ARIZONA AND NEW MEXICO DAIRY NEWSLETTER

COOPERATIVE EXTENSION
The University of Arizona
New Mexico State University

SEPTEMBER 2008

THIS MONTH'S ARTICLE:

Putting the Transition Period into Perspective

M.A. McGuire[1], M. Theurer[2], and P. Rezamand[1]

[1]Department of Animal and Veterinary Science, University of Idaho,
PO Box 442330, Moscow, ID 83844-2330
[2]Standard Nutrition Co., 383 East 300 South, Jerome, ID 83338
Corresponding author: mmcguire@uidaho.edu

(Reprinted from 2008 Southwest Nutrition & Management Conference Proceedings)

Putting the Transition Period into Perspective

M.A. McGuire[1], M. Theurer[2], and P. Rezamand[1]

[1]Department of Animal and Veterinary Science, University of Idaho, PO Box 442330, Moscow, ID 83844-2330
[2]Standard Nutrition Co., 383 East 300 South, Jerome, ID 83338
Corresponding author: mmcguire@uidaho.edu

Summary

- The transition period is a high risk period for various health problems. However, most cows proceed through the transition period with few health problems.
- Cows that do have health problems are at greater risk for other problems.
- Cows can use energy reserves in early lactation to support milk production.
- Cows return to energy balance by 6 to 7 weeks in lactation.
- Dry matter intake, not milk yield, is the driving force behind energy balance in early lactation.
- Milk production is not related to body condition score or use of body reserves.

Introduction

The transition period has been extensively studied with numerous papers and reviews documenting the significant changes cows undergo. Almost every dairy publication contains articles describing some method to reduce the risk of acquiring metabolic disorders associated with the transition period. Rapid increases in glucose, amino acid, mineral, and fatty acid requirements occur during the transition period requiring significant adjustment in metabolism to support these needs (Bell, 1995). Sometimes these alterations to meet nutrient requirements fail and metabolic disorders such as milk fever and ketosis occur. Additional health problems such as dystocia, retained placenta and metritis are associated with parturition and thus occur during this critical period.

The constant level of writing about problems associated with the transition period suggests that most cows experience health problems. Risks of various diseases range from 0 to 16% (Kelton et al., 1998; USDA 1996, 2002, 2007). Looking at the percentage of cows that do not have health problem, however, puts the risk into a different light (Table 1). For instance, many would consider that most cows are at risk for milk fever. The current incidence rate (USDA 2007) is estimated to be 4.9%. Thus, over 95% of cows do **not** contract milk fever. In fact, except for clinical mastitis or lameness, the percentage of cows not having any health problems such as retained placenta, dystocia, metritis, ketosis, milk fever, and displaced abomasums (DA) is all over 90%. Of course, the health problems are identified by clinical symptoms and signs but in many cases subclinical effects of hypocalcemia, ketosis and mastitis are detrimental to productivity and profitability with possibly greater effects than their corresponding clinical disease (Erb, 1987; Dohoo and Martin, 1984).

Table 1. Percentage of cows without the identified health problems listed as determined from a survey of 13 agencies, organizations and systems involved in the recording of the diseases of dairy cattle from around the world and by a survey of producers in the United States[1]

		USDA NAHMS		
Health problem	Kelton et al 1998	1996	2002	2007
Clinical mastitis	85.8	86.6	85.3	83.5
Lameness	93.0	89.5	88.4	86.0
Retained placenta	91.4	92.2	92.2	92.2
Dystocia, metritis	97.5	Not listed	96.3	97.2
Milk fever	93.5	94.1	94.8	95.1
Displaced abomasum	98.3	97.2	96.5	96.5
Ketosis	95.2	Not listed	Not listed	Not listed

[1]Numbers were determined by differences from 100 of the incidence rates presented in the two publications. Another estimate (Jordan and Fourdraine, 1993) of cows not developing ketosis would be 96.3%.

Rates of clinical diseases (100 minus values in Table 1) do not directly reflect the actual numbers of animals with disease as a cow could have one or more of these various diseases. The risk of having one health disorder is frequently positively related to a greater risk of many other disorders (Gröhn et al., 1989). Thus, the actual number of individual cows with the listed health problems is less than the sum of incidences. The changes in the incidence of milk fever and DA from 1996 to 2007 improved even though milk production increased from 16,479 to 19,951 #/lactation. On the contrary, the incidence of clinical mastitis and lameness slightly worsened.

