Comparison of Two Estrus Synchronization Programs in a Large, Confinement-Housed Dairy Herd

Jenks Swann Britt, *DVM, Diplomate ABVP-Dairy*
Food Animal Production Medicine Section
Department of Medical Science
School of Veterinary Medicine
University of Wisconsin-Madison 53706-1102
Jerome Gaska, *DVM*
Dairy Health Services SC
Columbus, WI 53925

Estrus synchronization programs have been used to manage reproduction in dairy cattle for many years. These programs involve various protocols for administration of a single hormone or combinations of hormones, but results have varied among programs and herds. Several synchronization programs use injections of prostaglandin F2a (PGF2a).[1-3] A commonly used PGF2a program includes per rectal palpation to identify a corpus luteum (CL). Cattle with a CL are injected with PGF2a, observed for estrus, and inseminated only after estrus is detected. This program depends on the palpator's ability to detect a prostaglandin-receptive CL and may not be the most effective way to evaluate CL activity. Other programs that use PGF2a include the administration of 2 injections of PGF2a at selected intervals (usually 12 to 14 days) and insemination at a predetermined time or after cattle are detected in estrus. Both of these programs have resulted in the highest conception rates when cattle were inseminated after being detected in estrus, rather than inseminating at a predetermined time without detection of estrus.[4]

A new ovulation synchronization program[5-11] does not require estrus detection. This program (Ovsynch) uses gonadotropin-releasing hormone (GnRH) and PGF2a to synchronize ovulation, which may not be accompanied by detectable signs of estrus. In the Ovsynch program, an initial dose of GnRH is used to synchronize waves of follicles and PGF2a is used to lyse the CL in groups of cattle and synchronize estrus. A second injection of GnRH induces ovulation of the dominant follicle in 85 to 95% of the synchronized cattle.[5]

Pregnancy rates often drop during seasons with high ambient temperature.[7] This may be related to heat stress, rather than problems with estrus or ovulation synchronization, because conception rates typically decrease during periods with high ambient temperature.[12]

Materials and Methods

Cows used in the study were from a herd of 960 lactating Holsteins located in east-central Wisconsin. Cows were housed in two 440-freestall, 6-row barns. Each barn was divided into 4 pens. Cows were fed a total mixed ration twice daily via a drive-through center alley. Cows were confined at all times on concrete in the freestall and feeding areas in the barns. All reproductive tract examinations, hormonal treatments, and artificial insemination (AI) were performed on cows while they were restrained in the freestalls. Reproductive management on this farm involved weekly reproductive tract examinations.

During each of 4 seasons during the year (season 1, Sept 11 to Oct 4; season 2, Oct 30 to Nov 14; season 3, Feb 12 to Mar 3; season 4, May 13 to Jun 12), cows were enrolled in the study for a 14-day period. Cows were randomly allotted to synchronization groups on the basis of ear tag number: cows with even numbers were assigned to the Ovsynch group and cows with odd numbers were assigned to receive PGF2a . At the time of entry into the study, cows ranged from 1 to 8 lactations (mean, 2.54), 46 to 220 days in milk (mean, 96.7), and had been inseminated previously 0 to 3 times (mean, 0.85).

All cows were palpated per rectum by the herd veterinarian (JG) on the first day of the study (day 0). The PGF2a program (PP) used in the study reported here included palpation of the ovaries by the herd veterinarian to detect a CL. When a CL was identified, PGF2a[a] was administered and an estrus detection device[b] or crayon (paint sticks) was applied to the cow's tail head. The Ovsynch program used has been described elsewhere.[5] The injection schedule for the two programs is shown in Table 1.

Table 1. Injection schedule of the two synchronization programs.

Program	Day 0	Day 7	Day 8	Day 9
Ovsynch	GnRH AM	PGF2a 6:00 AM	GnRH 5:00 PM	AI 10:00 AM
PP	PGF2a	Detect heat and breed on estrus		

One AI technician performed all of the inseminations in 2 time periods, and 2 other AI technicians inseminated cows during 1 time period each. Cows were examined by per rectal palpation at 34 to 41 days after insemination to determine pregnancy status.

Variables used in the χ^2 analysis of the 4 time periods included; number of cows submitted for AI, estrus detection rate, conception rate, and pregnancy rate. Insemination submission rate was the percentage of cows enrolled in each 14-day period that were actually inseminated during that period. Estrus detection percentage for the PP group was the number of cows actually detected in estrus, whereas the estrus detection percentage for the Ovsynch group was 100%, because all cows in that group were inseminated. Conception rate was the percentage of cows that were pregnant after one insemination. Pregnancy rate[13] was calculated for each group for each 14-day period in the study by multiplying estrus detection percentage by conception rate.

