Heat Detection: Problems, Evaluation and Solutions

David Marcinkowski
University of Maine
Cooperative Extension
Orono, ME

1993
Western Large Herd
Management Conference
♥
Las Vegas Nevada

Heat Detection: Problems, Evaluation and Solutions

David Marcinkowski
University of Maine Cooperative Extension
Orono, ME

To achieve maximum genetic gains in a dairy herd, artificial insemination with top proven sires must be used on all cows and replacement heifers. The benefits of AI are clear, however AI is not without its problems, the primary one being heat detection. Errors in heat detection have a substantial effect on the length of the breeding period, conception rates, days open and calving intervals. Estimates based on DHIA information put the level of detected heats at about 50%. In other words, for every heat period detected by a dairy producer, another goes unnoticed. Barr (1) estimated that missed heats were responsible for an additional 40 days open.

Heat Detection Errors

There are basically two types of heat detection errors which can be made on a dairy farm. The first is to not observe a cow that is actually in heat. This is normally referred to as an error in heat detection efficiency (13). Efficiency errors result in an increase in the days in milk at first breeding and days open. However, there is little effect on the overall conception rate of the herd. The second error which can be made, is when a cow is inseminated that is not in heat. This is referred to as an error in accuracy (13). Accuracy errors extend the breeding period similar to efficiency errors, however, the conception rate is also affected because there is little chance that these animals, when inseminated, will conceive. Efficiency problems are more common in most herds. The level of both types of errors are interrelated. Practices that increase efficiency can have a negative effect on accuracy. When making management changes to improve heat detection it is important to consider the effects these management changes will have on both efficiency and accuracy.

Measures of Heat Detection

In order to diagnose or manage a heat detection problem in a herd, you have to develop ways of accurately measuring heat detection efficiency and accuracy. A complete and accurate set of records with the ability to quickly summarize information is the most important component to monitoring heat detection. DHIA records, on-farm computer systems and hand-kept records can provide a number of statistics which can be used to evaluate heat detection. Some of the most common measures used to monitor heat detection efficiency include:

1. DIM at First Breeding. DIM at first breeding is a measure of early heat detection. Evaluation in a herd using this measure is dependent on the length of the postpartum rest period the dairy producer gives the herd. With good heat detection the average days in milk at first breeding should not exceed the rest period by more than 22 days (6). (i.e. rest period = 60 Days, DIM at 1st breeding <= 82 days)

2. Percent Detected Heats (2). Is calculated by the following formula:

Percent Heats Detected = ((Services per Conception X 21) / (Days Open - Voluntary Waiting Period + 10.5)) X 100

This is a very good measure available from DHIA summary information or can be calculated easily from DHI averages. The one disadvantage is that it is calculated using average days open. Average days open is historical in nature and may not represent what is currently happening in the herd. With good heat detection the percent detected heats should be >70%.

3. Breeding intervals. A breeding interval is the number of days between successive breedings. On the average, cows cycle at 21 days intervals. With good heat detection, breeding intervals should average 21 Days. However, because of missed heats, abnormal cycle lengths and a number of other factors a good average breeding interval would be 24-30 days (6,16). The distribution of individual breeding intervals indicating a herd has good heat detection would be as follows (15):

Breeding interval Length	Percent
<18 Days	10-15%
18-24 Days	55-60%
>24 Days	25-30%

4. Percent confirmed on pregnancy check. This is an easy measure to monitor on herds that have regularly scheduled reproductive health checks, because cows are already submitted for pregnancy determination. Cows that are diagnosed open on a pregnancy exam have probably had heat periods missed. The percent of animals confirmed pregnant will be proportional to the heat detection efficiency (5). However, interpretation of this measure depends on how long after breeding cows are submitted for pregnancy determination. Good heat detection should result in 80-85% of the animals found pregnant with 32-40 day pregnancy exams and 90-95% pregnant with 45-60 day exams (15).