Impact of Energy Balance during Early Lactation

Most cows go through some period of negative energy balance during early lactation when feed consumption does not meet demands of milk production particularly in a similar time frame to most of the health problems occurring in cows. This period of negative energy balance has been associated with immunosuppression, periparturient diseases and increased times to first ovulation and first breeding. A period of negative energy balance should actually be expected for dairy cows. Unlike rodents and humans that rely little on energy reserves in early lactation (Bauman et al., 1985), and seals, bears and baleen whales that consume very little during lactation and rely almost entirely on energy mobilization from tissue stores (Oftedal, 1993), cows increase feed intake rapidly during early lactation to supply most of their nutrient needs. Additional nutrients are derived from tissue mobilization. Several researchers have indicated that as cows are selected for greater milk production, they partition a greater portion of available energy to milk rather than body tissue accretion (Bines and Hart, 1982; Bauman et al., 1985; Veerkamp and Emmans, 1995). This concept has led to the perception that high producing cows mobilize more tissue and are in greater and more prolonged negative energy balance than lower producing cows. Clearly, many of the health problems associated with the transition period occur most frequently during negative energy balance. Additionally, personal communications with dairy professionals indicate that there is a large diversity of opinions as to the expectations for the duration of negative energy balance. Similarly, many dairy professionals and producers feel that greater production is associated with a more prolonged period of negative energy balance. Greater understanding of the changes in energy balance that occur during early lactation are important for managing herd health, reproductive programs, and use of POSILAC®.

Methods of Measuring

Energy balance can be determined by either direct or indirect calorimetry; however, these techniques are expensive, involve complicated equipment and are very labor intensive. A more common method to estimate energy balance calculates the difference between energy consumed and energy required for maintenance and milk production. Advantages of this method are that it can be done for long periods, such as for an entire lactation or portions of the lactation; and, no specialized equipment are required. The disadvantage is that the results are estimates and precision of the results is dependent on how accurately energy is calculated for consumed feeds, milk produced and that required for maintenance. The consequence of errors in accurately determining these values is dependent on the purpose of the studies in question. For instance, when comparing results of treatments within a study, errors that occur across all treatments may not be as critical as when comparing results between experiments because different types of experimental error, or bias, may exist.

Energy Balance during Early Lactation

In order to investigate the energy balance profile during early lactation with high-producing dairy cows, a study was conducted in Idaho using 29 multiparous cows. These cows were studied for the first 12 weeks of lactation. Energy balance was calculated by determining NE_L Consumed (DM intake × NE_L/lb DM) minus NEL Requirement (NE_L for maintenance + NE_L for milk). Body weights and body condition scores were obtained weekly.

The average milk production during the experimental period was 102 pounds/d. In spite of the high production of these cows, they reached positive energy balance by an average of four weeks following calving (Figure 1). In a review (Brixey, 2005) of 26 studies with energy balance data, positive energy balance was reached approximately 50 days in milk with the minimum energy balance about 11 days in milk.

Dry matter intake for the Idaho study cows averaged 58 pounds/d. Because energy balance is calculated from energy intake and energy retained in milk, it seems reasonable that both of these would contribute to the time it takes cows to return to positive energy balance. For all cows, however, the correlation between intake and energy balance was greater than between milk and energy balance (Table 2). These data suggest that the greater feed consumption had a larger effect on energy balance than did the greater amount of milk production. This should be expected based on the relationship among these variables. During the first 12 weeks of lactation, both DM intake and energy balance are increasing whereas milk yield has peaked and either

® POSILAC 1 STEP is a registered trademark of Monsanto Technology LLC.

plateaued or already begun to decrease. Therefore, it is important to manage cows to maximize feed consumption in early lactation because DM intake accounts for considerably more variation in energy balance than does milk production.

