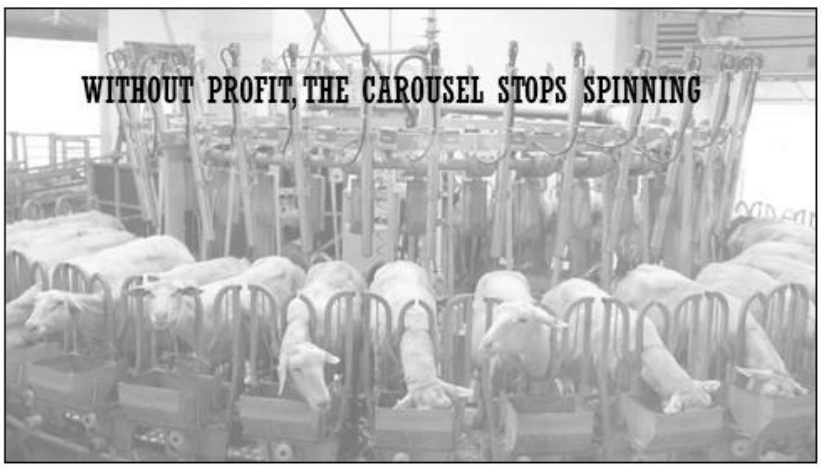
THE LAST 12 YEARS


COMPARED TO A GOAT
Sheep are Like Fluffy Cows
Less discriminant eaters
Lower cognitive capacity
Better suited for commercial operations
Do not carry a negative stigma

1


MILK COWS 101
The three main goals of every commercial dairy
1. Profit
2. Profit
3. Profit

2


WITHOUT PROFIT, THE CAROUSEL STOPS SPINNING

3


HOW IS PROFIT MEASURED?
WHAT IS YOUR PRODUCTION UNIT?
EWE
Income Over Feed Cost
DAIRY
Net Profit Per Animal
Ability to Attribute Fixed Costs at this Level
FARM
Total Profit per Year

4

PROFIT BY DAIRY UNIT

- Net Profit per Animal
  - Gross Income – Variable Costs – Fixed Costs
    - Gross Income
      - Saleable milk, meat and fiber
    - Variable Costs
      - Feed, labor, transportation, vet and supplies
    - Fixed Costs
      - Facility, equipment, interest

5

INCOME OVER FEED COST

- This Number Makes or Breaks Cow Dairy Operations
- The amount of Money left to pay for all other variable costs and all Fixed Costs
- Price of Milk has the most Influence
- Gross Milk Income – Cost of Feed
  - Price of Milk X Milk Production X Length of Milk Production
  - 3 pounds production @ $0.78 per pound = $2.18/day
  - $2.18 per day for 160 days = $344 per ewe per year gross income
  - Cost to Feed (Lactating and Dry Period)
  - $0.78 per day for 200 days lactating = $180 (Sharecropping lamb)
  - $0.88 per day for 168 days dry = $91
  - Total Feed Cost per Year = $241 (No Shrink)
  - $100 to cover labor/other variable costs and all fixed costs

6

INCOME OVER FEED COST

- Only 16.8% of dairy goat operations said that a source of income was their most important reason for raising goats. For small operations, over half of all farms rated their primary reason for raising goats as enjoyment. (U.S. Department of Agriculture)

7

PROFIT ROBBERS

8

METABOLIC DISORDERS

9

KETOSIS(PREGNANCY TOXEMIA)

- Expected in late-term, multiple fetus pregnancies
  - Gross conceptus demand and volume
    - Negative energy balance
      - Lipolysis
        - Hepatic lipidosis
          - Beta hydroxy butyrate formation
        - Inflammatory cascade positive feedback loop

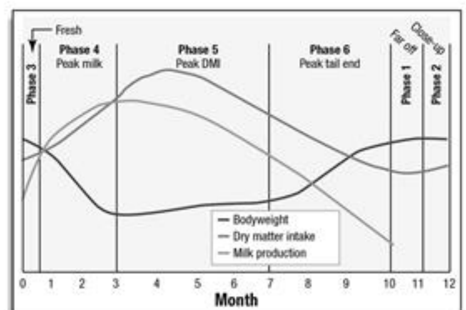
10

KETOSIS (LACTATIONAL)

- Same NEB as pregnancy toxemia
  - Different from Pregnancy Ketosis
    - Energy drain is from milk production
    - Hormonal dry matter intake (DMI) recovery
- Easily Prevented
  - ME, MP, choline

11

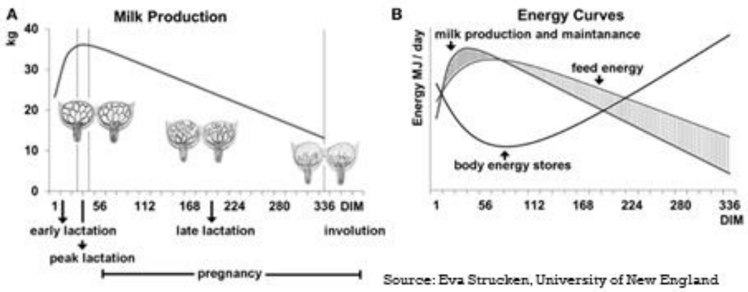
LACTATION CURVE COW



Source: Dr. Mike Hutjens, University of Illinois, Extension Dairy Specialist

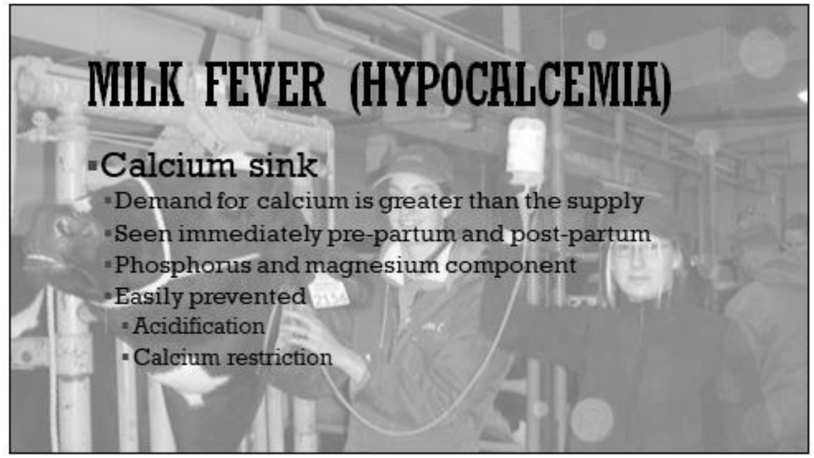
12

LACTATION CURVE COWS

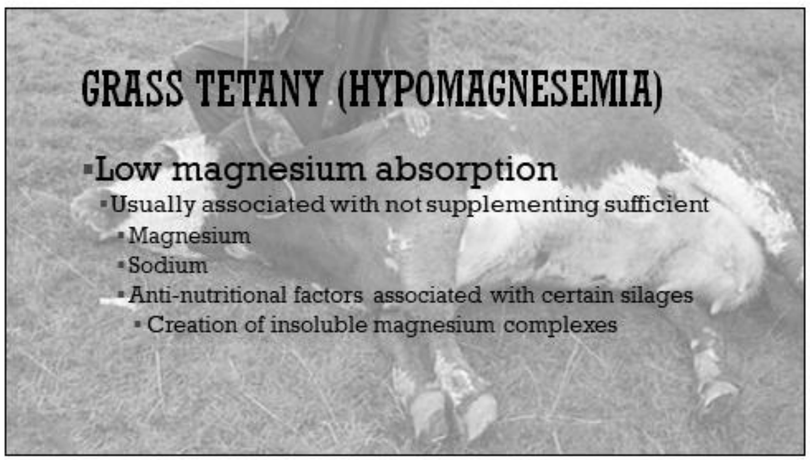


Source: Eva Strucken, University of New England

13



14



15

MILK COMPONENTS

- Casein (Milk Protein)
- Butterfat
  - de novo synthesis
    - Assembled in the mammary gland
  - Pre-formed fatty acids
    - Absorbed from Small Intestines

16

CASEIN

- Required to make cheese and yogurt
- Concentration changes cheese yield
- Easily manipulated
  - Starch level and digestibility
  - Amino acid composition and delivery

17

WHAT DO

1. Sheep
2. Cows
3. Goats

- All Ruminants
  - They have a big Fermentation vat in their Abdomen
    - We feed the Rumen and the Rumen feeds the Animal
      - Produces Energy(VFA), Protein, Fat and B-vitamins
      - Cobalt "requirement"

18

FIBER DIGESTION

- BASIS OF SURVIVAL FOR ALL RUMINANTS
  - FIBER DIGESTIBILITY VARIES DRAMATICALLY
    - LEGUMES(ALFALFA, CLOVER, VETCH)
    - GRASSES(ORCHARDGRASS, TIMOTHY, CORN, FESCUE, BERMUDA
    - BY-PRODUCTS(SOYBEAN HULLS, BEET PULP)
  - RUMEN DEGRADABLE PROTEIN(RDP)-DEPENDENT
    - SOLUBLE FRACTION(AMMONIA)
    - INSOLUBLE FRACTION

19

BACTERIAL FIBER DIGESTION

- Requires a Healthy Rumen
  - Stable pH above acidosis Threshold
  - Low anti-nutritional Load
    - Wild Yeast
    - Mycotoxins
  - Currency of Energy in Ruminants
  - Produces Acetic Acid (Butterfat Lego)

20

21

- Medium and Long-Chain Fatty Acids
- Dietary
  - Unsaturated
    - Saturated During Rumen Residence
  - Saturated
- de novo Synthesis Interaction (RUFAL)

PRE-FORMED FATTY ACIDS

22

- Short and Medium-Chain Fatty Acids
- Acetic acid Precursor
  - Created from Fiber Digestion
- Indirect methyl donor Influence
- Enzyme Machinery Sensitive to CLA's

DE NOVO FATTY ACID SYNTHESIS

23

RUFAL-MILK FAT DEPRESSION

- Rumen Unsaturated Fatty Acid Level
- Dietary Concentration
  - Polyunsaturated Fatty Acids (PUFA)
  - Rumen Residence Time
  - Methyl Donor Concentration
  - Microbial Driven Saturation
  - Only Understood this in the last Decade

24

BACTERIAL PROTEIN SYNTHESIS

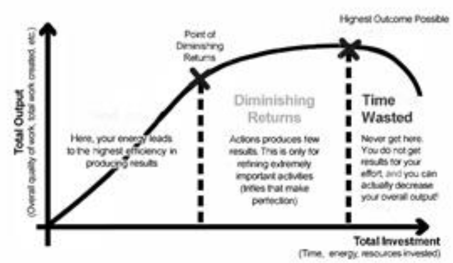
- Important source of Amino Acids
- Requires a carbon backbone and ammonia
- Bacteria continuously wash out of the rumen
- Ideal amino acid profile for milk

25

ECONOMIC PERFORMANCE V. SURVIVAL

26

ECONOMIC PERFORMANCE VS. SURVIVAL



That point at which the next additional unit of input results in less increase in output than the unit before

27

NUTRIENT IMPORTANCE

1. Oxygen – 50 gallons per day
   1. Air Quality(Aspect of Ewe Comfort)
2. Water – 2.5 gallons per day
   1. What else is in there besides H2O?
      1. Sulfur, Magnesium, protozoa, bacteria
3. "Feed" – 1.5 gallons per day

28

AMINO ACIDS

- Building Blocks for Casein
- Lysine and Methionine Primarily
- Two sources
  - Microbial (Bacterial and Protozoal)
  - Dietary

29

PROTOZOA

- They're Animals
- Least Understood Rumen Populations
- Used to View them as Predators
- Learning how to feed Them
- Significantly Contribute to Microbial Protein

30

FEED EFFICIENCY

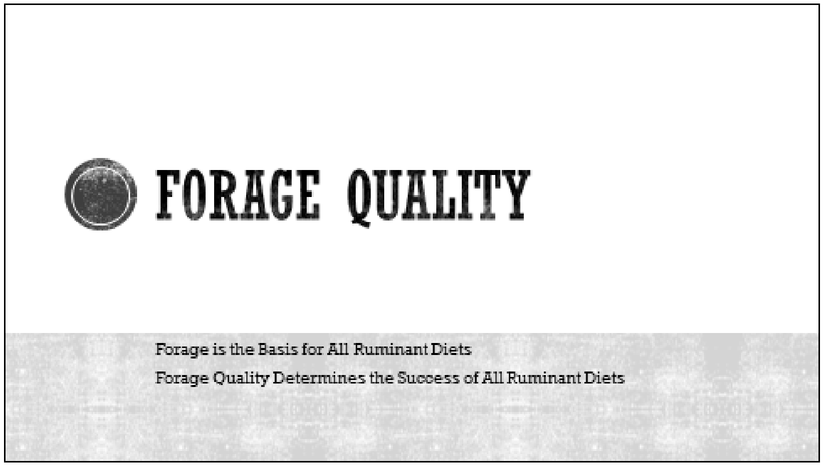
- Pounds of milk per (Dry Matter) pound of feed
  - Raw production
  - Energy Corrected Milk (ECM)
    - Takes components into account
      - Correlated to cheese yield
    - Most commonly used numerator
    - Looking for >1.6:1 in commercial cow dairies

31

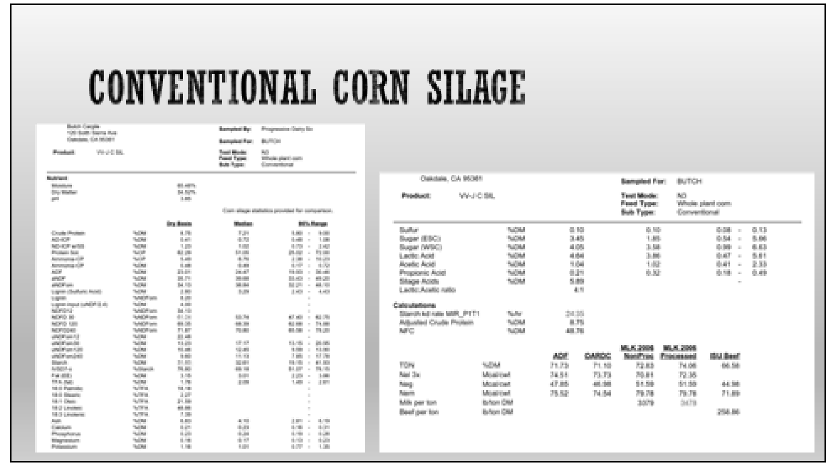
DRY MATTER INTAKE

- Controlled by 2 factors
  - Rumen Fill
    - Rumen Capacity
    - Passage Rate (Particle Size)
    - Rate of Digestion
  - Satiety (Hepatic Oxidation)
    - Energy-Dependent Negative Feedback Signal from the Liver
      - Chemical Signals the Brain to Stop Eating
        - Fats(dual role)>Starch>Protein>Fiber
      - Sensitivity of Response Determined by Stage of Lactation
        - Animal in Peak Lactation will Always be Limited by Rumen Fill
          - Insulin Sensitivity/Insensitivity

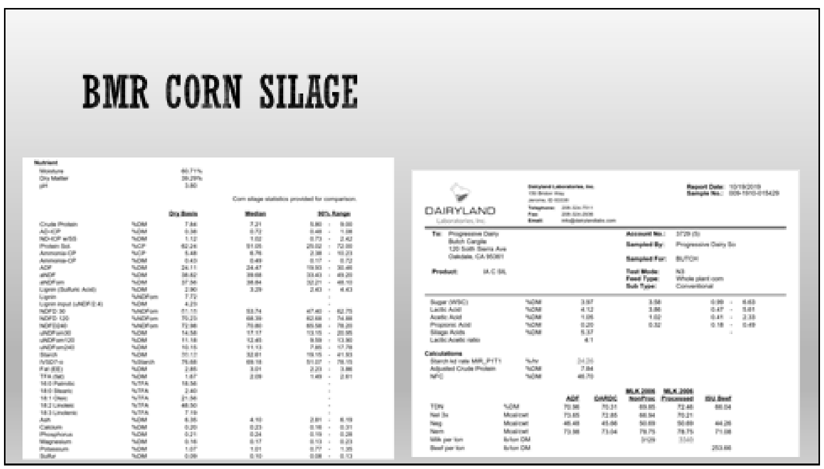
32


FORAGE QUALITY
Forage is the Basis for All Ruminant Diets
Forage Quality Determines the Success of All Ruminant Diets

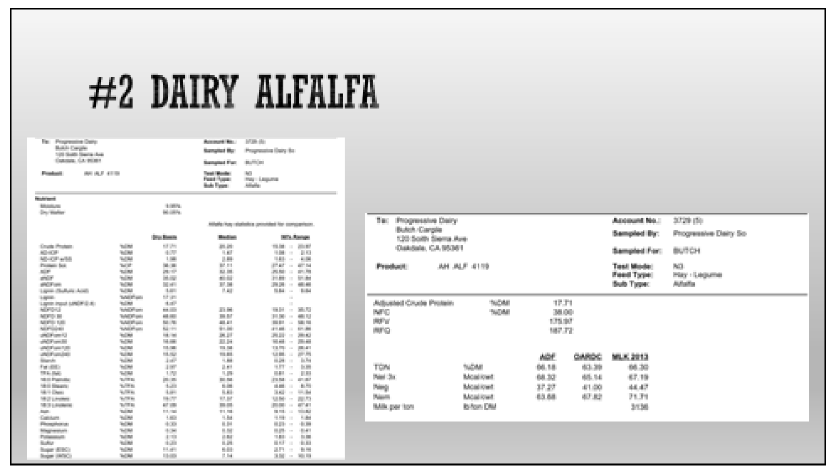
33


CONVENTIONAL CORN SILAGE

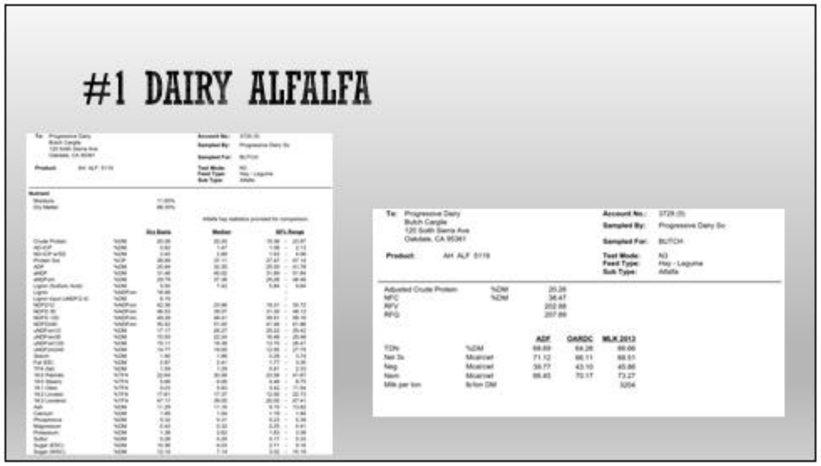
34

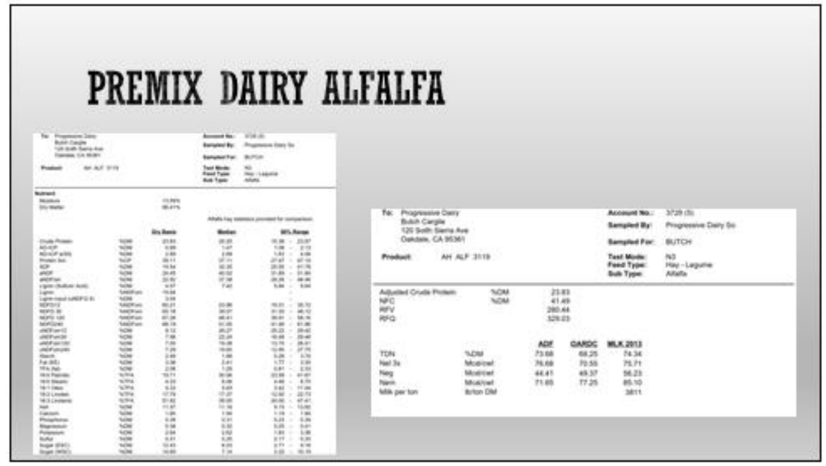

BMR CORN SILAGE
DAIRYLAND

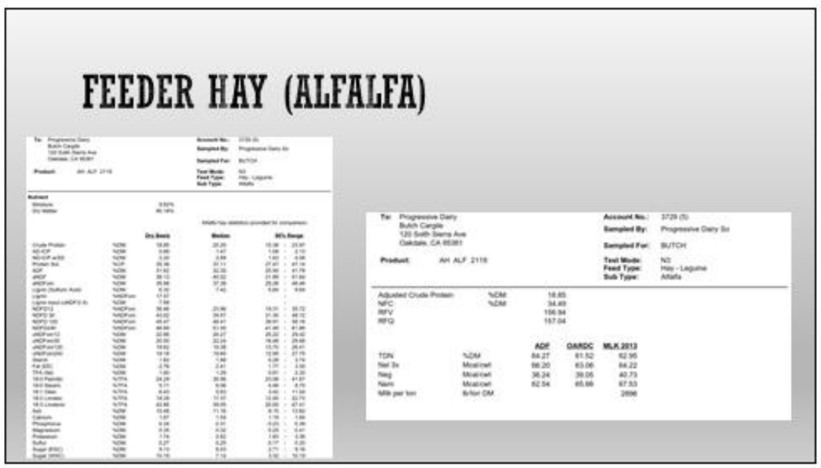
35

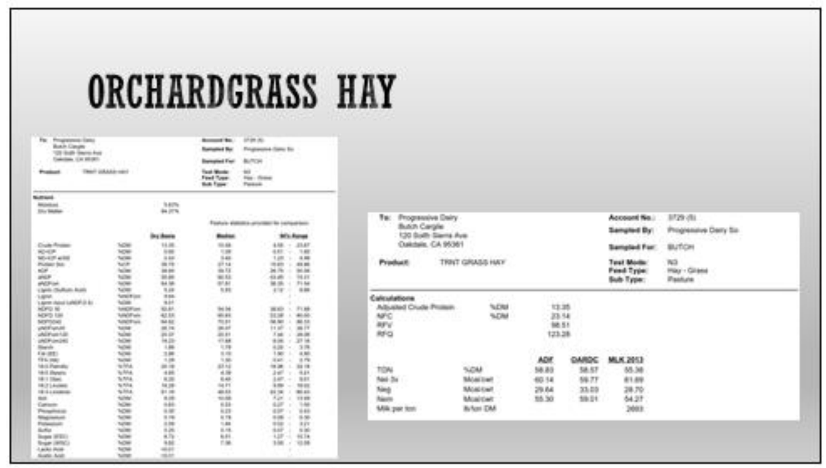

#2 DAIRY ALFALFA

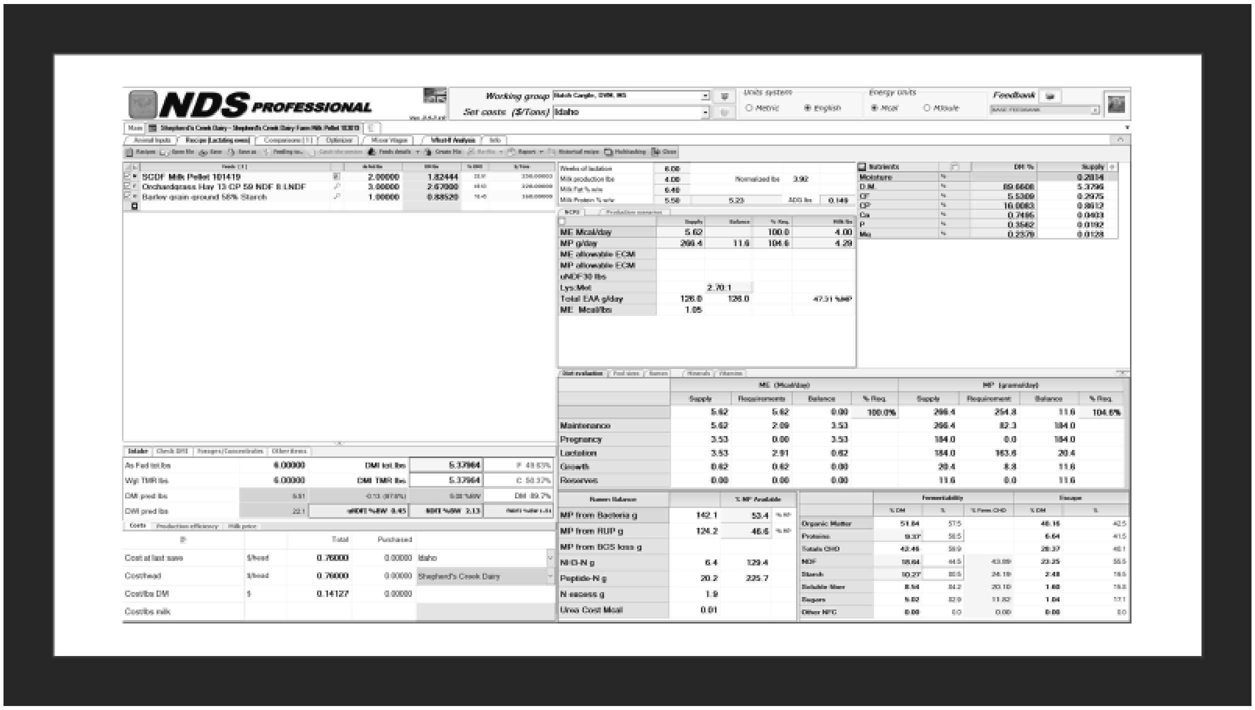
36


#1 DAIRY ALFALFA
To: Progressive Dairy
Butch Cargile
120 South Sierra Ave
Oakdale, CA 95361
Product: AH ALF 3119
Account No.: 3729 (5)
Sampled By: Progressive Dairy So
Sampled For: BUTCH
Test Mode: N3
Feed Type: Hay - Legume
Sub Type: Alfalfa
Adjusted Crude Protein %DM 20.26
NFC %DM 38.47
RFV 202.88
RFQ 207.89
ADF GARDC MLK 2013
TDN %DM 68.69 64.26 66.66
Nel 3x Mcal/cwt 71.12 66.11 68.51
Neg Mcal/cwt 39.77 43.10 45.86
Nem Mcal/cwt 66.45 70.17 73.27
Milk per ton lb/ton DM 3204
37


PREMIX DAIRY ALFALFA
To: Progressive Dairy
Butch Cargile
120 South Sierra Ave
Oakdale, CA 95361
Product: AH ALF 3119
Account No.: 3729 (5)
Sampled By: Progressive Dairy So
Sampled For: BUTCH
Test Mode: N3
Feed Type: Hay - Legume
Sub Type: Alfalfa
Adjusted Crude Protein %DM 23.83
NFC %DM 41.49
RFV 280.44
RFQ 329.03
ADF GARDC MLK 2013
TDN %DM 73.68 68.25 74.34
Nel 3x Mcal/cwt 76.68 70.55 75.71
Neg Mcal/cwt 44.41 49.37 56.23
Nem Mcal/cwt 71.65 77.25 85.10
Milk per ton lb/ton DM 3811
38


FEEDER HAY (ALFALFA)
To: Progressive Dairy
Butch Cargile
120 South Sierra Ave
Oakdale, CA 95361
Product: AH ALF 2118
Account No.: 3729 (5)
Sampled By: Progressive Dairy So
Sampled For: BUTCH
Test Mode: N3
Feed Type: Hay - Legume
Sub Type: Alfalfa
Adjusted Crude Protein %DM 18.85
NFC %DM 34.49
RFV 156.94
RFQ 157.04
ADF GARDC MLK 2013
TDN %DM 64.27 61.52 62.95
Nel 3x Mcal/cwt 66.20 63.06 64.22
Neg Mcal/cwt 36.24 39.05 40.73
Nem Mcal/cwt 62.54 65.66 67.53
Milk per ton lb/ton DM 2898
39


ORCHARDGRASS HAY
To: Progressive Dairy
Butch Cargile
120 South Sierra Ave
Oakdale, CA 95361
Product: TRINT GRASS HAY
Account No.: 3729 (5)
Sampled By: Progressive Dairy So
Sampled For: BUTCH
Test Mode: N3
Feed Type: Hay - Grass
Sub Type: Pasture
Calculations
Adjusted Crude Protein %DM 13.35
NFC %DM 23.14
RFV 98.51
RFQ 123.28
ADF GARDC MLK 2013
TDN %DM 58.83 58.57 55.36
Nel 3x Mcal/cwt 60.14 59.77 61.89
Neg Mcal/cwt 29.64 33.03 28.70
Nem Mcal/cwt 55.30 59.01 54.27
Milk per ton lb/ton DM 2683
40


NDS PROFESSIONAL


QUESTIONS

Tools to Monitor Flock Nutritional Status and Udder Health

445 Barnard Blvd ⬥ Sunnyside, WA 98944 ⬥ 509-836-2020
Dr. Fred Muller and Dr. Lynn VanWieringen

Services Offered

Milk Analysis
Feed Analysis
Blood Pregnancy Testing (BioPryn)
Manure Analysis
Small Ruminant Blood Testing
(CAE, CL, BioPryn, and Johnes)
Equine Feed Analysis
Water Analysis (e coli & nitrate)
Johnes Testing
Hops Analysis

Ag Health Laboratories

Fecal Nutrient Content

- Sometimes nutritionists will request fecal starch content
- This number is used to assess the digestibility of the Total Mixed Ration (TMR).
- Typically, it is assumed that the lower the fecal starch percentage the higher the digestibility of starch in the diet

Fecal Starch

- One drawback to this approach is we don't know the beginning starch value of the diet.
- Without knowing what the starting amount of starch was in the diet, it is difficult to know if the fecal starch level is high, medium, or low. Assumptions need to be made to interpret the results.

