ARIZONA AND NEW MEXICO DAIRY NEWSLETTER

COOPERATIVE EXTENSION
The University of Arizona
New Mexico State Universtiy

JUNE 2004

THIS MONTH'S ARTICLE:

Sprinkler Systems for Cooling Cows at a Dairy Feedline

J. P. Harner III, J. F. Smith, M. Brook & J. P. Murphy

Kansas State University

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FREE TRIP TO WORLD DAIRY EXPO

Lorenzo Barrera Dairy, Arrey New Mexico & their consultant, Shanon Cobb, were the winners of a trip to World Dairy Expo. The drawing, sponsored by Western Yeast Company, Chillicothe, IL, was held at the New Mexico Dairy Producers Conference on June 19, 2004.

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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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Sprinkler Systems for Cooling Dairy Cows at a Feed Line

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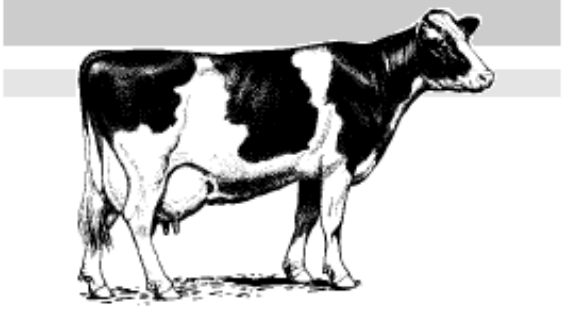

Kansas State University
Agricultural Experiment Station and
Cooperative Extension Service

Cows experience heat stress when the temperature-humidity index (THI) is above 72. During heat stress, respiration rates increase, while milk production and reproduction decrease. One practice in heat stress control is to install sprinkler systems over the feed line and in the holding pen.

The objective of the sprinkler system is to wet the cow's back, but to avoid moisture accumulation on the udder or in freestalls. Evaporative cooling occurs when the moisture is evaporated by natural or mechanical ventilation.

This publication discusses guidelines for sizing and installing sprinkler systems at the feed line. The information is not intended to cover the design procedures of highpressure fogging or evaporative-cooling systems.

System Components

System components include a timer, a thermostat, a solenoid valve, pressure reducer, piping, and sprinkler nozzles (See Figure 1). The casing of the equipment should be waterproof and dust proof to meet electrical codes.

The thermostat should be set to turn the sprinkler on when the air temperature exceeds 70 to 75° Fahrenheit. A thermostat will control a valve or solenoid located prior to the first nozzle. The solenoid valve controls the water flow through the pipe.

Sprinkler systems need a 15- to 30-minute on-off timer. A 15-minute cycle is common—the sprinkler is on for 3 minutes and off for the next 12 minutes. The timer should be controllable to the nearest 15 to 30 seconds. If flow quantity is a limiting factor, then sequencing the system is an option. If there are multiple sprinkler systems, a 60-minute timer may be needed to sequence the individual sprinkler systems.

The pressure reducer is needed to limit the sprinkler-line pressure at the inlet to 20 to 40 pounds per square inch depending on the recommendation of the nozzle manufacturer. This primarily is needed when the water pressure in the distribution pipe exceeds 40 pounds per square inch. Pressure losses through the distribution pipe should not exceed 5 pounds per square inch. Water usage during a summer may vary from 500 to 1,500 gallons per cow depending on the weather conditions and sprinkler system used.