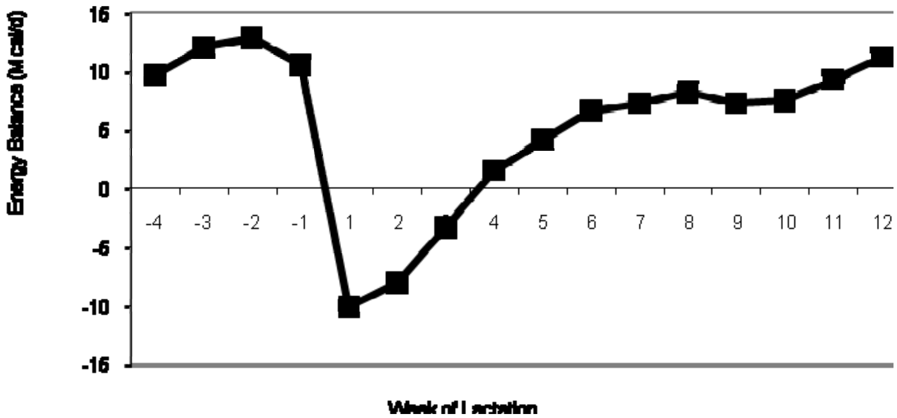

Figure 1. Energy balance of cows (*n* = 29) in early lactation (McGuire, unpublished data).

Table 2. Simple Correlations Between Intake, Milk Production, Body Condition Score (BCS) and Energy Balance

	DM Intake	Milk Yield	BCS
Energy Balance	*P < .0001* r = 0.751	*P < .037* r = 0.051	*P < .017* r = -0.136
DM Intake		*P < .0001* r = 0.511	*P < .009* r = -0.148
Milk Yield			*P < .0001* r = -0.327

From McGuire (unpublished data).

Body condition score was not well correlated with energy balance. This is not surprising for two reasons. First, a single BCS gives no indication of whether a cow is gaining or losing body reserves at that time. The second reason is based on the fact that body condition scoring is primarily an assessment of subcutaneous tissue change. When a cow begins to replenish mobilized tissue, abdominal fat and intermuscular fat are replenished before subcutaneous fat. These fat depots are not evaluated (they are not visible) in the body condition scoring procedure. Intermuscular and abdominal fat contribute significantly to the total energy available for mobilization (Butler-Hogg et al., 1985). Thus, although the cow is in positive energy balance and is replenishing body tissue, gain in BCS is not apparent until later in lactation.

Relationships Between Milk Production and Use of Body Reserves

Theurer et al. (2003) further evaluated the relationship between milk production and use of body reserves in 3 commercial herds in central Washington. Use of body reserves was estimated by maximal decrease in BCS. Cows (*n* = 252) were scored before calving then monthly until 150 DIM. The minimum BCS was reached by the second month of lactation indicating that further use of body reserves was minimal as the cows were in energy balance (Figure 3). Linear regression analysis did not detect any relationship between peak milk yield and close up BCS (Figure 4) or change in BCS from close up to minimum BCS postpartum. To further evaluate whether BCS had any effect on milk production, cows were grouped for analysis based upon close up BCS or maximal postpartum change in BCS (Table 3). Neither peak milk nor total milk production through 150 DIM (Figure 4) was affected by BCS at calving. Further, change in BCS was not associated with milk production (Figure 5). Therefore, cows can use a combination of mechanisms (consume more feed or use body reserves) to meet the energy demand of early lactation in the production of substantial quantities of milk. But, to date, milk production does not seem to be limited by extent of change in BCS.