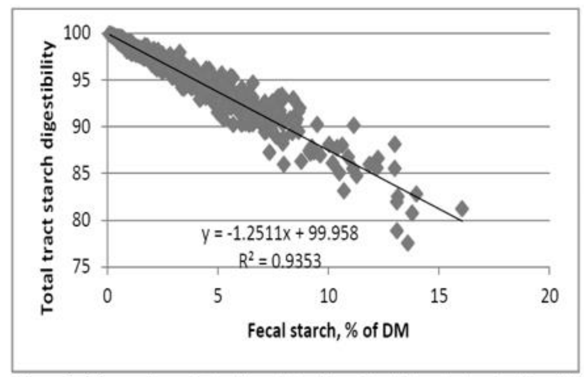
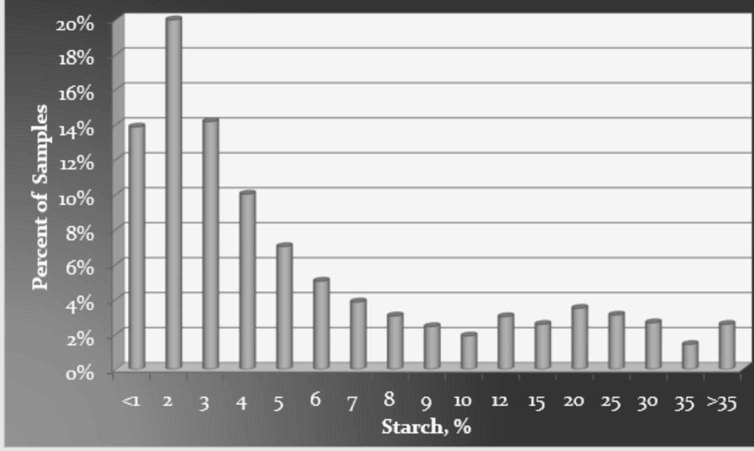


Figure 2. Regression plot of fecal starch and total tract starch digestibility.
$Y = 99.96 (\pm 0.065) - 1.25 (\pm 0.014) X$; RMSE = 0.936; $R^2 = 0.94$; $P < 0.0001$; n = 564.

Updated equation from Ferraretto & Shaver, 2012, PAS

Distribution of Starch Values in Feces (CVAS 2012, Chemistry Methods)



Apparent (whole tract) Nutrient Digestibility

- It is a tool available to the dairy industry to *estimate* whole tract digestibility of different nutrients in a Total Mixed Ration
- 240 hour undigestible NDF can be used as a marker
- The ratio of a nutrient to uNDF (starch, pNDF, and CP) in a ration plus the ratio of a nutrient (starch, pNDF, and CP) to uNDF of the remaining fecal material are determined
- From this information a ‘reasonable’ estimate of digestibility can be calculated

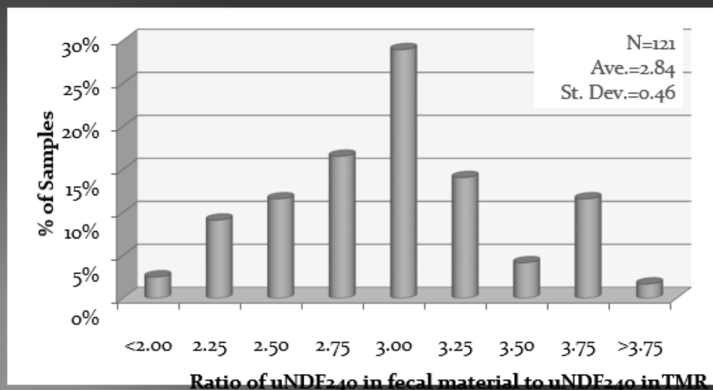
Apparent (whole tract) Nutrient Digestibility

- Feed analyses can be done via 2 methods
  - Wet Chemistry
  - NIR (Near Infrared Spectroscopy)
- Apparent Nutrient Digestibility can be determined using both methods of feed analyses
- The advantage of using NIR Apparent Nutrient Digestibility Estimates is:
  - Quick turnaround time
  - Cost savings
- However…

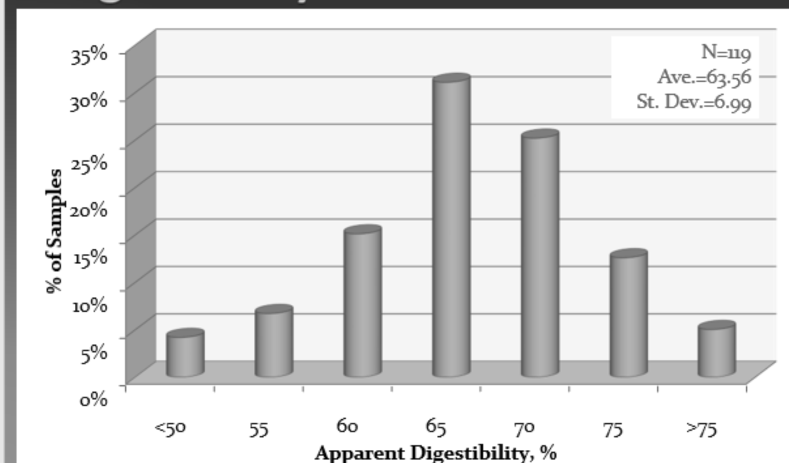
Apparent (whole tract) Nutrient Digestibility

- It is not available for Dairy Sheep
- It may be possible to get this measurement for dairy sheep using wet chemistry methods
  - Advantage: Get information about digestibility of diet
  - Disadvantage:
    - It will take at least 14 business days to get results
    - Cost
    - Takes time and effort to get ‘proper’ feed and fecal samples (otherwise results will be meaningless)

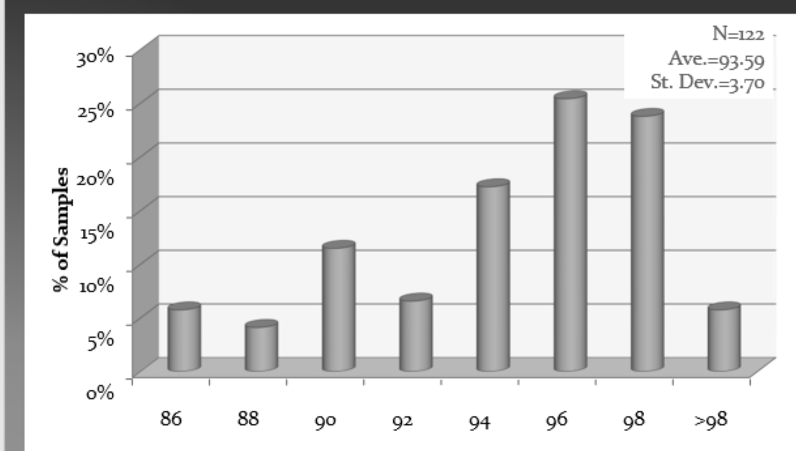
Distribution of Ratio of uNDF240 in Fecal Material to uNDF240 in TMR (CVAS Data)



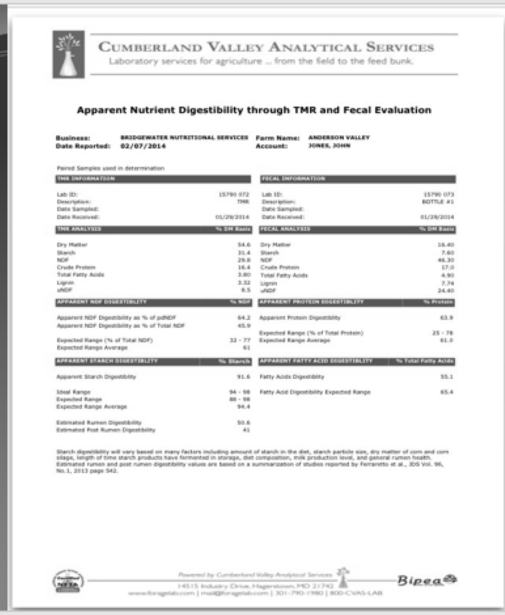
Distribution of Apparent Digestibility of TMR Protein (CVAS)



Distribution of Apparent Digestibility of TMR Starch Data (CVAS)



Apparent Digestibility, %



Cumberland Valley Analytical Services
Laboratory services for agriculture ... from the field to the feed bunk.

Apparent Nutrient Digestibility through TMR and Fecal Evaluation

Business: BRIDGEWATER NUTRITIONAL SERVICES **Farm Name:** ANDERSON VALLEY
Date Reported: 02/07/2014 **Account:** JONES, JOHN

Paired Samples used in determination

TMR INFORMATION		FECAL INFORMATION	
Lab ID:	15790 072	Lab ID:	15790 073
Description:	TMR	Description:	BOTTLE #1
Date Sampled:		Date Sampled:	
Date Received:	01/29/2014	Date Received:	01/29/2014

TMR ANALYSIS	% DM Basis	FECAL ANALYSIS	% DM Basis
Dry Matter	54.6	Dry Matter	16.40
Starch	31.4	Starch	7.60
NDF	29.8	NDF	46.30
Crude Protein	16.4	Crude Protein	17.0
Total Fatty Acids	3.80	Total Fatty Acids	4.90
Lignin	3.32	Lignin	7.74
uNDF	8.5	uNDF	24.40

APPARENT NDF DIGESTIBILITY	% NDF	APPARENT PROTEIN DIGESTIBILITY	% Protein
Apparent NDF Digestibility as % of pdNDF	64.2	Apparent Protein Digestibility	63.9
Apparent NDF Digestibility as % of Total NDF	45.9		
Expected Range (% of Total NDF)	32 - 77	Expected Range (% of Total Protein)	25 - 78
Expected Range Average	61	Expected Range Average	61.0

APPARENT STARCH DIGESTIBLITY	% Starch	APPARENT FATTY ACID DIGESTIBILITY	% Total Fatty Acids
Apparent Starch Digestibility	91.6	Fatty Acids Digestibility	55.1
Ideal Range	94 - 98	Fatty Acid Digestibility Expected Range	65.4
Expected Range	88 - 98		
Expected Range Average	94.4		
Estimated Rumen Digestibility	50.6		
Estimated Post Rumen Digestibility	41		

Starch digestibility will vary based on many factors including amount of starch in the diet, starch particle size, dry matter of corn and corn silage, length of time starch products have fermented in storage, diet composition, milk production level, and general rumen health. Estimated rumen and post rumen digestibility values are based on a summarization of studies reported by Ferraretto et al., JDS Vol. 96, No.1, 2013 page 542.

Powered by Cumberland Valley Analytical Services
www.foragelab.com | mail@foragelab.com | 301-790-1980 | 800-CVAS-LAB

Apparent Digestibility Sample Collection Method

- ✓Fecal Sample
- ✓TMR Sample
- ✓Labeling for Analysis

Fecal Sampling

- Sample 10 ewes in a group that have been consuming the same diet for 2 weeks.
- Ewes should be less than 150 days in milk
- Sample 1 good handful per ewe and mix well in a 5 gallon bucket.
  - If you are taking off the ground it should be freshly deposited
  - Make sure not to get any foreign matter (grass, straw, dirt, etc.) in the fecal sample
- Use manure sample containers from the lab
- We need about 250 mL for analysis

Diet Sampling

- Is a complex process compared to taking a grab sample of a Total Mixed Ration (TMR), as would typically be done with dairy cattle
- Must do some math (especially if the dry matter or moisture content of the feeds is different)
- Will need to make some assumptions about dry matter intakes and what a lactating ewe is consuming based on body weight
- Will take time and effort
  - To collect a representative sample
  - Process or prepare the sample (hay or pasture)
  - Weigh the samples of each feed ingredient to get into the proper ratio in the quart Ziploc bag.

Diet Sampling – Items Needed

- Time
- Paper, pen, and calculator
- Collection container (5 gallon bucket)
- Some device to clip pasture sample
- Hay corer (if collecting hay sample)
- Scale
- Container to weigh samples
- Quart Ziploc bags and Sharpie to write on Ziploc bag

Diet Sampling

- Take a sample of each ingredient in the diet (pasture, hay, grain, etc.)
- Put it into a Ziploc bag, tub or 5 gallon bucket in the ratio that the ewes eat it
    - This will most likely have to be estimated based on assumptions of how much a lactating ewe in early lactation is consuming and the ratio of forage to concentrate that is assumed to be in the diet
- For example, if feeding 80% hay and 20% concentrate. The Dry Matter content will be similar on these ingredients.
    - Add 8 parts hay (should be chopped)
    - Add 2 parts grain

Diet Sampling (cont.)

Example 2:

- The ewes are consuming a diet of 80% pasture and 20% grain on a dry matter basis.
- Must adjust ratio for moisture content before sampling
    - Ewe weighs ~150 lbs and DMI is 4% BW in early lactation
    - Ewe eats ~6 lbs of DM per day
    - Pasture is roughly 20% DM
    - Ewe will eat roughly 24 lbs pasture/day as-is
    - Grain is roughly 90% DM
    - Ewe will eat roughly 1.3 lbs grain/day as-is
- The sample collected needs to be in this ratio

Diet Sampling (cont)

- The ratio on an 'as-is' basis would be ~95% pasture to ~5% grain
    - Sample the pasture similar to how the sheep would graze it.
    - Clip pasture samples into smaller pieces in a tub or 5 gallon bucket
    - Mix thoroughly
- In a 'Labeled' quart Ziploc bag add:
    - Pasture sample that has been chopped and thoroughly mixed in a ratio of 95%
    - Grain sample in a ratio of 5%

Labeling for Analysis

- Label the Feed Sample "Apparent (Protein, NDF, Starch) Digestibility" by Chemistry
- Label the Fecal Sample "Apparent (Protein, NDF, Starch) Digestibility" by Chemistry
- Make sure the Account and Farm Name Information is Consistent on These 2 Samples (Feed and Fecal)
- Ship the 2 samples together in the same package
- Ship the sample to arrive in 2 days

Interpreting Results

- Use information within the same flock (not across flocks)
- Take fecal samples from early lactation ewes
- DO NOT sample across production levels (high, med, low)
- Do apparent digestibility estimates strategically over time based on
  - changes in feed quality
  - changes in diet
  - changes in milk production that can't be explained by other factors such as mastitis outbreak, DIM increasing past peak production on the majority of the flock

What is BioPRYN:

BioPRYN is a partial acronym for 'Pregnant Ruminant Yes/No'.

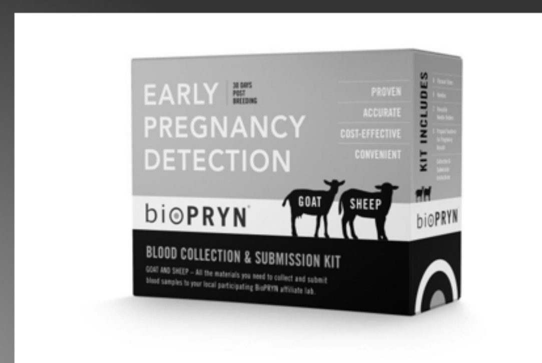
Evaluates ruminant blood for the presence of Pregnancy Specific Protein B (PSPB)

PSPB is produced by the placenta

Sheep MUST be 30 days post breeding or greater

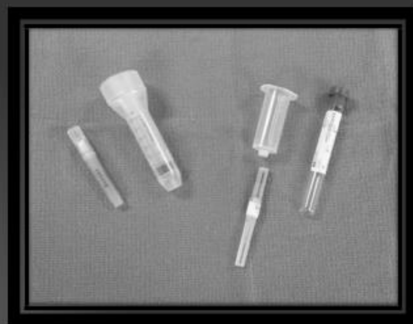
Greater than 99% Sensitivity

BioPRYN Blood Collection and Submission Kit



Blood Collection Supplies

You're welcome to pick them up at the lab or we can ship them to you.



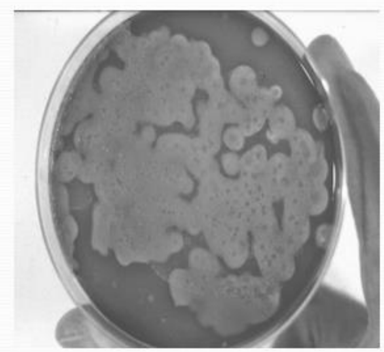
Ag Health Laboratories

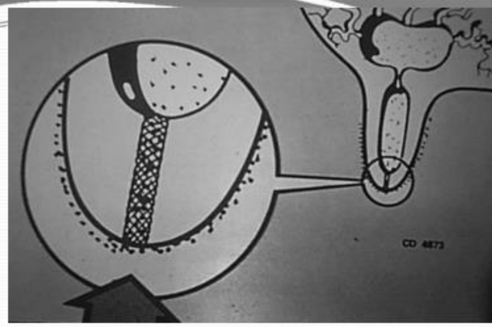
Blood Sample Collection

Blood Sample Collection

vetstudentinthetropics.wordpress.com

Mastitis is caused by bacteria



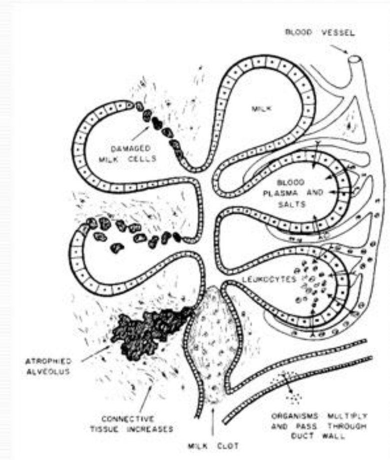


Two Factors to Prevent Mastitis:

- Reduce number of bacteria on teat end
- Prevent bacteria from getting into teat end

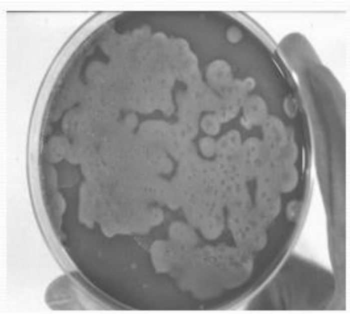
Somatic Cells

- Somatic cells are the cow's response to bacteria in the udder
- Large amounts of somatic cells in garget



Teats must be dry when milking

- Water carries bacteria to the teat end
- Milking wet cows contributes to cases of coliform mastitis



Pre-dip

- Should be used in place of water to remove soil from teats

Foremilking

- Detection of abnormal milk
  (evaluate milk on the floor)
- Contributes to milk let-down reflex

Step #3

Wipe Teats Clean

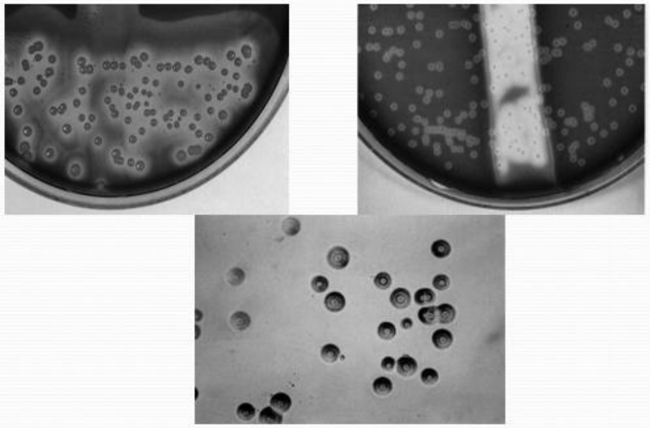
Proper Post Dipping

- Dip every teat after every milking
- Dip entire surface of teat that contacts inflation

Do Not Wet Hand Milk

- Milk on hands can spread contagious bacteria from quarter to quarter and cow to cow

Mastitis Pathogens



Specific Pathogens

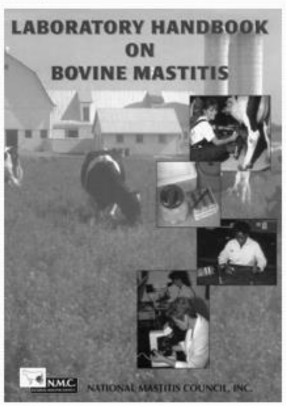
Contagious

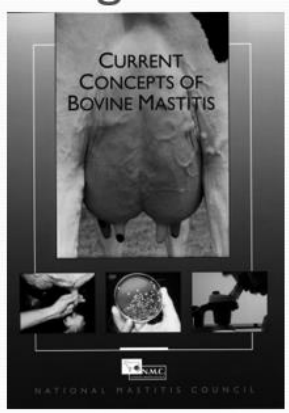
- *Staph. aureus*
- *Strep. ag.*
- *Mycoplasma sp.*

Environmental

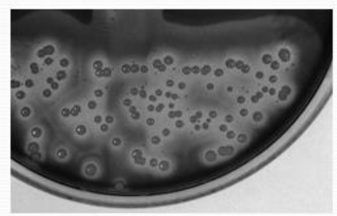
- ***Staph species***
- ***Strep non-ag.***
  - ***a) uberis***
  - ***b) dysgalactiae***
- **Gram negatives**

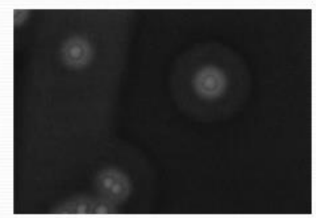
Supplemental Reading





Staphylococcus aureus





- Partial hemolysis (beta zone)
- Complete hemolysis (alpha zone)
- Partial and complete hemolysis

Progression of Pathology

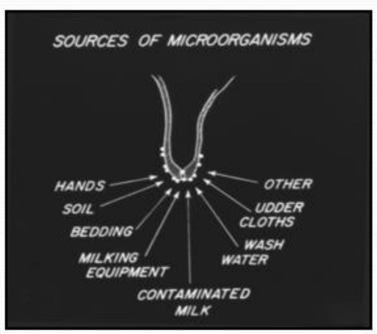
- Irritates tissue lining cisterns, ducts
- Establishes in alveolar tissue
- Wall off in interstitial space causing abscessation, scar tissue
- Intermittent shedder, progressive SCC

Epidemiological Factors

- Can be spread by flies
- Explosive with poor teat skin condition

Epidemiological Factors

- Spread during milking process by contaminated fomites.



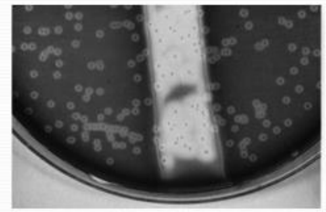
Control Measures

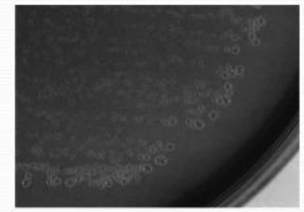
- <u>Effective</u> teat dipping
- Dry off therapy
- Culture all cows entering herd, high SCC cows, and clinical quarters
- Use of latex or nitrile gloves, hygiene
- Single use toweling only
- Segregate or cull problem ewes
- Cluster disinfection (different than backflush)

Treatment

- Responds to antibiotics early in infection
- Dry cow therapy is more cost effective than lactating therapy
- May not be cost effective (three-peat)

Streptococcus agalactiae





The clear stripe is a positive CAMP reaction resulting from the combination of hemolysins from *Strep ag* and a beta hemolysin of *Staph aureus* applied to the plate

Clinical Disease

- Milk clots in foremilk that diminish after milk let down
- Organisms can be shed in very high numbers (illegal SPC)
- Explosive spread from cow to cow and quarter to quarter (high numbers)
- Becomes clinical with poor milk out
- Responds well to intramammary antibiotic although re-infection common

Epidemiological Factors

- Organism easily killed by antibiotic or common hygiene practices
- Shed in very high numbers
- Explosive with poor teat skin condition
- Spread by milking process with contaminated fomites

Control Measures

- <u>Effective</u> teat dipping
- Effective dry off therapy
- Single use toweling only
- Latex or nitrile gloves and good milking hygiene

Treatment

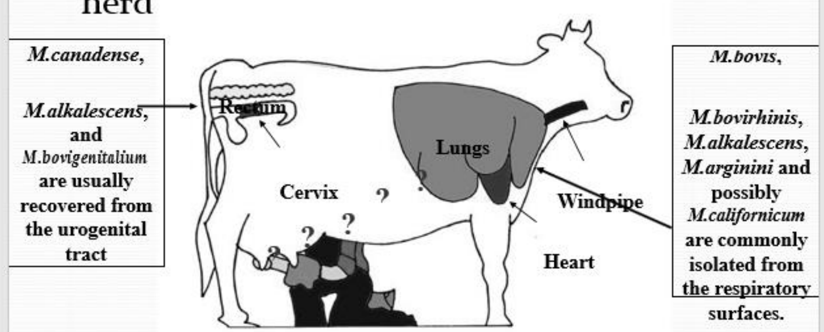
- Very responsive to beta lactams
- Lactating therapy can be cost effective
- Dry off therapy most cost effective
- "Blitz" treatment has been used economically in some herds. Seldom warranted if herd culture is possible

Strep ag Eradication

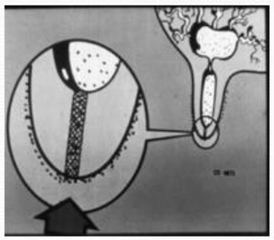
- Very possible
- It is a shame we see it as often as we do
- Milk production goes up
- Can be eliminated from herds relatively easily with good management

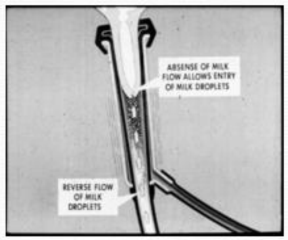
Relevant Mycoplasma Epidemology

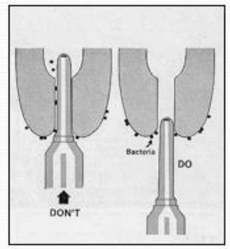
- Mycoplasma mastitis strains are in every herd



How Mycoplasma gets into teat





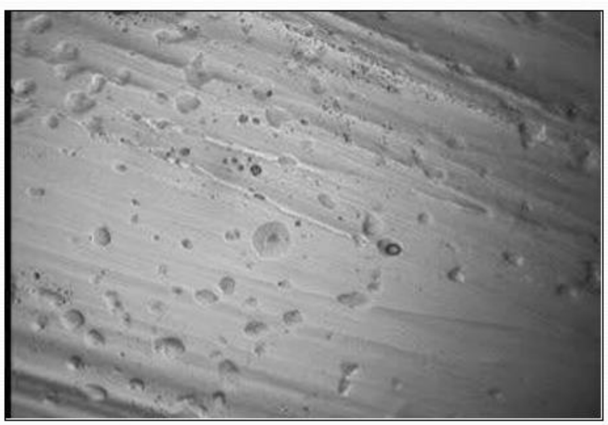


?? Occasionally may get to udder via blood??

