Extended Calving Intervals With The Use Of bST

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Calving intervals of 12 to 13 months have been recommended for maximizing herd profitability. Recently, some dairy producers have justified longer calving intervals for high-producing herds and individual cows. However, even with higher milk production, the shape of the lactation curve remains similar with only the level of milk production changing. Thus, greater profitability is still highly correlated with calving intervals from 12 to 13 months, with greater number of days spent in early lactation (4, 7, 10, 13, 14, 16).

The rate of decline in milk yield after peak yield is correlated with the rate of accumulation of profit. Thus, persistency is important in determining the appropriate calving interval (7). However, increased milk yield per se does not affect the optimum profitable calving interval except for first lactation animals because of their higher persistency (4). Pregnancy, nutrition and management are all factors that affect the magnitude and shape of the lactation curve. Hormonal changes associated with pregnancy decrease the activity of milk-producing cells and maintenance of cell numbers.

Supplementation of bST increases lactation milk yield by altering the lactation curve with an immediate increase in milk yield (1, 2, 3, 15). Furthermore, milk yield is maintained at a higher persistency with bST supplementation compared to lactation curves without bST (2, 3, 15).

Early simulations of bST use indicated that extension of the calving interval to 14 months and longer may be one of the changes in herd management which could optimize profitability (8, 11). Ferguson (8) indicated that if breeding was delayed until 150 to 200 days in

Table 1: A comparison for milk production per day of productive life in Holstein herds with 13.2 and 18.0-month calving intervals.[1]

	No bST		Initial bST response					
			8 lb/day		10 lb/day		12 lb/day	
	13.2 mo	18.0 mo	13.2 mo	18.0 mo	13.2 mo	18.0 mo	13.2 mo	18.0 mo
Additional bST Increase								
	46.91	44.26	**Low-Med production**					
.00			51.92	50.07	53.17	51.52	54.42	52.97
.02			53.45	52.88	54.70	54.33	55.96	55.78
.04			54.99	55.68	56.24	57.14	57.49	58.59
.06			56.52	58.49	57.77	59.95	59.03	61.40
	55.49	53.22	**Med production**					
.00			60.50	59.03	61.75	60.49	63.00	61.94
.02			62.03	61.84	63.29	63.29	64.54	64.75
.04			63.57	64.65	64.82	66.10	66.07	67.55
.06			65.10	67.46	66.36	68.91	67.61	70.36
	64.07	62.19	**Med-High production**					
.00			69.08	68.00	70.33	69.45	71.59	70.90
.02			70.62	70.81	71.87	72.26	73.12	73.71
.04			72.15	73.61	73.40	75.07	74.65	76.52
.06			73.69	76.42	74.94	77.87	76.19	79.33
	72.66	71.15	**High production**					
.00			77.66	76.96	78.92	78.41	80.17	79.87
.02			79.20	79.77	80.45	81.22	81.70	82.67
.04			80.73	82.58	81.98	84.03	83.24	85.48
.06			82.27	85.39	83.52	86.84	84.7	88.29

1: Production per day of productive life, using population solutions from the Cornell Test-Day Model. Animals are simulated in herd production levels ranging from low to high production and to no bST and bST. bST response is assumed to be for all stages of lactation or increase by .02, .04, or .06 lb per day starting on the first day of injection.

milk with bST use, improvements in energy balance, uterine health, number of estrous cycles, heat detection and conception rate would probably be observed. Marsh et al. (11) indicated the increased persistency of milk yield observed in bST-treated cows may allow pregnant animals to be milked longer and open cows to be retained in the herd longer before culling.

Herd life and animal health are additional considerations for increasing herd profitability. In a recent survey of dairy herd management practices (12), reproductive failure accounted for 26.7% of all culling decisions. Numerous studies (5, 6, 9) indicated that approximately 60% of veterinary costs are incurred during the first 45 days of lactation. Most metabolic disorders such as milk fever, ketosis, displaced abomasum, metritis and mastitis are observed during this period (6,9) . Thus, increasing the calving interval may reduce the portion of the animal's lactation cycle associated with this high risk period and may potentially increase productive life.

Given the potential for altering the lactation curve through bST supplementation and the delayed pregnancy effect on persistency of milk yield, a field trial was designed to examine effects of extended calving intervals with continuous use of bST during lactation on animal performance and profitability.

