ARIZONA AND NEW MEXICO DAIRY NEWSLETTER

COOPERATIVE EXTENSION
The University of Arizona
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This month's article:

"Increased Milking Frequency"

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New Mexico State University Extension Dairy Website: http://www/nmsu.edu/~dairy

The following videos are available for checkout from New Mexico State University. To obtain a video call Kathy Bustos, (505) 646-3326 or kbustos@nmsu.edu and the video will be sent in the mail, pending availability. There is only one copy of each video available, so we request that videos be returned within two weeks. Note that four of the videos contain an English and Spanish version.

1. The Milking School. Utah State University. Spanish and English. 30 minutes
2. Fitting and Showing Your Dairy Animal....A Winning Experience. Department of Dairy Science, University of Wisconsin. 20 minutes
3. Proper Milking Procedure. University of Florida. Spanish and English. 12 minutes
4. Milking Machine Maintenance. University of Florida. Spanish and English. 16 minutes
5. The Basics of Vacuum and Milking Systems. DHIA Services, 1991. 53 minutes
6. Understanding Dairy Cattle Behavior to Improve Handling and Production. Livestock Conservation Institute, 1992
7. Managing Milking/Ordenar Lecheria. Spanish and English. 1999. 33 minutes
8. Get Milk! Joining A Dairy Crew. University of New Hampshire, 1999. 45 minutes

Need to Calculate Production Costs?

University of Wisconsin dairy farm management specialist, Gary Frank, has developed a Excel spreadsheet to calculate variable cost of production and total cost of production. To access the spreadsheet, go to http://www.wisc.edu/dairy-profit, click on Decision Making Tools, then go to costcwt.xls.

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Increased Milking Frequency

By
Allison Fitzgerald, Ehrin Annen, Lance Baumgard and Matt VanBaale

Milk Frequency Summary:

1. Increased milking frequency (IMF) in early lactation **"primes"** the mammary gland and induces a carry-over effect throughout the entire lactation.
2. **Cows and heifers** may respond differently to IMF.
3. Increased milking frequency may have beneficial effects on **SCC**.
4. **Weather and heat abatement** strategies impact the effects of IMF.
5. The combined effect of **bST** and **IMF** in early lactation is not known.

Introduction

Low milk price and other financial pressures have required dairy producers to find ways to increase milk yield while minimizing expenses. Traditionally, dairies have milked cows two (2X) or three times daily (3X) however, some producers are currently milking cows four times daily (4X) during early lactation, followed by 2X or 3X milking thereafter. Producers implementing such practices have reported higher peak milk yields and greater 305-day productions. It has been suggested that milking fresh cows 4X for 21days postpartum supports a "carry-over" effect when animals return to a 2X-milking regime. Currently, the mechanism by which this occurs is not known. Some hypotheses are: 1) an increase in the activity of milk-secreting cells (increased milk synthesis), 2) an increase in the number of milk-secreting cells (mammary growth), 3) a decrease in intramammary pressure resulting in increased milk synthesis, 4) a change in hormone concentrations, or 5) any combination of the aforementioned.

Milk Response

There are two primary considerations surrounding the effects of IMF: 1) the enhanced milk yield due to increased milking frequency is a fixed response within parity in lbs/milk/day and 2) increased milking frequency in early lactation stimulates a carry-over effect throughout lactation (Bar-Peled et al., 1995; Erdman and Varner, 1995; Table 2.).

Table 1. Milk yield response to different milking frequencies compiled from 44 research articles.

Milking Frequency	Number of Studies	Milk Yield (lb/d/cow)
2X versus 3X	40	7.7
2X versus 4X	4	10.8

Adapted from Erdman and Varner, 1995.

Under typical IMF conditions, a cow producing 80 or 90 lbs/day when milked 2X, will increase by approximately 8.0 pounds/day when she is milked 3X (Erdman and Varner, 1995). Thus, high and low producers will increase production by the same increment (i.e. fixed response). However, there appears to be an effect of parity since

milk response between heifers and cows varies. A study by D.A. Poole in 1982, reported a difference in lactation yields between heifers and cows milked 3X (heifers = 10,738 vs. cows = 14,267 lbs) and 2X (heifers = 9,875 vs. cows = 12,526 lbs). Cattle were milked under different milking frequencies utilizing unequal milking intervals throughout lactation (Table 2; Poole et al., 1982).