Water Application Rate

A simple design criteria of wetting rate is 0.03 gallons per square foot of wetted surface area per sprinkler on the cycle. The wetted surface area is the area wetted as the sprinkler nozzle oscillates back and forth. Normally, a distance of 6 to 8 feet is wetted behind the feed line. One

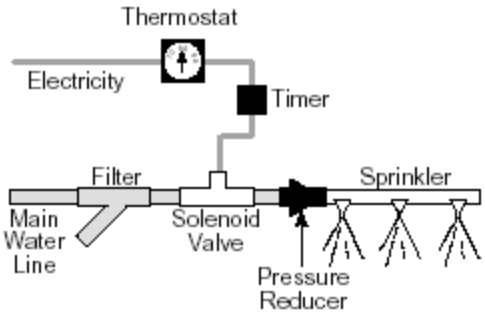

Figure 1. *Cooling system components*

guideline is to use 6 square feet per foot of feeding space. If the feed line is 100 feet long, then the wetted area per pen is 600 square feet (100 feet × 6 square feet). Therefore, 18 gallons (600 square feet × 0.03 gallons per square foot) of water is required to meet the design criteria of .03 gallons per square foot per cycle. The water pipes must be able to deliver 18 gallons of water during the selected sprinkler "on" cycle. If the sprinkler's cycle time is 3 minutes for the 18-gallon usage, the required flow rate is 6 gallons per minute (gpm).

Sizing of Water Pipe

The main distribution pipe is sized based on providing water to the number of sprinkler systems that are operating. If four pens are being cooled simultaneously, then the water usage per cycle rate is 72 gallons, using the above example of 18 gallons per cycle. Using 72 gallons in 3 minutes requires a water flow rate of 24 gallons per minute. Sequencing of the individual sprinkler systems requires a flow rate of only 6 gallons per minute.

Selecting the "on" time is also critical in sizing the water pipes. If the "on" cycle time of the above sample is 6 minutes, then the main pipe supply water to the individual sprinkler system must be able to handle 3 gallons per minute (18 gallons per 6 minutes). Increasing the "on" cycle time decreases the required water flow rate. The recommended flow rate in gallons per minute equals:

$$\frac{\text{wetted area (sq ft)} \times 0.03 \text{ gal/sq ft}}{\text{cycle on time (min)}}$$

Table 1 shows the maximum distance from a well or water meter connection to the sprinkler system controller based on flow rate, PVC pipe size, and limiting the pressure drop to 5 pounds per square inch. Assume a producer wants to determine if a 11/2 inch PVC pipe will carry 27 gallons per minute for 400 feet. Table 1 shows that, with a 30 gallon per minute flow rate, a 11/2 pipe should only be used if the distance is 200 feet or less. Therefore, a 2 inch PVC pipe would be selected since it can carry 30 gallons per minute up to 660 feet before exceeding the 5 pounds per square inch pressure drop. A new water line for sprinkling cows may have to be added in existing facilities if the current water lines were sized to handle peak demand of the waterers.

Table 2 shows the recommended minimum pipe size from the solenoid valve to the last sprinkler nozzle for the sprinkler distribution system. This table was developed based on applying 0.06 gallons per minute per foot length of feed line (note: (0.03 gal/sq ft × 6 ft/ft length) ÷ 3 min cycle = 0.06 gpm/ft length) and limiting the total pressure drop to 5 pounds per square inch or less. A 3-minute cycle was used in sizing the flow rate. If a feed line is 200 feet long and the solenoid valve is located at one end of the system, then the first 100 feet of pipe past the valve should be 11/4 -inch PVC pipe and the next 100 feet should be 1-inch PVC pipe. Another option is to bring the main distribution line to the center of the feed line. This limits the distance from the solenoid to the last nozzle to100 feet and then 3/4-inch PVC pipe could be used.

Table 1: *Recommended maximum distance from well or water meter connection for PVC pipe of varying diameters and flow rates and limiting pressure drop to 5 pounds per square inch (no allowances made for fittings or elbows).*

Pipe Dia.	Flow Rate (gpm)					
(inch)	10	20	30	40	50	100
0.5						
0.75	60					
1.0	180	40				
1.25	700	200	100	60		
1.5	1,500	400	200	120	80	
2.0	5,000	1,400	660	400	240	80
2.5	12,000	3,300	1,600	900	600	160
3.0	43,000	12,000	5,600	3,300	2,200	600