Segregation vs. Culling

- Cull
  - when a few cows are involved and there is no place to separate
- Segregate
  - when prevalence rate is significant
  - when segregation facilities exist
- Beware
  - many Mycoplasma cows appear "normal" after 30 days

Myco's Progressively More Difficult Colonies



Step One: Label milk tube

- Label tube with cow number first with dry hands
- Use a permanent marking pen
- Write collection date

Ag Health LABORATORIES

Step Three: Swab teat with alcohol soaked 4x4

- If composite sample swab far teats first, then near teats
- Concentrate on teat end

Ag Health Laboratories

Step Four: Discard 1-2 squirts of milk

- Clears teat canal of potential microbial contaminates
- Helps reduce false positiv results
- Do not get milk on glove surface

Ag Health Laboratories

Step Five: Take milk sample

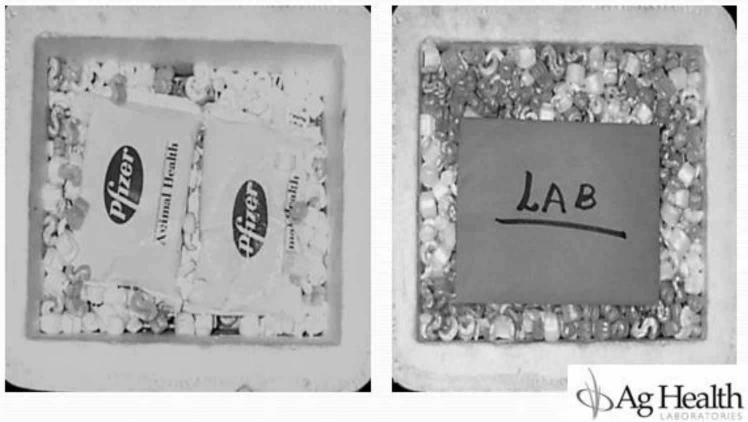
- If composite sample take equal amount from each quarter
- Sample near teats first, far teats last
- Do not fill tube more than 3/4 full

Ag Health Laboratories

Step Seven: Refrigerate or Freeze samples immediately

Ag Health Laboratories

Pack With Ice Packs, Popcorn, and Protected Lab Work



Producing & Selling Bottled Milk at Misty Meadow Sheep Dairy

Misty Meadow Farm, Petersburg, NJ

Bill Simmerman

Our farm is called Misty Meadow Sheep Dairy. We are in Southern New Jersey. We have 16 acres and we milked 35 ewes this year. Next year we will be milking 50 ewes. Most of our milk goes to making a plain yogurt. This year I used a lot of milk experimenting with all kinds of things, to see what might work best for our farm.

Our motivation for bottling milk was basically a demand. My wife, Barbara, bought bottles for me to bottle milk for the house. I filled them and put them in the refrigerator. They are a cute shape, a 32-oz quart glass bottle, and when people saw the bottled milk, they wanted to buy it.

Packaging

We package pasteurized fluid milk in a 32 oz. glass milk bottle with a tamper-resistant plastic cap. Our label is our logo, and is colored, and moisture resistant.

The glass bottle was chosen because we liked the idea of recycling and reusing the bottles. The label was a quick way of processing this year, while we planned our screen-printing label for future.

(Future bottles will be screen printed, because it will look better and there will be less trash from the foil labels and their backing.)

The Process

The milk is first pasteurized, run the through a chiller, and then bottled with the use of a micro dairy bottle filling system.

Why bottled milk?

Most of our consumers are people that just want good, fresh milk, and want to know:

- where it comes from
- that we are taking care of the animals well;
- feeding the ewes well with NON GMO feed, and
- using no sprays here on the farm.

People really appreciate this.

Customer response

The first response is "it's new" and people just want to "try" it! People are generally surprised at how delicious the milk is! They tell us later that they drank the bottle on the way home. For many, they just like it so much and want to keep getting more. We also have customers who cannot tolerate cow's milk and buy sheep's milk.

The Pros

1. We are offering another great product to our customers,
2. providing another item to purchase in our store (selection), and
3. Helping customers to have milk that they may not otherwise have.

The Cons

If our value-added products gain in popularity, we may have to decide whether it is important to keep customers happy by keeping the bottle milk, when more profit is made with the value-added products.

Bottling Sheeps Milk in Montana

KJ'n Ranch, INC. & Sheep Mountain Creamery
6460 Birdseye Rd, Helena MT 59602
Kim and Jim Ashmore

What motivated you to start bottling milk for consumer consumption?

As a small start-up creamery, we wanted more than one product line that would be affordable within our infrastructure budget and would address a need or interest in the community. We have a high population of milk-allergy consumers in Montana that would like to be able to taste and enjoy milk, and we wanted to address that need as well. We have several regular customers who now are enjoying milk products, fluid and solid/cheeses, which they have not been able to in the past.

Describe your bottled milk product

We use a signature squatty plastic quart bottle to package our fluid pasteurized milk. The state of Montana currently does not allow sale of raw milk for human consumption. We also freeze our raw milk to be able to process during our non-lactating season, providing milk locally year-round.

Why did you choose that packaging/presentation? How do you package the milk?

We wanted something unique, not typically used with cow's milk packaging to help make it stand out when shelved in a retail outlet. We use a bottling system that is not fully

automated but allows the movement of the fluid milk and sealing of the bottles without any human touch or possible contamination (see attached picture).

Describe your primary consumer of your bottled milk.

All-natural and organic consumers, and those with lactose sensitivity.

What has been the consumer/market response to your bottled milk?

SURPRISED! So many have commented on how good it tastes and that it does not taste or smell like SHEEP or GOAT. A creamy, smooth, comfortable, great taste without an aftertaste left in the mouth.

What do you see as the pros/cons to offering bottled milk?

A significant CON is that the production and labor costs are high and a challenge to get the price to a level that an average customer can afford, which directly impacts sales.

The PRO, which gives us hope for continued growth and increased sales, is the need and expressed demand for another HEALTHY CHOICE, the works for calcium, proteins, and solids needed for a balanced healthy diet.

Will you do anything differently next year?

As far as the packaging process nothing in the near future. Other things we look at each year are marketing opportunities, distribution options, and pursuing our customers needs.

Selling Bottled Sheep Milk Direct to the Consumer

Whispering Pines Farm, Mauldin, SC
Debbie Webster

We have 180 acres with over 150 ewes. Our farm's products range from cheese (60%), to yogurt, kefir and bottled milk (40%).

<u>How we got started bottling sheep milk.</u> Sheep milk is extremely rare. People were curious about the taste. We sold the majority of our raw goat milk bottled, probably as much as 80 percent. Since we were set up to bottle, it was easy to bottle the sheep milk. I sold it for twice the price of goat milk. Once the customers tasted it and researched the health benefits, we had regular customers. One of the best customers we have is a pharmacist who recorded the positive outcomes from his two children. His children, which were infants at the time, had immune disorders. Their growth and weight-gain percentiles were low. After using sheep milk the first time, they slept through the night for the very first time which made the price irreverent! The babies started to grow, gain weight, and were less fussy. Now that those infants are children, they ask for sheep milk!

<u>Our packaging.</u> We use plastic milk jugs in pint, quart, and half-gallon size. Currently, we make our own labels. We can freeze in the jugs. I can sell wholesale in 5-gallon containers – buckets or bags with a spout. We freeze the bags. If I plan to sell frozen milk to customers, I have only 2 gallons packaged in the bag to freeze. To make it work in their home freezer – so I don't need to store it all winter – I freeze in the dimensions that a home unit can handle. I can use food

storage containers to place bagged fluid milk in the freezer. Once frozen, it can store on edge and take less space.

We chose this packaging option because we were already set up with packaging equipment, and containers are easy to obtain and a minimal cost.

Our bottled-milk customers. Our primary regular users are infants and the elderly. For large quantities, but not as regular, our consumers are cheese makers.

Consumer response. To test consumer response, we had a group from the Sandburg goat farm volunteers come to visit. They did a blind taste test between the goat milk and sheep milk. 100% of them chose sheep milk as their favorite.

The pros and cons to bottling sheep milk. I assumed sheep milk would be well-received and bottled a bunch for a local market. But the price holds a lot of people from getting it regularly.

> *Pro:* A good price with the extra labor being minimal compared to cheese making.
>
> *Cons:* A short shelf life compared to aged cheeses. This can limit cheese batches. I only bottle by request.

Looking ahead. For next year, I'm looking into glass bottles for milk. We tried it before but it wasn't cost effective to use – expensive packaging on an already-expensive product. We used glass jars for yogurt for smaller portions. Glass keeps it colder quicker and longer, which helps with shelf life and taste. Our community likes the idea of recycling, so we would also like to contribute to caring for the environment in this way.

Using H-2A Workers on Our Seasonal Sheep Dairy Farm

Meadowood Farms, Cazenovia, NY

Bee Tolman

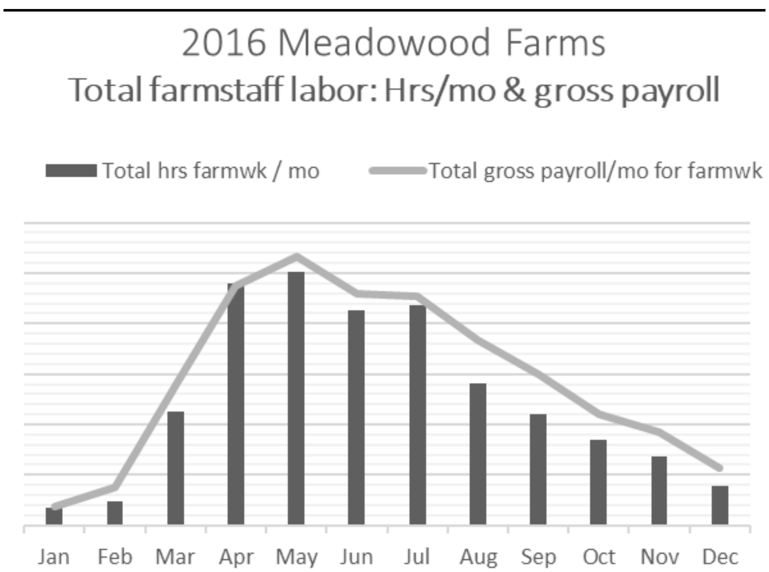
[Quincy Wool Parker, Operations Manager; Marc Schappell & Tom Anderson, Owners]

Dairy farming is not for the average bear. The work is hard, the hours are ugly, the conditions often are not made for human beings, the pay isn't so great, and the "opportunity for advancement" is … well, pretty limited. Although many *think* they want to farm, the reality of dairy farming usually sends people packing. I have been working in livestock agriculture since 1982. I started dairying (milking cows) in 1993, and shifted to dairy sheep in 1998. For the last 22 years I have either owned or managed a dairy farm. And if you were to ask me what was the biggest challenge, year in and year out, my answer would be --

"Labor": Can't find it, can't depend on it, can't keep it.

Here are the challenges to staffing a small seasonal dairy farm:

<u>The labor curve.</u> Here was the 2016 labor curve at Meadowood Farms. Generally speaking, we need only a half-time person for the winter months. And then suddenly at the start of lambing, and extending into mid-season, we need 3.0 full-time equivalents (FTEs) to cover winter lambing, baby lamb care, 14 milkings, feeding, the farmers market, daily fencing and pasture management, putting up forage, and the other necessary farm work, … and to cover the threat of attrition (more on that later).



The labor pool. Most of the middle-class Anglo kids that apply for these farm jobs are simply not prepared to work long hours, get up at unattractive hours in the morning, work weekends, and push through cold or rain or fatigue. At Meadowood we tended to hire at least a few part-timers, so that when kids would quit midseason, we'd still have enough bodies to cover the essentials. We tended to try to start the season with more employees then we really needed, because we knew that we would always lose at least a couple over the course of the season. There have been years when we dried off ewes early because we did not have enough bodies to cover milking.

Training. The breadth of training required on a seasonal, pasture-based dairy farm is enormous. Your farm staff needs to be trained in about 1,000 critical details every year: newborn lamb care, fencing, feeding animals, milking animals, operating the milking system. At any given moment, one detail can be your undoing: the bulk tank isn't switched on, the electric fence isn't switched on, your milkers don't get enough feed, the fence is not connected properly, the lamb bar doesn't have enough milk, your 8 rams were fed five gallons of corn daily (instead of 5 *pounds* of corn daily) one week before breeding, and on and on and on. It's a monumental amount of training, and one little piece of ignorance can derail your operation. But because so few of your staff return from one season to the next, it's like Groundhog Day: each year you start all over again.

Lack of reliability. The lack of reliability in staff is a real killer. We all have stories of staff not showing up for milking. I call them "past tense" stories – events or incidences that are extremely unfunny at the time, but which make for a good story years after the pain has subsided. I'll give you my top three. For each of these, you have to imagine an atmosphere of personal desperation, that these are the people that you have employed – the *type* of people you employ -- simply because sometimes there is no one else.

> *DJ, 2003.* Hired because he was the fiancé of my landlord's hairdresser, and he was unemployed and came *very strongly* recommended by his soon-to-be wife. He worked with me in the parlor for two weeks, during which time I could not, at any point, get him to remove his winter jacket and his gloves while milking. He finally told me that he liked the job except for the parts that had to do with touching sheep, and he would do anything I wanted on the farm except milk. I told him that as we had a sheep dairy, there probably would not be much more work for him.

Tommy, 2000. I did all the right things: interviewed, advertised, selected the most promising candidate. His hours were 4 AM to 2 PM, Tuesday through Saturday, except on Saturdays when he needed to stay until 3 PM. On Saturday mornings we sold about 20 lambs to the local Bosnian community who would come to the farm to buy and kill their lambs on site, right after we finished morning milking (300 ewes) and morning chores (600 lambs). I did the afternoon milking seven days a week, and every other night after supper I would I bag and freeze milk in the milk house while listening to NPR. [Please note a rather unhealthy environment for an ongoing marriage.] Tommy had worked with me for about a month when I got a call at 1:00 AM on a Saturday morning. It went as follows:

> *Me*: ***Hello !?!?!?*** (1:00 AM calls usually mean that the barn is on fire, or the sheep have gotten out and are in the middle of the road.)
>
> *Tommy*: Uh, is this Bee?
>
> *Me*: Yes!! What's happened?
>
> *Tommy*: Uh, I won't be able to make it to work in the morning. [Remember that "work in the morning" was to start only three hours from the time of this particular phone call].
>
> *Me*: Um, OK. … Why not?
>
> *Tommy*. I'm in jail. I got arrested.
>
> *Me*: Um, OK. … What for?
>
> *Tommy*: Assaulting a police officer. But it was a bullshit charge!
>
> *Me*: Ah.
>
> *Tommy*: So can you come and bail me out?
>
> *Me*: No, sorry.

And that was the last I heard from Tommy.

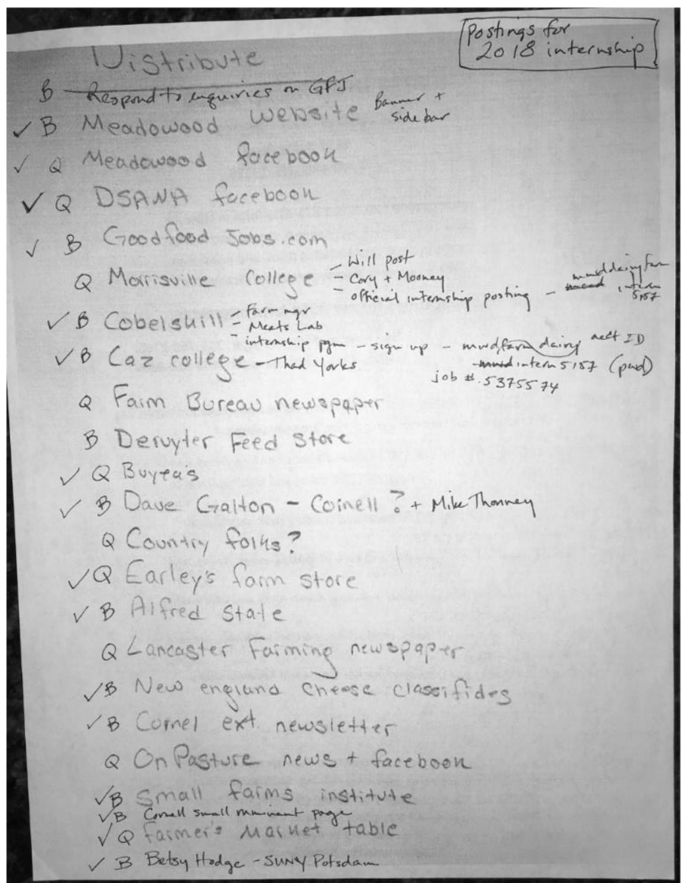
Gretchen, 2016. Gretchen worked part time in our creamery, and helped with milking three times a week. On one rare occasion she was scheduled to milk on a Sunday morning, and I was going to have the morning off. At 11:00 PM my cell phone dings next to my bed. It is a text from Gretchen, what I now think of as the classic millennial passive-aggressive gem:

> *"Hi Bee. I feel a cold coming on, and so I think I'd better not work tomorrow. I am going to shut my cell phone off now so that I can get a good night's sleep."*

It's absolutely brilliant. Still takes my breath away.

2018, the last straw

In our region most dairy farms who are unable to use undocumented workers usually need to staff about 50% more FTEs than they actually need. This is to balance the staff attrition that they are guaranteed to see. We were the same. We needed to start the season with about 50% more FTEs than we actually needed. We tried to make most of them part-time, so that when someone inevitably left – didn't like the hours, didn't like the work, got stoned too often, didn't wanna work this week because their friends were going back to college and they wanted more time to party – we could reshuffle the schedule and it wasn't as much of a blow.



Starting in November of 2017, in preparation for the 2018 season, Quincy and I posted job announcements in 26 separate locations. We posted in online job sites; placed newspaper ads; posted on employment-opportunity pages at every ag-related college in New York State, and numerous others in the Northeast (remember that each college has its own approval process and format for potential employers posting job announcements); made copies and pinned them up in our town, in our county, and in local high schools and colleges; personally sent notices to ag professors all over New York State; posted on social media, etc. For all of this effort, we got a total of four responses. One woman said that she'd always like to knit, and a past employer of one fellow told us that if we hired the guy we were idiots. We hired the fourth one, whose experience was in semiprofessional dance and bartending, but who seemed smart enough and cheerful enough and willing enough.

Of course, we still had to find enough other part-time people to be sure we could finish out 2018. And true to form, by the end of 2018 we had employed six people over the course of the season (in addition to Quincy), working in various forms of full-time and part-time schedules. And by the middle of August, we were down to one very part-time person, for all the usual reasons.

The H2-A program

So you get the picture. In February 2018, having worked hard to tell the world about our job opening/s, and having hired a semi-professional dancer at the end of it all, I was completely discouraged at the upcoming season's assured routine of revolving-door staff and the consequent drama. I was tired even before the season started, and pretty damned sure that this could not continue. Quincy, although some decades my junior, and naturally optimistic, was also fed up with the unreliability and was ready for a change in the staff script as well. At this Symposium in 2015, we had been told by somebody from the University of Wisconsin that the H2-A program was not an option for us as dairy sheep producers. But in February 2018, I was feeling desperate enough and tired enough to follow even a thin thread of hope. I signed up for in the first and only webinar that I have ever been participated in, which concerned the H2-A program. The speakers were a vegetable farmer in Michigan, a gentleman from the US Department of Labor, an ag economics professor at one of the Carolina universities, and Todd Miller of Head Honchos, an agency that provides H2-A workers to farms in the United States. It seemed like it was really only for horticultural operations, but during the course of the webinar, I texted Todd and asked him if he thought a small seasonal sheep dairy might possibly qualify. His answer was "I don't see why not."

Head Honchos sent us information on the H2-A program and their agency's services. At the farm, Quincy, Marc, and I discussed it. We knew we were required to pay H2-A workers a statutory $13.25/hr, provide housing, and pay for the transportation from Mexico to our farm, and back again at the end of the season. There were also fees to the agency and the government. We did the math. And we called a number of other farms that used H2-A workers. They were universal in their positive experiences, and reported that their H2-A employees had work ethics and motivation. Their primary message was that their farm staffing situation was *stable*. In all the farms we talked to, their H2-A workers, the same workers, returned year after year. All had been using virtually the same H2-A workers for 10 to 12 years. (Note: I did talk to one fellow I knew personally, who had employed H2-A workers many years ago, and who did not use an agent, to save money. He said he would never use the H-2A program again, because the federal government paperwork was crippling.)

The application process

Quincy, Marc, and I agreed that the hope of an improved labor situation was worth the risk, and we started the application process in the early fall, working with Head Honchos. We decided to apply for the full 10-month maximum, from February 1 to November 30, as we were to start the 2019 lambing on February 1st, and were planning to milk into November. As part of the application, I provided the US Department of Labor all sorts of information on seasonal sheep dairying in the United States to support our application -- a 12-page treatise, based on experience, data from this Association, and research around the world on the seasonality of dairy sheep.

At the same time, we started looking for workers. There is a dairy farm in the area that employs Central American workers whom I know personally. I asked them if they knew anyone who might want to come up here to work for 10 months. They almost immediately came back with two names, Alex and Jovani. Through my friends, we let the two guys know that we were waiting to hear if our farm was accepted into the program.

Then came some bad news. In mid-December our farm's application to the H2-A program was denied. The primary reason for denial was that the US Department of Labor did not believe we were a seasonal farm that qualified for the program.

We were given four business days to submit an appeal, supplying proof of seasonality and need. The proof required was three years' worth of our farm labor and wage records, broken out by month, and then broken out by temporary employee hours *vs* permanent employee hours, part time hours *vs* full-time hours, and labor hours *vs* management hours. It was four days without much sleep, but – ***HURRAH!!*** – only three days later we were approved (!!).

We immediately let our two guys, Alex and Jovani, know that they would be flying up here on February 1st, only six weeks later. For their part, they had to get passports, and come up with enough money to get themselves from their villages south of Mexico City, up to Monterrey in the north of Mexico, the location of the American consulate that processes most of the H-2A visas.

Meanwhile, we had to prepare housing for the guys. Once we had been approved by the USDOL, our file was handed over to the New York State Department of Labor's Division of Immigrant Policies & Affairs. This Division oversees the welfare and housing of immigrant ag workers, and has very stringent rules regarding housing for temporary agricultural workers. (In case you think this is a case of unreasonable government oversight, you should know that the four-person Division of Immigrant Policies & Affairs was created about a half-dozen years ago, after five apple pickers died inside a fire in a farm's substandard migrant worker dormitory, just to the north of us.) It took us two full months to meet all of the NYDOL's OSHA-based safety and space requirements.

We were advised by Head Honchos to *not* actually purchase a plane ticket until Alex and Jovani had their visas in hand. Wouldn't you know it, the printer at the consulate was broken, and the guys had to spend an extra day and a half in Monterrey, and ran out of money for their hotel. Head Honchos has an agent in Monterrey, who personally fronted Alex and Jovani the cash so that they could stay long enough to get on the plane. It was their first time on a plane, they got delayed for 12 hours in Detroit, but finally arrived at the Syracuse airport on February 1st, in frigid -20° weather, with the clothes on their back, no experience, and no English.

Alex and Jovani

It has been smooth sailing ever since. The day the guys arrived we took them to our local farm-supply store, and got them fitted out with clothes to withstand the polar vortex. We were starting our synchronized AI lambing, starting milking, keeping newborn lambs alive at 1:00 AM at -20° temperatures, and training day-old lambs to the lamb bar. Alex and Jovani hardly said a word, just followed Quincy's directions. Thank the good lord (or whomever) that Quincy had taken years of high school Spanish, and could put basic sentences together in Spanish. She and the guys also figured out essential key words, for things such as buckets, bales of hay, straw, pens, steers, milkers, bulk tank. (I myself remain quite dependent on Google translate, an absolutely brilliant app.)

Since they arrived, Alex and Jovani have worked anywhere between 45 and 62 hours per week. Once lambing was over, I stepped way back in terms of my work time. I didn't really milk with them until mid-July when Quincy had her baby. After I had milked with each of them for about a week in July, my husband Simon asked me how they were in the parlor. My answer was "They're focused, they hustle, and they care". Simon asked me "What else is there?" My response was "Nothing. That's it. That's everything."

Alex and Jovani have learned all aspects of the farm's operation: milking, hoof care, gauging the size of the 12-hour breaks of pasture for the milking ewes, skid steer operation, tractor operation. They take care to feed the right amount of feed to multiple groups of animals, and tell us when they see something wrong, such as a sick animal, or when they see something that needs re-ordering, such as feed or parlor supplies. They are careful when using equipment, and to date this season (unlike past employees in past seasons) have not taken out fence posts with the tractor, barn roofs with the skid steer, or a nearby vehicle with the truck. They have been well trained, although no more thoroughly than we have trained others in the past. **They treat their responsibilities with respect, and we have come to trust their care, observation, and caution.**

Isolation

I want to touch on the downside. The only downside is that even though this is truly an opportunity for these two guys (and they use the word "opportunity" themselves), the reality is that their circumstances forced them to leave their family, their community, their friends, their homes, and their culture. They were strangers to each other before they started on the bus ride from their home towns up to Monterrey. They have no one up here, other than each other, to speak Spanish to. Jovani was 29 when he arrived, and has a wife and a four-year-old daughter at home in Mexico. Alex was 18 when he arrived; his baby was born six days before he got on the bus to leave home. At about four months into being here, after the frenzy of lambing and the start of milking had subsided, I could tell that Jovani was depressed. The guys have FaceTime and texting and all that, but it is not the same.

Alex with Eloise, Quincy's baby

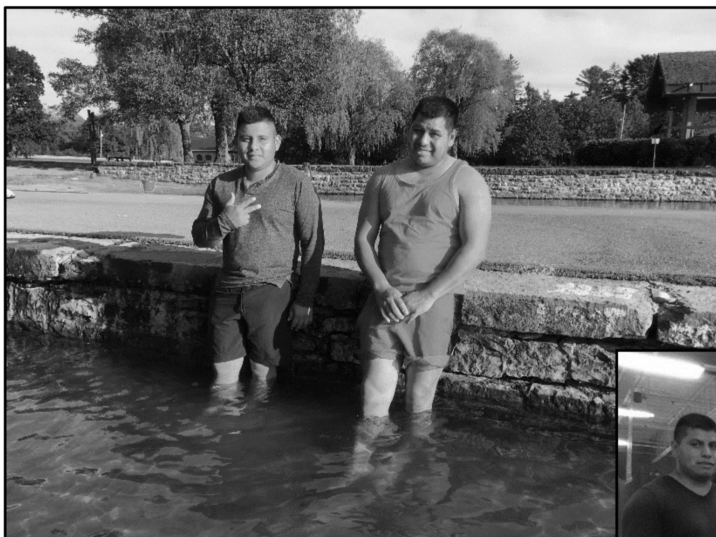
It’s hard not to empathize with that level of isolation. And even if you’re not someone who is naturally empathic, it doesn’t take a PhD to know that a depressed person will struggle to stay engaged in their work, and certainly will question whether or not they want to repeat the experience again. These are two great guys, whom we work with, essentially live with, who are in our lives 24/7, and whom we have become very fond of. It has been hard to watch them in the moments they’re down, knowing that very little can be done except to carry on until the end of November.

Jovani with Eloise

In efforts to combat their loneliness, we have dinners and game nights together fairly often, and we have taken them out into our community as often as possible, to events in the area – – horse shows, antique car meets, visits to other farms, swimming at the lake, a pick-up soccer game, a trampoline park. It sounds like a lot, but in truth it only adds up to a dozen or so occasions, which most people would not consider an enormous amount of socializing over a ten-month period!

To give them some outlet, we purchased Alex and Jovani memberships at a small gym in our village. We also convinced them to go to the library, where these most amazing women give them an English lesson once a week.

In spite of their apparent loneliness, Alex and Jovani have continued to work hard, remain focused, and be cheerful.



Looking forward to 2020

Over the course of a ten-second conversation in August, Quincy and I agreed that we absolutely wanted these two guys to come back next year if it all possible. The value of having someone that you can trust, that you can depend on, that wants to work, and that you don't have to train all over again from Point Zero, is a value that is hard to describe on a dairy farm. Marc and Tom, the farm's owners, agreed without hesitation. To our great relief, Alex and Jovani both said yes. Two weeks ago we started the farm's H2A application process with Head Honchos again for the 2020 season.

In closing, I will tell you that these two guys have changed our farm. I have just finished my 22nd year of either owning or managing a dairy farm. At times over the 22 years, there have been periods in which I had the pleasure of working with a motivated, interested, and hard-working person (Quincy foremost amongst these), who at least could offset the challenges presented by other staff that would pass through. But 2019 has been truly unusual. It is the first time in 22 years in which there has been no staff turmoil, no upset, no drama. And this peace has happened in a year when I personally have needed to work less due to my Fall-Chicken status, and in a year when Quincy had her first baby mid-season and has also had to step way back. We have been able to farm without incident, and have also achieved our highest production ever. With Alex and Jovani we now have a productive, cheerful, can-do team.