Table 2. Difference in milk yield between 2X and 3X in heifers and cows for different stages of lactation.

Cows (stage of lactation)	**Difference in Milk Yield (3X-2X)**
1-20 weeks	1351 lbs
21-30 weeks	255 lbs
305-d lactation	1741 lbs
Heifers (stage of lactation)	
1-20 weeks	669 lbs
21-30 weeks	91 lbs
305-d lactation	843 lbs

Adapted from D.A. Poole, 1982.

Milking Frequency - 2X, 3X, 4X, and 6X

Most experiments have compared 2X vs. 3X and unfortunately not many have compared 4X milking. Researchers are currently evaluating what the cause(s) are that elicit a carry-over effect observed throughout lactation from early postpartum IMF. Dahl and coworkers (2001) evaluated the effects of 2X versus 4X and reported a significant increase in milk yield. An economic analysis of IMF was recently presented at the Arizona Dairy Production Conference in Phoenix, October 16, 2003 (Table 3).

Table 3. Milk response and economic benefit from milking fresh cows 4X for 21 days postpartum.

	Potential Milk Response		
Costs to Consider	*3 lb.*	*6 lb.*	*9 lb.*
Labor[a]	$0.11	$0.11	$0.11
Feed[b]	0.09	0.18	0.27
Supplies[c]	0.05	0.05	0.05
Milk revenue[d]	0.33	0.66	0.99
Marginal profit/cow[e]	0.08	0.32	0.56
Marginal profit/farm[f]	$2,928	$11,712	$20,496

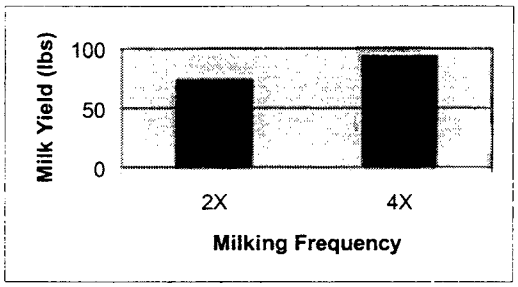
[a]Labor cost: $10/hour, 4 hours/cow/lactation.
[b]Dry matter: $.06; 0.5 lb DM for each pound of milk increase.
[c]Cost for supplies for an extra 42 milkings distributed over entire 305-day lactation.
[d]Milk at $11.00/cwt
[e]Estimate is for each day of a typical 305 day lactation.
[f]Calculated from profit/cow for 305 day lactation for 120 cow herd.

A recent study by Hale et al. (2003), utilized 31 Holstein cows milked either 2X throughout lactation, 4X (starting day 1 postpartum) through 21 days postpartum, or 4X (starting day 4 postpartum) through 21 days postpartum. The objectives were to determine early lactation milking frequency response, carry-over effects, and effects on mammary growth and hormones responsible. Cows milked 4X beginning on day 1

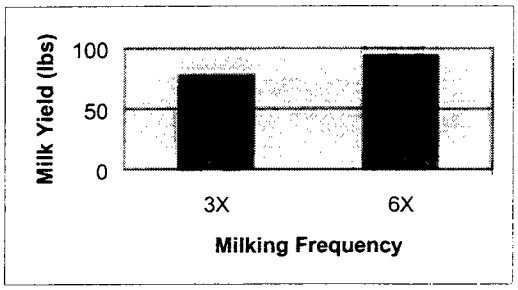
postpartum produced 19.4 lbs/day more milk than those milked 2X during early lactation. Similarly, cows milked 4X beginning on day 3 postpartum through day 21 produced 10.6 lbs/day more milk than the 2X group. Milk yield for both groups converged at day 252 in milk.