5. 24-Day Chart. A 24-day chart is simply a list of all the open, cycling cows in the herd on a given day (5). As cows on this list are noticed in heat over a period of 24 days they are crossed off the list. At the end of the 24 days you can determine the percent detected heats by the following formula:

Percent Detected Heats = (No. of animals cross of list / Total No. on list) X 100

Identifying heat detection accuracy problems can be much more difficult than identifying efficiency problems. No one intends to breed a cow that is not in heat, however this type of error can be a common problem in some herds. A study of 467 dairy herds in the Northeast (11) showed that 30% of herds had a problem with heat detection accuracy. From 10-30% of the cows in these herds were not in heat at the time of insemination. This can have a tremendous effect on conception rate because the conception rate as a result of these inseminations would be 0.

Accuracy errors occur when animals are inseminated based solely on heat detection aids or secondary signs of heat. There are a few indications that your herd may have such a problem. These include a low conception rate, a high percentage of abnormal length estrous cycles not associated with cystic ovaries or the use of prostaglandins, a lack of uterine tone in cows to be bred, and difficulty in passing the pipette through the cervix. Probably the best method to determine if an accuracy problem exists is to use cowside milk progesterone tests on 20 cows submitted for breeding. No more than 1 in 20 should have high progesterone readings at the time of breeding.

There are a number of cow, environmental and people factors that effect heat detection. These are summarized in Table 1. Heat detection programs need to consider all of these factors in order to maximize heat detection efficiency and accuracy.

Table 1: Factors that effect the heat detection (4).

Cow Factors	Environ. Factors	People Factors
Energy Balance	Temperature	Knowledge of Heat Signs
Body Condition	Ventilation	Heat Checks per Day
General Health	Footing	Time of Observations
Repro. Tract	Grouping Strategy	Intensity of Observation
Dystocia		Responsibility for Observation
Ret. Placenta		Reporting of Observation
Involution		
Infection		
Cyst		

Cow Factors

When considering the cow factors that effect heat detection the first question to ask is "Are the cows cycling?". Immediately following calving cows undergo a period of anestrus. The length of this postpartum anestrus period and the subsequent expression of estrus are determined by a number of factors, including the level of milk production, severity of the negative energy balance, calving complications and health problems. Table 2 is a summary of when first ovarian and estrous activity occur in normal cows following calving.

Table 2: Average Days Postpartum When Ovarian and Estrous Activity Occur in Normal Cows (14).

	Days Post Partum		
	When 70% of Cows Have Activity	When 90% of Cows Have Activity	Average for All Cows
Ovarian Activity	32 Days	40 Days	24 Days
First Estrous Activity	50 Days	63 Days	38 Days

Results from routine postpartum examinations and estrus observation can be compared to values in Table 2 to determine if a problem exists in a group of cows. Upon rectal palpation, 90% of the herd should have major palpable structures (follicles or CLs) on the ovaries by 32 days and standing heats reported by 63 days postpartum. In herds where ovarian and estrous activity are delayed, the incidence of postpartum reproductive disorders and the nutritional program need to be considered. Many of the cow factors that affect heat detection can be improved through fine tuning the nutrition of the dry and milking herds and a comprehensive health program for the prevention and early identification of problem cows.

Environmental factors

Two main environmental factors that effect heat detection are temperature and the type surface on which they are housed:

Temperature; Dairy animals in large operations are housed in facilities which leave them more exposed to the elements. Both high and low temperatures can effect heat detection. Warm temperatures (>80°F) shorten the estrus period and reduce the expression of heat, which result in decreased heat detection efficiency (7). Cold temperatures (<0°F) can have similar effects (7). In addition, cold nighttime temperatures can cause a shift to greater estrus expression during warmer daylight hours.

Footing; The type of surface on which cows are housed and observed for heat has an effect on heat detection. Britt et al. (3) compared heat activity of heifers on concrete versus dirt surfaces. The results in Table 3 show that heifers were in heat for a longer period of time and showed more activity on dirt which should allow for increased detection of heats.

Table 3: Estrous activity on dirt versus concrete surfaces. (3)

	Dirt	Concrete
Duration of estrus (hours)	13.8	9.4
Mounts	7.0	3.2
Stands	6.3	2.9

People Factors

Knowledge of heat signs. The visual detection of estrus depends on the herdperson's ability to detect behavioral changes that take place during heat. These changes are highly variable between cows, which make them difficult to evaluate objectively. It is important for observers to have a knowledge of the various visual signs of heat. The decision to breed or not breed a cow is not always a clear one. A cow standing to be mounted is the only definitive sign of heat. All the other behavioral changes we normally associate with heat are considered secondary signs and have greater rates of error when used to determine heat. Good observers also have the ability to judge the significance of various secondary heat signs they observe in order to make an accurate determination of whether to breed. Some of the more common signs of heat and the errors rates associated with their use are shown in Table 4. Error rates can be reduced when more than one secondary sign is used to determine whether a cow is to be inseminated or not.