Economic values were calculated on the basis of the number of units of hormones, labor, and semen to produce a pregnancy and the number of days from calving to conception. Prices for hormones were determined by surveying 4 veterinary practices in Wisconsin. Additional labor costs were not assigned to the Ovsynch group for the PGF2a injection or the second GnRH injection, because it was estimated that the time required would equal the time required to affix the estrus detection device on the cows in the PP group. At the end of each period and for the entire study, the amount of goods used for each group was divided by the number of pregnancies produced per group to determine the number of goods used for each pregnancy. The number of inseminations performed on cows before they entered the study were not included in the calculations.

Results

The Ovsynch group had a higher insemination submission rate than for the PP group. Insemination submission rate for the Ovsynch group was 100% during all 4 periods and for the entire study, whereas rates for the PP group ranged from 52 to 66% for the 4 periods,

Table 2. Variables for groups of cows in 2 estrus synchronization programs.

Variable	Period 1	2	3	4	Overall
No of Cows					
Ovsynch*	25	24	25	24	98
PP**	25	24	25	25	99
Submission rate (%)					
Ovsynch	100[a]	100[a]	100[a]	100[a]	100[a]
PP	52[b]	66[b]	52[b]	60[b]	58[b]
Conception rate (%)					
Ovsynch	44	50	56	38	47
PP	46	31	38	13	32
Pregnancy rate (%)					
Ovsynch	44	50[a]	56[a]	38[a]	47[a]
PP	24	21[b]	20[b]	8[b]	18[b]
Services/ conception					
Ovsynch	2.27	2.0	1.79	2.67	2.13
PP	2.16	3.2	2.6	7.5	3.17

a,b within a variable means in a column with different superscripts differ significantly (P<0.05).
*Ovsynch = (Gonadotropin releasing hormone, Prostaglandin F2α -GnRH)
**PP = Palpation and prostaglandin F2α

with a mean of 58%, (Table 2). The Ovsynch group had higher pregnancy rates than the PP group during all periods and for the entire study. Pregnancy rates for each period ranged from 38 to 56% (mean, 47%) for the Ovsynch group, compared with 8 to 24% (mean, 18%) for the PP group. The Ovsynch group tended to have higher conception rates than the PP group in 3 of 4 periods. Conception rates, by season, for the Ovsynch group ranged from 38 to 56% (mean, 47%), compared with 13 to 46% (mean, 32%) for the PP group. All cows of the Ovsynch group (n = 98) were inseminated during the study, whereas only 57 of 99 (58%) cows in the PP group were inseminated during the study. Number of inseminations per conception was 2.13 for the Ovsynch group and 3.17 for the PP group.

Significant ($P < 0.05$) differences were detected for insemination submission rates during all 4 periods between the Ovsynch and PP groups, whereas pregnancy rates differed significantly between the 2 groups for periods 2, 3, and 4. Insemination submission rate and pregnancy rate for the entire study also differed between the 2 groups.

Economic analysis

Costs for hormonal treatments and labor for each pregnancy were calculated for the 2 groups, (Table 3). Analysis of results for this study revealed an economic advantage of $29.14/pregnancy for the Ovsynch group, compared with the PP group. These savings would exceed $20,000 yearly if extrapolated to the entire herd.

Table 3. Economic analysis of 2 estrus synchronization programs.

Variable	Cost/ Unit $	Ovsynch No of units	Ovsynch Cost ($)*	PP No of Units	PP Cost
GnRH	5.52	4.26	23.52	0	0.00
PGF2α	3.30	2.13	7.02	5.56	18.35
Heat 1.00 detection device	0	0.00	5.56	5.56	
Semen	6.00	2.13	12.78	3.17	19.02
Labor	10.00	0	0.00	1.90	19.00
Additional days open	1.00	0	0.00	10.53	10.53
Total Cost			43.32		72.46

GnRH = gonadotropin releasing hormone,
PGF2α=prostaglandin F2α
*Cost per pregnancy determined on data from 47 pregnancies

Discussion

Low pregnancy rates in the PP group for each of the periods may have reflected problems with estrus detection, because these cows were always confined to the concrete freestall and feeding area and did not have access to an outside exercise lot.[14] Poor estrus activity in the PP group may have been attributable to cows that were estimated by palpation to have a prostaglandin-receptive CL but that did not respond to PGF2a.[15] Although cows in the Ovsynch group were not observed for signs of estrus, 100% were inseminated because of the use of AI at a predetermined time after administration of PGF2a. Pregnancy rates for the Ovsynch group were higher than for the PP group, because these rates are directly affected by the estrus detection rate, which the authors assumed to be 100%. Conception rates may have been higher in the Ovsynch group, because ovulation and time of insemination were more closely synchronized than for cows in the PP group.