Minimal research has been done on milking cows 6X. Bar-Peled et al. (1995) compared 3X and 6X milking for 21 days postpartum. Compared to the 3X group, cows milked 6X produced 16.1 lbs/day (77.7 vs. 93.7 lb/day) more milk up to 6 weeks in lactation and 11.2 lb/day (82.3 vs. 93.5 lb/d) more from weeks 7 through 18. Another study reported an increase in milk yield and a carry-over effect when cows were milked 6X versus 3X for 42 days postpartum (Sanders et al., 2000). Milk responses observed for 2X, 3X, 4X and 6X milking frequencies are compiled in Figure 1.

Figure 1. Milk yield responses to 2X vs. 4X (Hale et al., 2003) and 3X vs. 6X (Bar Peled et al., 1995) milking in early lactation.



Adapted from Hale et al., 2003.



Adapted from Bar Peled et al., 1995

Unequal Milking Interval

When increasing milking frequency, the ability to milk all of the cows in one shift can be a challenge. Limitations or questions to consider when increasing the milking frequency are: 1) is your parlor at full capacity, 2) what is cow throughput, and 3) can throughput be increased without sacrificing milk quality. Researchers evaluating milking frequency have used unequal milking intervals to compensate for the aforementioned challenges (Schmidt and Trimberger et al., 1962; Hale et al., 2003). Hale et al. (2003) employed a 4-8 hour milking interval in the 4X treatment and still obtained benefits from IMF. Implementing a protocol to increase milking frequency in fresh cows will be dependant upon parlor capacity, cow throughput and associated costs for increased milking frequency (i.e. electricity, equipment etc.).

Somatic Cell Count and Milk Composition

The majority of the research indicates that with increased milking frequency, somatic cell count (SCC) is either unaffected or decreased. In theory, an increase in udder emptying should decrease SCC and improve overall udder health. Sanders et al. (2000) reported no significant differences in SCC for cows milked 6X versus 3X for 42 days postpartum. Smith et al. (2002) compiling performance records representing approximately 10,600 cows per year (1998-2000) observed an overall decrease in SCC when cows were milked 3X versus 2X. No effect on SCC was observed between groups milked either 2X or 4X (Hale et al., 2003).

As for milk components, milk fat and protein are typically reduced as milking frequency increases. Smith et al., (2002) and Erdman and Varner, (1995) reported that

protein and fat percentages were lower when cows were milked 3X vs. 2X. Cows milked 2X versus 4X in early lactation had decreased protein percentages from weeks 4 – 44, but no effects on fat were detected (Hale et al., 2003).

Considerations When Increasing Milking Frequency

Walking distance recommendations from John Smith and co-workers (2002) suggest the following maximum walking distances to the parlor under dry lot conditions for different milking frequencies to minimize feet and leg stress are:

- 2X – 1,000 ft.
- 3X – 700 ft.
- 4X – 500 ft.

Holding pens exert the greatest stress to dairy cattle on the dairy, as it becomes humid from crowding, udder washing and ambient temperature. Cows being cooled in the holding pen increased milk yield by 1.7 lb/day (Wiersma and Armstrong, 1983). Minimizing time spent in holding pens will decrease pre-milking stressors and support the potential milk yield increase for 4X or 6X milking.

Cow throughput must be considered when planning to increase the number of cows entering the parlor in one shift. As mentioned above, current parlor capacity, cow throughput, number of milkers, and wash time will be considerations for increasing milking frequency. Throughput is typically a function of:

- Number of stalls in parlor **X** 4.5 = cows milked per hour (CPH)
- # of cows being milked = CPH **X** length of milking shift

Water availability upon exiting the parlor is crucial to maximize feed intake and milk yield. Dairy cattle may increase water intake by 50% under periods of heat stress (Jones and Stallings, 1999).

- Adequate **feed** and **feeding times**. Schedule feeding times upon cows exiting the parlor. This may minimize cows heading for the shade versus the feedbunk.
- **Shade** and **cooling**. Supplying the lactating dairy cow with shade and cooling is pertinent. With sweltering temperatures and little or no cooling at night during summer months, cattle will expend energy to cool down.
- The Arizona and New Mexico environment may be a deciding factor when calculating revenue received from IMF.

