Observations on Bodmin Nu-Pulse milking system

Thomas A. Shultz □ Richard N. Eide □ Larry S. Collar

The Bodmin Nu-Pulse milking system, developed in New Zealand, has been used to a limited extent in the United States and was introduced more recently to the larger dairies common in California. Relatively little information has been reported on its use on the larger dairies where the cows are grouped by level of milk production. We therefore conducted a study to observe the operational characteristics of the Bodmin milking unit under routine conditions in California drylot dairies and to compare these observations with average performance of dairies using other types of milking systems.

Unlike other milking systems, the Nu-Pulse has a single pulsation action, and the entire unit is operated by the milk pipeline vacuum. The single or alternating pulsation of other milking systems is either pneumatically or electrically controlled from a separate air line.

The Nu-Pulse pulsator control is in a plastic dome directly above the milk cluster. The vacuum level increases between shell and inflation (liner) for milking. During the milking phase, the vacuum increases in the dome to lift a bobbin that closes a valve to the shell, causing the inflation to remain open. As the inflation releases and the teat is massaged, the vacuum level drops in the dome and the bobbin returns to the original position. This reopens the valve to equalize vacuum and begins the cycle again. This setup permits automatic individual unit adjustment to milk flow, which results in a fluctuating cycle, as opposed to preset fixed intervals in other pulsation systems.

Milking system study

Observations were made on dairies equipped with the Bodmin system in Tulare County, in California's San Joaquin Valley.

Milking performance characteristics of the system were recorded throughout one year at 75-day intervals on a 500-cow dairy. This farm had a yearly rolling herd average of nearly 19,000 pounds, 3.5 percent fat corrected milk (FCM), with cows grouped by production into four pens. During the observation period the herd had an annual 13.5 percent dry-cow and 22 percent culling rate.

The milking barn consisted of a double-8 herringbone design with a 2-inch low-looped milkline. Vacuum was furnished by a 15-hp pump regulated at 12 inches mercury (Hg) in the pipeline with one unit engaged; 11 inches Hg in pipeline and 10.5 inches Hg at the cluster were observed when all units were milking high-production cows.

Measurements were made with a Sentinel Dairy Meter and consisted of milk-to-rest ratios, pulses per minute, and vacuum readings at the short milk tube. While milking cows producing 65 pounds daily, vacuum fluctuations were also recorded on tape produced by a dual chamber Detco recorder.

Herd data and milk quality values were monitored for one year from nine Bodmin-equipped herds using information obtained from local dairy industry offices and the Tulare Dairy Herd Improvement Association.

Results

The dairy operator routinely set the Bodmin units, without the aid of analytic equipment, to approximate an average 55:45 milk-to-rest