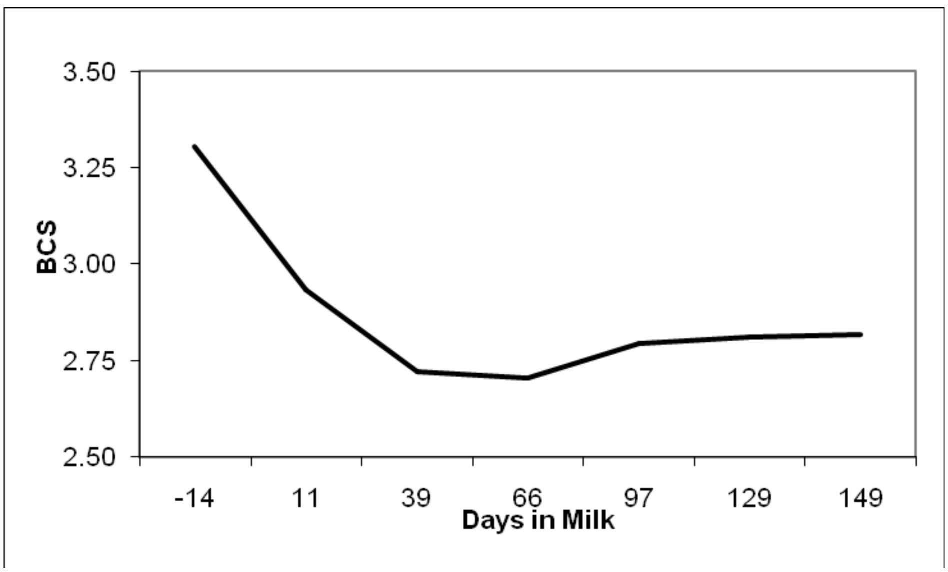

Figure 3. Average body condition score from 14 days prepartum until 149 days in milk. Cows (*n* = 252) were evaluated every 2 weeks from approximately 2 weeks before expected calving until 150 days in milk (Theurer et al., 2003).

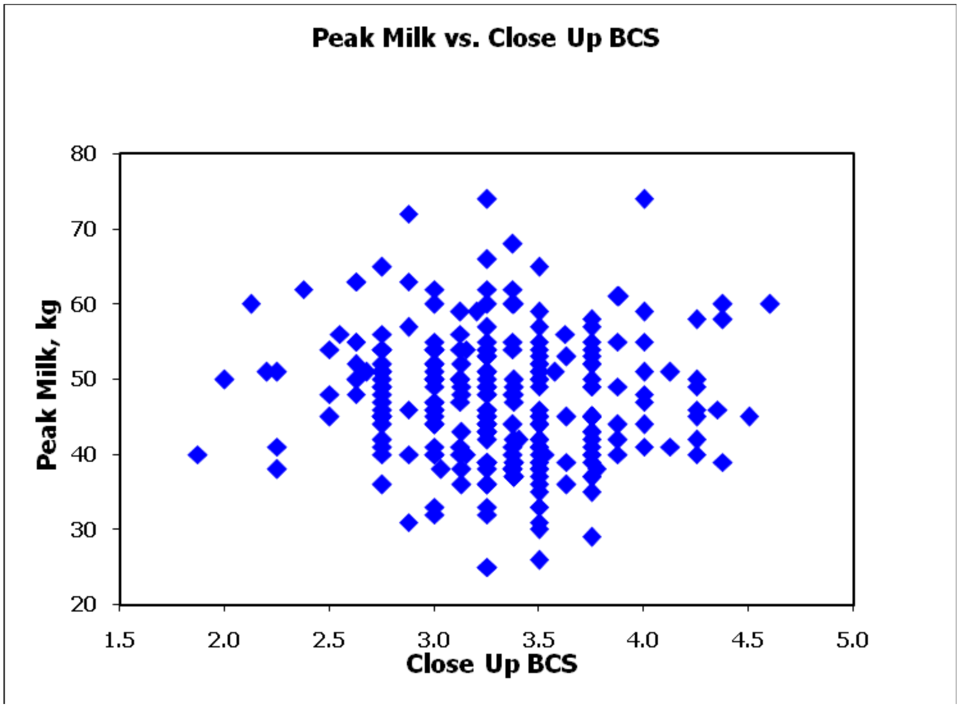

Figure 4. The relationship between close up BCS and peak milk production. No significant linear regression was detected for peak milk by close up BCS and the fit (r^2) of the regression was 0.0057 (Theurer et al., 2003).

Table 3. Description of body condition score (BCS) groups used in statistical evaluation

BCS Group	Close up BCS	Change in BCS
High	>3.5 (*n* = 65)	>0.75 (*n* = 91)
Mid	3.0 to 3.5 (*n* = 110)	0.5 to 0.75 (*n* = 73)
Low	<3.0 (*n* = 77)	<0.5 (*n* = 88)

From Theurer et al. (2003).