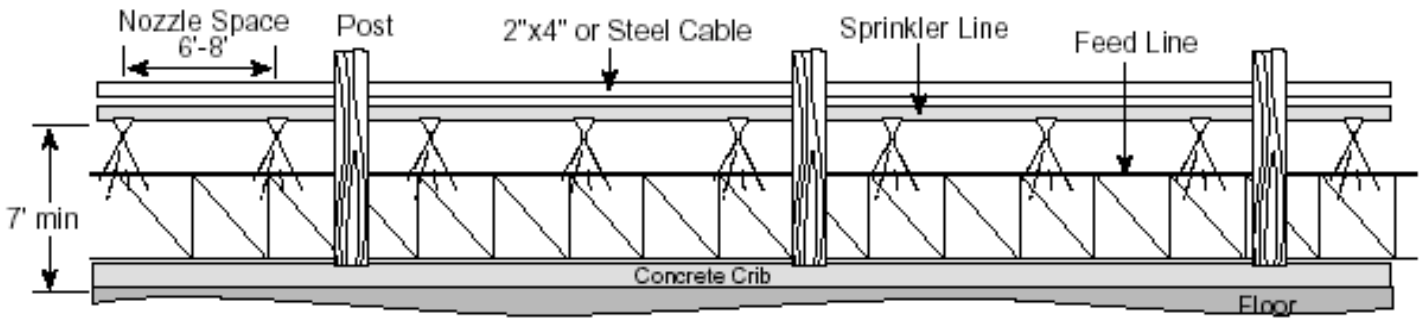

Figure 2. *Typical sprinkler system located over feed line.*

The sprinkler nozzles and pipe must be supported between the building post if post spacing is greater than 4 feet (Figure 2). A steel cable can be placed along the feed line and stretched tightly. The pipe can be fastened to the cable by using wire ties. Another option is to place a 2×4 along the post and use clamps to hold the pipe in place. Ideally, the nozzles should be located 12 to 18 inches behind the feed line (cow side of the feed line is considered the back side) (See Figure 3). The bottom of the nozzle should be 7 feet above the concrete floor (See Figure 2).

Sprinkler Nozzles

Sprinkler nozzles are rated to deliver a set number of gallons per minute (gpm) or gallons per hour (gph). An adequately sized nozzle should have a rating near 0.5 gallons per minute or 30 gallons per hour. The nozzle pattern or diameter should be 6 to 8 feet. Normally, there is an adjustment on the nozzle that adjusts the diameter. Nozzles can be purchased to spray water in a 180-degree or 360-degree pattern. The 180-degree nozzle works well at the feed line. If the 360-degree nozzle is used, then the sprinkler system needs to be suspended 5 feet behind the feed line and spray diameter limited to 8 feet.

Nozzle spacing is equal to the nozzle diameter or pattern. If the nozzle spray diameter is 8 feet, then the maximum spacing of the nozzles should be 8 feet on center. It is better to reduce maximum nozzle spacing 5 to 20 percent to ensure adequate coverage where the nozzles overlap and provide allowance for wind direction. The maximum spray diameter of a nozzle should be an 8 feet diameter to avoid wetting the free stall bedding.

Operating Cost

Sprinkler systems can be installed for less than $5 per foot of feed line. Sprinkler packages are available from most dairy equipment and suppliers for $200 to $300. Most operations will require one sprinkler package per 100 feet of feed line. Normally, additional nozzles and piping are all that is required for extending the sprinkler system from 100 to 200 feet. Beyond 200 feet, the economics of installing larger pipe to handle the high flow rates has to be compared against purchasing multiple controllers. Multiple controllers may be better sincepart of a feed line can still be cooled if a component fails.