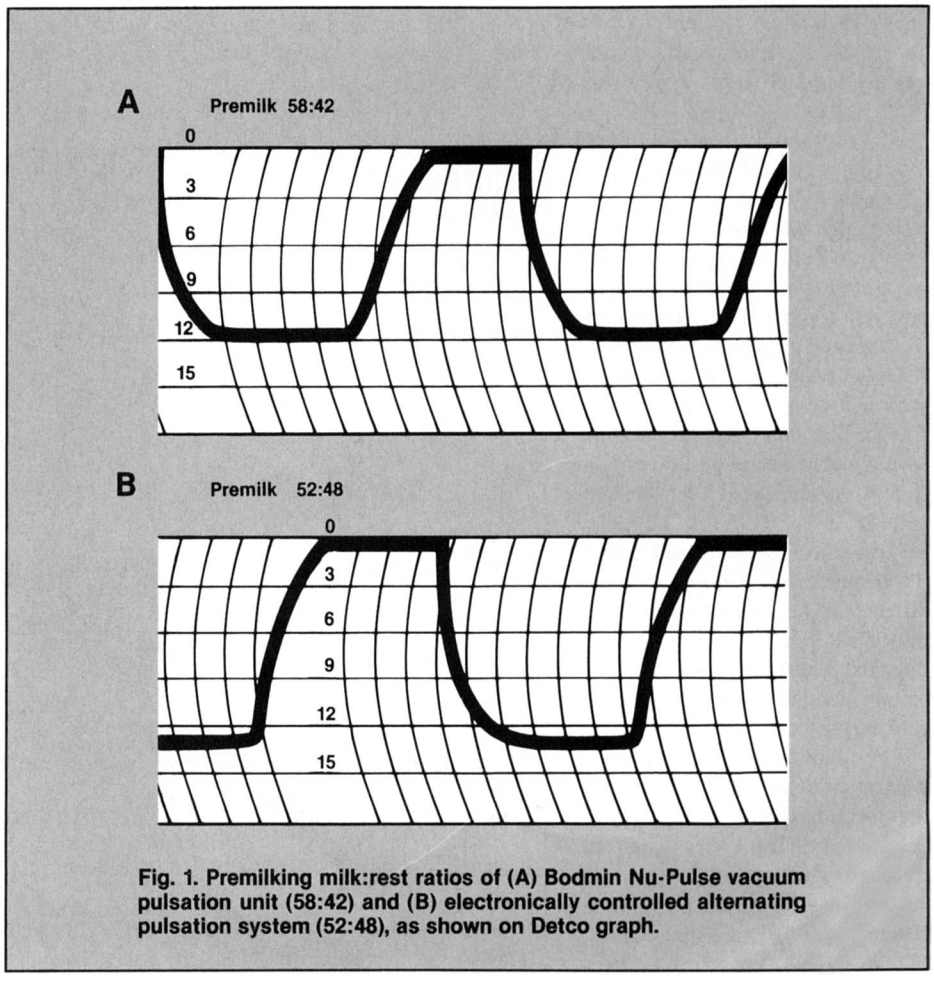

Fig. 1. Premilking milk:rest ratios of (A) Bodmin Nu-Pulse vacuum pulsation unit (58:42) and (B) electronically controlled alternating pulsation system (52:48), as shown on Detco graph.

ratio and 55 pulses per minute. The values monitored show an actual average near the desired levels, but variation occurred from one unit to the next, as indicated by the wide range and standard deviation from the average (table 1).

Pulsation characteristics measured in other milking systems have shown comparatively less variation than is shown in table 1 for the Bodmin system. A review of the literature has shown that minimizing these variations lessens mammary tissue trauma and the incidence of mastitis. In this study, however, no apparent detrimental effects were observed under the conditions reported with either high-production cows or first-calf heifers.

The inflations used routinely in the Bodmin Nu-Pulse units, the Smith No. 16 E.L., were frequently left unchanged for 5,000 to 7,000 milkings. We compared used and new Smith No. 16 E.L. inflations and new inflations of other brands (table 2).

The Smith No. 16 E.L. inflations in this study are guaranteed by the manufacturer for 5,000 milkings. Although inflations used for 8,000 milkings appeared in usable condition, measurement indicated that the mouthpiece orifice was stretched out of shape and the collapse force resistance was considerably weakened.

Using the known collapse force for the respective inflations, we compared the milk-to-rest ratios for the Nu-Pulse system with those for the electronically controlled pulsation system previously used in this dairy. Both systems recorded a similar graphic display before milking began (fig. 1).

During milking, the self-adjusting vacuum pulsation in the Nu-Pulse unit is evidenced by the change from a 56:44 milk:rest ratio at the start of milking to an interval 47:53 ratio at mid-milking as milk flow increased (fig. 2). At the end of milking, the milk:rest ratio returned to approximately the original reading but showed some variation. A fluctuating milk flow can be observed throughout the milking. In contrast, the original electronic preset pulsation system had a 53:47 milk:rest ratio throughout the milking and no fluctuating milk flow was apparent (fig. 3).

Averages of nine Bodmin-equipped dairy herds were compared for a period of one year against the Tulare County average for California Mastitis Test (CMT) values and against the percentages of dry and culled cows. No appreciable differences appear in CMT values, or in dry-cow or culling rate percentages (table 3). Considerable variation from the average, as evidenced by the large standard deviation, was noted in CMT 2's and 3's and for culling in two Bodmin equipped herds. The wide variation for culling was due to management reasons other than herd health.

Monthly quality readings from farm bulk tanks were reviewed and averaged for one year before the Bodmin systems were installed and similarly during one year after installation on the nine dairies. No other equipment changes were made.