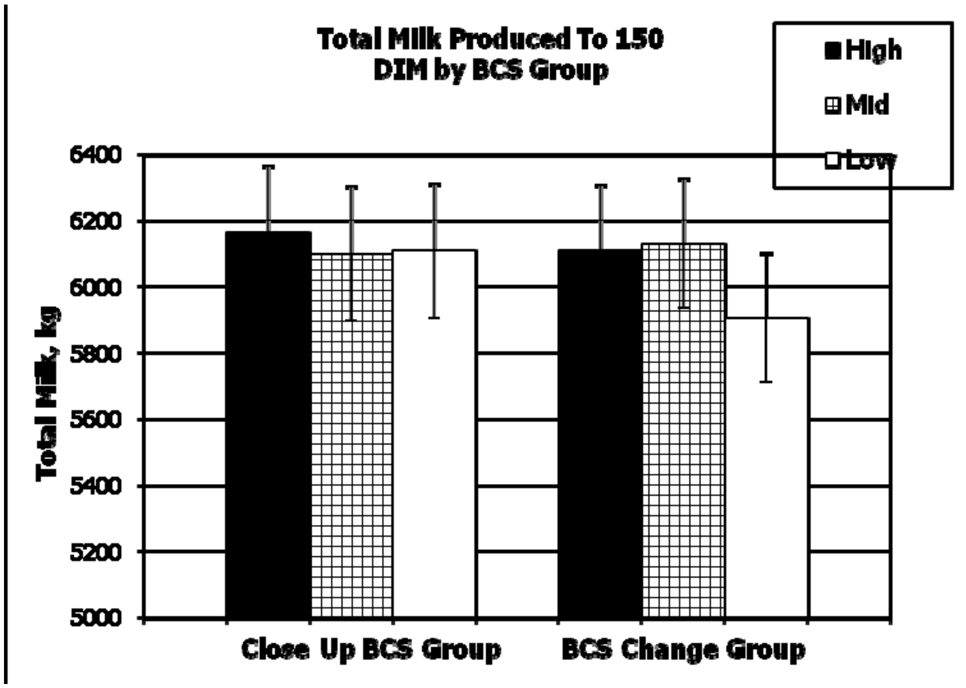

Figure 5. The relationship between close up BCS or change in BCS from close up to minimum observed postpartum and total milk production through 150 days in milk (From Theurer et al., 2003). The BCS groups are as defined in Table 3. Vertical bars represent the standard errors of the mean for each group.

Summary

The incidence of health problems in dairy cows is significant but might be less a problem than actually suggested by the preponderance of publications on the topic. Trends for the past 10 years in the United States suggest that health problems, other than clinical mastitis and lameness, are improving even with increasing milk production. High production itself does not appear to negatively impact energy balance in early lactation. High producing cows partition considerable amounts of energy towards milk production throughout lactation making a determination of energy balance based on BCS impossible. These data indicate that major goals for managing high producing cows should be to manage transition cows during lactation to optimize health and maximize feed consumption. Cows though can choose to either eat more or mobilize reserves to meet their nutrient requirements.

References

Bauman, D. E., S. N. McCutcheon, W. J. D. Steinhour, P. J. Eppard and S. J. Sechen. 1985. Sources of variation and prospects for improvement of productive efficiency in the dairy cow: A review. J. Anim. Sci. 60:583-592.

Bell, A.W. 1995. Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. J. Anim. Sci. 73: 2804-2819.

Bines, J. A., and I. C. Hart. 1982. Metabolic limits to milk production, especially roles of growth hormone and insulin. J. Dairy Sci. 65: 1375-1389.