Conclusion

More research is needed to establish the number of days increased milking frequency should be employed. Furthermore, profitability of increasing peak yields and the subsequent carry-over effect should be determined. The mechanism by which increased milking frequency increases peak milk yield and a carry-over effect throughout the entire lactation is still under investigation.

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HIGH COW REPORT
SEPTEMBER, 2003

MILK

Arizona Owner	Barn#	Age	Milk	New Mexico Owner	Barn #	Age	Milk
* Stotz Dairy	12663	05-08	44,770	* Hide-Away Dairy	2814	5-06	44,500
* Red River Dairy	4076	05-05	42,023	* Goff Dairy	11806	5-06	40,770
* Mike Pylman Dairy	5705	04-05	38,760	Breedyk Dairy	6830	6-06	39-580
* Mike Pylman Dairy	3807	06-00	38,440	* Goff Dairy	8053	4-03	38,760
University of Arizona	218	04-04	38,141	Breedyk Dairy	6737	6-06	38,500
* Mike Pylman Dairy	6523	08-01	37,560	S.A.S. Dairy	2405	7-02	37,564
* Red River Dairy	7428	07-07	37,536	Vaz Dairy	Y-705	4-10	36,900
* Red River Dairy	1665	04-04	37,116	* Hide-Away Dairy	2750	6-06	36,890
* Mike Pylman Dairy	4605	05-10	37,000	* Hide-Away Dairy	3810	4-03	36,800
* Red River Dairy	1898	03-03	36,941	* Hide-Away Dairy	3254	5-06	36,730

FAT

* Red River Dairy	4076	05-05	1867	* Milagro Dairy	5264	6-06	1580
* Red River Dairy	1822	04-04	1660	Vaz Dairy	Y-705	4-10	1480
* Red River Dairy	4119	05-05	1604	Price's Roswell Farm	4342	3-01	1471
* Red River Dairy	63	05-05	1600	* Hide-Away Dairy	3254	5-06	1442
* Stotz Dairy	12663	05-08	1575	* Hide Away Dairy	2814	5-06	1397
* Red River Dairy	2222	03-03	1563	* Hide Away Dairy	4494	4-03	1384
* Red River Dairy	6531	07-07	1562	* Hide Away Dairy	3023	5-06	1368
* Red River Dairy	437	05-05	1543	* Hide-Away Dairy	4639	4-03	1353
* Red River Dairy	9745	3-11	1536	* Providence Dairy	3039	6-04	1352
* Red River Dairy	1827	04-04	1512	Pareo Dairy	906	6-07	1349

PROTEIN

* Red River Dairy	4076	05-05	1185	* Hide Away Dairy	2814	5-06	1270
* Stotz Dairy	12663	05-08	1162	* Goff Dairy	11806	5-06	1184
* Red River Dairy	4527	03-03	1130	Vaz Dairy	Y-705	4-10	1181
* Mike Pylman Dairy	5705	04-05	1088	Breedyk Dairy	6830	6-06	1140
* Red River Dairy	1665	04-04	1087	S.A.S. Dairy	2405	7-02	1123
* Red River Dairy	2009	04-04	1084	S.A.S. Dairy	3508	5-06	1121
* Red River Dairy	63	04-04	1081	* Goff Dairy	8053	4-03	1120
* Mike Pylman Dairy	6619	04-02	1079	* Goff Dairy	14230	4-03	1106
* Mike Pylman Dairy	6345	03-05	1079	S.A.S. Dairy	5050	4-00	1097
* Red River Dairy	7428	07-07	1075	* Hide Away Dairy	3190	5-06	1078