The comparison showed an average increase of 4.8 percent in the standard plate count after Nu-Pulse installation, which is a relatively small rise in bacteria (table 4). The large standard deviation both before and after installation indicates that some dairies had more problems than others. A more notable rise of 19.6 percent was observed for lab pasteurization scores. Again, the relatively large standard deviation values indicate particular problems on some dairies, while others had smaller changes. This suggests that the Bodmin increases the potential for unit washup deficiencies, but that adequate attention to detail in the cleaning procedures

TABLE 1. Pulsation characteristics observed on dairy using Bodmin milking units*†

Date	Milk/rest ratio		Pulse/minute	
	Range	Average‡	Range	Average‡
May 1980	53:47-69:31	58:42 ± 3	44-56	52 ± 4
August 1980	49:51-64:36	59:41 ± 4	45-63	51 ± 5
November 1981	50:50-65:35	61:39 ± 4	45-66	56 ± 5
March 1981	50:50-62:38	57:43 ± 4	45-70	55 ± 9
June 1981	46:54-60:40	56:44 ± 4	42-65	54 ± 5

*Values for 16 units in double-8 herringbone milking parlor.
†Pre-milking individual unit observation.
‡± Standard deviation.

TABLE 2. Comparative characteristics for inflations*

Inflations	Collapse force	Inner diameter	
		Milk tube	Mouthpiece
	mm Hg	*mm*	*mm*
Smith No. 16 E.L. (8,000 uses)	40.6	7.1	22.0
Smith No. 16 E.L. (4,000 uses)	53.3	7.0	21.5
Smith No. 16 E.L. (new)	78.7	7.0	21.0
Milk Rite OIAU (new)	81.3	8.1	20.0
Lee Morgan OAI (new)	91.4	8.1	20.0

*Average of 12 observations.

TABLE 3. Comparison of nine Bodmin-equipped dairies against Tulare County averages*

Item	Tulare County†	Bodmin system‡
	%	%
CMT values:		
Negative	31 ± 7	30 ± 3
Trace	28 ± 7	27 ± 4
1's	36 ± 5	36 ± 3
2's and 3's	5 ± 3	7 ± 5
Dry cows	16 ± 2	15 ± 3
Culled cows	28 ± 3	24 ± 12

*Observations from July 1980 to July 1981, California Mastitis Test (CMT) and percent dry and culled.
†Average for 128 herds ± standard deviation.
‡Average for 9 herds ± standard deviation.

TABLE 4. Monthly bacteria counts for one year before and after Bodmin installation

Observation	Bacteria count method	
	Standard plate	Pasteurization
Pre-Bodmin system*	28,281 ± 14,395	328 ± 152
Post-Bodmin system*	29,695 ± 18,780	408 ± 287
Post-net effect, counts	1,414	80
Post-net effect, %	4.8	19.6

*Monthly average for nine herds ± standard deviation.

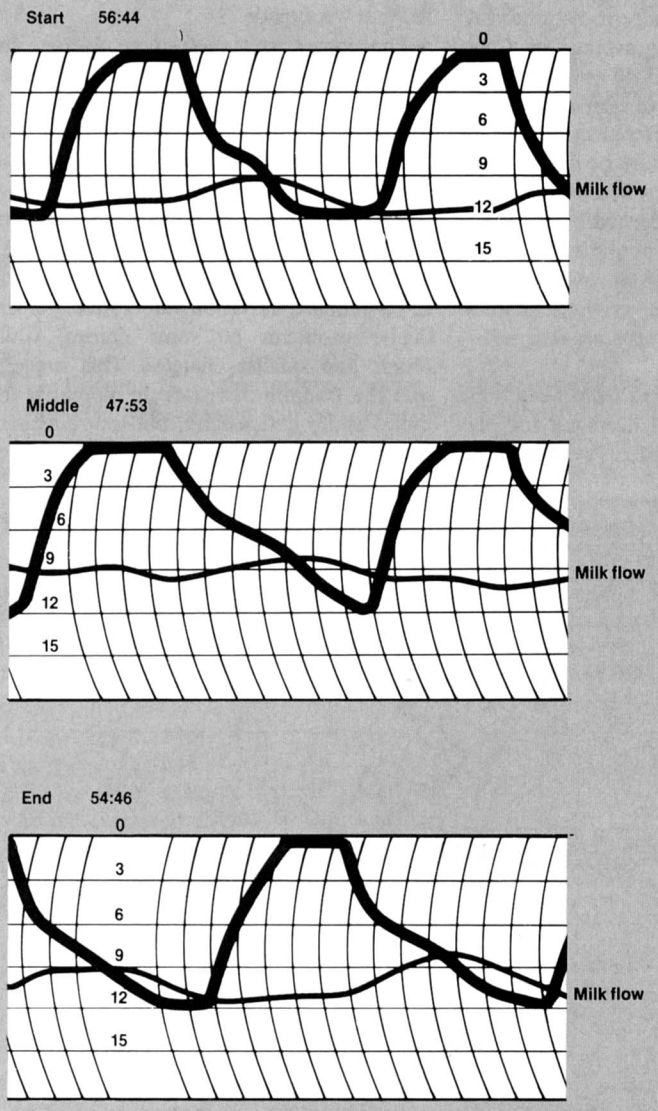

Fig. 2. Bodmin Nu-Pulse self-adjusting vacuum pulsation with milk:rest ratio of 56:44, 47:53, and 54:46 at start, middle, and end of milking, respectively.