Conclusion

Analysis of the results of the study reported here indicated that, for confinement dairy operations in which estrus detection is a problem, use of the Ovsynch program may decrease semen use, improve insemination submission and pregnancy rates, decrease labor requirements, and decrease costs of reproductive management. It is important for large dairy farms to have cows calving at scheduled intervals to maintain facility capacity at manageable levels and to enable optimum stocking rates for milking parlor and other facilities. The Ovsynch program may enable producers to achieve a more predictable pregnancy rate, which would allow maximum use of facilities and reduce reproductive management costs.

Although we did not detect a significant difference in conception rates between time periods, there was a decrease in conception rate during period 4, which had more days with ambient temperature of > 80 F (26 C), higher humidity, and higher night-time temperature, compared with other periods. Significant effects of temperature on conception rate may have been evident if the warmest months of the year (July and August) had been included in a treatment period.

The economic impact of the Ovsynch program, compared with the PP program, should be evaluated on dairy farms. It is important that small dairy farms evaluate a program like Ovsynch over a period of several months. Herds with 10 cows inseminated by means of AI monthly may need to compile data for several months before significant results can be determined for this type of managed breeding program. Furthermore, the Ovsynch program can be used successfully on lactating cows, but because of differences in follicular wave formation, the program has not been successfully used on virgin heifers.[16] Veterinarians should include economic evaluations in programs they recommend for dairy farms.