Table 4: Heat signs and associated accuracy errors (12)

Heat Sign	Percent Error
Standing	2.4
Riding other cows	2.5
Rough tailhead	3.3
Unusually active	4.2
Bawling	4.6
Mucus on the vulva	5.2
Not letting down milk	8.0
Fully triggered detector	0.6
Blood on the vulva	7.6
Partially triggered detector	20.9

Heat checks per day. Many cows are in heat less than 12 hours (9). Two to three 30-minute intensive observation periods per day can enable observers to achieve high rates of efficiency (See Table 5).

Time of observations

Studies have shown that 70% of the mounting behavior occurs at night (9). At least one observation time scheduled in the early morning or late evening, when activity is highest, will increase efficiency. One observation should also be scheduled when most cows are laying down. This will enable the observer to check for abnormal or mucus discharge and metestrus bleeding.

Intensity of observations

Intensity of observations has to do with the responsibilities of the observer while heat detecting. Good heat detection requires the undivided attention of the observer. Mounts normally last about 7 seconds (9). This means that observers performing other chores such as feeding, scraping alleys and moving cows, while detecting heats, are more likely to miss brief mounts. Feeding has been shown to reduce mounting activity because estrus animals become more interested in eating than mounting other animals. Estrus activity increases when more than one animal is in heat at the same time (8,9). The number of mounts can increase by more than 300% when two animals are in heat. Intensity of observation can also be increased when estrus animals are left with the herd to stimulate activity in others. Responsibility for observation. On most farms, everyone that comes in contact with the animals is expected to watch for heat. But when the primary responsibility for heat detection and recordkeeping is placed on one individual, there is less confusion and the job is more likely to get done.

Reporting of observation. Accurate records are essential in a large operation. They eliminate confusion and can be used to help observers anticipate future heat periods.

Heat Detection Aids

A number of heat detection aids have been developed to improve heat detection efficiency and eliminate the subjectivity associated with observation. It is important to note that there is no replacement for good observation. Best results are achieved when heat detection aids are used to supplement, not eliminate observation. Examples of the heat detection efficiency rates which can be expected using various methods and aids are shown in Table 5.

Table 5: Heat detection rates using various methods.

Heat Detection Method	% Detected
Watched 24 hours per day	89
KaMaR heat mount detectors	87
Visual observation - 3X(Dawn, Noon Evening)	86
Continuous videotape	81
Visual observation - 2X(Dawn, Evening)	81
Marker animals	75
Chalked tail heads	71
Two trained dairymen (at milking)	50
Herdsman (at milking)	50
Casual observation	43

Adapted from Grusenmeyer et al. (6)

Tailhead chalk and heat mount detectors

As can be seen in Table 6, the use of tailhead chalk or heat mount detectors can substantially increase heat detection efficiency over more casual methods of heat detection. However, use of these aids can result in an increase in accuracy errors if animals are bred solely based on the aid. Successful individuals will use triggered aids to call additional attention to animals which need closer observation and will based their decision to breed on the additional secondary signs that are noticed.

Marker animals

Deviated or vasectomized bulls, cystic cows and androgenized steers, cows and heifers can be effective methods to increase heat detection efficiency. The introduction of a sexually active animal into a group of cycling females will increase estrus activity. Some of the disadvantages of marker animals are that marker animals tend to get fat on a lactating cow ration and they occupy space which could be used for an additional lactating cow. When marker animals are used there should be one marker per 40-50 cycling females.

Electronic monitoring.

Computerized milking systems have spawned a number of electronic monitoring devices which can be used to aid heat detection. These include the electronic monitoring of individual milk weights and measuring animal activity with the use of pedometers. When a cow comes into heat, milk production will drop slightly below normal levels (9). Most milk recording systems will store a running average of daily milk production and allow the printing of a list of those cows that on a given day produce significantly below this running average. Such lists can aid in heat detection, however there are number of reasons other than heat which can cause a drop in daily milk production. Research results using pedometers indicate that activity will increase an average of 380% on the day of estrus (10). This makes activity readings an excellent indicator of heat. However, there are questions concerning the cost and reliability of many of the systems available today.