*all or part of lactation is 3X or 4X milking

ARIZONA – TOP 50% FOR F.C.M. [b]
SEPTEMBER, 2003

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	R.R.
* Stotz Dairy West	1996	28,307	1042	29,139	36
* Red River Dairy	4549	27,135	976	27,562	35
* Triple G Dairy, Inc.	4126	25,397	945	26,307	35
* Danzeisen Dairy, LLC	1293	25,288	907	25,643	36
* Mike Pylman Dairy	2506	25,239	906	25,606	36
University of Arizona Holsteins	172	25,271	884	25,264	19
* Stotz Dairy East	1216	24,000	859	24,308	36
* Wigwam Dairy	1512	23,767	864	24,289	36
* Zimmerman Dairy	1217	23,406	853	23,954	34
* Arizona Dairy Company	6062	24,181	832	23,943	35
* Hillcrest Dairy	2303	23,973	822	23,691	42
* Treger Holsteins, Inc.	498	23,595	829	23,646	34
University of Arizona Brown Swiss	104	22,284	855	23,502	30
* Del Rio Holsteins	1015	23,003	811	23,093	41
* D C Dairy, LLC	1065	22,724	816	23,059	34
Paul Rovey Dairy	412	21,928	790	22,923	34
* Dairyland Milk Company	2694	22,575	787	22,524	34
* Saddle Mountain Dairy	2117	22,486	733	21,609	36
* Caballero Farms LLLP	1780	21,254	761	21,526	31
* RG Dairy, LLC	1208	21,362	753	21,448	34
Lunts Dairy	558	20,536	761	21,221	34
Shamrock Farm	7767	21,202	738	21,170	36
* Butler Dairy	537	21,090	733	21,001	42
Goldman Dairy	2021	20,781	740	20,986	36
* Del Rio Brown Swiss	168	20,455	742	20,873	46
Mountain Shadow Dairy	1205	16,687	805	20,271	29

NEW MEXICO TOP 50% FOR F.C.M.[b]
SEPTEMBER, 2003

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	R.R.
* Pareo Dairy #1	1356	26,843	958	27,142	25
* Hide-Away Dairy	2126	26,168	868	25,391	27
Providence Dairy	2797	25,864	857	25,081	22
* Pareo Dairy #2	2903	23,710	887	24,636	17
Ken Miller Dairy	387	24,496	853	24,424	27
* Tallmon Dairy	481	25,239	832	24,405	34
* Do-Rene Dairy	2287	24,128	843	24,103	36
* Goff Dairy # 1	3962	23,671	840	23,857	35
New Direction Dairy	33	22,110	881	23,847	19
Hafliger Dairy	1652	23,224	835	23,582	39
Butterfield Dairy	1530	22,697	839	23,419	19
* S.A.S. Dairy	2037	23,461	818	23,409	NA
New Direction Dairy # 2	1907	22,464	828	23,140	26

[b] average milk and fat figure may be different from monthly herd summary; figures used are last day/month

ARIZONA AND NEW MEXICO HERD IMPROVEMENT SUMMARY FOR OFFICIAL HERDS TESTED SEPTEMBER, 2003

		ARIZONA	NEW MEXICO
1.	Number of herds	51	27
2.	Total cows in herd	77,960	52,696
3.	Average herd size	1529	1952
4.	Percent days in milk	87	87
5.	Average days in milk	209	209
6.	Average milk – all cows per day	52.2	62.5
7.	Average percent fat – all cows	3.5	3.5
8.	Total cows in milk	73,890	45,748
9.	Average daily milk for milking cows	59.8	71.9
10.	Average days in milk – 1st breeding	83	72
11.	Average days open	158	149
12.	Average calving interval	14.0	14.0
13.	Percent somatic cell – linear 0-4	83	80.5
14.	Percent somatic cell – linear 5-6	11	12.4
15.	Percent somatic cell – linear 7 & above	5	5.4
16.	Average previous days dry	62	64
17.	Percent cows leaving herd	34	30.8
		STATE AVERAGE	
	MILK	21,927	22,915
	Percent butterfat	3.49	3.55
	Percent Protein	2.91	2.97
	Pounds fat	845	814
	Pounds protein	631	680

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Upcoming Events:

Southwest Nutrition and Management Conference

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Tempe, Arizona

February 26 &27, 2004