Optimal Timing of Insemination Using Activity Collars

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Introduction

Hi activity collars developed and manufactured by SCR incorporate a unique accelerometer, an onboard CPU that analyze the movements of the cow using a complex algorithm, and memory that stores the resulted activity index in 12 two hours blocks. Each time the cow walks under a collar reader, data are sent via infra red communication from the tag to a simple terminal (Heatime®) or to the farm computer (Heatime® for PC). Using a specially developed algorithm, a weighted activity index is calculated which express the momentary deviation of the activity from the average activity in the same time period in the past seven days. In a typical heat this weighted activity index is gradually increasing reaching the heat alert level usually 4 hours after the start of activity increase and reaches its peak about 4-6 hours later. Typically 4-6 hours after this peak, the weighted activity index falls under the heat alert level. The time of this weighted activity peak is usually well defined and is presented to the farmer in the high activity report.
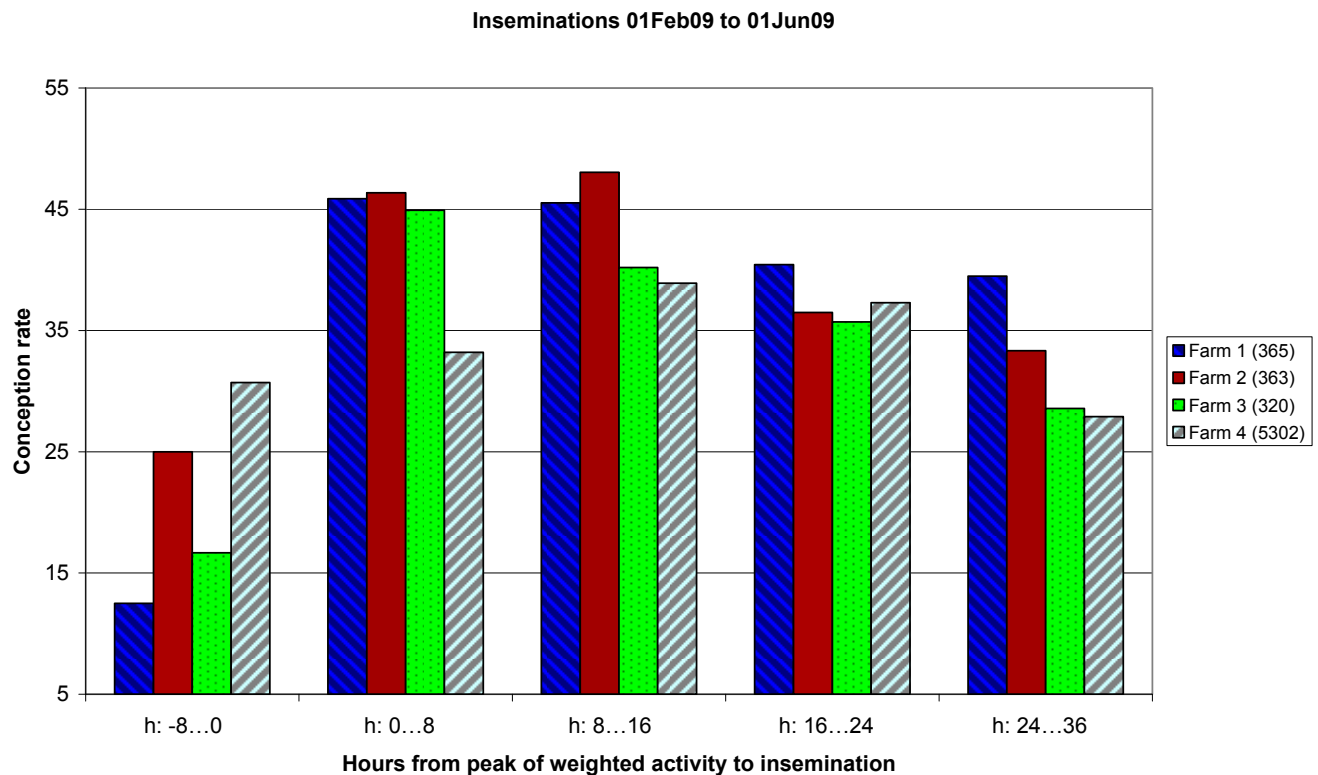
Although a very popular heat detection device (few hundred thousand such tags are in use world wide), there are no well established recommendations on the best time point of insemination using these activity collars. The objective of this study was to use insemination data from farms with known activity dynamics and insemination timings to find the best insemination strategy using this system in farms inseminating once or twice per day.

Materials and methods

Data were accumulated over 6 months period (AI performed between February 09 to May 2009) from three medium size farms in Israel (400-800 milking cows per farm) and one large herd in TX, USA with over 8000 milking cows. No heifers were included in this study. All cows were high producing Holstein cows (average yearly milk production was about 12,000 kg or 24,000 lb of milk per cow). Cows were housed in open dry lots (USA) or covered corrals (Israel) and were fed exclusively a total mixed ration. Activity data and the time of artificial insemination were analyzed using the SAS software.

Results and Discussion

The relation between conception rates and the time passed since the peak of activity index is presented in the following figure. Inseminations performed before the peak of activity are inferior to insemination done after the peak. Cows Inseminated within the first 16 hours after the peak have the best chance to become pregnant. There seem to be farm specific conditions that determine the best time point of insemination and the degree of conception decrease in suboptimal timings. Some farms would significantly benefit from two AI sessions in a given day. The optimal timing for insemination is in concordance with results coming from visual observations, pedometers, or mounting detection devices (see references). Using the data from these studies, the estimated average time of ovulation is about 30-28 hours from activity peak (using the weighted activity index).

Inseminations 01Feb09 to 01Jun09

Chart: Conception rate (y-axis, 5 to 55) vs Hours from peak of weighted activity to insemination (x-axis: h: -8…0, h: 0…8, h: 8…16, h: 16…24, h: 24…36)

Legend:
- Farm 1 (365)
- Farm 2 (363)
- Farm 3 (320)
- Farm 4 (5302)

Recommendations

For farms inseminating once per day, cows should be presented to the inseminator only after the peak of activity (as expressed by the weighted activity index) had passed. This can be done by studying the activity graph or simply to use the two columns "time since peak of activity" and "time since last ID". If the second number is lower, the cow passed the peak and is ready for insemination. If both numbers are the same, the cow might be before her peak and it is advised to wait to the next AI session.

For farms inseminating once per day, cows should be presented to the inseminator as soon as they appear on the Heat list. In the case (usually less than 5%) that the cow was inseminated yesterday, but her peak was few hours after actual insemination, an additional insemination might increase the probability of pregnancy.

References

Dransfield M.B.G., R. L. Nebel, R. E. Pearson, and L. D. Warnick. 1998. Timing of insemination for dairy cows identified in estrus by a radiotelemetric estrus detection system. J. Dairy Sci. 81:1874.

Roelofs J.B., F.J.C.M. van Eerdenburg, N.M. Soede, and B. Kemp. 2005b. Pedometer readings for estrous detection and as predictor for time of ovulation in dairy cattle. Theriogenology 64:1690

Roelofs J.B. , E.A.M. Graat, E. Mullaart, N.M. Soede, W. Voskamp-Harkema, and B. Kemp. 2006. Effects of insemination–ovulation interval on fertilization rates and embryo characteristics in dairy cattle. Theriogenology 66:2173