The costs

H-2A non-labor expenses 2019	
	2019
HH fee	$ 5,900
US ICE (MRV)	$ 391
Mex fee (Omar)	$ 100
Flight in	$ 1,310
Travel exp in	$ 567
Initial food	$ 50
Winter clothing	$ 450
Flight out, Syr to MC	$ 370
Travel exp out	$ 100
Gym	$ 500
Total	***$ 9,738***

Actual gross wages 2019 for two H-2A workers *(@$13.25/hr statutory wage)*		
	Hrs/ person/wk	Gross/2 peo/mo
Jan	0	$ -
Feb	45	$ 5,128
Mar	50	$ 5,701
Apr	57	$ 6,443
May	49	$ 5,578
Jun	49	$ 5,618
Jul	60	$ 6,817
Aug	56	$ 6,406
Sep	62	$ 7,095
Oct	53	$ 6,075
Nov	47	$ 5,300
Dec	0	$ -
	Total for 2019	**$ 60,162**

Real hourly cost for two H-2A workers Meadowood Farms, 2019 season	
Total expenses 2019	$ 9,238
Total hrs, Feb-Nov	4,541
Equiv of expenses, $/hr	$ 2.03
Therefore total real cost/hr	$ 15.28

Our two guys will have worked a total of 4,541 hrs by the end of November. With fees and expenses totaling $9,738, this adds the equivalent of another $2.03/hr to the hourly cost

---

Cost of H-2A hrs at $15.28 vs $12.25	
	$ 13,622
Staff hours worked from 1st day of lambing to 200 days milking	
2018	2019
5,172	4,810
Value of difference at $12.25/hr	
	$ (4,435)

Paying the equivalent of $15.28 for the 4,541 hrs put in by Alex and Jovani this year would have cost us $13,622 less if we had been able to hire [good] domestic workers, at $12.25 hr.

However, our total staff hours in the first 200 days of milking in 2019 were 362 hours less than in 2018. At $12.25/hr, that is a labor savings of $4,435.

Quincy's question: What is the value/cost of HR time?

But then you have the additional cost of error, which comes with multiple part-time staff members with varying degrees of attention or work ethic (or training!).

As just a single example, in 2018, the bulk tank didn't get turned on on two occasions. Cost of dumped milk: -$1,354.

Cost of 2 milkings dumped in 2018	
$ (1,354)	

Lb milk collected in 1st 200 days	
2018	2019
93,591	103,062

Overview of the H-2A Program

Helotas, TX

Todd Miller, Head Honchos LLC

Welcome

DSANA
The Dairy Sheep Association of North America

A little bit about Head Honchos

- Started in year 2000.
- Small company based in San Antonio, TX
- Accessible by phone, text, and email.
  NOT JUST EMAIL
- Compliance Experts
- We sweat the DETAILS!!!!!

What is the H2-A Program?

- Allows employers to hire seasonal workers then return each year.
- If sufficient number of U.S. workers are NOT available.
- Wage and working conditions in the U.S. can not be "adversely affected".

1

H-2A Workers are in the U.S. on temporary non-immigrant work visas

- Work visas are tied to the employer.
- Jobs must be certified by the U.S. Department of Labor.
- Employer must provide (free to the worker) housing, to/from country of origin via bus transportation, to/from work transportation, workmen's compensation insurance, and the current required wage.

2

How many of your have heard of the H-2A Program?

- Do you think that the numbers of farmers using the H-2A program are increasing, decreasing, or stagnant?

3

Numbers are on the rise!!

- The popularity of the H-2A Program is INCREASING at a very rapid rate with no signs of slowing.

4

Posted April 13, 2017 at 5:54 pm by **Philip Martin**

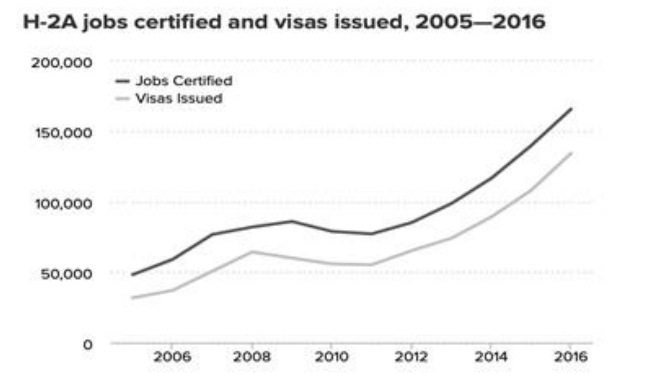
The H-2A farm guestworker program is expanding rapidly

Here are the numbers you need to know

H-2A visas by the numbers:

- **165,741**: Number of H-2A jobs certified in 2016
- **14%**: Increase in H-2A jobs since 2015
- **160%**: Increase in H-2A jobs since 2006
- **134,368**: Number of H-2A visas issued to workers in 2016
- **167**: Average number of days H-2A jobs were certified for in 2016
- **Approximately half** of H-2A jobs in 2016 were certified in 5 states: Florida, North Carolina, Georgia, Washington, and California
- **7%**: Percentage of the crop workforce that H-2A workers represent

5



6

- That's an estimated 180% increase since 2006.

7

What keeps you up at night?

8

Farmers Struggle to Find Labor, Threatening Americans' Food Supply and Prices

Posted by American Immigration Council Staff | Aug 14, 2017 | Business & the Workforce, Employment and Wages, Employment Based

9

The Good, the Bad, and the Ugly… about H-2A

10

Some people are afraid of using the H-2A Program….

They are afraid that BAD things will happen to them.

11

Stuck in the mud……..flat tire…

12

Broken phone…….

13

Some of the most common knocks on the H-2A Program

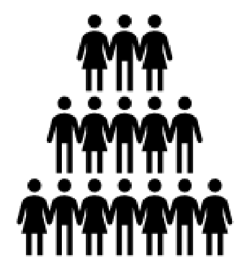
- ”It’s cheap labor”
- “It’s slavery”
- “Workers have to suffer in poor working conditions”
- “Employers invite government interference and irritation”
- “I am afraid I won’t get my workers on time”

14

Some of the good things about the program?

- “Workers love working in the U.S.”
- “Make more money in ONE day in the U.S. than in an entire week in Mexico”
- “Workers are hungry for work…….relationship…. and stability”
- “A workforce that shows up EVERYDAY, on time, and ready to work”

15



90% of all H-2A workers return the following season

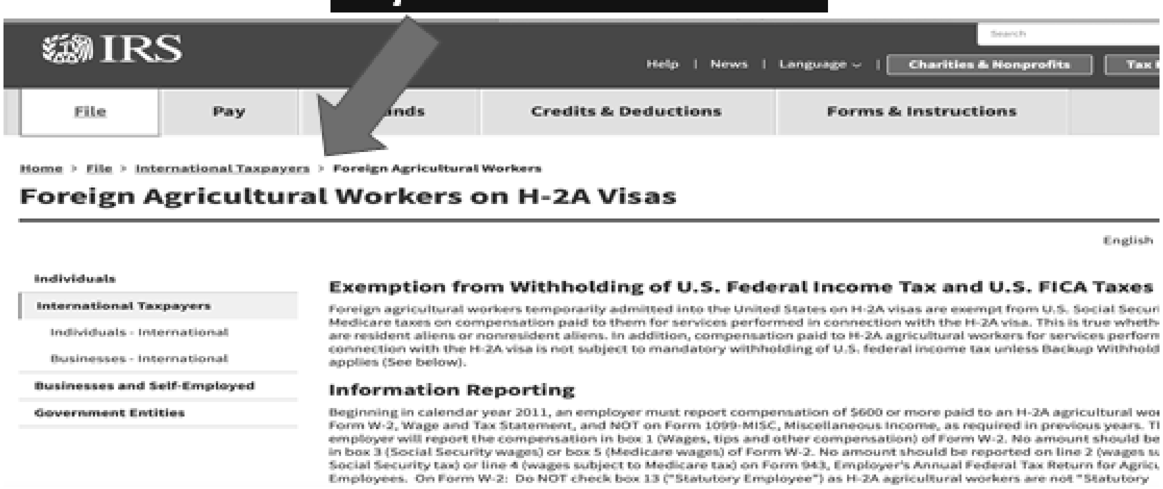
16

Some of the things that an H-2A employer will have to be willing to do.....

- Be open to occasional DESK Audit and/ or Site Inspection from U.S. Department of Labor.
- Be willing to pay the fees to get your workers here LEGALLY & SAFELY.
- Be willing to provide housing and transportation.
- Be willing to provide current Workmen's Compensation Insurance.
- Be willing to pay the current AWER Wage for your state.

17

How do I handle payroll and IRS with my H-2A workers?



18

Head Honchos Fees / H-2 Program Fees

- Head Honchos fees (includes mandatory advertising costs, USDOL fees, USCIS fees, & contains our overhead/ profit.
  - ONE – FOUR worker category = $5,900 (for group – NOT EACH)
  - FIVE – FIFTEEN worker category = $7,900 (for group – NOT EACH)

- Other governmental fees/ program costs
  - $525 per worker to cover bus transportation, daily travel subsistence, $190 Visa fee, and $50 guide fee

19

Snap a picture with your phone!!!

Todd Miller

Head Honchos

(210) 482-0641

20

Thank you!

HEAD HONCHOS

21

Forages and Flavor

How diet can influence the sensory qualities of dairy products

Thomas G. Pyne
Partner and Farm Manager at Twenty Paces Sheep Dairy & Creamery
Charlottesville, VA

Introduction

Many factors combine to influence the flavor profiles and sensory qualities of dairy products. Of those factors, animal management, and in specific dietary management, has garnered interest amongst producers, processors and consumers. Romanticized notions of antiquated management systems employed in the development and production of famous cheeses are often linked to the idea of superior flavor. Grass or pasture-based diets have received particular attention for their links to geographical specificity and “uniqueness”. On-farm feeding strategies can greatly influence the chemical, compositional and microbiological characteristics of milk utilized for processing into cheese, yogurt, ice cream or other dairy products. Links have been established between changes in these milk characteristics and the flavor profiles and sensory qualities of the resulting products. This presentation aims to provide an overview of the influence of changes in dietary management on milk characteristics, and a review of the relevant research associated with this topic.

Modification of Milk Fat Composition

Fat in milk is present as globules of different sizes with a triglyceride core (Figure 1). More than 98% of lipids(fats) in sheep’s milk consist of triacylglycerols, which are composed of glycerol and 3 fatty acids with different carbon chain lengths (Nudda et al., 2014). Milk fatty acids originate from multiple sources- they are ingested in feed and reach the mammary gland unmodified; they are ingested in the feed but are modified in the rumen or by the ewe’s metabolism; they are synthesized *de novo* in the mammary gland; and finally, they are mobilized from body reserves (Elgersma, 2006). Feeding strategies can modify milk fatty acid composition by influencing their precursors produced in the rumen and those available in the blood (Vasta et al., 2008). Blood precursors depend on the fatty acid profile, particularly polyunsaturated fatty acids, of the feed ingested by the ewe and the extent of biohydrogenation in the rumen (Vasta et al., 2008). Fatty acids are characterized by the length of their carbon

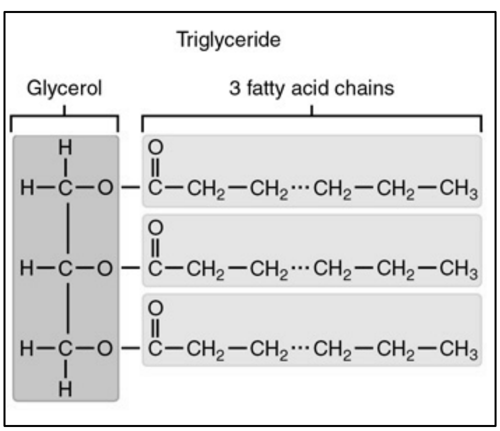


Figure 1- Source: brainly.com

chains and the types and positions of bonds within those chains (Figure 2). Some important fatty acid terms and distictions are as follows,

- Short chain
  - C4-C10
- Medium chain
  - C12-14
- Long chain
  - C16 or greater
- Saturated (SFA)
- Monounsaturated (MUFA)
- Polyunsaturated (PUFA)

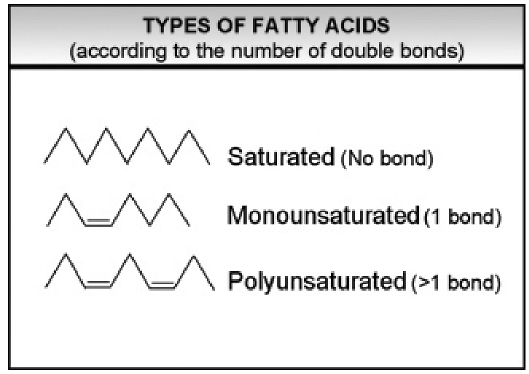


Figure 2- Source: eufic.org

Forage Lipids

Forages are defined as any plant material consumed by livestock. Forage can refer to pasture, browse, hay or silage. Lipids occur in forages, mainly in growing leaf tissue, and account for approximately 2-4% of the weight of the forage on a dry matter basis (Elgersma, 2006). Forage lipid content is dependent on the proportion of leaf area, which is affected by species, maturity, environmental conditions, and management (Mir, 2006).

Table 5
Mean fatty acid (FA) composition (μmol/100 g of DM) of the main botanical families collected in May and June in the grazing area of the commercial flock, and average FA composition of the pasture (*P*) and the sheep diet (*D*).

Compound	Monocotyledon families			Dicotyledon families							*P*	*D*
	Po[a] (*s* = 4)	*Ju*[b] (*s* = 1)	*Cy*[b] (*s* = 1)	*Fa*[a] (*s* = 4)	*Ro*[a] (*s* = 1)	*As*[a] (*s* = 2)	*La*[c] (*s* = 1)	*Ca*[a] (*s* = 1)	*Er*[a] (*s* = 1)	*Ra*[c] (*s* = 1)		
iso C5†	nd	nd	nd	nd	nd	9.14	nd	nd	nd	nd	0.58	0.31
C6†	3.58	15.5	12.5	4.22*	10.3	19.4	8.22	15.7	nd	nd	5.69	5.40
C7†	nd	6.92	nd	nd	nd	2.03	nd	nd	nd	nd	0.57	0.39
C8†	nd	5.86	nd	8.36	nd	20.2	nd	nd	nd	24.0	2.91	1.85
C9†	nd	11.4	14.5	nd	1.64	nd	nd	nd	nd	nd	0.99	1.44
C10†	nd	4.65	nd	31.7	7.62	3.77	nd	nd	4.61	160	6.34	4.06
Short chain FA	3.58	44.3	27.0	44.3	19.6	54.5	8.22	15.7	4.61	184	17.1	13.5
C11†	nd	5.87	nd	nd	nd	0.668	nd	nd	nd	nd	0.418	0.287
C12†	19.2	14.9	7.74	75.3	56.8*	18.1	4.47	14.4*	16.8	115	25.8	22.8
C13†	0.378	nd	nd	nd	nd	5.32	nd	nd	nd	nd	0.535	0.412
C14†	35.4	28.4	16.4	164	43.8*	99.8	30.3	48.3*	53.6	500	55.8	47.4
iso C15†	nd	nd	nd	nd	nd	0.798	nd	nd	nd	nd	0.0503	0.0310
anteiso C15†	nd	nd	nd	nd	nd	1.26*	nd	1.04	nd	nd	0.10	0.07
C15†	6.40	11.8	7.24	9.25	6.92	11.8	9.02	21.3*	2.88	11.0	7.13	7.00
C16†	479	748	546	654	370	712	571	628*	424*	165 · 10^{1}	496	482
C16:1c9†	8.00*	31.9	10.5	7.11	6.55	8.85	8.41	12.1*	5.38*	15.6	8.76	8.55
C17†	6.60	11.1	8.32	9.25	10.3*	7.81	10.7	7.55	3.63	11.3	6.95	6.74
Medium chain FA	555	852	596	919	494	866	634	732*	506*	230 · 10^{1}	602	575
C18†	96.7	109	181	111	133	115	73.1	67.6	64.0	155	92.4	95.3
C18:1c9†	170	910	127	96.6	95.1	208	156	197	181	161	190	179
C18:1c11†	9.63	42.7	8.87	9.13	3.98	7.92	10.2	18.3	6.67	19.9	10.6	10.3
C18:2c9c12 (LA) †	745	167 · 10^{1}	105 · 10^{1}	118 · 10^{1}	695*	202 · 10^{1}	821	182 · 10^{1}	824	351 · 10^{1}	911	862
C19†	2.84	6.42	8.01	4.34	1.62	2.51	7.47	4.59	nd	3.55	3.10	3.25
C18:3c6c9c12†	nd	nd	nd	nd	nd	nd	nd	313	nd	nd	4.70	8.45
C18:3c9c12c15 (ALA)†	182 · 10^{1}*	560	803	189 · 10^{1}	832*	121 · 10^{1}*	113 · 10^{1}	939	149 · 10^{1}	178 · 10^{1}	144 · 10^{1}	147 · 10^{1}
C20†	32.2	115	228	50	93.3	30.4	38.8	nd	30.1	22.9	41.0	47.1
C20:1c11†	3.75	37.1	6.91	1.13	nd	nd	10.8	9.23	14.7	nd	5.21	5.01
C20:4c5c8c11c14†	nd	nd	nd	nd	nd	nd	nd	45.9	nd	nd	0.689	1.24
C22†	50.5*	92.9	172	61.2	97.4*	49.3	51.0	nd	39.8	47.7	52.0	55.8
C22:1c13†	nd	52.5	nd	nd	nd	nd	nd	nd	nd	nd	3.36	2.42
Long-chain FA	293 · 10^{1}	360 · 10^{1}	259 · 10^{1}	340 · 10^{1}	195 · 10^{1}*	364 · 10^{1}	230 · 10^{1}	342 · 10^{1}	265 · 10^{1}	570 · 10^{1}	275 · 10^{1}	274 · 10^{1}
SFA	733	119 · 10^{1}	120 · 10^{1}	118 · 10^{1}	833 · 10^{1}*	111 · 10^{1}	804	808*	639*	270 · 10^{1}	824	810
MUFA	191	107 · 10^{1}	153	114	106	225	185	237	208	197	218	205
PUFA	257 · 10^{1}*	223 · 10^{1}	185 · 10^{1}	307 · 10^{1}	153 · 10^{1}*	323 · 10^{1}	195 · 10^{1}	312 · 10^{1}	231 · 10^{1}	529 · · 10^{1}	233 · 10^{1}	232 · 10^{1}
UFA	276 · 10^{1}	330 · 10^{1}	201 · 10^{1}	318 · 10^{1}	163 · 10^{1}*	346 · 10^{1}	214 · 10^{1}	335 · 10^{1}	252 · 10^{1}	549 · 10^{1}	255 · 10^{1}	252 · 10^{1}
Total FA	349 · 10^{1}	449 · 10^{1}	321 · 10^{1}	437 · 10^{1}	247 · 10^{1}*	456 · 10^{1}	294 · 10^{1}	416 · 10^{1}	316 · 10^{1}	819 · 10^{1}	337 · 10^{1}	334 · 10^{1}

s, Number of plant species collected.
nd, Not detected.
Po, *Poaceae*; *Ju*, *Juncaceae*; *Cy*, *Cyperaceae*; *Fa*, *Fabaceae*; *Ro*, *Rosaceae*; *As*, *Asteraceae*; *La*, *Lamiaceae*; *Ca*, *Caryophyllaceae*; *Er*, *Ericaceae*; *Ra*, *Ranunculaceae*.
LA, linoleic acid.
ALA, α-linolenic acid.
SFA, saturated FA.
MUFA, monounsaturated FA.
PUFA, polyunsaturated FA.
UFA, unsaturated FA.

Figure 3- Valdivielso et al.,

There are five major fatty acids in forages, but generally over 95% of the total consists of C18:3 (alpha-linolenic acid), C18:2 (linoleic acid) and C16:0 (palmitic acid) (Elgersma, 2006). Figure 3 illustrates the variation in fatty acid profile based on species by providing a detailed breakdown of fatty acid composition of various botanical families in a study conducted in the Basque region of Spain, following a commercial flock of grazing Latxa ewes producing milk for the production of Idiazabal cheese. Figure 4 provides an example of forage lipid composition of various hays and silages-

Forage	c12:0	c14:0	c16:0	c16:1	c18:0	c18:1	c18:2	c18:3	Other[b]	$(g\ kg^{-1})$[c]
Hay										
Alfalfa	1.07	0.47	19.72	0.00	3.01	2.35	19.36	50.56	3.46	19.8
Ryegrass	0.85	0.25	13.64	0.00	1.08	2.09	13.49	67.21	1.39	26.7
Bromegrass	0.00	0.00	16.77	0.00	0.97	2.13	37.74	38.89	3.50	12.0
Timothy	1.26	0.53	17.83	0.00	1.26	5.02	19.18	51.55	3.38	14.9
White clover	2.75	0.00	19.05	0.00	2.75	2.91	17.52	50.29	4.72	18.9
Orchardgrass	0.92	0.00	15.74	1.53	1.33	2.61	17.19	57.41	3.26	21.8
Red clover	0.94	0.28	14.58	1.59	2.74	2.37	18.77	56.28	2.45	21.6
Silage										
Alfalfa	17.98	0.59	18.04	1.84	2.94	1.60	16.65	35.66	4.71	18.5
Grass	10.79	0.54	17.12	0.43	2.02	8.71	22.60	35.25	2.54	14.7
Corn	0.27	0.33	20.99	0.41	2.13	16.24	45.98	11.63	2.03	20.0
Ryegrass	0.71	2.00	21.86	1.28	2.42	5.50	20.49	41.87	3.86	11.3
Sorghum-sudan	5.88	0.90	24.77	0.00	2.66	8.26	32.11	19.51	5.90	10.8
Alfalfa										
Pellets	1.45	0.61	20.07	1.90	3.46	2.07	18.35	49.32	2.77	19.4
Hay	1.79	0.87	24.31	1.97	3.64	2.23	18.86	41.02	5.31	12.8
Meal	1.18	0.59	20.30	1.72	3.38	3.05	21.29	45.39	3.10	21.2
Cubes	0.96	1.02	29.75	2.33	5.29	3.85	18.60	31.85	6.36	13.0

[a]Fatty acids are expressed as number of carbons:number of double bonds.
[b]The sum of the remaining minor fatty acids, including unidentified peaks.
[c]Fatty acid content expressed as g total fatty acids per kg dried forage.

Figure 4- Hatfield et al.,

Figure 5 and Figure 6 illustrate the variation in forage lipid concentration based on maturity. In a study conducted in Slovakia with a commercial flock of grazing ewes, six forage species were sampled throughout the grazing season, and the concentration of particular fatty acids were monitored.

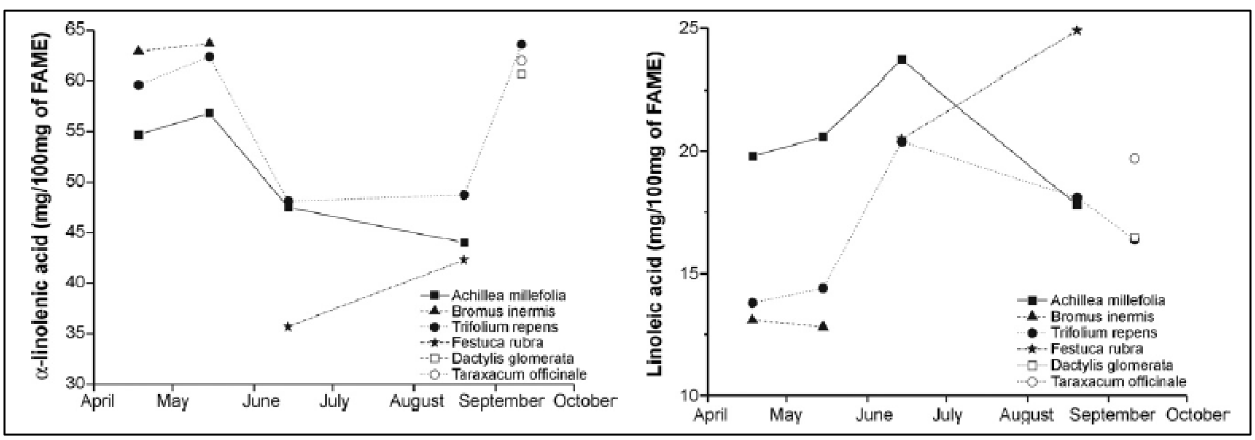


Figure 5 & 6- B. Meluchova et al., 2008

Biohydrogenation and CLA

In the rumen, ingested PUFA from forages are broken down by bacteria to separate the glycerol from the fatty acids, which are in turn modified into saturaed fatty acids which can then pass through to the small intestine for absorbtion (Drackley, 2004). This modification process is called biohydrogenation. Conjugated linoleic acid (CLA) refers to a group of positional and geometric isomers of linoleic acid with conjugated double bonds. CLAs are formed as intermediates during linoleic acid biohydrogenation to stearic acid by the anaerobic rumen bacteria. CLA's can escape the rumen and be incorperated into body fat or milk fat (Drackley, 2004).

Pasture vs. Hay

Various studies have shown an increase in PUFA and CLA in milk fat of ruminants grazing pasture vs. fed hay. Figure 7 shows the results of a feeding study conducted in Tunisia with Sicilo-Sarde ewes utilizing three different feeding treatments. Similar levels of short chain fatty acids were observed in all three treatments. Higher levels of medium chain fatty acids were observed in the feedlot treatment, while long chain fatty acids were higher in both pasture treatments. Valvo et al. (2007) found similar results in their study (Figure 8) with Comisana ewes in Sicily. Levels of CLA in the milk fat was nearly double for ewes on pasture. Figure 9 shows the results of a study conducted in the Auvergne region of France. Milk fatty acid composition of cows from three farms(x,y,z) producing milk for the production of Abondance cheese were monitered. On each farm, groups of cows were either confied and fed hay, or grazed in valley or mountain pastures with distictly different botanical compositions. Significant variations in milk fat composition were observed.

Table 2. Effect of ewes feeding system on main milk fatty acids (g/100g total fatty acids)

Feeding system	Pasture	Stall	S.E.M.	P-value
No. of ewes	10	10		
C4:0	5.82	5.70	0.149	0.706
C6:0	5.73	5.91	0.172	0.609
C8:0	5.06	5.05	0.113	0.976
C10:0	10.15	11.33	0.388	0.134
C12:0	5.47	5.97	0.123	0.037
C14:0	9.11	10.29	0.184	0.000
C16:0	17.10	19.16	0.352	0.001
C18:0	9.14	8.86	0.294	0.645
C18:1 *trans*11	1.72	0.79	0.140	0.000
C18:1 *cis*9	15.58	14.52	0.411	0.204
C18:2 n-6	3.00	4.02	0.278	0.063
C18:3 n-3	4.87	3.56	0.188	0.000
C18:2 *cis*9, *trans*11	2.53	1.33	0.151	0.000
C18:2 n-6/C18:3 n-3	0.61	1.14	0.086	0.001
SFA†	67.58	72.27	0.757	0.000
MUFA†	17.30	15.31	0.456	0.000
PUFA†	10.40	8.91	0.359	0.006

†SFA = sum of ($C_{4:0} + C_{6:0} + C_{8:0} + C_{10:0} + C_{12:0} + C_{14:0} + C_{16:0} + C_{18:0}$); MUFA = sum of $C_{18:1\ trans11} + C_{18:1\ cis9}$); PUFA = sum of ($C_{18:2\ n\text{-}6} + C_{18:3\ n\text{-}3} + C_{18:2\ cis9,\ trans11}$).