Table 2: *Recommended minimum PVC pipe size per 100-foot section based on the distance from the solenoid valve to last sprinkler nozzle and limiting total pressure drop to 5 pounds per square inch.*

Total Length	Distance from solenoid valve to last sprinkler nozzle (ft)*				
(ft)	0-100	100-200	200-300	300-400	400-500
100	¾ in**				
200	1¼ in	1 in			
300	1½ in	1¼ in	1 in		
400	2 in	1½ in	1¼ in	1 in	
500	2 in	2 in	1½ in	1¼ in	1 in

*** Minimum recommended PVC pipe size for this section*

** Based on water application rate of 0.06 gallons per minute per foot length (0.03 gal/ sq ft, wetted distance 6 ft, 3 min sprinkler on-cycle)*

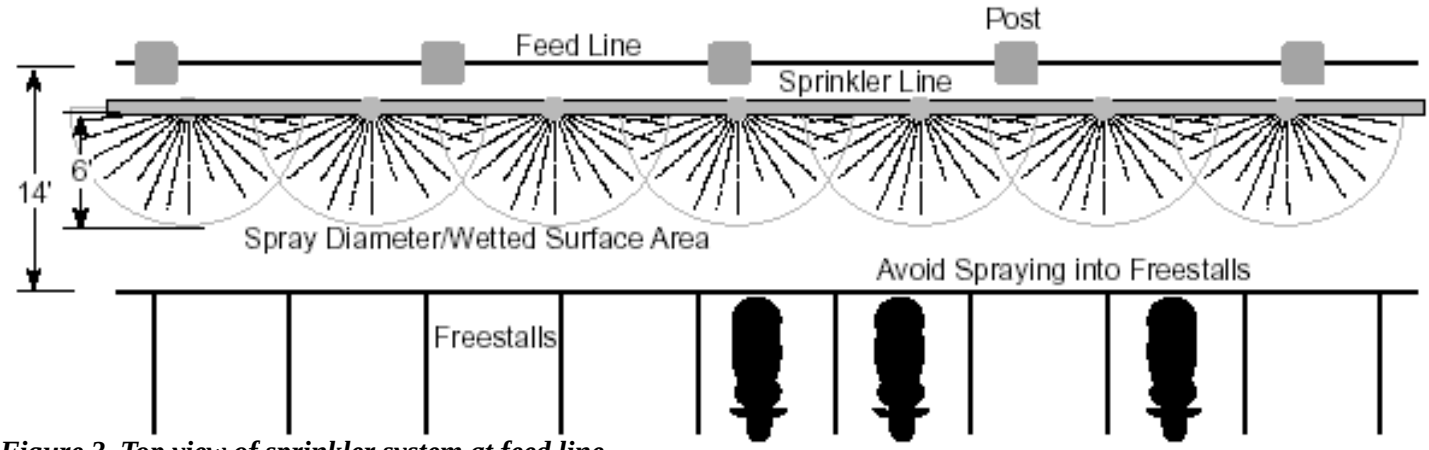

Figure 3. Top view of sprinkler system at feed line.

Kansas weather patterns are such that a sprinkler system will probably operate 8 to 12 hours per day and from 100 to 150 days per year. Limited data in Kansas indicates about 40,000 gallons of water will be required for sprinkling 100 feet of feed line. Based on 100 days of operation, this is equal to 800 gallons per day. Cost of rural water ranges from $1.50 to $2.00 per 1,000 gallons. Estimated daily cost for water is $1.50 per 100 feet of feed line or about 3 cents per 2 feet feeding space. Water cost can be recovered by seeing a daily increase in milk of less than 1 pound. An increase of 100 pounds weight of milk per cow during the summer is needed to cover the fixed and variable cost of most sprinkler systems. The life expectancy of a sprinkler system is 5 years.

Maintenance

Annual cleaning or replacement of some nozzles is required. Nozzles should be removed each fall and soaked in vinegar or other solutions to remove the calcuim build up due to hard water. Water filters may be required with some water sources to remove particles that can plug nozzles. The piping should be drained in October to avoid frozen water lines. Compressed air can be used to remove all of the water from the system. Sprinkler systems should not be placed on 24-hour timers or shut off during the night hours particularly with 3 times milking. Cows will come to the feed bunk during the night and Kansas conditions are such that heat stress is a 24-hour problem rather than a dawn to dusk problem.