Field Study

The field study was designed for four years of which two and one-half years have been completed. Nine New York Holstein herds were used that averaged during the first two years between 21,461 and 24,356 lbs of milk sold per cow per year. Herd size ranged between 220 and 1,327 cows with an average of 520 cows per herd. Five of the nine herds were on 3X milking compared to 2X milking.

Across herds, 108 second lactation animals were assigned to one of two treatments: 1) cows were bred beginning at 60 days in milk; and 2) cows were bred beginning at 150 days in milk. The cows were assigned to the same treatment for each subsequent lactation. Injections of bST began at 57 to 71 days in milk and were given until two weeks prior to drying-off date. Herdmates received bST at the discretion of management. The treatment cattle were housed and managed with the other cattle in the herds. Culling decisions were determined by the individual farms.

Milk yield was measured monthly and milk samples were taken for measurement of fat, protein, and somatic cells. Lactation milk and component yields were analyzed using the Cornell Test Day Model. This Model adjusted the milk yield data for herd-test-day, age, days in milk, month-fresh, pregnancy, and management effects. Reproductive and health performance along with culling rates were monitored.

From the data for the first two and one-half years of the field study, lactation curves, milk production per day of life, and associated animal performance with the use of bST were determined and used for comparison of a 13.2 month calving interval and an extended calving interval of 16.5 months. For the economic analysis and lactation milk curves, an 18 month calving interval was used as the maximum length of extended calving inter-

Table 2. Economic comparison of calving interval lengths of 13.2 and 18.0 months.

	Per calving interval[1]	
Calving interval (CI)	13.2 month	18 month
Days/CI[2]	401d	547d
Days dry/CI[3]	55d	55d
Days milking/CI	346d	492d
	Per 2.9 lactations/productive life[4]	
Days/productive life	1,163d+423d[5] = 1,586d[6]	1,586d[7]
Years of productive life/animal[8]	3.19 yrs	4.35 yrs
Lactations/1,586d[8]	3.95 lactations	2.9 lactations
Days milking/1,586d	1,384d	1,476d
Days dry/1,586d	202d	110d
Milking days w/o bST	245d[9]	180d
Pregnancy cost/1,586d[10]	$99	$73
Herd health cost/1,586d[11]	$336	$247
Culling rate (annual)[12]	34.5%	25.3%
Replacement heifer cost	$.644d	$.472d
/1,586d[13]	($1,022)[14]	($750)[13]
Bull calf value/1,586d1[5]	$133	$98
	Added Receipts	
Bull calf value	$35	
Milk income over feed costs[17]		$885
	Added Expenses	
Extra bST cost[16]		$46
Pregnancy cost	$26	
Herd health cost	$89	
Replacement heifer cost	$272	
Added receipts-added expenses	($352)	$839
	Profit Difference	
Difference/productive life (1,586d)		+$1,191
Difference/yr of productive life		+$274
Difference/day of productive life		+$.75

