Theriogenology Insight: 5(2): 125-133, August, 2015
DOI Number: 10.5958/2277-3371.2015.00013.3

Heat (Estrus) Detection Techniques in Dairy Farms- A Review

Nagappa Banuvalli, M. Harisha*, P.M. Gururaj, B.U. Umesh, B.G VeerannaGowda and G.T. Gopala

Veterinary College, Vinobanagar, Shivamogga-577204, Bangalore, India.

**Corresponding author: harisham618@gmail.com*

ABSTRACT

Dairy producers who achieve reasonably good pregnancy rates in dairy animals are always benefited from improved heat detection. Proper heat detection is to know the appropriate timing of insemination is the biggest constraint in attaining high conception rate in a herd. Boosting heat detection rates by 10 to 20 percentage points could be invaluable to increasing your herd's pregnancy rates. Traditional heat detection methods involve visual observation of sexual behavior displayed by the cows. Accuracy of visual observation varies according to the expertise of farm personnel, frequency of observation, housing and footing conditions, and milk production levels. The challenge of an excellent heat detection program is not only identifying animals in correct estrus (accuracy), but also not missing any heat activity displayed (efficiency). Generally, well trained farm personnel are quite accurate in identifying the cows in heat, but lack of efficiency of observing all possible cows in heat is the limiting factor. Therefore aids/techniques of heat detection along with visual observation for improving efficiency of heat detection in turn it can give better results in the form productivity in the dairy farms.

Keywords: Estrus detection, Techniques, Dairy farms, Heat

The most important limiting factor in artificial animal reproduction is the improper detection of cows or heifers in estrus. Estrus or "heat" is that period of time that occurs every 18 to 24 days in sexually mature, non pregnant female when they are receptive to mounting activity by bulls or other cows. In beef cattle or dairy animals where artificial insemination is the main means of breeding the females,

the herdsman must recognize and interpret a cow's heat signs. Proper timing of the artificial insemination is necessary to accomplish a high percentage of conceptions in the dairy animals.

Estrus detection directly affects calving interval and milk production and thus it can significantly increase the profits of a dairy farm (Pecsok *et al*., 1994). The traditional form of estrus detection has been visual observation; however, this method is tedious and incurs high labour costs. Several methods have been used to facilitate detection of estrus; these methods have focused on physical (Kiddy, 1977; Liu and Spahr, 1993), behavioral (Dinsmore and Cattell, 1993; Gwazdauskas, *et al.,* 1990), and physiological (Carter and Duffy, 1980, Ezov *et al.,* 1990; Pankowski *et al.,* 1995) signs that are associated with estrus. Among the signs linked with estrus in dairy cows, standing to be mounted is the most reliable indicator of estrus (Glencross, *et al.,* 1981; Sprecher *et al.,* 1995). Aids such as chalking the tailhead and chin ball markers have been used in the past to detect this estrus behavior (Halsey, 1978). More recently, heatmount detectors (HMD) have become more popular for the detection of estrus (Dinsmore and Cattell, 1993; Piggott *et al.,* 1996). Another sign commonly associated with estrus is an increase in physical activity and cows housed in free-stall barns may be four times as active during standing estrus than at other times (Kiddy, 1977). Pedometers have been used to study physical activity and thereby determine the time of estrus (Liu and Spahr, 1993) and predict optimal time of insemination (Maatje *et al.,* 1997).

Heat Detection Efficiency

Heat detection efficiency (rate) is defined as the percentage of eligible cows that are actually seen or detected in heat. Several methods of calculating the efficiency with which heat is detected are available. A detection rate of 80 to 85 per cent can be achievable. The detection rate can be measured by the 24-Day Heat Detection Rate Test, which is a test that the producer can implement to self-evaluate the heat detection efficiency (or inefficiency).