Brixey, J.D. 2005. Validation of a prediction equation for energy balance in Holstein cows and heifers. M.S. Thesis, University of Idaho, Moscow.
Butler-Hogg, B. W., J. D. Wood, and J. A. Bines. 1985. Fat partitioning in British Friesian cows: the influence of physiological state on dissected body composition. J. Agric. Sci. Camb. 104: 519-528.
Dohoo, I.R., and S.W. Martin. 1984. Subclinical ketosis: prevalence and associations with production and disease. Can. J. Comp. Med. 48: 1-5.
Erb. H.N. 1987. Interrelationships among production and clinical disease in dairy cattle: a review. Can. Vet. J. 28: 326-329.
Gröhn, Y.T., H.N. Erb, C.E. McCulloch, and H.S. Saloniemi. 1989. Epidemiology of metabolic disorders in dairy cattle: Association among host characteristics, disease, and production. J. Dairy Sci. 72: 1876-1885.
Jordan, E.R., and R.H. Fourdraine, 1993 Characterization of the management practices of the top milk producing herds in the country. J. Dairy Sci. 76: 3247-3256.
Kelton, D.F., K.D. Lissemore, and R.E. Martin. 1998. Recommendations for recording and calculating the incidence of selected clinical diseases of dairy cattle. J. Dairy Sci. 82: 2502-2509.
Oftedal, O. T. 1993. The adaptation of milk secretion to the constraints of fasting bears, seals and baleen whales. J. Dairy Sci. 76: 3234-3246.
Theurer, M.L., M.A. McGuire and J.J. Higgins. (2003) Relationships between body condition score and peak milk. J. Anim. Sci. 81(Suppl.1)/J. Dairy Sci. 86(Suppl. 1):282.
USDA. 1996. Dairy 1996, Part I: Reference of 1996 Dairy Management Practices. USDA-APHIS-VS, CEAH. Fort Collins, CO.
USDA. 2002. Part I: Reference of Dairy Health and Management in the United States, 2002. USDA:APHIS:VS,CEAH, National Animal Health Monitoring System, Fort Collins, CO. #N377.1202
USDA. 2007. Dairy 2007, Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007. USDA-APHIS-VS, CEAH. Fort Collins, CO. #N480.1007.
Veerkamp, R. F., and G. C. Emmans. 1995. Sources of genetic variation in energetic efficiency of dairy cows. Livestock Prod. Sci. 44: 87-97.

ARIZONA - TOP 50% FOR F.C.M.[b]
August 2008

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	CI
*Stotz Dairy West	2,205	29,012	1,052	29,605	15
*Danzeisen Dairy, Inc.	1,793	26,277	943	26,655	14
*Stotz Dairy East	1,242	25,138	917	25,741	13
*Goldman Dairy	2,409	24,702	840	24,303	14
*Zimmerman Dairy	1,217	23,659	846	23,950	14
*Arizona Dairy Company	5,743	22,862	807	23,636	14
*Butler Dairy	622	23,733	820	23,554	
*Shamrock Farms	8,395	23,959	794	23,235	14
*Mike Pylman	7,197	23,339	809	23,211	16
*Withrow Dairy	5,191	22,788	797	22,778	13
Paul Rovey Dairy	257	22,699	797	22,740	13

NEW MEXICO - TOP 50% FOR F.C.M.[b]
August 2008

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	CI
Coonridge Organic	80	937	41	1,070	12.40
La Farmita	60	2,277	78	2,249	12.50
*Desperado	2,356	15,902	649	17,400	13.01
Dutch Valley Farms	3,757	14,905	677	17,423	13.10
Rocky Top Jersey	1,515	15,178	675	17,509	13.44
*Goff 2	3,233	16,143	717	18,607	13.63
*High Plains	1,177	18,618	684	19,142	15.50
*North Star	5,744	19,206	712	19,850	15.61
Breedyk	2,739	21,675	711	20,902	14.33
Caballo	3,750	21,487	743	21,339	13.50
Tres Hermanos	645	20,995	767	21,516	13.20
Ridgecrest	3,867	21,058	768	21,559	13.44
*Mid Frisian	1,541	21,468	759	21,591	13.91
Flecha	2,587	21,368	764	21629	13.26
*Red Roof	1,610	21,400	779	21,886	13.60
*Hide Away	3,969	22,194	762	21,953	13.00

* all or part of lactation is 3X or 4X milking
[b] average milk and fat figure may be different from monthly herd summary; figures used are last day/month

HIGH COW REPORT
August 2008

MILK

Arizona Owner	Barn#	Age	Milk	New Mexico Owner	Barn #	Age	Milk
*Stotz Dairy	18202	06-02	42,760	*Providence Dairy	6347	5-06	36,160
*Cliffs Dairy	418	05-04	39,790	*Cross Country Dairy	6049	5-06	35,920
*Goldman Dairy	4502	04-10	39,380	*Providence Dairy	8858	3-01	35,220
*Goldman Dairy	9525	04-09	38,450	*Cross Country Dairy	92	6-06	35,100
*Goldman Dairy	6782		38,190	*North Star Dairy, Llc	11785	3-04	34,780
*Goldman Dairy	4291		38,180	*Butterfield Dairy	6859	4-03	34,760
*Stotz Dairy	21938	04-00	37,530	*Goff Dairy	22947	4-03	34,460
*Goldman Dairy	4122	04-08	37,220	*Cross Country Dairy	105	5-06	34,430
*Stotz Dairy	8440	05-09	37,200	*Providence Dairy	4746	8-00	34,220
*Ambian Dairy	2312	05-01	36,980	*Wayne Palla Dairy	10899	5-07	34,010