Summary

When the THI (temperaturehumidity index) is above 72, sprinkler systems can be installed to prevent heat stress to cows. Estimated daily cost for water is about 3 cents per 2 feet feeding space. A response of 100 pounds of milk per cow during the summer is needed to cover the fixed and variable cost of most sprinkler systems.

Publications from Kansas State University are available on the World Wide Web at: http://www.oznet.ksu.edu

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2401 July 1999

File code: Dairy Sciences

HIGH COW REPORT
MAY, 2004

MILK

Arizona Owner	Barn#	Age	Milk	New Mexico Owner	Barn #	Age	Milk
Saddle Mountain Dairy	2191	4-08	52,760	* Providence Dairy	8157	---	40,540
* Mike Pylman Dairy	106	3-03	36,160	* Goff Dairy	9319	6-06	40,540
* Mike Pylman Dairy	2152	3-06	35,290	* Providence Dairy	3871	5-07	40.020
* Withrow Dairy	4974	3-00	35,280	* Providence Dairy	4675	3-10	38,640
* Mike Pylman Dairy	3873	6-08	35,200	* Providence Dairy	8442	4-02	38,610
* Mike Pylman Dairy	2294	3-02	34,550	* Hide Away Dairy	2908	6-06	38,270
* Stotz Dairy	14838	4-06	34,470	* Providence Dairy	8343	---	38,050
Saddle Mountain Dairy	2359	2-11	34,210	* Hide Away Dairy	4888	4-03	36,740
* Mike Pylman Dairy	1881	4-02	34,030	* Hide Away Dairy	3705	5-06	37,680
* Withrow Dairy	1390	4-01	33,630	* Providence Dairy	4941	3-06	37,670

FAT

Saddle Mountain Dairy	2191	4-08	1378	* Goff Dairy	9319	6-06	1433
* Mike Pylman Dairy	6566	6-05	1376	* Providence Dairy	8442	4-02	1401
* Dutch View Dairy	3	2-11	1354	* Hide Away Dairy	4105	5-06	1372
Shamrock Farm	8533	2-00	1323	* Goff Dairy	18885	5-06	1361
* Stotz Dairy	14838	4-06	1295	* Hide Away Dairy	2868	6-06	1323
* Stotz Dairy	16441	3-05	1249	* Hide Away Dairy	5033	4-03	1316
* Stotz Dairy	14720	4-07	1245	* Hide Away Dairy	4194	5-06	1287
* Mike Pylman Dairy	3873	6-08	1242	Price's Roswell Farm	1787	6-05	1282
* Mike Pylman Dairy	5556	5-03	1237	Caballo Dairy	3982	4-09	1269
* Mike Pylman Dairy	417	2-00	1233	* Hide Away Dairy	4907	4-03	1266

PROTEIN

Saddle Mountain Dairy	2191	4-08	1271	* Goff Dairy	9319	6-06	1246
* Mike Pylman Dairy	2152	3-06	1098	* Providence Dairy	8442	4-02	1193
* Mike Pylman Dairy	106	3-03	1025	* Providence Dairy	4525	4-02	1110
* Mike Pylman Dairy	2139	3-07	1003	* Providence Dairy	8833	3-08	1108
* Stotz Dairy	8378	3-00	989	* Providence Dairy	4642	3-11	1102
* Treger Holsteins, Inc.	968	---	984	* Hide Away Dairy	3705	5-06	1102
* Mike Pylman Dairy	1825	4-02	947	* Providence Dairy	3871	5-07	1085
* Stotz Dairy	16033	3-08	971	* Providence Dairy	8381	4-04	1079
* Mike Pylman Dairy	417	2-00	971	* Hide Away Dairy	2908	6-06	1074
* Mike Pylman Dairy	6566	6-05	969	* Providence Dairy	4126	5-00	1074