Figure 8- Valvo et al.,

Table 4
Average fatty acid (FA) profile[a] in milk fat (g/kg) of dairy ewes rose on feedlot (FL) diet or grazing green barley (GB) or ryegrass (RG) pastures

	FL	GB	RG	SE	p	C1	C2
C4	18.1	17.8	17.9	10.8	ns	ns	ns
C6	17.4	18.7	16.9	0.90	ns	ns	ns
C8	19.4	22.0	18.7	1.02	ns	ns	ns
C10	70.0	72.5	62.0	1.11	ns	ns	ns
C12	39.5	38.2	33.9	1.23	ns	ns	ns
C14	120.3	107.6	112.3	1.87	**	**	ns
C16	318.8	261.8	276.5	7.08	**	**	ns
C16:1	17.5	13.3	13.4	0.65	**	**	ns
C17	19.4	20.5	19.3	0.60	ns	ns	ns
C18:0	70.3	85.7	90.9	2.50	**	**	ns
C18:1	191.2	214.1	211.5	6.69	ns	ns	ns
C18:2	15.6	17.2	16.2	0.34	ns	ns	ns
CLA	2.4	7.3	10.3	0.83	***	***	ns
C18:3	2.7	4.7	4.4	0.23	***	***	ns
C4–C10	125	130	115	5.5	ns	ns	ns
C12:0–C16	518	445	452	9.3	ns	***	ns
SFA	715	668	687	8.1	ns	*	ns
MUFA	215	233	230	6.8	ns	ns	ns
PUFA	20.6	29.2	30.9	1.15	***	***	ns
UFA	236	263	261	7.4	ns	ns	ns
PUFA/SFA	0.29	0.44	0.45	0.020	***	***	ns
UFA/SFA	0.33	0.39	0.38	0.015	ns	ns	ns
DFA	306	348	352	9.1	*	*	ns

SFA: saturated fatty acids, MUFA: mono-unsaturated FA, PUFA: poly-unsaturated FA, UFA: total unsaturated FA, DFA: desirable fatty acids (the sum of all unsaturated fatty acids and C18:0).
C1: contrast 1: feed lot vs. grazing; C2: contrast 2: green barley vs. ryegrass.
[a] The used column is a 25 m GC one, so it cannot separate out 18:1 fatty acid isomers, in particular oleic acid (*cis*-9 18:1) from (*trans* 18:1) isomers.
* $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Figure 7- Atti et al., 2006

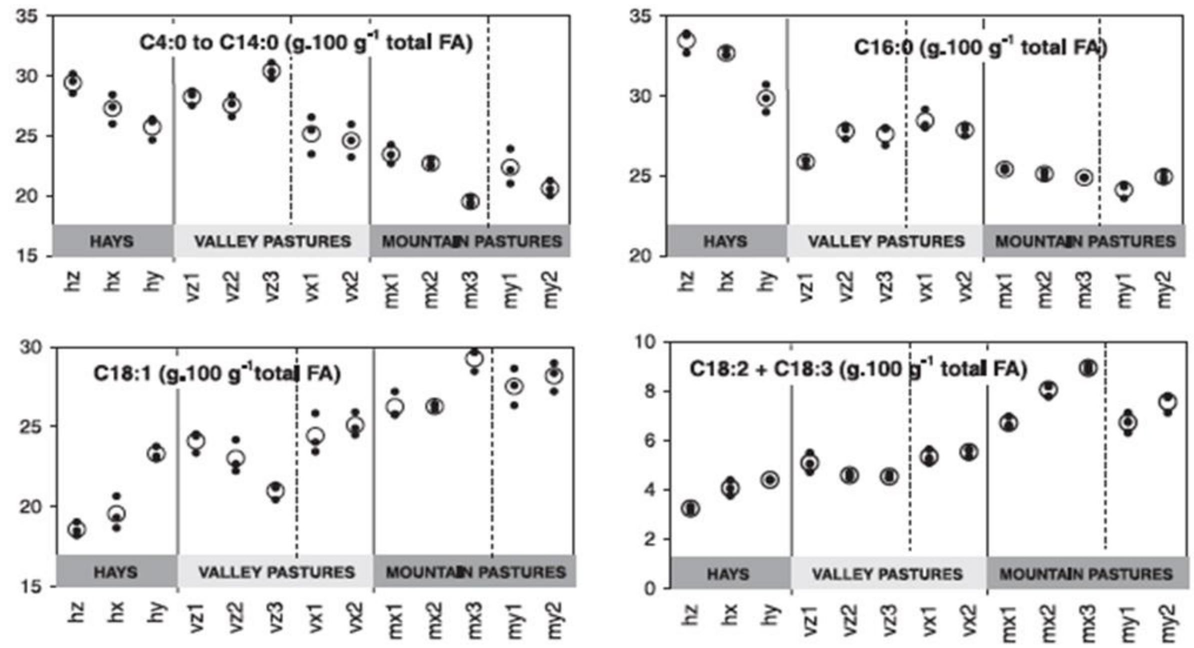
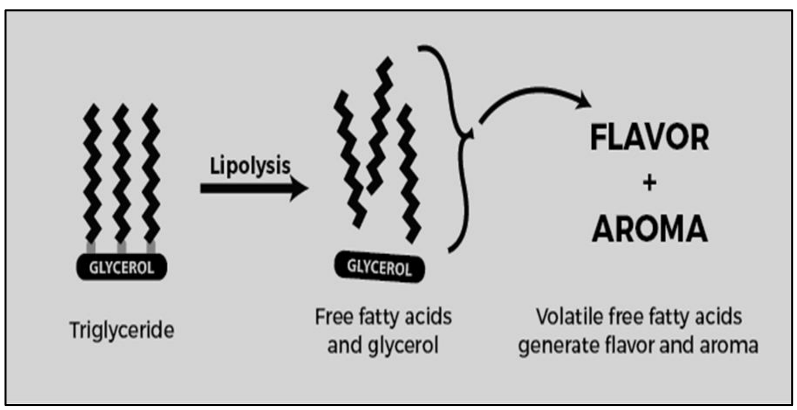


Figure 5. Fatty acid composition of milk. Replicates (●); mean of the replicates (○).

Figure 9- Bugaud et al., 2001

How milk fat becomes flavor



Cheesescience.org

Intact milk fat is mostly flavorless. Milk fat is broken down through a process called lipolysis, creating flavor and aroma. Enzymes called lipases, which may be naturally occurring or introduced, separate the fatty acids from the glycerol creating Free Fatty Acids (FFA). The length of the FFA determines flavor and aroma characteristics. There are some distinct and notable FFA flavor profiles, including Butyric Acid (C4), which produces a rancid flavor. Caprylic acid (C8) produces a distinctly "goaty" aroma. And Long chain FFA (C18+) are often associated with soapy flavors. FFAs can be further modified during cheese ripening into other flavor inducing compounds including lactones, esters, alcohols and ketones. Figure 10, from Woo and Lindsay (1984) shows the FFA concentrations and the flavor profiles of well-known Italian cheeses.

TABLE 2. Free fatty acid (FFA) compositions and flavors of retail samples of Italian cheese varieties.

Cheese variety	Sample code	Concentration of FFA (ppm)								Flavor
		$C_{4:0}$	$C_{6:0}$	$C_{8:0}$	$C_{10:0}$	$C_{12:0}$	$C_{14:0}$	$C_{16:0}$	C_{18} Congeners	
Provolone	A	376	162	45	259	83	104	245	258	Lacks full flavor, coarse
	B	386	139	56	94	114	198	352	388	Tart, coarse, lacks full flavor
	C	782	308	81	172	122	120	199	334	Very balanced FFA flavor
	D	1892	1062	284	718	446	496	890	1019	Very strongly rancid, soapy
Parmesan	A[a]	140	106	84	158	181	684	1750	1890	Full, blended mild FFA flavor
	B	502	174	98	223	163	368	621	662	Strong flavor, lacks balance
Romano	A	1756	843	328	942	428	448	785	1224	Full blended flavor, smooth
	B	2680	1478	607	1350	1006	1063	1857	2748	Pronounced, coarse flavor
	C[a]	5508	2814	1061	2074	1902	2581	4796	4424	Very strong butyric, soapy
Mozzarella[b]	A	48	0	6	10	26	72	147	156	Bland, flat, milky
	B	54	7	1	120	12	27	76	66	Mild, milky, tart

[a]Grated cheese.

[b]Mozzarella samples A and B were made from whole and part skim milk, respectively.

Figure 10- Woo & Lindsay, 1984

Short chain FFA are considered to have a low sensory threshold, meaning we are able to perceive the flavors and aromas they create most readily. Longer chain FFA are considered to have less of an impact on flavor because of their high sensory threshold. Some research suggests long chain fatty acids are oxidized during the ingestion and digestion process, resulting in further modification into flavor and odor producing compounds (Martin et al., 2005). However, there is some dispute amongst researchers as to the degree on influence this process has on flavor development. Perea et al. (2000) analyzed the milk fatty acid composition of ewes producing milk for Idiazabal cheese during three months when the diet was shifting from hay-based to grazing-based. They found significant differences (Figure 11) in milk fatty acid composition, in both short and long chain, between milk sampled in February, April and June. FFA concentrations in the resulting cheese were also varied, along with discernable differences in sensory properties.

Fig. 1 Fatty acid mean content (>1%) of sheep milk fat in February, April and June; *a* significantly different for $P \leq 0.05$

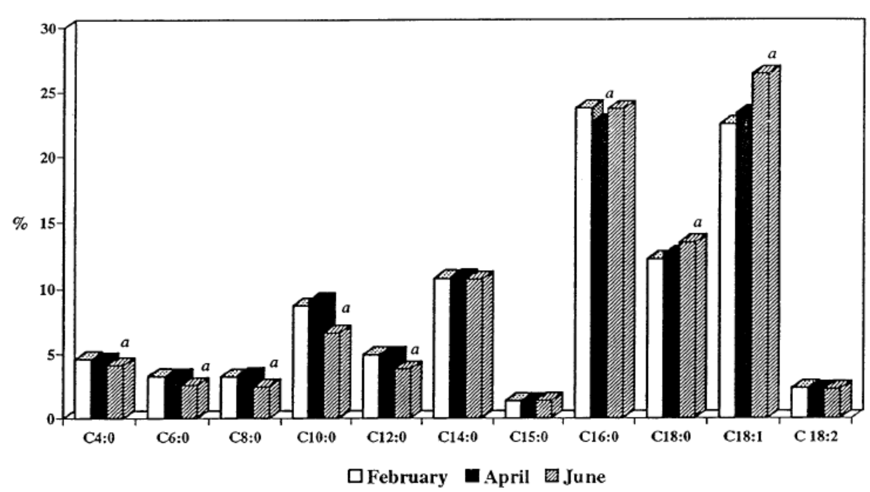


Figure 11- Perea et al., 2000

Terpenes

Terpenes are plant-specific molecules with distinct aromatic properties. Terpenes in plants can serve as deterrents to herbivory, antifungal defenses and attractants for pollinators (Carvalho, 2006). Terpenes pass readily into milk following the ingestion of terpene rich plant material during grazing. Concentrations of terpenes are higher in dicotyledons than in monocotyledons, and they are partially lost during forage harvest and storage. Some research suggests that terpenes can be used to characterize forages to a specific geographical location (Viallon et al., 1999). Terpenes come in various chemical forms including monoterpenes and sesquiterpenes. In a study (Viallon et al., 2000) conducted at a research station in Cantal, France, Tarantaise cows were fed a succession of diets to illustrate the effect of terpene rich forages on milk terpene levels. For the first period of the study (P1) the cows were fed *Dactylis glomerata* (cocksfoot/orchardgrass) hay, a monocot low in terpenes, along with barley and soybean meal. During the second period (P2) the hay was supplemented with *Achillea millefolium* (yarrow), a terpene-rich species commonly found the region and readily grazed by the cows. During the final period (P3), the cows were returned to only the *D. glomerata* hay. Figure 12 shows the quantities of monoterpenes and sesquiterpenes extracted from milk fat during the different diet periods.

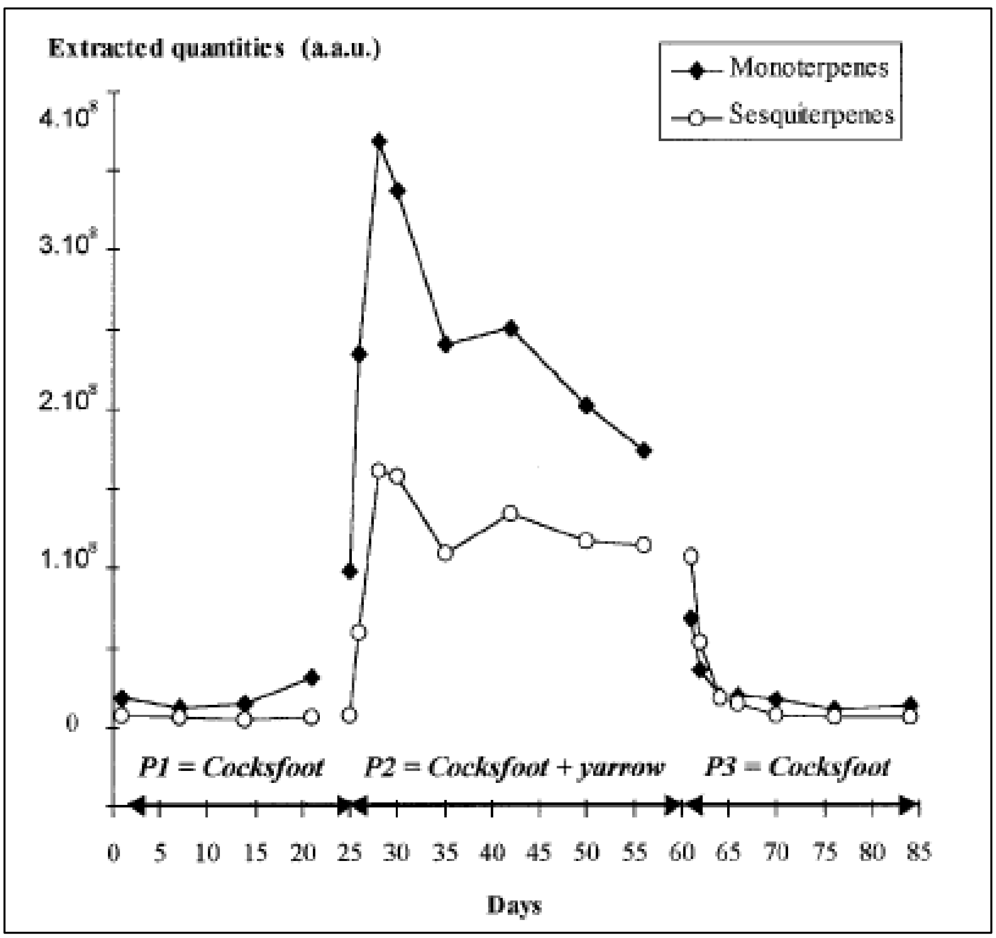


Figure 12- Viallon et al., 2000

Other organic compounds

Other organic compounds found in forages which are known to be odor-active and aromatic include aldehydes, esters and Sulphur compounds. Carpino et al. (2004) looked at these various compounds in Ragusano cheese produced in Sicily. In their study, cows in two treatments were fed a total mixed ration (TMR), but one group of cows was allowed to graze native Sicilian pastures during the day. The authors identified fourteen key species present in the pastures that were readily consumed by the cows. Ragusano cheese was produced from the milk of cows in both treatments, and then the cheeses were chemically analyzed after four months of aging. Figure 13 shows the comparison of the odor-active compounds isolated in cheeses of the two treatments.

Table 3. Comparison of odor compounds isolated with solid phase microextraction (SPME) and detected by gas chromatography olfactometry (GCO) in pasture (n = 4) and TMR cheeses (n = 4) at 4 mo of aging.

Odor description	RI[1]	Odorant	Compound class	Identification method	Cheese: Pasture	Cheese: TMR
Acetic	747	Acetic acid	Acid	MS[2]/PI[3]	+[4]	+
Dirty-sock	823	Butyric acid	Acid	MS/PI	+	+
Sweaty	890	Hexanoic acid	Acid	PI	–[5]	+
Daisy	1007	Phenylacetaldehyde	Aldehyde	MS/PI	+	–
Soapy	1079	Nonanal	Aldehyde	MS/PI	+	+
Green flower	1086	(E,E)-2,4-octadienal	Aldehyde	SORt[6]/PI	+	–
Green	1128	(E)-2-nonenal	Aldehyde	MS/PI	+	–
Hay	1133	(Z)-2-nonenal	Aldehyde	MS/PI	+	–
Fried	1290	2,4-decadienal	Aldehyde	MS/PI	+	–
Vanilla	1348	Vanillin	Aldehyde	MS/SORt/PI	+	–
Lilly	1391	Dodecanal	Aldehyde	PI	+	–
Woody	1100	Hexadecane	Alkane	PI	–	+
Fruity	787	Ethyl butyrate	Ester	MS/SORt/PI	+	+
Sweet	835	Ethyl 2-methyl butyrate	Ester	SORt/PI	+	–
Orange	981	Ethyl hexanoate	Ester	MS/PI	+	+
Fresh flower	1560	Geranyl acetate	Ester	MS/PI	+	–
Jasmine	1612	(E)-methyl jasmonate	Ester	MS/PI	+	–
Buttery	701	3-Hydroxy-2-butanone	Ketone	PI	+	–
Mushroom	956	1-octen-3-one	Ketone	MS/PI	+	+
Body odor	1055	8-nonen-2-one	Ketone	PI	–	+
Hot milk	1080	2-nonanone	Ketone	MS/PI	+	–
Peach	1452	δ-decalactone	Lactone	SORt/PI	+	–
Nutty	883	2,6 dimethyl pyrazine	Pyrazine	PI	+	–
Onion	725	Dimethyl disulfide	Sulfur	MS/SORt/PI	+	–
Potato	864	Methional	Sulfur	MS/SORt/PI	+	+
Orange	941	Methionol	Sulfur	PI	+	–
Sulfur	1173	Dimethyl tetrasulfide	Sulfur	MS/PI	+	+
Herbaceous	1210	1-carvone	Terpenoide	SORt/PI	+	–
Rose	1228	Citronellol	Terpenoide	SORt/PI	+	–
Metallic	912	Unknown	. . .	NI[7]	–	+
Sulfuric	936	Unknown	. . .	NI	+	+

[1]RI = retention index.
[2]MS = GC/mass spectrophotometer.
[3]PI = published index (Flavornet – Acree T. E. and Arn H. 1997–1999 – ©Cornell University GCO of natural products (http://www.nysaes.cornell.edu/flavornet)).
[4]+ Indicates the compound was detected in each of the four cheeses.
[5]– Indicates the compound was not detected in any of the four cheeses.
[6]SORt = chemical standard odor retention time.
[7]NI = not identified.

Figure 13- Carpino et al., 2004

In a study (Buchin et al., 1999) conducted in the Auvergne region of France on a single farm producing Abondance cheese, the pasture-based cows were subjected to a grazing control study. Forty-five cows were grazed on two sides of a mountain, north and south, with distinctly different botanical compositions. The herd was first grazed on the southern slope for eight days, then moved to the northern slope for eight days, and finally returned to the southern slope for six days. Cheese was produced every day, but only cheeses produced after four days on each pasture were analyzed for the study. Figures 14 and 15 graph the results of the of the chemical analysis overlaid with the sensory analysis of aroma characteristics. In Figure 14, the chemical compounds identified are plotted along with the aromas (in caps). Chemical compounds of the same family are grouped in circles. In Figure 15, the cheese tested are plotted on a corresponding graph. Triangles represent the cheeses produced from the first grazing of the south slope, squares represent the cheeses produced on the second grazing of the south slope, and circles represent the cheese produced while grazing the north slope. The position of the cheeses on the graph correlates to the chemical compound analysis and aroma characteristics plotted on Figure 14.

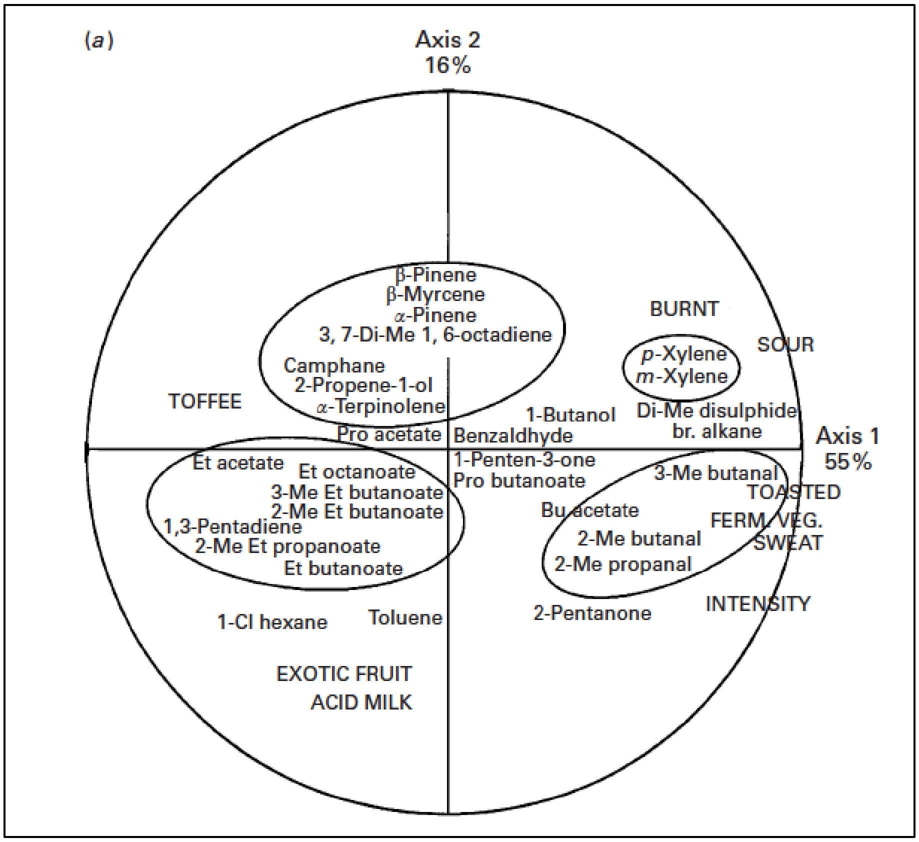


Figure 14- Buchin et al., 1999

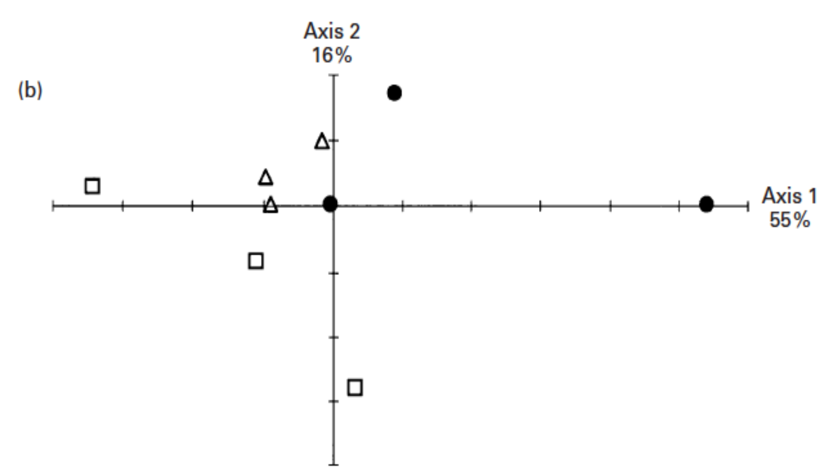


Fig. 1. Principal component analysis of the aroma characteristics of the cheeses: plot of principal axes 1 and 2. (*a*). Correlation circle. Aromas are represented in capitals. Volatile compounds that varied significantly ($P < 0{\cdot}05$) between series of cheeses by analysis of variance are added as additional variables. Compounds of the same chemical family, characteristic of a series of cheeses, are included in ovals. FERM. VEG., fermented vegetable; Bu, butyl; Cl, chloro; Et, ethyl; Me, methyl; Pro, propyl; br., branched. (*b*). Representation of the experimental cheeses: △, 'south 1' cheeses; □, 'south 2' cheeses; ●, 'north' side cheeses. For details of pastures, see text.

Figure 15- Buchin et al, 1999

Summary of studies on sensory properties

Martin et al. (2005) provides a review of studies related to the influence of diet on cheese sensory properties and characteristics. Figures 16 and 17 summarize the changes determined in flavor and texture by altering diet.

Table 1 *Significant differences (P < 0·05) in the sensory properties of dairy products from animals given diets based on maize silage or grass: the proportions in parentheses represent the differences between diets 1 and 2 related to the total scale used by the panel to evaluate the corresponding attribute*

				Dairy products from diet 2, in comparison with diet 1 are :		
Reference	Diet 1	Diet 2	Product	Colour	Texture	Odour, aroma and taste
Verdier *et al.*, 1995	Maize silage	Ryegrass silage	Saint-Nectaire cheese	More yellow and coloured (19%)	Less sticky (3%)	
Verdier *et al.*, 1995	Maize silage	Cocksfoot hay (second cut)	Saint-Nectaire cheese	More yellow	More sticky (9%), less firm (10%)	
Houssin *et al.*, 2002	Maize silage	Grass silage	Butter	More coloured (55%)	Less tough (22%), easier to spread (13%), more melting (9%)	
Houssin *et al.*, 2002	Maize silage	Grass silage	Camembert cheese		Less tough (8%), smoother (9%), more fondant (8%)	More matured (10%), More aromatic (13%)
Hurtaud *et al.*, 2002a	Maize silage	Pasture	Butter	More yellow	Less firm (21%)	More intense flavour (12%)
Hurtaud *et al.*, 2002b	Maize silage	Hay	Butter	More yellow	Less firm (8%)	Less intense odour (6%)
Hurtaud *et al.*, 2004[†]	Maize silage	Grass silage + haylage	Camembert cheese	More yellow	Aspect less appreciated (8%), more melting (8%), more pasting (4%)	More ammoniac aroma (26%), more acid taste (14%), higher aromatic intensity (7%)
Hurtaud *et al.*, 2004[†]	Maize silage	Grass silage + haylage	Pont l'Eveque cheese	More yellow	Aspect more appreciated (8%), more melting (19%)	
Carpino *et al.*, 2004[‡]	Total mixed ration	TMR + pasture	Ragusano cheese	More yellow	Less oily (3%), easier to fracture (5%)	Higher floral odour (5%), higher green/herbaceous odour (4%)
Gaborit *et al.*, 2002	Maize silage	Lucerne hay	Fresh goat cheeses			More intense flavour (5%), more oxidized flavour (14%), less bitter (2%)
Gaborit *et al.*, 2002	Maize silage	Lucerne hay	Ripened goat cheeses			More oxidized flavour (6%), more pungent (9%) and bitter taste (7-11%), less fermented flavour (2%)
Cavani et al., 1991[§]	Total mixed ration	Hay	Ripened ewe cheese			

[†] In diet 1, 700 g/kg of forage was given with 300 g/kg of concentrate, though in diet 2, 850 g/kg of forage was given with only 150 g/kg concentrate in order to simulate an extensive herbage feeding system.
[‡] Total mixed ration (TMR) comprises 200 g/kg rye grass hay, 240 g/kg maize silage and 560 g/kg concentrates and by-products. The group of cows given TMR + pasture, grazed 7 h/day on a diversified pasture. Grass accounted for 15% of the DMI. Only cheeses ripened for 4 months were considered.
§ Total mixed ration was composed of 480 g/kg of maize silage, 280 g/kg of hay and 240 g/kg of concentrate.

206

Figure 16- Martin et al., 2005

Table 2 *Significant differences (P < 0·05) in the sensory properties of dairy products from animals given different grass-based diets: the proportions in parentheses represent the differences between diets 1 and 2 related to the total scale used by the panel to evaluate the corresponding attribute*

				Dairy products from diet 2, in comparison with diet 1 are :		
Reference	Diet 1	Diet 2	Product	Colour	Texture	Odour, aroma and taste
Buchin et al., 1998	Spring pasture	Hay	Morbier cheese			Higher milky odour (5%) and aroma (4%), higher manure aroma (5%)
Verdier-Metz et al., 2000b†	Grass	Hay	Saint-Nectaire cheese	Less yellow		More sour odour (7%), less salted taste (4%)
Verdier-Metz et al., 2002b	Spring pasture	Grass silage (0.6 of dry matter intake)	Saint-Nectaire	Less yellow cheese	More firm (9%),	Taste: less intense (6%), more melting (6%) less typical (4%), less sour (7%), less bitter (4%) Odour: more pungent (11%), more sour (5%), more fruity (6%)
Verdier-Metz et al., 2002a	Spring pasture	Hay (350 g/kg) + concentrates	Raw milk Cantal cheeses	Less yellow	Higher strength for compression	Less eggy odour (8%), and more intense (3%) rancid (8%) aromas, more bitter (11%)
Verdier-Metz et al., 2002a	Spring pasture	Hay (350 g/kg) + concentrates	Pasteurized milk Cantal cheeses	Less yellow	Higher strength for compression	
Soryal et al., 2004	Pasture	Lucerne hay	Domiati goat cheese			Lower flavour score (6%)
Verdier-Metz et al., 1998‡	Hay	Grass silage	Saint-Nectaire cheese	More yellow		More bitter (3%)
Verdier-Metz et al., 2005§	Hay	Grass silage	Saint-Nectaire cheese	More yellow	More gritty (3%)	Less rancid aroma (5%)
Verdier-Metz et al., 2005§	Hay	Grass silage	Cantal cheese	More yellow	Less melting (10%), less mellow (9%)	Higher alcohol odour (4%), lower butter odour (10%), lower grass odour (7%), less citrus aroma (7%), higher chemical odour (6%), lower persistent odour (6%)

† Both grass and hay were from the same paddock composed of proportionately about 0·7 Gramineae. Hay was harvested 1 year before and grass was distributed inside.
‡ Both grass silage and hay were harvested the same day on the same paddock. Hay was barn-dried.
§ Ryegrass silage and hay from a mountain diversified pasture.