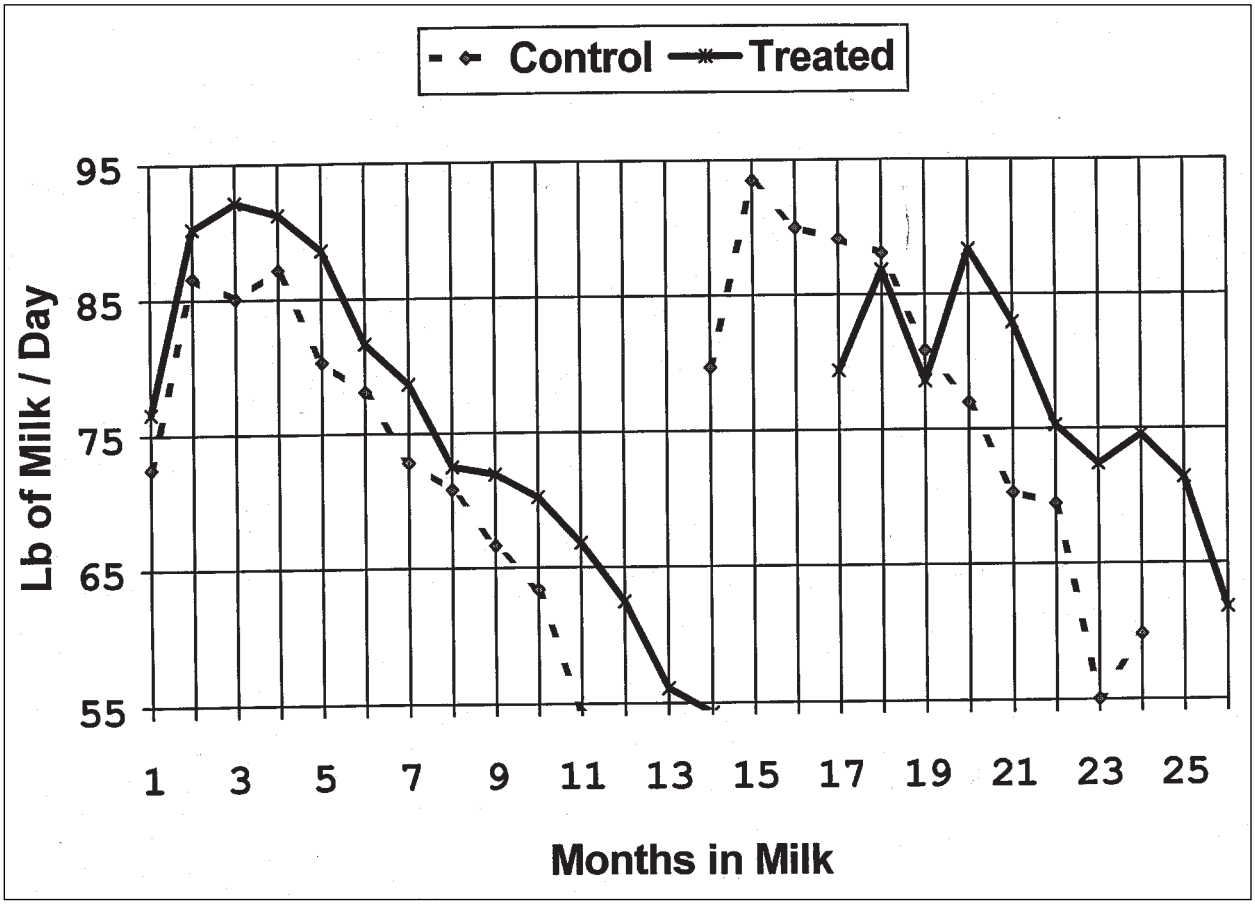
val.

Results From The Current On-Going Field Study (2 1/2 Years):

Milk Production Performance

- Average days in milk were 364 and 486 days for the 13.2 and 16.5 month calving intervals with lactation milk yield averages of 25,480 lbs. and 33,582 lbs. Average daily milk yield per lactation were 70.0 and 69.1 lbs. for the 13.2 and 16.5 month calving intervals, both supplemented with bST.
- Fat and protein percentages averaged 3.75% and 3.2% for the 13.2-month calving interval and 3.69% and 3.3% for the 16.5-month calving interval.
- Actual lactation milk curves that represent the second and third lactations for both treatments (control: 13.2 months CI; treated: 16.5 months CI) in the study are presented in Figure 1. The differences between the two curves represent the effects of bST in achieving higher milk production with greater persistency. For the third lactation of the treated group (16.5 months CI), the data are more variable because of fewer animals calving at the time of the analysis which is a result of the longer calving interval.
- In Figure 2, the absolute and accumulated daily milk production is displayed by treatment group across the time of the study (26 months). The absolute daily milk production is presented by the open line and the accumulated milk production is presented by the open line and the accumulated milk production is presented by the solid line. Both illustrate the effects of peak yield, persistency, and days dry on the differences between the two treatments and the accumulated total production. At 26 months into the study, the cattle with the extended calving interval treatment have accumulated approximately

Figure 1: Lactation milk curves for 2nd and 3rd lactations by treatment (control = 13.2 months CI and treated = 16.5 months CI)



4,700 more pounds of milk than the cattle with the shorter calving interval, averaging 13.2 months.

Reproductive Performance

- Voluntary wait periods of 60 and 150 days resulted in calving intervals of 13.2 and 16.5 months.
- Days to first insemination averaged 68 and 161 days for the 13.2 and 16.5 month calving intervals.
- Overall heat detection efficiency rate and conception rate were 49% and 71% for the 13.2 month calving interval and 57% and 62% for the 16.5 month calving interval which yielded a pregnancy rate of 35% for both calving intervals.