In order, to include cows in the test, cows should have the heat cycles at least 30 days post-calving for dairy or 50 days post-calving for beef cows and cows should be free of reproductive disorders such as cystic ovaries, pyometra or other reproductive tract infections and should be non pregnant. What is wanted is a group of cows which are most likely to display estrus signs in the next 24 days. Some of these cows will in fact be serviced during this interval will be excluded from the next heat detection. This fact alone is considered a major cause of heat detection inefficiency.

Importance of Heat Detection: he heat detection is important for improving reproductive efficiency, shortening calving interval and to increase conception rate among dairy animals.

Heat detection technologies

The heat detection technologies which can be used in a dairy farm as follows.

Teaser Bull

Vasectomised bulls incapable of breeding a cow can aid in heat detection. Teaser bulls are routinely used in dairy farms, where heat detection rates are as high as 84 per cent have been reported.

Visual observation

Visual observation is a commonly used method of heat detection. It involves a trained personnel's' recognizing and recording the signs of heat in animals. Observable signs of heat include mounting or attempting to mount other cattle, standing to be mounted by other cattle, smelling other females, trailing other females, bellowing, depressed appetite, nervous and excitable behavior, mud on hindquarters and sides of cattle, roughed up tail hair, vulva swelling and reddening, clear vaginal mucous discharge and mucous smeared on rump. The surest sign of heat is when a cow or heifer allows other cattle to mount on her while she remains standing. This is called standing heat. Cattle may be willing to mount others but may not stand to be mounted when animal is not in standing heat. This usually indicates that cow is either coming into or going out of standing heat. This method requires observation of cows at least twice daily, typically early in the morning and late in the evening for best results. More frequent observation of a cow for heat improves the heat detection accuracy and increases the likelihood of recognizing the optimal time for breeding cows, particularly in cows in which heat is less intense or shorter in duration. Nearly 20 per cent more cows will be observed in heat when checked four times per day than checking twice daily. Check cows as often as practical/possible. Space heat detection observation times evenly over 24 hours. Each observation period must be sufficiently long, usually at least 30 minutes to be effective. Standing heat can occur any time in a 24-hour period. However, the most likely time for a cow or heifer to show heat signs is at night. The different season of the year can influence this, with more cows showing heat at night in hot weather and more showing heat during the day in cold weather. Housing conditions can also have an effect on the distribution of heat during a

24- hour period. Hot weather, high production, crowded conditions and high stress environments may reduce mounting activity. Observers must distinguish among cows coming into heat, cows in standing heat and going out of heat. Females that are in standing heat, were in standing heat yesterday or will be in standing heat tomorrow are the most likely herd mates to mount on other cows or heifers in heat. Observe cows away from the feed bunk so that feeding behavior does not interfere with heat detection. Cows need nonslip footing and ample room to interact freely. Dirt footing increases mounting and standing activity more than that of concrete footing (Jane et al 2010).

Record keeping

Good recordkeeping is an essential part of good herd management and is a very economical method in aiding estrus detection. By accurately recording the animal number, dates in standing estrus and dates inseminated (naturally or artificially), one can anticipate the next standing estrus for each cow. Furthermore, a good recordkeeping makes it possible to know when animals are bred and to which bull allowing for better overall farm management.

Detection aids

A wide variety of heat detection devices/aids are available, ranging considerably in both price and effectiveness. The following aids are used to detect animals in heat.

Marking crayons

Marking crayons are used on the rump of the cow and then it will be smeared if the cow is ridden.

Tail painting

Tail-painting is a cheap and effective method to detect estrus. In this case, oil or water based paints are applied on to the back of a cow's spine where most oftenly rubbed by the brisket of the mounting companion cow. (Van Eerdenburg *et al.,* 2006).