Figure 17- Martin et al., 2005

References

Atti, N., Rouissi H., Othmane M.H. 2006. Milk production, milk fatty acid composition and conjugated linoleic acid (CLA) content in dairy ewes raised on feedlot or grazing pasture. Livest. Sci. 104: 121–127.

Buchin, S., Martin M., Dupont D., Bornard A. and Achilleos C. 1999. Influence of the composition of Alpine highland pasture on the chemical, rheological and sensory properties of cheese. Journal of Dairy Research 66: 579-588.

Bugaud, C., Buchin S., Coulon J. B., Hauwuy A. and Dupont D. 2001. Influence of the nature of alpine pastures on plasmin activity, fatty acid and volatile compound composition of milk. Lait 81: 401-414.

Carpino, S., Horne J., Melilli C., Licitra G., Barbano D. M. and Van Soest P. J. 2004. Contribution of native pasture to the sensory properties of Ragusano cheese. Journal of Dairy Science 87: 308-315.

Carvalho C. C. and Fonseca M. M. 2006. Biotransformation of terpenes. Biotech. Adv. 24: 134–142.

Drackley, J.K. 2007. Overview of fat digestion and metabolism in dairy cows. http://

www.thedairysite.com/articles/793/overview-of-fat-digestion-and-metabolismin-dairy-cows. Accessed: 10/21/19.

Elgersma, A., Tamminga S., Dijkstra, J. 2006. Lipids in herbage. in: Elgersma A., Dijikstra J., Tamminga S. (Eds.), Fresh Herbage for Dairy Cattle, Springer, The Netherlands, pp. 175–194.

Hatfield, R. D., Jung H. J. G., Broderick G., and Jenkins T. C. 2007. Nutritional chemistry of forages. In: R. F. Barnes, C. J. Nelson, K. J. Moore, and M. Collins, editors, Forages: The science of grassland agriculture. Blackwell Publishing, Ames, IA. p. 467–485.

Martin, B., Verdier-Metz I., Buchin S., Hurtaud C., and Coulon J.-B. 2005. How do the nature of forages and pasture diversity influence the sensory quality of dairy livestock products? Animal Science 81: 205–212.

Meluchová, B., Blaško J., Kubinec R., Górová R., Dubravská J., Margetín M., Soják L. 2008. Seasonal variations in fatty acid composition of pasture forage plants and CLA content in ewe milk fat. Small Ruminant Research 78: 56–65.

Mir, P.S., Bittman S., Hunt D., Entz T., Yip B. 2006. Lipid content and fatty acid composition of grasses sampled on different dates through the early part of the growing season. Canadian Journal of Animal Science 86: 279–290.

Nudda, A., Battacone G., Boaventura Neto O., Cannas A., Francesconi A. H. D., Atzori A. S., and Pulina G. 2014. Feeding strategies to design the fatty acid profile of sheep milk and cheese. R. Bras. Zootec. 43: 445–456.

Perea, S., de Labastida E. F., Najera A. I., Chavarri F., Virto M., de Renovales M., and Barron L. J. R. 2000. Seasonal changes in the fat composition of Lacha sheep's milk used for Idiazabal cheese manufacture. European Food Research and Technology 210: 318–323.

Valdivielso I., Bustamante M., Aldezabal A., Amores G., Virto M., Ruiz de Gordoa J.C., de Renobales M. and Barron L.J.R.. 2016. Case study of a commercial sheep flock under extensive mountain grazing: Pasture derived lipid compounds in milk and cheese. Food Chemistry 197: 622-633.

Valvo, M. A., Bella M., Scerra M., Biondi, L. 2007. Effects of ewe feeling system (grass vs concentrate) on milk fatty acid composition. Options Mediterraneennes, series A, 74: 227–231.

Vasta V., Nudda A., Cannas A., Lanza M. and Priolo A. 2008. Alternative feed resources and their effects on the quality of meat and milk from small ruminants. Animal Feed Science and Technology 147: 223–246.

Viallon, C., Martin B., Verdier-Metz I., Pradel P., Garel J. P., Coulon J.B. and Berdagué J.L. 2000. Transfer of monoterpenes and sesquiterpenes from forages into milk fat. Lait 85: 635-641.

Viallon, C., Verdier-Metz I., Denoyer C., Pradel P., Coulon J.B. and Berdagué J. L. 1999. Desorbed terpenes and sesquiterpenes from forages and cheeses. Journal of Dairy Research 66: 319-326.

Woo A.H., Lindsay R.C. 1984. Concentration of major free fatty acids and flavor development in Italian cheese varieties. Journal of Dairy Science 67: 960–968.

Realizing the Potential of Domestic Sheep's Milk Cheeses in a Contemporary Context

Boise Co-Op, Boise, ID dorota@boisescoop.com

Dorota Siejek-Hendershot

Fresh Foods Purchasing Coordinator, ACS Certified Cheese Professional

<u>The Boise Co-op:</u>

- Among the 10 Biggest Co-ops in the Nation
- 5 Store Fronts
- Strong Focus on Local

<u>Boise Co-op cheese departments</u>

- 2 cheese departments - over 200 sku's in each
- One averaging 15 K a week, the other 10 K
- Total sheep's milk domestic cheeses: 6 (16 including imports)

This small number surprised even me. Currently, when I focus specifically on domestic sheep's milk cheese, there is very little variety in my cases. Most of them are semi- soft cheeses. No representation of soft, bloomy, or blue cheeses at the moment.

When we add imports, the diversity increases and covers all of the categories: bloomy, blue, semi-soft, hard

<u>Domestic Sheep's Milk Cheeses Fly under the Radar:</u>

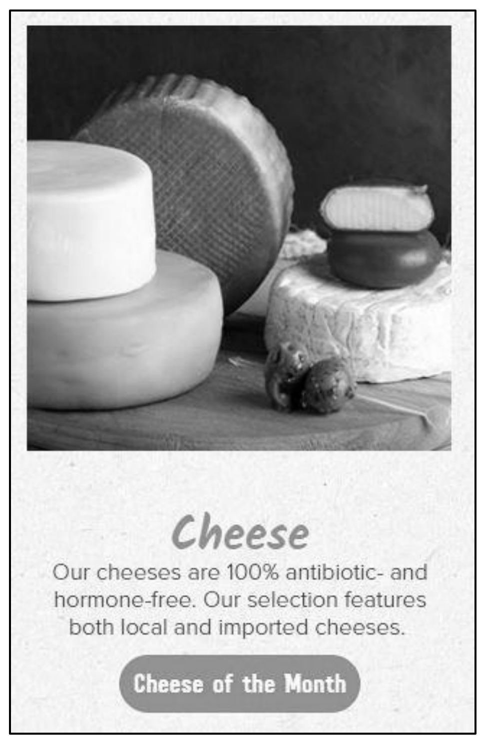
- Customer's reach for Big Names first
- Cost of domestic cheeses are typically higher than imports, averaging $3-5 more (set to increase due to tariffs by $1.00-$2.60)
- Price point might be a factor
- Retail price can be comparable
- A lot depends on the route the cheese takes to reach us. If you are able to do direct delivery - do it. This allows us to keep retail pricing more competitive
- Consider minimum orders. Make it worth your trip.
- Margins are the same for domestic vs imported cheeses
- Retail margins range from 40-50%
- Exceptions to the rule- $ 4.99ea, 5.99 ea, 24.99lb, 25.99 lb
- It is rare that we get asked specifically for domestic sheep's milk cheeses.

THE TIME OF OPPORTUNITY

Sheep's Milk Cheeses at an Advantage

- Allergies: More and more allergies or intolerance issues. Customers ask for alternatives to cow's milk
- Availability: European soft cheeses are often not available to us, or by the time they get to us they will be past their prime
- The story: The more we know about you, the better we can tell your story
- Seasonality can be an advantage - it's ok for customers to miss your cheese
- Seasonality is something we train our customers to understand and can be your advantage. Makes customers more excited to see it back.
- Tariffs position domestic sheep's milk cheeses at an advantage: I am currently seeing increases from $1.00 - 2.60 in some cases. This will move retail pricing closer. Customers who were on a budget might be more willing to reach for domestic over imported
- The strong trend for domestic and local. The trend is *local*. There are more and more customers who put local first. We are, for example, introducing another monthly promotion for our members for only-local products
- At our stores, we developed a set of purchasing guidelines that give our local producers a priority

The time is now to make your cheese known.



Pricing our sheeps-milk cheeses

Glendale Shepherd
Whidbey Island, WA
Lynn Swanson

Our farm is located on 85 acres on Whidbey Island, thirty miles north of Seattle. We use 25 acres for our sheep dairy and currently have 90 ewes rotating through lactations for a year-round milk supply. We make 11 types of cheese and yogurt, which is sold at local year-round farmers markets. We raise our lambs on the farm, and are members of the Island Grown Farmers Cooperative, which allows us to sell our USDA lamb at farmers markets.

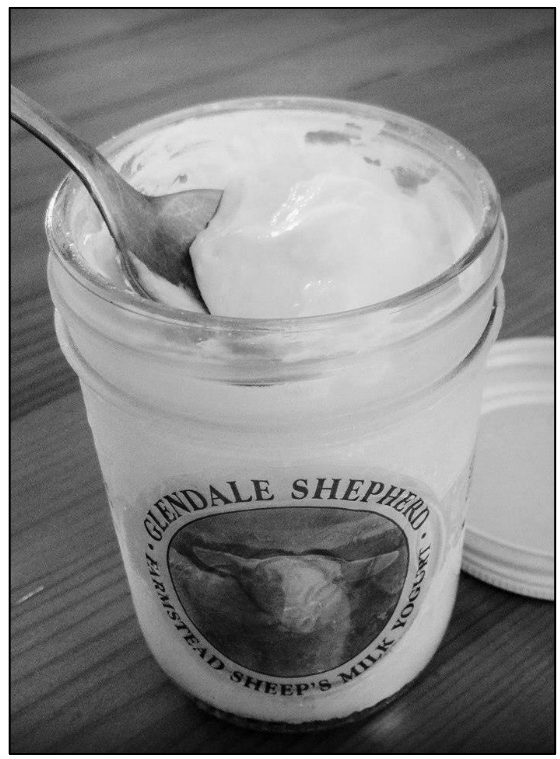
Pricing our cheeses

To price our cheese and yogurt, we first consider what it's costing us to produce a gallon of milk including feed, labor and utilities on the dairy side. We also calculate production and distribution costs on the cheese plant side. We track the yield of each batch of cheese and calculate the gallons of milk to finished pounds of product ratio. Since we know the yearly average cost for us to produce a gallon of milk, and our annual production costs, we know what we have to charge per pound of cheese to cover our costs and make a profit. In simple terms, we base our prices on what a gallon of milk is worth in each product.

Hypothetical example: A wheel of cheese weighs 5 pounds and used 4 gallons of milk to produce. You know you need to get $50.00 a gallon for your milk to cover costs so you must price your cheese at $40.00 per pound.

We have never used a distributor and very rarely sell wholesale. Our products are all sold at either local farmers markets or our farm store.

Our retail prices seem to be average for most sheep milk cheeses and yogurt, except for those you see at Costco.


GLENDALE SHEPHERD
EIRNSTEAD SHEEP'S MILK YOGURT

Pricing Our Cheeses at Black Sheep Creamery

Black Sheep Creamery, Chehalis, Washington

Brad Gregory

We have a 130-acre farm in Western Washington, midway between Portland, OR and Seattle, WA, along I-5.

We started sheep dairying in 2004 with 15 ewes. We have grown to over 240 head at one time, and now keep about 120 ewes. We also buy milk from Tin Willows Farm in Oregon, who milks between 80-100 ewes. We grow our own grass hay, buy in local grains and, some years, alfalfa hay.

We started out selling cheese at farmers markets and slowly worked our way to the last four years primarily sell to distributors, and now we are only selling at 4-5 events a year.

We also have our own storefront where we sell maybe .5% of our cheese. This storefront is part of a yarn store/restaurant that we started 4 years ago. Our cheese making room is also in this building.

Our “fresh cheese season” lasts from mid-February till mid-September, when we sell between 400-600 lbs of fresh cheese a week. Fresh cheese sales make up about 65% of our cheese sales.

We also make 5 kinds of hard cheese that we sell year-round.

We started out pricing our cheese just by comparing it to other cheeses we found around us. Added a little “sheep milk” premium for like styles. We wait until the end of the season to evaluate pricing so as not to adjust mid-season. End of each season, we look at what our expenses are and where we can change things. Our margins have improved by going wholesale vs farmers market, because of reduction in our own labor to get cheese out the door. Our latest bottom-line improvement was to go from Day 4 milking with lambs on replacer, to going to a Mix system after talking with Kendall. Besides not buying replacer last year we eliminated a “lamb manager” part-time position.

We have run into a harder wall to increase prices with distributors. Takes more work to convince them of our expenses vs just raising prices at market.

Pricing sheep milk cheeses for the market

Fairy Tale Farm, Bridport, VT
Alissa Shethar

Overview

My company is very small. I started as a gypsy cheesemaker in California in 2010, buying milk and renting time in various creameries. I worked for other cheese companies. Now I have my own flock and, finally, a small farmstead creamery and dairy. I make mostly semi-hard sheep and cow milk cheeses for local farmers' markets, grocery stores and restaurants. I've worked with three distributors but don't work with any continuously. No employees for much of the year, but my kids help sometimes, and I love them for it.

Pricing our cheeses

My process for pricing is to try to figure out what the market will bear. This worked out differently, for me anyway, on the west coast than it does on the east.

When I first started, we all heard the story of $25/lb wholesale for farmstead sheep cheese. There was also a lot of openness between small cheesemakers about costs and pricing, which was very very helpful.

Here are some questions I ask myself:

How much are you paying for milk? When I bought milk in the West, it was a scarce commodity and the price was firm: $8.60/gallon, which gives you a bit more than a pound of cheese, theoretically. Cow milk costs between $2.30 and $3.30? Here in the Northeast there has been a lot of sheep milk for sale, but that does not make it necessarily cheaper.

When you are milking your own sheep, the milk cost is harder to figure. What am I doing to increase milk production and how is that changing my feed costs? Sometimes it's actually cheaper to feed for milk.

Is sheep milk cheese a "thing" for your consumers, or relatively unknown? Do you live near affluent urban centers where customers are looking for artisan cheese and willing to pay higher prices?

Are you selling cheese to restaurants for a cheese plate or as an ingredient? Do you grade your cheeses and have a market for 'seconds'?

What is the retail markup for your individual direct wholesale accounts? Find out because.... it can vary a lot. And there are reasons why you don't want to undercut your retail outlets with your farmers market prices.

What is your distributor markup? Find out what they expect before you offer, if you can.

And finally... the margin on aged cheeses will always be thin. *Sigh.* It helps to balance your business with higher-moisture whole milk products like fresh cheese and yoghurt. Make every drop of milk count!

Starting a Local Sheep's Milk Cheese Revolution to beat BIG IMPORT CHEESE!

Boise Co-Op, Boise, ID dorota@boisescoop.com

Dorota Siejek-Hendershot

Fresh Foods Purchasing Coordinator, ACS Certified Cheese Professional

Beating the big boys

So, does the quality of the cheese speak for itself?

What I hear a lot is that the cheese speaks for itself. True… but before the customers taste your product, first they need to pick it up...

Packaging matters.

Labels - it is worth spending money on

Too many words on the label is the most common challenge. All you need is the name of your cheese, with ingredients in the small font. Too much information and everything gets lost.

Many local folks I work with choose to produce their own labels. I understand that it might be a necessary move at the beginning, but don't settle for it.

Flavor profiles

Flavor profiles - don't take it to market too soon

That first taste is crucial. Everything will sell one time… will it the second time? Are you going to make that customer return? I have had some cheese that I know that I will not be able to sell. It just needs more time. I recently met with a cheesemaker who let me sample his 7-year old Romano. That is a long time to wait to get paid… and I would not suggest that route to anyone. But, it is better to wait than lose the customer forever.

Portion size

Portioned to sell - 4 oz is your ideal

Let them eat cheese:

This is your biggest advantage over the imported cheeses: customers can actually meet you, talk to you, see your farm

- Active Sampling, check for the times the stores are busiest. If you can, combine deliveries with active sampling, use these during the times when stores are busiest
- Events - check if your retailers do any events.
- Co-op puts on a few events over the year. PARTICIPATE. Wine and Cheese Event at the beginning of December is always a huge hit
- Wine and Chocolate Event - absolutely needs cheese

Be a face behind the cheese

The story

What's your story?

Reach out to people who sell your cheese:

Educating the folks who sell your cheese is absolutely crucial. Find the people who have been at the stores, cheese shops, wineries for a while and invite them over

- Farm Tours. Open doors to cheesemongers
- Better yet - Put them to work

You can't fake Authenticity

Imagining what ifs?

Find unlikely outlets for your cheese

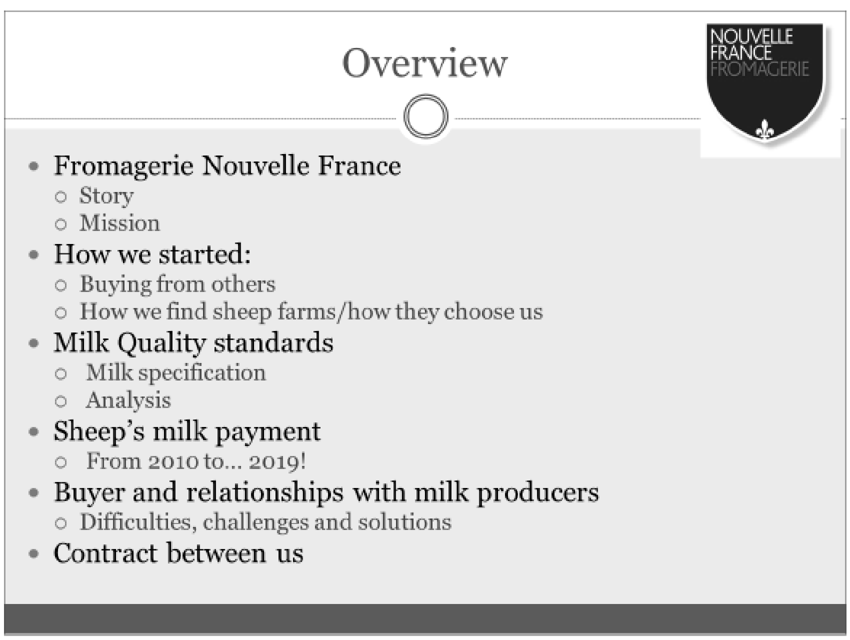
- Partner with local restaurants and chefs, galleries, wine bars
- School tours
- Teach classes
- Winery partnerships

Again, you are here…. BE HERE

Look for opportunities. Where there is wine, there should be cheese. And what drives me absolutely insane is that most often I see amazing wines and awful cheese. Cheese is often an afterthought, and it is our responsibility to bring it to the front.

Buying sheep's milk…   What an adventure!

Nouvelle France Fromagerie, Marie-Chantal Houde,pres.
Racine, Qc. Canada819-578-7234
Marie-Chantal Houde



Story

- Family business
  - Owned by brother-sister
    - **Jean-Paul and Marie-Chantal**
  - Located in Racine, Qc.
  - Sheep Farm and cheesefactory
- Started in 2010

1

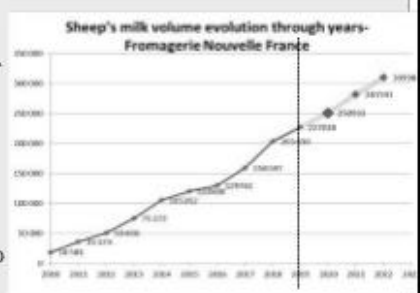
Our farm

- 2010: 26 000L
- 2019: 71 000L

2

Story

- 2010:
  - Milk production:
    26 000 Liters (18 500 L for our cheeses)
  - Cheese production:
    3 300Kg
  - 1 working sheep farm
- 2019:
  - Milk production: 227 000 Liters
  - 7 working sheep farms



3

Story

- Products
  - 4 cheeses
    - **Pasteurized , heat treated and raw**
  - 2 yogurts
    - **Plain**
    - **Maple**
- Award winning cheeses (> 50)
  - Best Quebec cheese (3)
  - Best canadian sheep cheese (2)
  - ACS winning cheese and yogurt

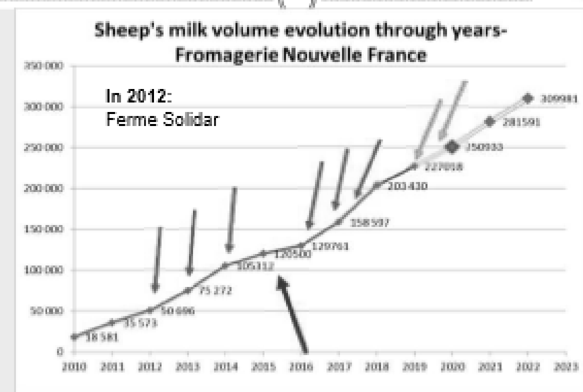
4

Our Mission

"Make the finest ewe's milk products to become the reference while creating profits to ensure the financial sustainability of the company, promoter of regional sheep dairy farms so this positively contributes to our community, our region and the province of Quebec"

5

When we started buying milk…



6

Why we started buying milk…

- It was our mission…
- We were not ready (in 2012!)
- The farm was in a state of emergency
  - A cheesefactory stop buying without any notice!
- Help was requested and we gladly accepted to help!

…. The adventure start here!

7

How do we find dairy sheep producers?

We do not find them…

- THEY FIND US!
  - Usually, the process starts before milking (for new farms)
- Or…THEY CHOOSE US!
  - Not being satisfied with other cheesefactories
- But now, we look to find new partners:
  - Symposiums/formations
  - We help new farmers get started:
    - Give FREE advices, internship
  - Our good reputation: mouth to mouth
    - Dairy sheep communities is a small world!

8

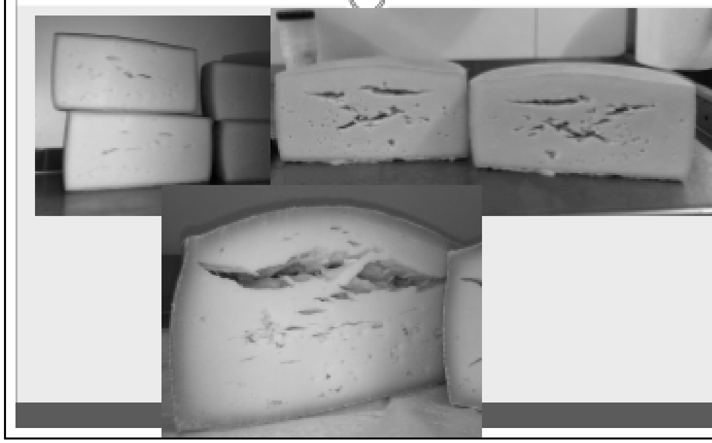
Milk specifications

Not every body want to achieve our milk standards and… IT'S OK LIKE THAT! ☺

1. Quality BEFORE quantity
2. Dry hay (no silage or bailage)
   1. Butyric blowing in firm fine cheeses
3. Wash and removing 1st milk
4. 5 days after lambing before accepting milk
5. Addition of 4 days rejecting milk (medicine treatment)
6. Fresh (liquid) milk only accepted
   1. Frozen milk as to be melt in the farm

9

Silage/bailage/ or bad quality dry hay



10

Milk analysis

Fromagerie Nouvelle France: Federal license

Analysis are Costly! (2018: 21 000$, 2019: 24 000$) its an Investment…

- Federal's requirements for raw milk
  - Every month: Federal Lab
    - 1 milk sample send for 4 pathogens testing
  - Each milk reception: At cheesefactory
    - Quantity
    - pH
    - Dornic Acidity
    - Smell and visual aspect
    - Temperature
    - Antibiotic: all milk received at the cheesefactory

11

Reception milk sheet

Month: October

Day	Dairy Sheep Farms							Milk volume			Results					Cheesemaker resp.
	Nouvelle France	Fox Borger	Audrey	Sonji (Sophie)	Chien Blanc (Pierre)	L'Angélus (Benoit)	Valle	Them	Us	Average	T°C	Smell	Aspect of filter	pH	Dornic Acidity	
01-oct	X							515	500	508	5	ok	ok	6,52	22	David
01-oct		X						486	490	488	5	ok	fle. straw	6,5	22,5	David
02-oct							X	340	340	340	4	ok	ok	6,61	23,5	Sophie

12

Monthly Fabrication sheet

Month:

Day	Sheep Farm								Milk volume						
	Nouvelle France	Fox Berger	Audrey	Sergi (Sophie)	Chien Blanc	L'Angelus (Benoit)	Valis	TOTAL	Zacharie	Pionnier	Madeleine	Yogourt	Zakaví	Other	TOTAL
01-oct	500	496						996	401			590		5	996
02-oct							540	540			540				540

13

Milk analysis

Fromagerie Nouvelle France: Other analysis we do

- Each milk reception:
  - 1 milk sample send to Lactanet (Valacta)
    - Fat, Protein, Lactose, Urea, SCC
  - 1 milk sample go to our «lab »
    - Coliform and Ecoli
    - Staph Spp. And Staph Aureus
    - Total bacterial count
  - 1 milk sample to freezer:
    - In case a problem occurs (bloating, antibiotic, coloration…)
- Every week:
  - 1 milk sample send to Federal Lab for L.Mono testing

14

Milk analysis

Lactanet:

Troupeau no: 74012

Date réception: 2019-07-11
Date analyses: 2019-07-11

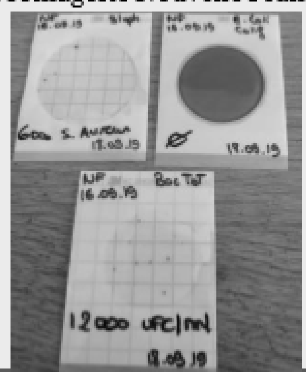
Tech Lab: JK

	No Echantillon	Fat B (% poids/poids)	Protéin (% poids/poids)	SCC '000/ml	Urea mg/dl	Lactose (% poids/poids)
	ID	Fat B	Protein	Cells	Urea	Lactose
1	A8 07	5.04	4.64	965	17.5	4.66
2	S 8 07	5.17	4.70	369	13.2	4.69
3	F 8 07	5.74	4.94	837	20.8	4.62
4	V 8 07	5.90	5.02	201	29.9	4.75
5	F 4 07	5.55	4.93	870	15.7	4.47
6	S 4 07	5.28	4.67	312	9.3	4.65
7	N 4 07	6.34	4.53	1263	29.2	4.77
8	N 8 07	6.20	4.67	1656	32.3	4.79
9	P 4 07	5.46	4.61	1031	27.8	4.76
10	P 8 07	5.55	4.67	854	22.1	4.78

15

Milk analysis

Fromagerie Nouvelle France « LAB »



16

Milk analysis

Fromagerie Nouvelle France « Federal LAB »

17

Sheep's milk payment

Our beginning… and evolve

NOTE: transportation cost is paid half by farmer, half by cheesefactory.

- 2010: based on volume only
  - 2,05$/L
  - Not very accurate
- 2012: based on cheese yield
  - From 2,10$ to 2,35$/Liter
  - We were making seperate batchs of cheese for 3 different farms

Prix du lait 2012		
rdmt 14% à 14.99%		2,10 $
rdmt 15% à 15.99%		2,15 $
rdmt 16% à 16.99%		2,20 $
rdmt 17% à 17,99%		2,25 $
Rdmt 18% à 18,99%		2,30 $
rdmt 19% à 19.99%		2,35 $

18

Sheep's milk payment

- 2014: We gave « fidelity » bonus: 0,10$/L
  - End of the year to farm that sold all their milk to us
- 2016: we increased the price
  - + 0,10$/L (dry hay bonus)
  - + 0,05$/L for milk produced year round.
  - Until, 2017, separate batch was still possible (or blend of two producers…)
- 2018: we decided to mix all milks!
  - We needed a proper method to pay our producers:
  - …BASED ON COMPONENTS!