FAT

*Stotz Dairy	18202	06-02	1,648	*Providence Dairy	6347	5-06	1,359
*Stotz Dairy	20465	05-03	1,602	Pareo Dairy	3816	7-02	1,358
*Shamrock Farms	11300	05-05	1,447	*North Star Dairy, Llc	1533	6-06	1,338
*Stotz Dairy	20976	04-11	1,439	*Vaz Dairy	4656	3-09	1,335
*Dutch View Dairy	874	04-10	1,421	*Vaz Dairy	3402	5-05	1,312
*D & I Holstein	242	08-10	1,401	Cross Country Dairy	2083	6-06	1,310
*Stotz Dairy	22130	03-11	1,399	*Providence Dairy	7299	4-05	1,304
*Stotz Dairy	21415	04-06	1,385	*Providence Dairy	9626	7-06	1,296
*Shamrock Farms	15526	04-02	1,383	*Providence Dairy	7735	4-01	1,293
*Mike Pylman	20668	04-03	1,383	*Providence Dairy	2067	5-00	1,292

PROTEIN

*Stotz Dairy	18202	06-02	1,327	*Providence Dairy	6347	5-06	1,174
*Cliffs Dairy	418	05-04	1,195	*Cross Country Dairy	105	5-06	1,143
*Goldman Dairy	4502	04-10	1,165	*Butterfield Dairy	6859	4-03	1,108
*Cliffs Dairy	522	04-06	1,120	*Vaz Dairy	1212	7-00	1,075
*Ambian Dairy	2312	05-01	1,115	*Cross Country Dairy	92	6-06	1,072
*Goldman Dairy	9525	04-09	1,112	*Providence Dairy	8858	3-01	1,067
*Stotz Dairy	20465	05-03	1,081	*Wayne Palla Dairy	10899	5-07	1,059
*Mike Pylman	8874	05-05	1,078	Red Roof Dairy	7056	4-06	1,049
*Mike Pylman	22590	03-11	1,069	Pareo Dairy	5889	4-10	1,040
*Danzeisen Dairy, Llc.	1116	04-10	1,067	*Goff Dairy	18570	6-06	1,038

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

ARIZONA AND NEW MEXICO HERD IMPROVEMENT SUMMARY FOR OFFICIAL HERDS TESTED AUGUST 2008

		ARIZONA	NEW MEXICO
1.	Number of Herds	31	26
2.	Total Cows in Herd	69,453	62,649
3.	Average Herd Size	2,240	2,409
4.	Percent in Milk	86	87
5.	Average Days in Milk	224	204
6.	Average Milk – All Cows Per Day	51.2	65.9
7.	Average Percent Fat – All Cows	3.5	3.6
8.	Total Cows in Milk	58,266	17,816
9.	Average Daily Milk for Milking Cows	61.0	69.4
10.	Average Days in Milk 1st Breeding	89	77
11.	Average Days Open	174	146
12.	Average Calving Interval	14.5	14.1
13.	Percent Somatic Cell – Low	82	84
14.	Percent Somatic Cell – Medium	11	10
15.	Percent Somatic Cell – High	6	5
16.	Average Previous Days Dry	65	63
17.	Percent Cows Leaving Herd	32	34
	Milk	22,260	22,476
	Percent butterfat	3.61	3.61
	Percent protein	2.96	3.12
	Pounds butterfat	800	832
	Pounds protein	656	683

THE UNIVERSITY OF ARIZONA ®

COOPERATIVE EXTENSION

Department of Animal Sciences
PO Box 210038
Tucson, AZ 85721-0038

Phone: 520-626-9382
Fax: 520-621-9435
Email: stefanic@ag.arizona.edu