Synchronization

Estrous synchronization with prostaglandins can be used to develop a whole herd program to increase heat detection efficiency. The most familiar of these whole herd programs is the "Monday Morning Program". With this program, healthy cows that have received an adequate rest period following calving are treated with prostaglandins on Monday morning. Cows in the proper stage of the cycle will respond to the treatment and are bred when observed in heat. Heat normally occurs 2-5 days following treatment. Cows that do not respond are reinjected each Monday until they respond or a problem is diagnosed. This type of synchronization program can result in a dramatic improvement in heat detection and reproductive performance. Heat detection improves as a result of prostaglandin use because there is a an increased probability that the treated cow will be in heat in 2-5 days following treatment. Highest conception rates can be achieved when cows are inseminated based on standing heat. These programs require that cows be healthy and cycling normally prior to treatment. Accurate records are needed to avoid abortions, and prostaglandins can only be obtained through a licensed veterinarian. For these reasons it is important to consult with your veterinarian to prior to starting any synchronization program.

Summary

There are a number of factors that influence the heat detection in a herd. Visual observation is a necessary part of any heat detection program. Each dairy farm must develop a program that reduces heat detection errors and must be particularly suited for their facilities, recordkeeping system, management, personnel and daily schedule.

REFERENCES

1. Barr, H.L. 1975. Influence of estrus detection on days open in dairy herds. J. Dairy Sci. 58:246-247.

2. Britt, J.H 1982. Measures of reproductive efficiency Invitational Dairy Cattle Reproduction Workshop, Louisville, Kentucky. April 13-15 1982, pp. 63-68

3. Britt, J.H. and R.G. Scott, J D. Armstrong and M D. Whitacre. 1986 Determinants of estrous behavior in lactating holstein cows. J. Dairy Sci. 69:2195-2202.

4. Ferguson J. 1991. Detecting reproductive opportunities Pro-Dairy Dairy Records Management Cornell Cooperative Extension. Animal Science Mimeo 144. p. 13.

5. Fuhrmann, T.J., D.V. Armstrong and O G Lough 1984 Routine fertility examinations as part of a reproductive dairy herd health program. Western Regional Extension Publication #70 pp. 1-10

6. Grusenmeyer, D., J. Hillers and G Williams. 1983 Evaluating reproductive status using DHI records. Western Regional Extension Publication #67 pp 1-14.

7. Gwazdauskas, F.C. 1985. Effect of climate on reproduction in cattle J Dairy Sci. 68:1568-1578.

8. Helmer, S D. and J.H. Britt. 1985. Mounting behavior as affected by stage of estrous cycle in holstein heifers. J. Dairy Sci. 68:1290-1296

9. Hurnik, J.F., G.J. King and H.A. Robertson. 1975. Estrous and related behavior in postpartum dairy cows. Appl. Anim Ethol. 2:55-68.

10. Kiddy, C.A. 1977. Variation in physical activity as an indicator of estrus in dairy cows. J. Dairy Sci. 60:235-243.

11. Reimers, T.J., S.K. Newman, R.G. Cowan, R.D Smith, D.H. Lein and T.R. Rounsville. 1981. Survey of estrus detection and early pregnancy rates in dairy cows of the Northeast. J. Anim. Sci. 53:361 Supplement 1.

12. Reimers, T.J., R.D. Smith and S.K. Newman. 1985. Management factors affecting reproductive performance of dairy cows in the Northeastern United States. J. Dairy Sci. 68:963-972.

13. Smith, R.D. 1982. Estrus Detection - Failure, accuracy and aids. Proceedings of National Invitational Dairy Cattle Workshop. Louisville, Kentucky. April 13-15 1982, pp. 19-30

14. Varner, M.A. Anestrus and estrous detection aids - IRM-7. In: Dairy Integrated Reproductive Management Manual. editor E. Jordan. West Virgina University.

15. Williamson, N. 1983. Improving heat detection. Dairy Herd Mgmt. 20 June 1983 pp 26-33

NOTES