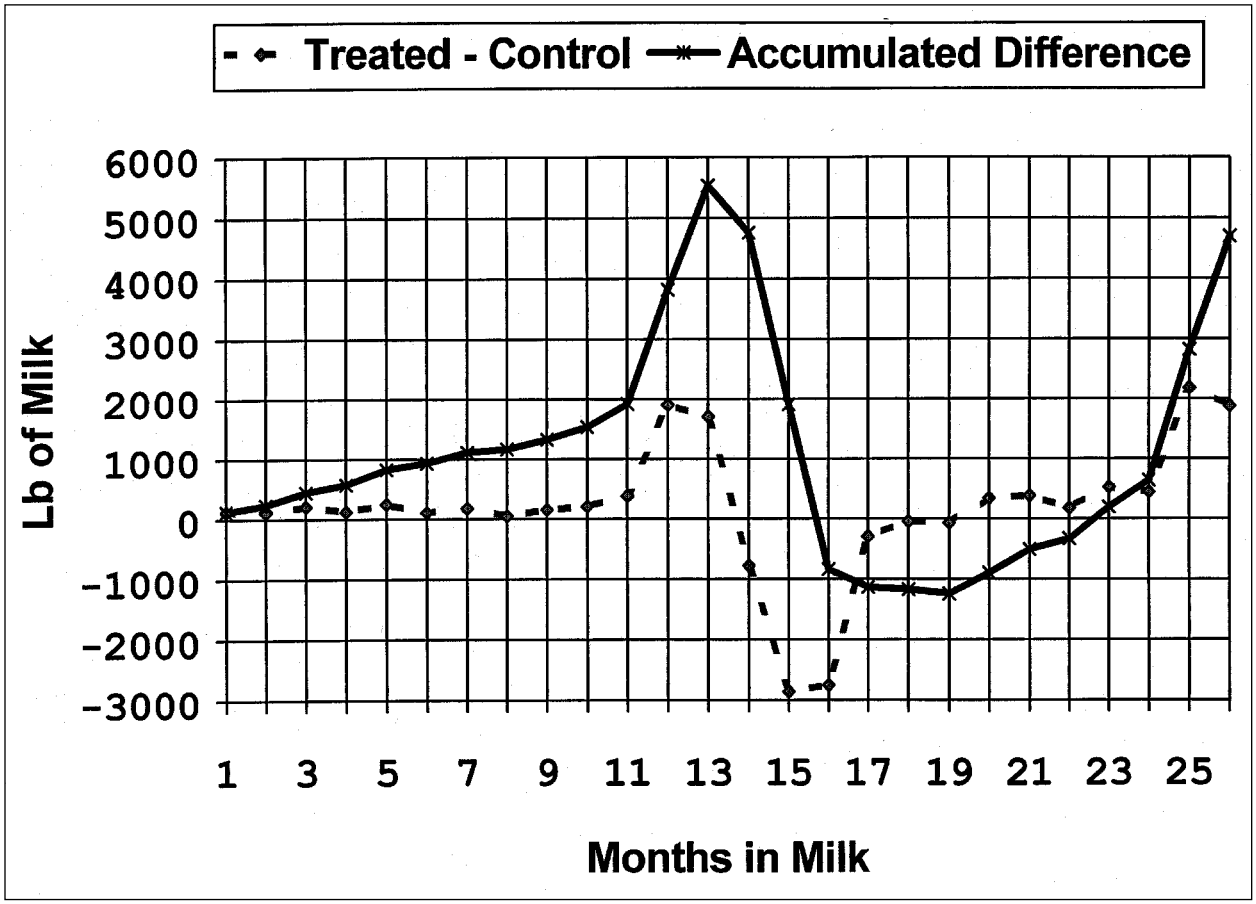
Culling Rates

- Annual culling rates for reproduction and low milk production were 16.6% and 9.2% for 13.2 and 16.5 month calving intervals. Culling rates for other reasons were similar both treatments. On an annual basis, the culling rates averaged 34.5% and 25.3% for the 13.2 and 16.5 month calving intervals.