Chin-ball markers

Bulls, steers and even hormone treated cows can be used as marker animals and these has to be fitted with a chin ball marking device, when these animals mounts on animal in estrus the chin presses down on the back or rump of the cow, then a

spring in the device is depressed and the marker fluid is released and the mark can be seen on the rump or back of the animal. Marker bulls have been employed in the detection of estrus, having first been renderd incapable of inseminating, cows by vasectomy, deviation of the penis or fixing the penis within the sheath. All these which would not lessen the bulls libido but render him sterile but this method have some disadvantages like the cost of the operation and the possible risk of spreading venereal disease.

Temperature Measurement

The temperature of a cow changes during the estrus cycle. Just before the estrus the temperature becomes lower. During the day of the heat the temperature will be high and only to drop again during ovulation. In the luteal phase the temperature is high again (Brenn *et al.,* 1958). However, this fact is difficult to put into use. To adequately use this information, a baseline data of each cow needs to be present. This means every cow's temperature needs to be taken at least once a day to make any predictions about oestrus detection. A system which has been in use for several years is the ALT-pedometer. In this system the activity, lying time and temperature are all used to come to a conclusion that the cow is in estrus (Brehme *et al.,* 2008).

Progesterone test

Progesterone concentrations fluctuate during the oestrous cycle but are low in the days around the time of heat. Therefore the measurement of milk progesterone has been used to assess the heat. Progesterone testing kits are available and routinely used by veterinary practitioners as a part of herd fertility programmes. Biochemical sensors for measuring milk progesterone concentrations in the line in milking parlours are currently being developed. These should allow the development of action lists of non-cycling cows and cows likely to be in heat. (Clay comb and Delwiche, 1998).

Pedometers

These devices are attached to the leg of a cow to monitor the activity. Since cows in heat are generally more restless than usual the pedometer will pick up increased activity compared to the average for that cow and the herd as a whole on a particular day, indicating possibility of animals in heats. (J. Rodenberg and B. Murray, 2007)

Kamar heat mount detector

These devices are glued to the hair over the midline just in front of the tail-head. Pressure from a mounting animal squeezes dye from a reservoir so that a color change is visible to the observer. A triggered device on the cow indicates that it has been mounted and may be in estrus.

((http://kamarinc.com)

Activity Meter: Neck Mounted tag

The activity tag sends its data via radio frequency linked on 24 hour schedule via antenna to the main processor and the data is continuously updated. The processor does the analysis per individual cow and takes into account of the individual animal. The activity meter system delivers accurate heat alarm and start time for the heat. The high activity alarm reports printed automatically before each milking session. If the cow is pregnant then the tag is removed and stored or to be mounted to another non pregnant cow. (Taras and S.L.Spahr, 2007)

Close Circuit Televisions

Close circuit television cameras can be set to scan above cow height, so that they are triggered only when there is mounting activity. Alternatively, passive Infra Red detectors can be used to automatic switch on the camera. The waves are transferred to the antenna and from that the waves are again transferred to main computer. Night activities can be played back at high speed and the action slowed or frozen to identify the cows which are displaying estrus activity. (J.S.Stevenson, 2000).

Altered vocalization rate

The calls of female animals can contain information about reproductive status. It is also suspected that the vocalizations of cattle contain information about age, sex, dominance status, and stage of estrus cycle. In this method a continuous automatic recording of vocalization of animals during the periestrus period is recorded. Increased vocalization was correlated with the visual observation of estrus by farm personnel. This method of automatically detecting the rate of cattle vocalization could be used solely or in combination with the other automated systems for detecting the estrus and could considerably increase the current estrus detection rates once its applicability can be demonstrated in non tethered cattle. (P. C. Schon *et al.,* 2007)