19

Sheep's milk payment in 2019

- We pay according to:
  - Milk volume
  - FAT
  - Protein
- Bonus given for:
  - Year round producers (+0,05$/L)
  - Milk from september to december (+0,10$/L)
- In 2020, we plan to…
  - Give bonus for low SCC, Urea, bacteria
  - Add penality for high SCC, Urea, bacteria…

20

Sheep's milk payment in 2019

NOUVELLE PWE
Farm's name: Mr.John | Month: avr-19

Payment- calculated with component

month	day	milk volume	Fat B	Protein	Cells	Urea	Lactose	Transportation cost
	1er avril		5,86	5,07	803	21,9	4,65	(65,00 $)
	2 avr. 2019	684						
	3 avr. 2019							
	4 avr. 2019	509	5,99	5,14	812	22,1	4,68	(80,00 $)
	8 avr. 2019		5,88	5,11	803	24,7	4,65	(60,00 $)
	9 avr. 2019	678						
	10 avr. 2019							
	11 avr. 2019	510	5,96	5,10	797	24,2	4,69	(80,00 $)
	15 avr. 2019		5,92	5,08	522	24,1	4,69	(60,00 $)
	16 avr. 2019	677						
	17 avr. 2019							
	18 avr. 2019	503	5,84	5,05	683	19,9	4,65	(80,00 $)
	22 avr. 2019		5,93	5,08	688	19,0	4,68	(60,00 $)
	23 avr. 2019	667						
	24 avr. 2019							
	25 avr. 2019	493	5,89	5,07	480	24,0	4,68	(80,00 $)
	29 avr. 2019		6,17	5,16	526	25,3	4,68	(60,00 $)
	30 avr. 2019	622						
	Litrage total	5343					TOTAL:	(625,00 $)

21

Sheep's milk payment in 2019

Average component from Lactanet (Valacta)				
Fat B	Protein	Cells	Urea	Lactose
5,94	5,10	674,89	22,80	4,67

Amount of fat/protein produce (month)	
total of fat (kg)	317,2554667
Total of protein (kg)	272,2555333

Values given for ($/Kg)	
Fat price ($/Kg)	17,80 $
Protein price ($/Kg)	26,70 $

Protein based on total nitrogen

Monthly payment	
Money from fat	5 647,15 $
Money from protein	7 269,22 $
Annual bonus= 0,05$/L	267,15 $
sept- dec bonus = 0,10$/L	0 $
Bonus/malus SCC	n/d
Bonus/malus Urea	n/d
Bonus/malus bacteria	n/d
Total	13 183,52 $
Transportation cost	(625,00 $)
TOTAL	12 558,52 $

$/Liter (no transport)	2,47 $
$/Liter (transport cost included)	2,35 $

22

Buyer and relationship with dairy farmers

BIG ADVANTAGE: We have a dairy sheep farm ☺
(we understand the dairy sheep production)

- Based on honesty, transparency, responsability
  - Farmers come making cheese. My team goes to milk the sheep
  - We call farmer ASAP if something wrong
  - We help farmers to find solutions/solve problems
- We organised meeting with everybody (2 x year)
  - We share information (the project..)
  - We talk about what is going well… what is more difficult
  - Give opportunity to farmers to talk and share with each other

23

Buyer and relationship with dairy farmers

- We created a « committee » for big decision:
  Ex. For new payment method, I asked them to help me. To fix the standards and penalities.
  - 1 member of FNF
  - 1 seasonal dairy farm
  - 1 annual dairy farm
- We pay every month
  - The 15th of each month, we pay the previous month.
- Special prices for cheese
- Special events:
  - Christmas party, cheese award invitations
- We want everybody to be happy!

24

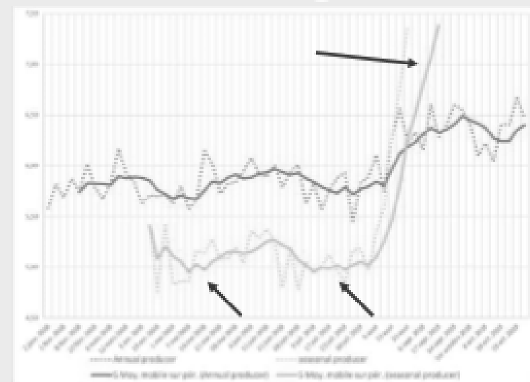
Challenges

- Dry hay feeding
  - Not easy for every body
  - Dry hay bonus and we try to give higher milk price to our farmers
- Milk component variations
- Need the cheesemakers to adapt rapidly to keep same cheese quality
  - Rich in fat is not an advantage
    - We need to make the same cheese year round!
  - Challenge for yogurt
  - We explain the advantage to become year round for them and for us!
  - Overall, the milk components is much higher for year round farmers

	Fat%	Protein%	SCC%	Urea	Lactose
Annual Prod.	5,84	4,89	1193,53	20,90	4,62
Seasonnal Prod.	5,37	4,72	688,85	19,00	4,66

25

Fat% evolution through year
(annual vs seasonal)



26

Challenges

- Milk quality
  - No penality until today
  - So many factors: seasonal lambing (big group), frozen milk, smallm milk volume, bad hay...
  - Bonus/penality in 2020 (SCC, Urea, Bacterial, color defect, bloating...)
- Small milk volume (transport)
  - Costly and time consuming for everybody
  - Happens to new farmers (small volume)
  - We pick up milk from 3 farms 2 x week (it reduces cost)
  - We help new farmer to start... small... but not too small!!!
- Having cheese year round for distributor and consumers

27

Challenges

- Uneven milk production in the year

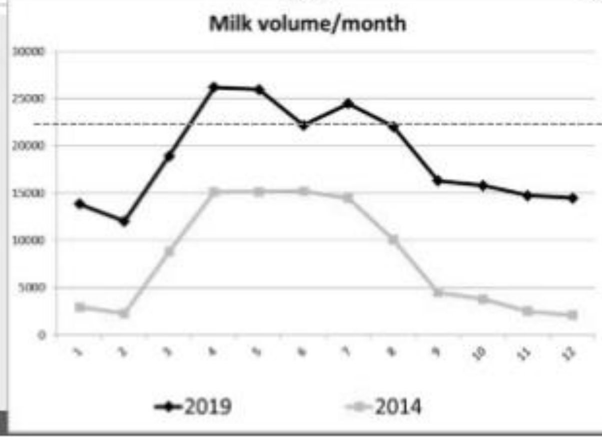
  Mainly du to seasonal podücers

  Common for starting farmers

  - Milk component variation
  - A cheesefactory can not accept ALL MILK within 6 months!
  - Lack of production during low season
  - Bonus given from september to december
  - We explain how it is important to « flat the line » for distributor and consumers satisfaction ☺
  - Key for futur market

28

Milk production through year



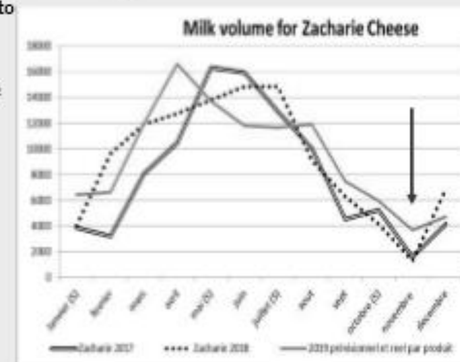
29

Milk production through year

From oct-dec, milk goes to soft cheese and yogurt.

There is less for Zacharie Cheese.

Less milk



30

If you want a good relation to stays...

- Keep informed everybody
- Give and share informations
  - Explain « why » you ask this
- Keep farmer involve in the business
  - Bring them to the cheesefactory
  - Committee
- Be honest
- Pay your farmers monthly (with money! Not cheese....!)
- Make good products.
- Do your best for the best of everybody

31

Thank you!

32

Milk Quality Standards and Supplier Agreements

Green Dirt Farm, Weston, MO
Sarah Hoffmann

Green Dirt Farm is an award winning artisan cheese maker and sheep dairy in Weston, Missouri.





In 2018 we processed 180,000 lbs of sheep milk and 53,000 lbs of cow milk, selling 30,000lbs of cheese

Milk Quality is Critical

It's impossible to make high quality cheese without high quality milk!

Over the years we've made many changes and additions to our processes to encourage our suppliers to bring us high quality milk

- Initially we were a Farmstead producer making cheeses with only our own milk and only selling them at local stores and farmers' markets
- As we've grown we've needed to find additional sources of milk.
- Our Amish Partnership started in 2014- with 7 sheep dairy farms participating
- In 2017 we eliminated all but 3 of the sheep milk producers primarily due to milk quality issues
- In 2016 we added an Amish cow dairy and began making blended cow and sheep milk cheeses
- This year, due to quality problems with our Amish cow's milk producer we changed to a new non-Amish cow dairy who milks 100% grass-fed Jersey cows.

Amish Suppliers bring unique challenges

- Communications
- Cultural differences
  - Building Trust
  - Overcoming Assumptions
- Sanitation
- Refrigeration
- Delivery

Requires patience and a willingness to assist with problem solving

Indicators of Milk Quality We Evaluate *and Record*

- Standard Plate Count (SPC, units= cfu)
- Squamous Cell Count (SCC, units= #of cells)
- Fat
- Protein
- Flavor/Appearance
- Freezing Point Depression

Every year we've created a new agreement to set quality expectations, goals and pricing standards. These are delivered at a meeting at the beginning of the year along with a weekly forecast of our expected milk volume requirements.

Initially, we created a payment scheme that combined paying for milk components and low SCC and SPC. It was pretty slick, but way too complicated.

Fat Levels	**Payment**
6.6 and above	$0.01 per point above To be changed if fat levels are much higher than projected
Between 5.5-6.5	$0.28 per pound
Between 4.8-5.4	$0.22 per pound
Between 4.0-4.7	$0.17 per pound
Lower than 3.9	$0.00 per pound
Protein Levels	**Payment**
5.9 and above	$0.01 per point above To be changed if fat levels are much higher than projected
Between 5.0-5.8	$0.28 per pound
Between 4.2-4.9	$0.22 per pound
Between 3.5-4.1	$0.17 per pound
Somatic Cell Counts	**Payment**
0 – 250,000	$0.28 per pound
250,001 – 500,000	$0.20 per pound
500,001 – 750,000	$0.10 per pound
Over 750,000	Reject Milk
Plate Counts	**Payment**
0 – 10,000	$0.28 per pound
11,000 – 20,000	$0.20 per pound
21,000 – 50,000	$0.15 per pound
51,000 – 75,000	$0.10 per pound
76,000 – 100,000	$0.05 per pound
Over 100,000	Reject Milk

2019 GDF Milk Quality Standards and Guidelines

High quality milk will have:

- SCC (squamous cell count)- less than 500,000 cells
- Bacteria count (standard plate count or spc)- less than 20,000cfu
- MUN > 12 and <25*
- Sheep milk components: **protein** >5.5<8, **fat**>6.0<8*
- Cow milk components: **protein** >3.2, **fat** >3.0*

*MUN count and milk component protocols are still in process and values outside of the acceptable ranges above will be considered on a case by case basis

- MUN counts > 25 generally indicates overfeeding of protein and can cause poor drainage in cheese making resulting in batch failure
- MUN <12 generally indicates poor animal nutrition and is not in line with our Animal Welfare Standards. In addition, an MUN <12 will generally lead to low protein in the milk resulting in low cheese yield.
- Protein and fat values outside of the above ranges can result in problems with cheese making and poor quality cheese

High Squamous Cell Count

SCC counts over 500,000 generally indicate a problem with infection in one or more udders. To evaluate for this very animal should be individually screened and tests sent to the lab for confirmation. It is a wise practice to screen every animal for possible infection once a week using CMT or Portacheck

- After 1st High SCC >500,000.
  - Phone call to alert producer. Test must be <500,000 on next test
- After 1st SCC (>750,000)
  - Milk from will be rejected. Milk with count over 750,000 (even if it was commingled with other milk and used in cheese making) will not be paid for.
  - Testing will be repeated with the very next milk delivery.
  - If SPC is still >750,000 after repeat testing jump to procedure for 2nd high SCC count
- After 2nd SCC (>750,000) :
  - Every batch of milk will be tested (test cost to be borne by producer), until the results show acceptable quality (SCC <500,000) on three separate consecutive tests.
    - During the testing period milk from that producer will not be accepted
    - Any milk that is determined to have an unacceptable SCC (>750,000) and/or contains pathogens will be discarded and the cost will be borne by the producer.

High Bacteria Count

High bacteria counts, *combined with a high SCC count,* is usually caused by udder infection. High bacteria count (>10,000) with a low SCC count usually means a problem with cleanliness, such as dirty hands, dirty udders or dirty equipment

- After 1st High Count of SPC >20,000.
  - Phone call to alert producer. Test must be <20,000 on next test
- After 1st SPC > 50,000
  - Milk will not be picked up until further testing is done as follows: Milk with count over 50,000 (even if it was commingled with other milk and used in cheese making) will not be paid for.
  - Testing will be repeated with the very next milk delivery.
  - Milk will not be accepted from the producer until additional test results are obtained
  - If SPC is still >50,000 after repeat testing jump to procedure for 2nd high plate count
- After 2nd high plate count (SPC >50,000) :
  - Every batch of milk from the producer will be tested (test cost to be borne by producer), until the results show acceptable quality (SPC <20,000) on three separate consecutive tests.
    - During the testing period milk from the producer will not be accepted
    - Any milk that is determined to have an unacceptable SPC (>50,000) and/or contains pathogens will be discarded and the cost will be borne by the producer.

REJECTION OF MILK

1. An individual producer's milk will be rejected on site if the milk is off colored or if there is excessive organic matter in the milk. Milk should be creamy yellow or white therefore any milk that is tinted brown, pink
or red will be rejected. All pickup costs will be the responsibility Producers
and will be written off invoice.

2. An individual producer's milk will be rejected on site if the milk or milk cans are excessively dirty with organic material. All pickup cost will be the responsibility of the Producer and will be written off invoice.

3. An individual producer's milk will be rejected at Green Dirt Farm if the milk has a Porta Check reading over 750,000 SCC.

4. If Individual Producer's milk is rejected at Green Dirt Farm for high SCC then the next test will be performed on the Producers Farm. If that test is above 750,000 SSC the milk will not be picked up.

5. Co-mingled milk will be rejected if the milk has been adulterated. Milk suspected of adulteration will be tested and if the test is conclusive of adulteration, all co-mingled milk will be rejected. All pickup costs will be the responsibility of the Producers and will be written off invoice.

6. Presence of antibiotics. Co-mingled milk will be rejected if antibiotics are detected in the milk. All pickup costs will be the responsibility of the Producers and will be written off invoice. Producer may also be required to bear the cost of production waste that occurs due to antibiotics in the milk.

7. See info on frozen milk quality regarding rejection of frozen milk

Frozen Milk Standards and Guidelines

- Samples must be sent off to the lab the same week that milk is frozen, and samples may not be frozen.
- Lab results must include testing of components (fat, protein), as well as SCC + SPC and antibiotic screening test (per State regulations)
- SCC must be <500,000
- SPC must be <20,000
- Sharing of lab results with GDF should happen real-time, not just at the time of selling the milk. This will help us troubleshoot with producers as the year goes along.
- Each bucket must contain milk from only one bulk tank. (Under filled buckets should never be topped off with milk from the next bulk tank)
- The bulk tank must be emptied and cleaned every 48 hours
- The outsides of the buckets MUST be clean. No milk, leaves, mud, or other visible filth is permissible. If necessary, hose down the buckets once they are sealed, on a non-muddy surface (gravel, concrete) prior to freezing.

This year we've created a payment scheme for to provide milk price incentives for producing fluid milk in the Fall

2019 Sheep Milk Delivery and Payment Forecast
See milk delivery schedule for milk volumes and delivery days
2019 Dates of non-delivery- see milk delivery Schedule for known dates of non-delivery

Pricing**
Fluid Milk 2019 prices*
March, April, May, June, July- $1.00/lb
August, September, October- $1.10/lb
November, December, January, February- $1.15/lb

Fluid Milk 2020 prices
March, April, May, June, July- $0.90/lb
August, September, October- $1.10/lb
November, December, January, February- $1.25/lb

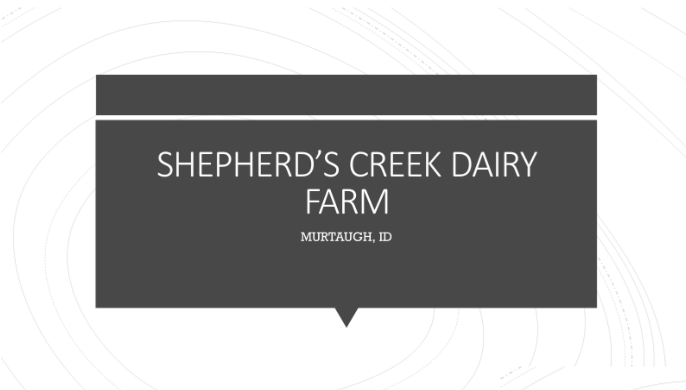
Frozen Milk*
Less than 3 months old- $1.00 for **2019**,
More than 3 months old- $0.90
Starting **2020**, $0.90
More than 3 months old- $0.70

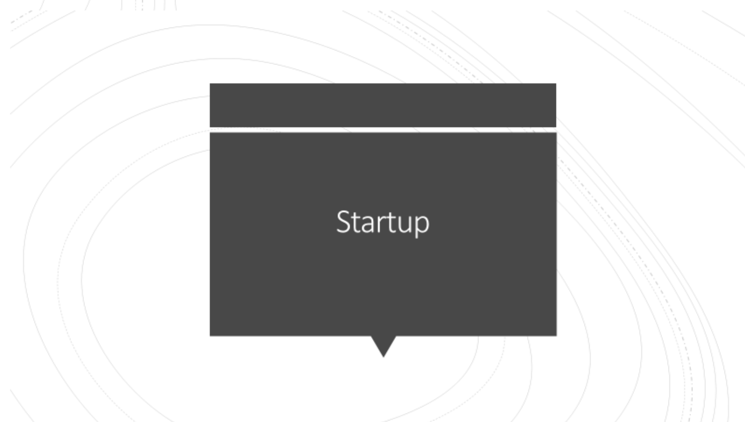
*Assumes milk meets our quality standards. (See Milk Quality Standards sheet given to you with this information.)
**Prices may change due to economic conditions. We will do our best to give you 60 days advance notice of price changes.

Many Challenges Ahead
Be Ready

Virtual Tour of a Shepherd's Creek Dairy Farm

Murtaugh, Idaho
Butch Cargile





Breeding Program

Lacaune X Icelandic X East Friesian

1

Artificial Insemination

Laparoscopic with Lacaune Semen

2

Sedation

3

Cradled

4

5

6

7

8

Insemination

9

Protocol

- 10-12-day CIDR
- PMSG when CIDR is removed
- Inseminate 51-53 hours after CIDR removal

10

2018 Results

- Bred 48 ewes on December 21st
- 44% conception rate
- Cleaned up with 2-50% Lacaune rams
- 1 ewe lamb failed to conceive
- Led to the birth of 14 live ewe lambs and 16 live ram lambs from AI
- One ewe lamb was stillborn from AI
- Cleanup breeding led to the live birth of 9 ewe lambs and 17 ram lambs

11

2019 Breeding

- Exposed 20 ewes to rams on August 28th
- Exposed 48 ewe lambs to rams on September 18th
- Bred 28 ewes AI on October 21st
- Will breed 30 ewes AI on December 4th
- Cleaning up with 2-50% Lacaune rams

12

Icelandic Rams

- Will cover ~150 Lacaune sired ewe lambs in 2020

13

East Friesian Rams

Will cover ~90 Icelandic sired ewe lambs in 2021

14

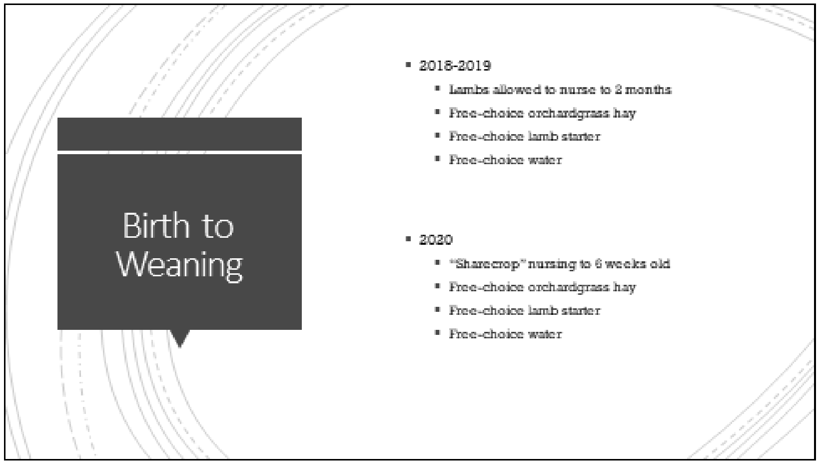
Feeding Program

No Moving Parts

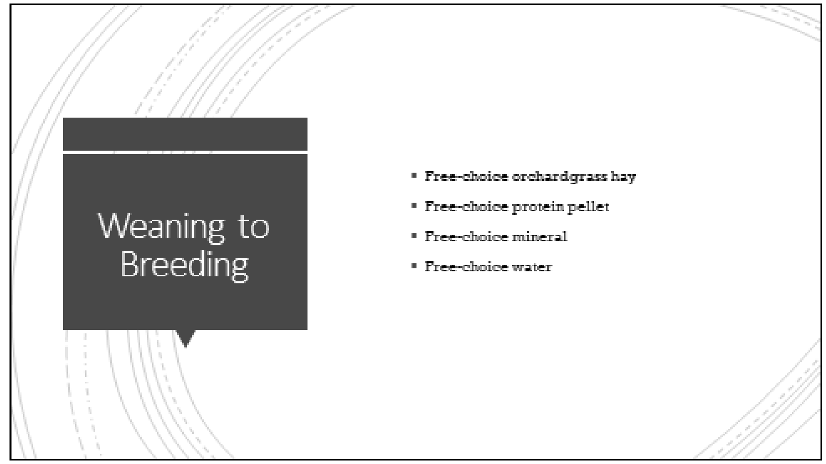
15

Replacements

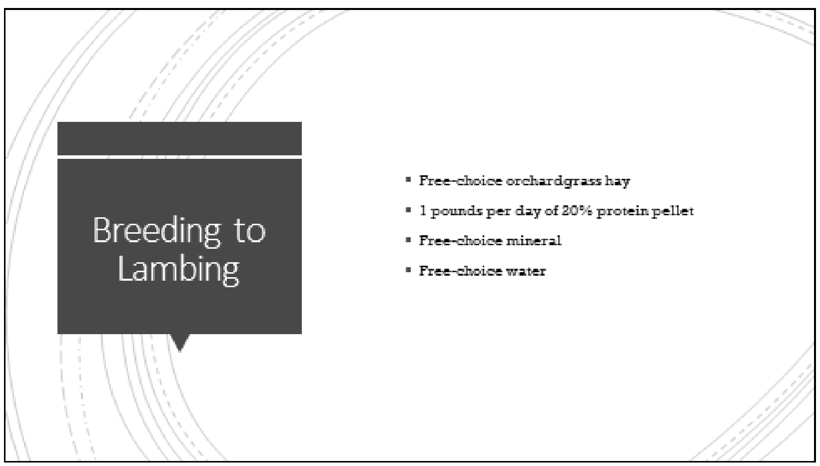
16


Birth to Weaning
2018-2019
Lambs allowed to nurse to 2 months
Free-choice orchardgrass hay
Free-choice lamb starter
Free-choice water
2020
"Sharecrop" nursing to 6 weeks old
Free-choice orchardgrass hay
Free-choice lamb starter
Free-choice water

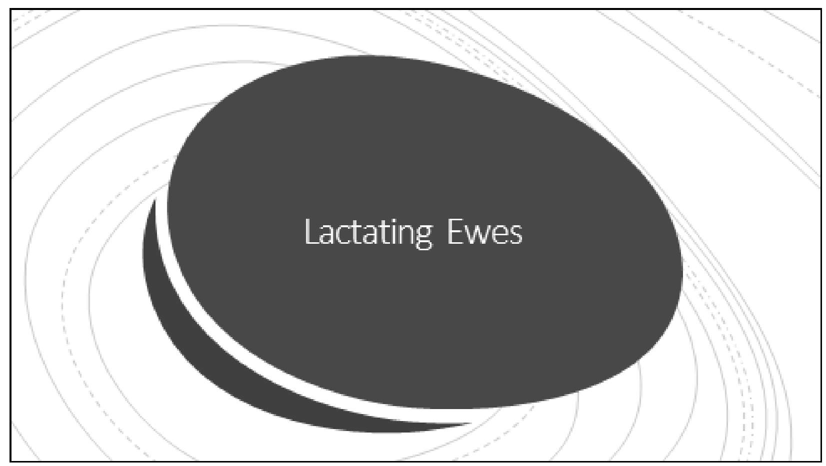
17


Weaning to Breeding
Free-choice orchardgrass hay
Free-choice protein pellet
Free-choice mineral
Free-choice water

18


Breeding to Lambing
Free-choice orchardgrass hay
1 pounds per day of 20% protein pellet
Free-choice mineral
Free-choice water

19


Lactating Ewes

20

160-day Lactation

- Free-choice orchardgrass hay
- 2 pounds per day of 20% protein pellet
- Free-choice mineral
- Free-choice water
- 1 pound per day pelletized barley

21

Dry Ewes

22

75 to 180-day Dry Period

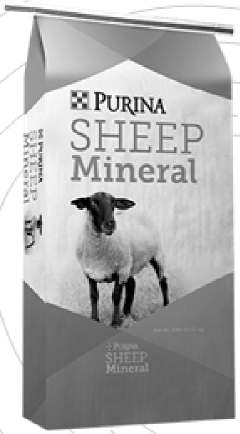
- Free-choice orchardgrass hay
- 1 pounds per day of 20% protein pellet
- Free-choice mineral
- Free-choice water

23

Free-Choice Hay

- Primarily Orchardgrass w/ Alfalfa
- About 3.5 pounds intake per day

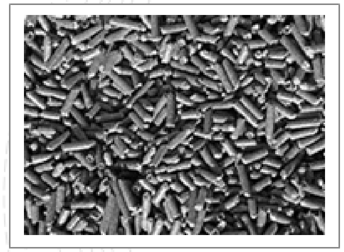
24



Free-Choice Mineral

25

Protein Pellet



- 20% crude protein
- Fed at 2 pounds per day

26

Diseases experienced year-1

- Barberpole worm parasitosis
- Pneumonia
- Clostridial enteritis
- Tetanus
- Frothy bloat

27

Vaccination Program

28

Clostridial Diseases

- Covexin-8
  - 2-days old
  - 10-weeks old
  - 16-weeks old
  - 4-weeks before lambing

29

Economics

30

Cash Flow

INCOME

- Sale of lambs - $10.50 per hundredweight
- Sale of culls - $7 per hundredweight

EXPENSE

Labor - $20 per hundredweight
Cows - $1.68
Feed LDR - $43 per hundredweight
Cows - $11.68
Facility - $7.50 per hundredweight
Vet/Breeding - $7 per hundredweight
Total - $77.50 per hundredweight

31

Break Even and Beyond

BREAK-EVEN POINT

- $60 per hundredweight

EXTRAPOLATION

4.8 hundredweights of saleable milk per ewe per year
Net mailbox price of $75 per hundredweight
$72 net per ewe per year
Milking 1,000 ewes for $72,000 per year

32

The Lamb Weaning System at Lark's Meadow Farms

Lark's Meadow Farms, Rexburg, ID
Kendall Russell

It is important to note that our operation philosophy is to operate on a cash basis outside of our farm mortgage. This has pros and cons; and is its own story. An extension of that philosophy is low input / high output through efficiencies and planning.

<u>The genesis of Lark's Meadow Farms lamb rearing method.</u>

When Lark's Meadow Farms was purchased from our in-laws, we had limited credit (saved for emergency use only), limited cash on hand and much much less cash flow, and no workers other than ourselves. Merrick and Land O'Lakes Lamb milk replacer was running $125+ per 50 lb. bag at the time…..when you bought it by the pallet! Factor in all the labor in mixing milk twice a day for 300 hungry lambs, cleaning milk bars, replacing chewed nipples. We were rebuilding a stripped-out farm in need of replacement of numerous items and a lot of repairs. Time and money were both in short supply in the face of the mandatory duties of milking/feeding twice a day, making cheese, etc.

When you are out of resources you have to be resourceful. Our cheese sales at the time were far less than our capacity to produce even our lower-yielding hard cheese. We had milk to spare so we left lambs on. The relief on cash and time was profound and kept us sane. We were also amazed our milk loss was only about 43% of our production prior to that decision, and it only lasted 40 days. Our incidence of mastitis did not change, neither did our somatic cell count, and our solids changed only slightly in a minor drop in butter fat. We metered every two weeks at the time and sent milk samples to Rocky Mountain DHIA in Utah.