Conclusions From The Current On-Going Study:

- Per life-time, the 16.5 month calving interval may average a higher percentage of days in milk and fewer days dry than the 13.2 month calving interval, thus greater total milk yield per life-time.
- With a lower annual culling rate for the longer calving interval, the cows may have longer herd-life, thus decreasing the heifer inventory (costs) needed to maintain herd size.
- The persistency of lactation milk yield is greater as days in milk increases because of the increased responsiveness to bST.
- The marked improvement in persistency of the bST milk production response significantly influences total lactation milk yield and milk production per day of productive life (Table 1).
- The lactation curves with the use of bST are changed by achieving a higher level of milk pro-

Figure 2: Absolute & accumulated milk differences between treatments (13.2 and 16.5-month CI)



duction with greater persistency. With the altered lactation curves, the length of calving interval needs to be based on profitability per day of productive life rather than total lactation milk yield in a given time interval (i.e. 305 days in milk). In addition, with the changes in the lactation curves with the use of bST, standard lactation curves cannot be used with accuracy in determining milk response, expected milk deviation, and lactation milk yield.

- For extended calving intervals, bST needs to be used on a continuous basis throughout lactation to maximize the bST milk production response. The use of bST early in lactation is essential to improve persistency throughout lactation in order to realize maximum profit. The greater persistency is achieved by maintenance and activity of more milk-producing cells throughout lactation.
- Cattle with longer calving intervals may have better overall health and longer herd life.

Economics Of Extended Calving Intervals With Use Of bST

The economics of 13.2 and 18.0 month calving intervals are presented in Table 2. An 18 month calving interval was used for the economic analysis as the maximum extended calving interval. Using the herd trial data for the analysis, the 18.0 month calving interval increased profitability approximately by $.75 per day of productive life ($274 per cow per year of life). This substantial increase in profitability is mainly due to extended herd life, additional milk income over feed costs and reduced heifer costs per cow being replaced over a longer time, along with other savings in associated costs. The additional milk income over feed costs is a reflection of further dilution of maintenance costs and delayed pregnancy costs at lower daily feed costs, and the widening of the bST milk response as calving interval lengthens.

Summary:

Extended calving intervals of 16 to 16.5 months (maximum of up to 18.0 months) may be warranted, especially in high producing herds. An extra benefit of the extended calving intervals may be realized with the first lactation animals because of their greater persistency. In addition, the longer calving interval allows the young animals to have more time to reach mature body weight and desired body condition prior to the second lactation. With extended calving intervals, the herds need to be managed to maximize the bST milk response throughout the year in order to realize the profitability associated with longer calving intervals. Extended calving intervals may be utilized during times of problem breeding with individual animals and groups.

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Footnotes:

1: Calving intervals devised from data from a 9 herd field study 230.4 days per month.
2: 30.4 days per month.
3: Standardized days dry at 55 days/lactation.
4: Assumed 2.9 lactations per productive life regardless of calving interval data are compared against 1586 days (18 mon CI); 1,586 days derived from 2.9 lactations x 547 days/lactation.
5: Extra days beyond 1,163 days of productive life (2.9 lactations) for 13.2 mon CI to equal 1,586d.
6: Consists of full first and second lactations and .9 of third lactation of one animal and full first lactation of replacement (second) animal.
7: Consists of full first and second lactations and .9 of third lactation of one animal.
8: Used length of calving interval per respective CI.
9: Reflects fourth lactation for 13.2 month CI; BST injections initiated at 63 days of lactation.
10: $25 / pregnancy / CI x number of lactations.
11: $85 herd health costs / CI x number of lactations.
12: Cull rates for respective CI.
13: $1,150 used per replacement calving at 22 month minus $400 salvage value; thus $750 was used as the replacement cost.
14: Includes additional replacement costs for the 423 days of the second animal's first lactation.
15: $75 bull calf value, 90% survival (sold) rate; total number of lactations used in calculation.
16: bST cost includes bST product, labor, and feed costs associated with the milk response from bST.
17: Milk income over feed costs; $12.50 net milk price; 3.5% fat, 3.2% protein, milk production was determined by Test Day Model Deviation Method using actual milk production data from 9 field study herds; feed and ration requirements and costs determined by Cornell Nutrition Model; .486 Mcal (ME) / lb of milk; 1.19 Mcal (ME) / lb of feed; 8.6 cents / lb of feed (DM).

Notes

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