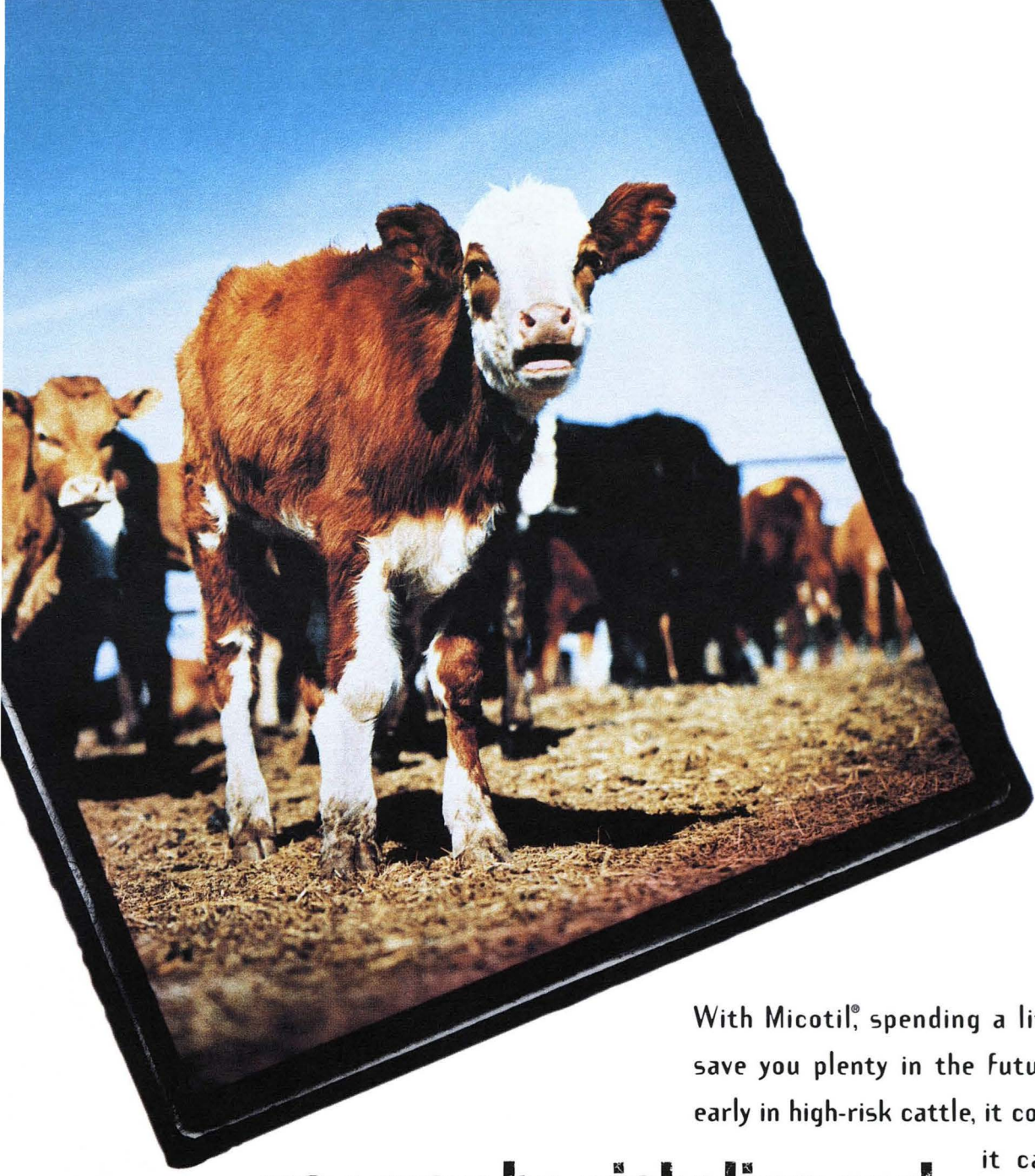
References

1. Selk GE, Fink MS, McPeake CA.. Estrus synchronization of cattle using eleven day or fourteen day prostaglandin protocols. Oklahoma Agriculture Experiment Station, 1988 Animal Science Research Report 1988; 34-37. 2. Garcia-Winder MJ, Gallegos-Sanchez. Estrus synchronization in Holstein cows using reduced doses of prostaglandin F2 . *Theriogenology* 1991;36:191-198. 3. Folman Y, Kaim M, Herz Z, et al. Comparison of methods of the synchronization of estrus cycles in dairy cows. 2. Effects of progesterone and parity on conception. *J Dairy Sci* 1990, 73:2817-2825. 4. Stevenson J. Controlled breeding programs in dairy cattle. Seminar 9, In *Proceedings* 28th Annu Conf Am Assoc Bov Pract, 1995, 36-50. 5. Pursley JR, Kosorok MR, Wiltbank MG. Reproductive management of lactating dairy cows using synchronization of ovulation. *J Dairy Sci* 1997, 80:301-306. 6. Stevenson JS, Kobayashi Y, Shipka MP, et al. Altering conception of dairy cattle by gonadotropin-releasing hormone preceding luteolysis induced by prostaglandin F2 . *J Dairy Sci* 1996; 79: 402-

410. 7. Burk JM, DeLaSota RL, Risco CA, et al. Evaluation of timed insemination using a gonadotropin-releasing hormone agonist in dairy cows. *J Dairy Sci* 1996; 79:1386-1394. 8. Tanabe TY, Deaver DR, Hawk HW. Effect of gonadotropin-releasing hormone on estrus, ovulation, and ovum cleavage rates of dairy cattle. *J Anim Sci* 1994; 72:719-724. 9. Twagiramungu H, Guilbault LA, Dufour JJ. Synchronization of ovarian follicular waves with a gonadotropin-releasing hormone agonist to increase the precision of estrus in cattle: a review. *J Anim Sci* 1995; 73:3141-3151. 10. Stevenson JS, Frantz KD, Call, EP. Conception rates in repeat breeders and dairy cattle with unobserved estrus after prostaglandin F2 alpha and gonadotropin-releasing hormone. *Theriogenology* 1988; 29:451-459. 11. Wiltbank MC, Pursley JR. Improving efficiency of dairy herd reproduction. In, *Proceedings* University of Wisconsin School of Vet Med PostGrad Conf 1996;19-25. 12. Britt JS. The effect of ambient temperature, solar radiation and humidity on dairy animal reproductive performance. In, *Proceedings* University of Wisconsin School of Vet Med PostGrad Conf 1996;113-122. 13. Galligan DT, Ferguson J. Optimal economic goals in reproduction. In, *Proceedings* National Reprod Symp 1994;55-64. 14. Britt JH, Scott RG, Armstrong JD, et al. Determinants of estrus behavior in lactating Holstein cows. *J Dairy Sci* 19XX; 69:2195-2202. 15. Momont HW, Seguin BE. Treatment of unobserved estrus in lactating dairy cattle with prostaglandin F2 products. Reprod Management in Food Anim , The Compendium on Continuing Education for the Practicing Veterinarian 1983; P28-31. 16. Pursley JR, Wiltbank MC, Stevenson JS, et al. Pregnancy rates per artificial insemination for cows and heifers inseminated at a synchronized estrus. *J Dairy Sci* 1997; 80:295-300.

Footnotes

[a]Lutalyse, The Upjohn Co, Kalamazoo, MI
[b]Kamar heat detection patches, Kamar, Portland,ME
[c]Cystorelin, Rhone Merieux Inc, Athens, GA



With Micotil®, spending a little up front can save you plenty in the future. Because used early in high-risk cattle, it controls BRD before it causes significant sickness and death loss. The fact is, Micotil just works better to save your cattle's health. Not to mention your money. To find out more, talk to your veterinarian, or simply call 1-800-428-4441.

you may be nickeling and diming him to death.

it's time.

Micotil® is a trademark for Elanco's brand of tilmicosin.
© 1998 Elanco Animal Health