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

ARIZONA – TOP 50% FOR F.C.M. [b]
MAY, 2004

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	R.R.
Stotz Dairy West	2025	27,375	986	27,820	45
Red River Dairy	4490	26,403	951	26,832	27
Triple G Dairy, Inc.	4112	25,231	938	26,115	38
Treger Holsteins, Inc.	602	25,605	880	25,336	28
University of Arizona Holsteins	163	25,271	888	25,322	31
Mike Pylman Dairy	3779	25,188	888	25,286	39
Danzeisen Dairy, LLC	1397	24,263	888	24,886	37
Stotz Dairy East	1182	24,063	853	24,232	24
Arizona Dairy Company	5787	23,907	840	23,954	37
Del Rio Holsteins	814	22,542	802	22,748	41
Paul Rovey Dairy	386	22,155	797	22,499	39
Zimmerman Dairy	1102	22,363	790	22,476	30
Saddle Mountain Dairy	2648	23,503	753	22,369	33
Dairyland Milk Company	2751	23,122	763	22,366	29
Butler Dairy	611	22,783	767	22,284	29
D C Dairy, LLC	1056	21,977	788	22,276	28
Hillcrest Dairy	2299	22,818	759	22,170	41
Withrow Dairy	5001	22,743	738	21,797	29
Shamrock Farm	7993	21,924	747	21,589	29
Goldman Dairy	1969	21,489	742	21,320	38
RG Dairy, LLC	1232	21,381	743	21,289	30
Lunts Dairy	540	20,682	747	21,052	30
Dutch View Dairy	1544	20,648	717	20,551	29
Caballero Farms, LLP	1927	20,072	719	20,334	32
Yettem Dairy	2838	18,548	661	18,735	22

NEW MEXICO – TOP 50% ACTUAL MILK
MAY, 2004

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	R.R.
Pareo Dairy #1	1422	26,133	934	26,769	24
Hide-Away Dairy	2075	26,821	837	25,170	29
Providence Dairy	2846	26,762	836	25,128	22
Tallmon Dairy	470	26,018	851	25,050	33
Ken Miller Dairy	396	24,797	864	24,733	25
Do-Rene Dairy	2286	24,504	834	24,120	36
Desperado Dairy	2286	24,504	834	24,120	36
Pareo Dairy # 2	3036	23,5498	855	24,047	22
New Direction Dairy # 2	1847	23,147	862	23,987	30
New Direction Dairy # 1	37	22,925	851	23,713	26
Wormont Holsteins	1390	22,721	830	23,284	33
Hafliger Dairy	1924	22,315	820	22,946	30
Price's Roswell Farm	3346	22,789	806	22,924	33
Goff Dairy # 1	4158	22,331	811	22,807	35
Vaz Dairy	1817	23,263	781	22,724	30
Milagro Dairy	3272	22,542	793	22,606	25
Butterfield Dairy	1695	22,203	800	22,573	20

all or part of lactation is 3X or 4X milking
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 MAY, 2004

		ARIZONA	NEW MEXICO
1.	Number of herds	50	31
2.	Total cows in herd	69,964	52,781
3.	Average herd size	1399	1703
4.	Percent days in milk	92	87
5.	Average days in milk	222	203
6.	Average milk – all cows per day	61	62
7.	Average percent fat – all cows	3.5	3.4
8.	Total cows in milk	66,849	46,233
9.	Average daily milk for milking cows	67.1	70.7
10.	Average days in milk – 1st breeding	85	74
11.	Average days open	160	149
12.	Average calving interval	14	14
13.	Percent somatic cell – linear 0-4	85	79.7
14.	Percent somatic cell – linear 5-6	10	13.6
15.	Percent somatic cell – linear 7 & above	5	6.8
16.	Average previous days dry	63	64
17.	Percent cows leaving herd	33	30.6
		STATE AVERAGE	
	MILK	21,762	23,103
	Percent butterfat	3.53	317.75
	Percent Protein	2.91	3.04
	Pounds fat	774	496.3
	Pounds protein	636	710.8

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UPCOMING EVENTS:

Arizona Dairy Production Conference

Tempe, Arizona

November 4, 2004