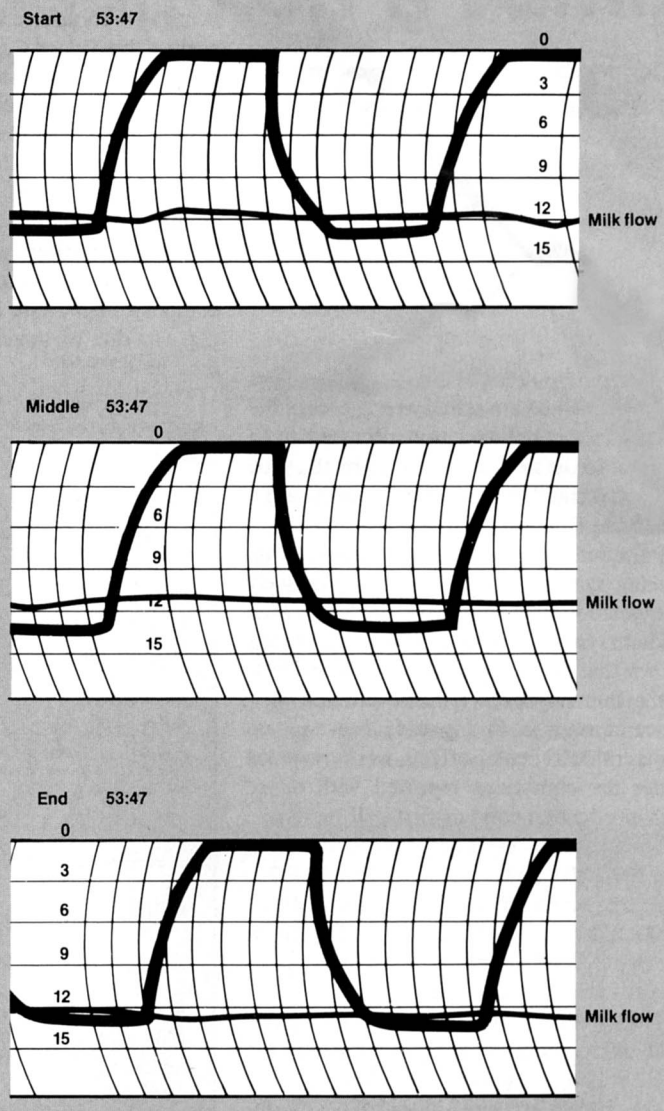

Fig. 3. Preset electronic pulsation system with 53:47 milk:rest ratio at start, middle, and end of milking.

makes the difference between it and other systems inconsequential.

In addition to the dairies mentioned, which had the Bodmin system during the yearly observations, three Tulare dairies installed units on a two-month trial basis and returned to using their previous systems for management reasons. Our analysis and the opinions of dairy operators using the Bodmin system in Tulare County, during the observation period from May 1980 to October 1981, may be summarized as follows.

Apparent advantages:

☐ Smith inflations required less vacuum collapse force and had relatively long life.

☐ Cluster characteristics permitted lower milking vacuum.

☐ Milking and udder health were satisfactory.

Apparent disadvantages:

☐ Breakage and maladjustment of pulsator control with the cluster plastic dome were encountered.

☐ Additional sanitation instruction or control, or both, were needed.

☐ Increased milk quality problems occurred on some of the monitored dairies.

These points are substantiated by the tabulated results. However, the study was limited in scope, and additional observations with cows at all levels of production would be useful.

In summary, the cluster characteristics and lower operating vacuum of the Bodmin Nu-Pulse system permitted a milking performance with no apparent increase or decrease in udder health as measured by Dairy Herd Improvement Association California Mastitis Test scores, and no significant changes in dry and cull cow percentages. The comments related to sanitation of the units and potential effects on milk quality at some Bodmin-equipped dairies suggest that the manufacturer, as well as the dairies, should give special consideration to cleaning. Performance is then likely to be acceptable.

Thomas A. Shultz, Richard N. Eide, and Larry S. Collar are Farm Advisors, University of California Cooperative Extension, Tulare, Fresno, and Kings counties, respectively.