That fall my wife and I, happy with the results, thought how can we modify our new lamb weaning system into a permeant system with less loss of milk? We have always left lambs on for the first 2-3 days to clear the colostrum, so there was step one. We made the business decision to not be in the meat lamb business other than farmers market lambs. So we pulled all no-replacement ewe lambs and unneeded ram lambs at Day 3 of age, and sell them for $25 as bottle lambs. We looked at the profit ratios for time and inputs. It's a great return for essentially no effort.

Next was pulling lambs off their mothers but for how long and when. We settled on the idea of overnight and pulling the lambs before the evening milking -- a 14-hour overnight separation and then 10 hours with the ewes in the day.

Being a former science student, we ran two control groups and the grand experiment group of pulled lambs. Control 1 was 30 ewe lambs left on mothers for 30 days or twice their birth weight, with free access to 20% protein lamb creep and hay. Control 2 was thirty ewe lambs on a free choice milk bar, free choice 20% protein lamb creep and hay.

<u>Comparison of three rearing methods. The results:</u>

Control group 1 (lambs left on mothers):

- Lambs left on mother grew fastest, most doubled their birth weight by day 25-30.
- Lowest 30, 90, and 1-year mortality
- Nearly no scours (1 lamb).
- 30-day mortality less than 1% (1 of 60)
- 60-day mortality less than 4% (2 of 60)
- 1-year mortality of 10% (6 of 60).
- All lambs from this group were bred that same year.

The experiment group (10 hours with mother, 14 hours separated)
This group was the next best

- All birth weights doubled by day 30-35
- Nearly identical 30- and 60-day mortality to control group 1
- Nearly no scours (2 lambs)
- This group had a 1-year mortality of 15% (3)
- All lambs from this group were bred that same year.

Control group 2 (the milk bar ewe lambs)
The last place group

- Doubling of birth weigh for 77% of these lambs was 35+ days
- Scours in 6 lambs
- 30-day mortality of 15% (3)
- 60-day mortality 25% (25)
- 1-year mortality 30% (6 total out of 20)
- 3 lambs of this group did not breed in their birth year
- The perception was of less vigor and brightness in these lambs in the first 60 day compared to the other groups.

This is by no means a valid scientific experiment – groups of unequal size, and rearing environments not identical or equal in numerous ways. But it provided enough information to steady a gut decision to make permanent change in our lamb rearing.

This is not a perfect system there is some butter fat loss of about 1.5% and a total milk volume loss of around 30% in the first 30 days of lactation in our farm's experience.

There has been no loss in length of lactation nor negative change in the peak of our lactation curves. The losses of initial milk volume are more than tenable for our farm and family's needs given the immediate savings in time and cash. If our overall production of soft cheese exceeds 35% total cheese production, we may need to reevaluate. For now, we are more than happy.

Eureka! The LMF Lamb-weaning system was born for the following year, and we have never stopped.

<u>The Nutshell of the LMF Lamb-weaning system</u>

1. All lambs on mother to Day 3.
2. All non-essential lambs pulled and sold at Day three/four of age, off the farm. (We have a wait list and the price goes up $5/day so folks are usually prompt. We also will sell to who is next in line for lambs.)
3. All lambs pulled before the evening milking (4 pm) and returned after the following morning's milking 6am. Effectively a 14-hour off / 10-hour on split.
4. Ewe lambs are completely weaned at Day 30 or double their birth weight whichever comes last.

Using a 12-hour Suckling System in the 1st 30 Days of Lactation

Meadowood Farms, Cazenovia, NY
Quincy Wool Parker, Manager

In 2015, we met Kendall Russell at the Dairy Sheep Symposium and he told us how he had adapted the MIX system, and how it worked very well for him. (We had tried the MIX system in 2002, as presented by the Spooner Station. It didn't work well, and so we had not continued to use it then.) Kendall's system focused on taking a week to transition the ewes and the lambs to being separated at night.

Most ewes on 12-hr system in 2016 & 2017

In 2016, we used Kendall's System on 85 of the 110 mature ewes that we lambed out in the spring. It was very successful: on those 85 ewes and approximately 150 lambs, we used neither milk replacer nor labor to manage baby lambs. We made very good cheese with the milk, even when ¾ of our mature ewes were on the 12-hr Suckling System. And the 12-hr lambs were as well-conditioned as lambs who were continuously suckling, and we did not see any drop in their consumption of creep feed, condition, or weight gain when they were weaned at D30. We did make some mistakes at the start:

- We didn't have a good system for separating ewes and lambs
- We didn't have a secure way to move the ewes away from the lambs, and they kept trying to return to their lambs
- We thought we should have the ewes out of earshot, but that meant in outside pastures, and they made mudpits

But once we moved the separation chute to a place where it was easy to separate ewes and lambs, and decided to keep the ewes inside until they were settled, everything went smoothly.

Selected ewes and market lambs on 12-hr system in 2018 and 2019

In 2018 and 2019, we used the 12-hr Suckling System again. By this time we had good systems for the early transition pens, and we had set up a really good system for separating the ewes and lambs, and the whole process was smooth and simple and successful.

Also, we only put enough ewes on this system to satisfy our contract to supply finished market lambs. In 2019, this was 25 ewes with 50 Dorper twin lambs at side. (Replacement females were removed at D1 and raised on milk replacer; all other lambs were sold at D1.)

In 2019 we selected 25 ewes for whom it was most convenient and efficient for us to put on the 12-hr Suckling System:

- They all lambed in a 10-day period
- They were either already nursing when we found them, or were easy to get onto the teats.
- They all had twins, preferably males (no triplet females on pendulous udders!)

Why the adapted 12-hr Suckling System works at Meadowood Farms

1. For us:
    - No lamb bar costs -- no milk replacer, no lamb bar labor
    - We get milk for the first 30 days
    - Results in high-quality meat lambs
2. For the ewes:
    - Doesn't compromise ewe's seasonal production – because their udders are emptied completely at least twice per day, the production of dairy ewes is not stunted
3. For the lambs:
    - Lambs get dam's milk
    - Heavy weaning weights without a hiccup.   Lambs transition well at 30-day weaning – they have already become used to creep feed, and already used to dam being absent

The system used at Meadowood Farms. On Table 1, we have laid out the entire 12-hr Suckling System as we use it at our farm.

Components of ewes on the 12-hr Suckling System

Back in 2001, there was a lot of discussion about MIX system ewes withholding their milkfat, so that the milk collected was lower in fat. But we have found that in the first month or so of lactation, for about 25-50% of each row for ***all*** of our ewes – whether they are 12-hr Suckling ewes or ewes with no lambs – we have to give an upper-udder massage to get some of the ewes to full let down, or we have to put the cups back on after taking them off, to fully milk them out.

On Table 2, we have laid out the component analysis for 23 ewes in 2019, each suckling twins while being milked 2x/d through D30. You can see that on average at D22, they produced an average of 3.7 lb/hd/d while suckling twins, and their component levels did not differ significantly from 20 ewes (Table 3) who were at a similar stage of lactation and who had no lambs on them. (Not in the tables: SCC, which was almost identical between the two groups.)

Table 1. the 12-hr Suckling System used at Meadowood Farms

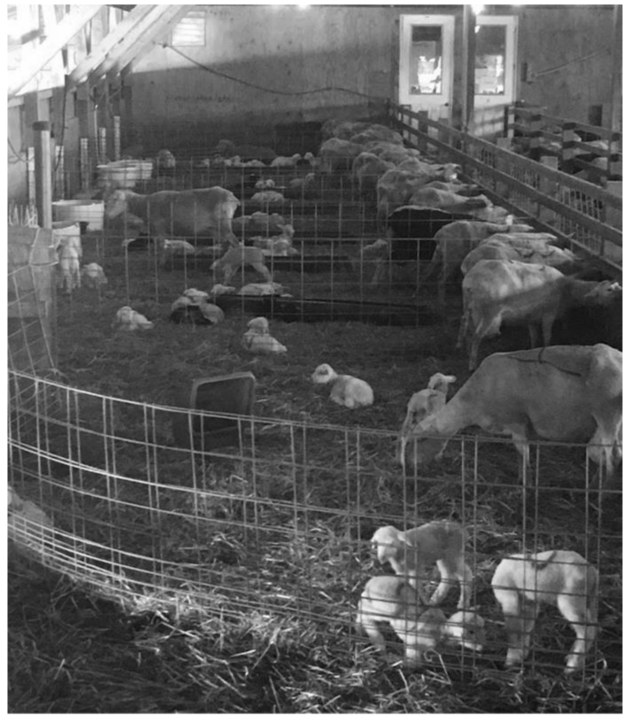
	Day 1	Day 2-3	Day 4-7	Day 8-30	Day 30 +
	Bonding pen	**Small group pen**	**Transition pen**	**12-hr suckling & separation**	
Where?	In jug with ewe	Family Pens: 2-3 ewes and their lambs	Single group of all ewes and lambs Day 4-7	• Single group of all ewes and lambs Day 8-30 • On each D8, put 8-day-old lambs into this group; run D8 ewes into this grp after AM milking	Weaned at D30
Milking?	Colostrum milking	Ewes milked 2x/day and immediately returned to lambs	Ewes milked 2x/day and immediately returned to lambs	• Milked in the AM • Ewes & lambs together for the day • Separated just before PM milking • Ewes and lambs separate all night • Ewes return to lambs ~ ½ hr after milking	2x/day
Extra labor/ care	Assisting lambs onto ewes	Watch for lost/hungry lambs	Sorting off lambs before milking	• Lamb night pen cozy, well bedded, grain, hay, water, etc. • Lambs always stay in same pen/area – ewes leave & return	
Really important Key points	24-hour bonding time with ewe.	• Only twins • Paint on lambs/ewes • Easy jug/pen for lambs during milking	easy jug/pen for lambs during milking	• Have an easy sort gate/chute, with anti-backup gate. A cozy night pen for lambs away from ewes. • Ideal to have plenty of space for E & L when together during the day	
Challenges?	Ewe has teats pointing down/ low udder/ full udder. May have to milk out ewe before lambs can nurse (do not bottle-feed).	• Mis-mothering • Multiple pens with hay, water, grain, etc.	• Need an easily expandable pen • Time spent catching lambs before each milking.	Teaching ewes and lambs to run into chute/ sort gate. (Time once settled is only 5 min for 25 ewes & 50 lambs)	
Milk production			AVG DIM: 8 AVG LBS/D: 3.7	AVG DIM: 22 AVG LBS/D: 4.0	AVG DIM: 38 AVG LBS/D: 7.0
Weaning				Weaned @ 30 days. AVG wt: 34lbs	

Table 2.

23 ewes suckling twins on 12-hr system: Component percentages on May 2, at avg 22 DIM									
# lamb suckling	Tag	Ewe age	Days in milk 5/2	FAT	PRO	LAC	SNF	TSOLIDS	Lbs milked 5/2
2	1256	7	26	5.52	4.61	5.19	10.88	16.40	2.42
2	1314	6	19	6.20	4.94	5.10	11.13	17.33	5.28
2	1345	6	23	6.22	4.35	5.06	10.43	16.65	4.18
2	1425	5	24	6.15	4.98	4.44	10.42	16.56	5.5
2	1508	4	23	6.62	4.36	5.08	10.47	17.09	3.3
2	1528	4	20	5.84	4.10	5.19	10.33	16.16	4.4
2	1532	4	25	5.70	4.87	5.22	11.20	16.89	2.2
2	1533	4	20	6.26	4.31	5.16	10.51	16.77	3.08
2	1548	4	25	5.52	4.54	5.13	10.74	16.26	2.31
2	1602	3	22	5.77	4.44	5.05	10.54	16.31	2.64
2	1606	3	22	7.80	5.45	4.20	10.63	18.43	1.98
2	1609	3	26	7.13	4.48	5.18	10.70	17.83	4.84
2	1611	3	17	6.40	4.12	5.16	10.30	16.69	5.06
2	1613	3	23	5.61	4.73	5.29	11.13	16.73	3.3
2	1614	3	25	4.39	4.58	5.10	10.77	15.16	3.74
2	1615	3	25	5.18	4.38	5.29	10.75	15.93	2.64
2	1623	3	19	6.28	4.45	5.22	10.73	17.01	3.52
2	1628	3	14	4.67	4.00	5.21	10.26	14.93	3.52
2	1632	3	26	5.51	4.68	4.64	10.33	15.84	3.08
2	1633	3	25	4.93	4.55	5.37	11.03	15.96	5.06
2	1656	3	24	7.33	4.12	5.19	10.31	17.64	3.52
2	1657	3	23	6.86	5.06	5.05	11.19	18.05	4.73
2	15190	4	17	6.06	4.36	5.27	10.70	16.76	3.96
	Average	**3.8**	**22**	**6.00**	**4.54**	**5.08**	**10.67**	**16.67**	**3.7**

Table 3.

20 ewes w/ no lambs: Component percentages on May 2, at average 34 DIM								
# lamb suckling	Tag	Ewe age	Days in milk 5/2	FAT	PRO	LAC	SNF	TSOLIDS
0	1335	6	3	5.46	4.60	5.22	10.92	16.38
0	1343	6	24	6.49	5.11	4.59	10.74	17.23
0	1400	5	41	5.78	4.52	5.15	10.73	16.51
0	1427	5	42	5.77	4.39	4.88	10.28	16.05
0	1431	5	38	6.28	4.69	5.04	10.78	17.05
0	1436	5	39	6.26	4.65	4.96	10.64	16.90
0	1445	5	52	6.99	4.71	4.97	10.71	17.70
0	1521	4	42	6.41	4.84	5.17	11.11	17.52
0	1604	3	40	5.92	4.56	4.89	10.48	16.40
0	1605	3	54	6.65	5.00	5.36	11.48	18.13
0	1626	3	38	6.65	5.00	5.08	11.17	17.82
0	1629	3	23	6.75	4.40	5.34	10.80	17.55
0	1634	3	39	6.58	4.89	5.17	11.14	17.72
0	1635	3	37	7.10	4.96	5.26	11.32	18.42
0	1638	3	41	5.03	4.68	5.38	11.19	16.21
0	1639	3	11	6.31	4.11	5.38	10.54	16.84
0	1641	3	22	7.37	5.00	5.26	11.35	18.72
0	1644	3	39	5.73	4.65	5.02	10.73	16.45
0	1648	3	40	7.01	5.05	5.17	11.32	18.32
0	1654	3	12	6.50	4.87	5.21	11.16	17.66
	Average	**3.9**	**34**	**6.35**	**4.73**	**5.12**	**10.93**	**17.28**



Top: D2-3 E&L outside of original jugs

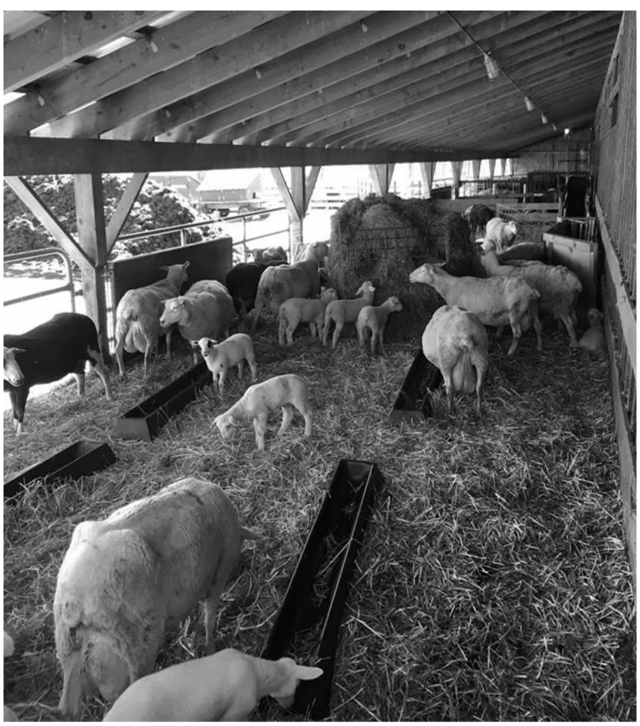
Top R: (2017) many pens of Day 4-7 E&L, each w hog panel to scoop up lambs in pen during milkings.

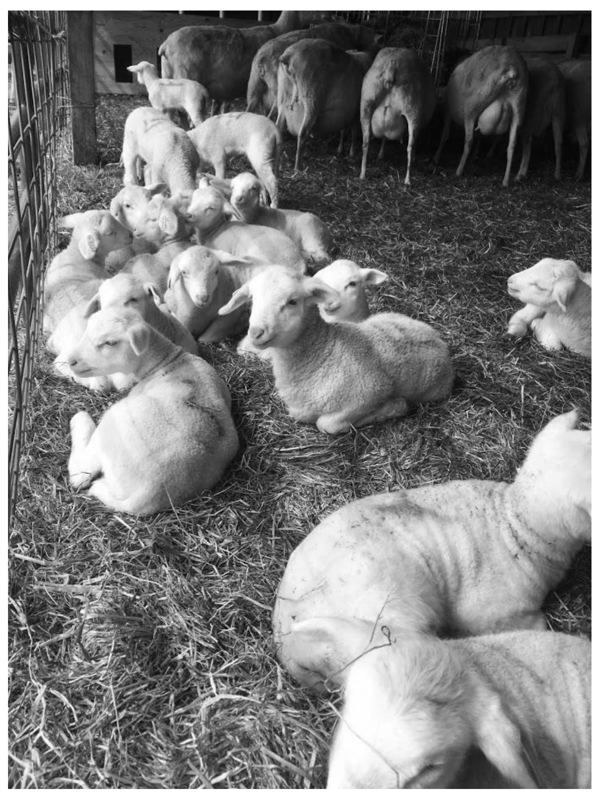
Bottom L: Day 4-7 E&L.

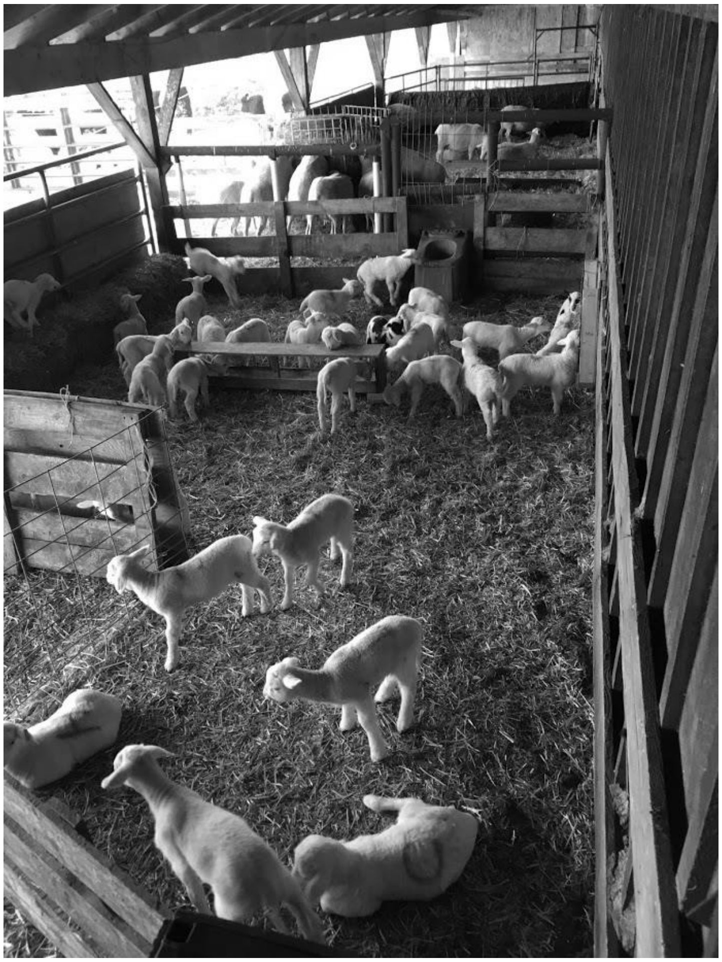
Bottom R: Day 4-7 lambs enclosed during milking.

Top: In Day 8-30 group, ewes rejoin lambs after morning milking (~ 5am in this picture).

Botom L & R: Day 8-30 E&L hang out during day







Top & bottom: Day 8-30 lambs shortly after being separated from ewes for afternoon milking and the remainder of the night. Lambs in these pictures are averaging 1-2 weeks old.

The William J Boylan Distinguished Service Award

(prior to 2009, known as the DSANA Distinguished Service award)

The Bill Boylan Distinguished Service Award recognizes those who have made significant contributions to the growth and progress of the North American dairy sheep industry. This honor is awarded annually to a nominee or nominees who has been considered and voted on by the DSANA Board of Directors; the award is presented at the Symposium during the Banquet.

Recipients of the Distinguished Service Award

Dr Richard Bourassa, 2017. Hôpital Vétérinaire, Sherbrooke, Quebec;

and Andre Charest, OVIPRO advisor, CEPOQ, Quebec

Michael Thonney, 2016. Cornell University, Ithaca NY, Sheep reseacher

Sid Cook, 2015. La Valle, Wisconsin, Sheep milk processor

Terry Felda, 2014. Ione, Oregon, Dairy sheep producer

Axel Meister, 2013. Markdale, Ontario, Dairy sheep producer

Bill Halligan, 2012. Bushnell, Nebraska, Dairy sheep producer

Tom and Laurel Kieffer, 2011. Strum, Wisconsin, Dairy sheep producers

Eric Bzikot, 2010. Fergus, Ontario, Dairy sheep producer and sheep milk processor

Dave Yves Berger, 2009. Spooner Wisconsin, Dairy Sheep Researcher

William Wendorff, 2008. Cross Plains, Wisconsin, Sheep milk processing researcher

Tom and Nancy Clark, 2007. Old Chatham, NY, Dairy sheep producers & sheep milk processors

Pat Elliot, 2006. Rapidan, Virginia, Dairy sheep producer and artisan cheese maker

2005 (no award given)

Dan Guertin, 2004. Stillwater, Minnesota, Dairy sheep producer

Dave Thomas, 2003. Madison, Wisconsin, Dairy sheep researcher

The DSANA Mentorship Award & Scholarship Fund

The DSANA Mentorship Award recognizes those who have generously given their time and experience to newcomers in the North American dairy sheep industry. The sheep dairy industry of North America, since its inception, has benefited from the generous giving of time, support and mentoring by many people who have provided the backbone and foundation for growing a new industry. These are the people who worked through the good and challenging times in their own businesses, yet were ever willing to share what they learned with whoever asked, or give their time and energies to support the emerging dairy sheep industry in North America. These are the familiar faces that bring us back to the Symposia year after year and the people we contact throughout the year when we are stumped by industry challenges. The DSANA Mentorship Award recipient will be nominated by the DSANA membership, then considered and voted on by the DSANA Board of Directors. A scholarship that covers the registration costs of that year's upcoming DSANA Symposium will be given to a dairy sheep producer new to the industry, to be identified by that year's Mentorship Award recipient.

Recipients of the DSANA Mentorship Award

	DSANA Mentorship Award Recipient	Scholarship Recipient
2018	**Kendall Russell, Lark's Meadow Farms, Rexburg, ID**	
2017	**Eric and Elisabeth Bzikot, Best Baa Dairy, Fergus, Ontario.**	Meghan Spares, Nova Scotia.

DSANA: History, Current Board of Directors

Board of Directors, 2018-2019

Bee Tolman, President. Meadowood Farms, Cazenovia, NY
Jim Ashmore, Treasurer. KJ'n Ranch & Sheep Mountain Creamery, Helena, MT
Sarah Hoffmann, Secretary. Green Dirt Farm, Weston, MO
Carrie Abels Wasser. Willow Pond Sheep Farm, Gardiner, NY
Tom Clark. Old Chatham Sheepherding Farm, Old Chatham, NY
Terry Felda. Tin Willow Farm, Ione, OR
Rebecca King, Garden Variety Cheese & Monkeyflower Ranch, Royal Oaks, CA
Tom Pyne. Twenty Paces Creamery, Charlottesville, VA
Lynn Swanson, Glendale Shepherd, Clinton, WA
Debbie Webster. Whispering Pines Farm, Mauldin, SC
Kyle White. Milkhouse Farm & Dairy, Smith Falls, ON

Brief History of DSANA

November 1-3, 2001 – Decision made at the 7th Great Lakes Dairy Sheep Symposium, Eau Claire, Wisconsin, to form the Dairy Sheep Association of North America. Nancy Clark, New York, elected the interim/organizational President.

June 26, 2002 – DSANA by-laws, written by Nancy Clark, New York; Alistair McKenzie, Quebec; Carol Delaney, Vermont; and Charles Capaldi, Wisconsin, were adopted.

November 7, 2002 - Charter Meeting of DSANA held at the 8th Great Lakes Dairy Sheep Symposium, Cornell University, Ithaca, New York

DSANA Presidents

2017 - 2019: Bee Tolman, New York
2015 - 2017: Laurel Kieffer, Wisconsin
2013 - 2015: Michael Histon, Maryland
2012 - 2013: Bill Halligan, Nebraska
2011 - 2012: Laurel Kieffer, Wisconsin
2009 - 2011: Bill Halligan, Nebraska
2007 - 2009: Claire Mikolayunas, Wisconsin
2005 - 2007: Larry Meisegeier, Wisconsin
2004 - 2005: Mike Thonney, New York
2002 - 2004: Nancy Clark, New York

Locations of Past Dairy Sheep Symposia

and Chairs of the respective Symposium Organizing Committees

2019 25th DSANA Dairy Sheep Symposium, Idaho Falls, Idaho. Org'd by Symposium Committee.

2018 24th DSANA Dairy Sheep Symposium, Kansas City, Missouri. Chair: Sarah Hoffmann.

2017 23rd DSANA Dairy Sheep Symposium, Orford, Quebec. Chair: Marie-Chantal Houde.

2016 22nd DSANA Dairy Sheep Symposium, Ithaca, New York. Chair: Michael Thonney.

2015 21st DSANA Dairy Sheep Symposium, Madison, Wisconsin. Co-chairs: Brenda Jensen and David Thomas.

2014 20th DSANA Dairy Sheep Symposium, Chehalis, Washington. Co-chairs: Terry Felda, and Brad & Megan Gregory.

2013 19th DSANA Dairy Sheep Symposium, Cambridge, Ontario. Chair: Eric Bzikot.

2012 18th DSANA Dairy Sheep Symposium, Dulles, Virginia. Chair: Laurel Kieffer.

2011 17th Great Lakes Dairy Sheep Symposium, Petaluma, California. Chair: Cynthia Callahan.

2010 16th Great Lakes Dairy Sheep Symposium, Eau Claire, Wisconsin. Chair: Claire Mikolayunas.

2009 15th Great Lakes Dairy Sheep Symposium, Albany, New York. Chair: Claire Mikolayunas.

2008 14th Great Lakes Dairy Sheep Symposium, Maryville, Tennessee. Chair: Claire Mikolayunas.

2007 13th Great Lakes Dairy Sheep Symposium, Guelph, Ontario. Chair: Eric Bzikot.

2006 12th Great Lakes Dairy Sheep Symposium, La Crosse, Wisconsin. Chair: Yves Berger.

2005 11th Great Lakes Dairy Sheep Symposium, Burlington, Vermont. Chair: Carol Delaney.

2004 10th Great Lakes Dairy Sheep Symposium, Hudson, Wisconsin. Chair: Yves Berger.

2003 9th Great Lakes Dairy Sheep Symposium, Victoriaville, Québec. Chair: Lucille Giroux.

2002 8th Great Lakes Dairy Sheep Symposium, Ithaca, New York. Chair: Michael Thonney.

2001 7th Great Lakes Dairy Sheep Symposium, Eau Claire, Wisconsin. Chair: Yves Berger.

2000 6th Great Lakes Dairy Sheep Symposium, Guelph, Ontario. Chair: Axel Meister.

1999 5th Great Lakes Dairy Sheep Symposium, Brattleboro, Vermont. Chair: Carol Delaney.

1998 4th Great Lakes Dairy Sheep Symposium, Madison, Wisconsin. Chair: Yves Berger

1997 3rd Great Lakes Dairy Sheep Symposium, Madison, Wisconsin. Chair: Yves Berger

1996 2nd Great Lakes Dairy Sheep Symposium, Madison, Wisconsin. Chair: Yves Berger

1995 1st Great Lakes Dairy Sheep Symposium, Madison, Wisconsin. Chair: Yves Berger

The Scharine GROUP INC.
We live milk
"The Business Built on Service"

N4213 Scharine Road
Whitewater, WI 53190
1.800.472.2880
www.thescharinegroup.com/dairy-division

Like us on facebook

Hamby Dairy Supply
Hamby
dairy supply

Thanks to all of our 2019 DSANA Dairy Sheep Symposium sponsors!!