Heat watch system

The Heat Watch System consisted of pressure-sensitive radio transmitters, a radio receiver unit, a buffer unit, and the software, which updates the status of each cow enlisted in the program. The transmitters were housed in a burlap or polyester pouches with an attached strap; the pouch was attached to the trailhead of the animal and the strap was secured to the tail. Transmitters sent a radio signal to the receiver when the cow was mounted (Heatwatch, 1992). The receiver detected signals within a 1200 mtr radius and send the signal to the buffer unit where the time and date were stamped electronically and the signal was stored until the Heat Watch program was accessed on a personal computer (Heatwatch, 1992). The program summarizes the data in the form of lists, tables and graphs including the information about the cows confirmed as being in estrus, suspected of being in estrus and with brief cycles. Furthermore, the software contained a mount data log, which recorded each mount by time, date, cow number, transmitter number, duration of mount and signal strength (from 0 to 7). In addition, there was a daily supervisory check feature that reports the status of all transmitters. Cows will be classified in to any of the following lists according to default system parameters: estrus list, suspected estrus list, non return list, brief cycle list and inactive list. For example, if any cow is receiving three or more mounts within 4 h was diagnosed as being in estrus and was therefore placed on the estrus list. Those cows receiving one or two mounts within a 4-h period were placed on the suspected estrus list. Cows not having at least three mounts within a 4-h period in the last 25 d were placed on the non return list, and those placed more than once in a 13-d period on the estrus list were listed on the brief cycle list. Cows that had been enrolled for at least 25 d and had not had a qualifying estrus were placed on the inactive list.

Showheat

Showheat is also a mounting detection system. It functions with one light, which activates when the cow is mounted three times. The light flashes in a series of 12 seconds. When the light flashes once in a series, the standing heat has been going on for two hours. With every flash in the series, another 2 hours are added till a maximum of 18 hours is reached after the onset of estrus. With this system, the optimum moment of insemination can be calculated. It is a system that does not require any additional hardware and is location-independent and is easy in use. The downside is that the amount of time per cow is quite high because of the interpretation and the necessity of checking the animals at least twice a day. (Rorie *et al.,* 2002).

Conclusion

The only definitive behavioral sign of estrus is that the cow will stand to be mounted by other cow or the bull. Currently available aids to estrus detection are not alternatives to careful & frequent observation, backed up by good records & clear identification. In this commercialized world with large dairy farms electronic estrus detection aids are of at most importance. The heat detection aids will enhance the reproduction rates in the dairy farms.

References

At-Taras, E. E. and Spahr. S. L. 2007. Detection and characterization of estrus in dairy cattle with an electronic heat mount detector and an electronic activity tag. *J. Dairy Sci.,* **84**: 792-798.

Brehme, U., Stollberg, U., Holz, R. and Schleusener, T. 2008. ALT pedometer-New sensor aided measurement system for improvement in oestrus detection. *Computers and Electronics in Agriculture*., **62**: 73-80.

Brenn, T. R., Bitman, J. and Sykes, J. F. 1958. Body temperature variations in dairy cattle during the estrous cycle and pregnancy. *Journal of Dairy Science*, **41**: 1071-1076.

Carter, P. D. and Dufty, J. H. 1980. Assessment of vaginal impedance measurements as an indicator of oestrus in cattle. *Austr. Vet. J.*, **56**:321–323.

Claycomb, R. W. and Delwiche, M. J. 1998. Biosensor for on-line measurement of bovine progesterone during milking. *J. Dairy Science*., **81**: 2890-2896.

Dinsmore, R. P. and Cattell, M. B. 1993. Field trial of a radio telemetry estrus detection system. *J. Dairy Sci.* **76**(Suppl. 1):227 (Abstr.).

Ezov, N., Maltz, E., Yarum, R., Lewis, G. S., Schindler, D., Ron, M., Aizinbud, E. and Lehrer, A. R. 1990. Cell density, fluid volume and electrolyte content of bovine vulvar tissue during oestrus and di-oestrus. *Anim. Reprod. Sci.* **22**:281–288.

Glencross, R. G., Esslemont, R. J., Bryant, M. J. and Pope, G. S. 1981. Relationships between the incidence of preovulatory behaviour and the concentration of oestradiol-17β and progesterone in bovine plasma. *Appl. Anim. Ethol.* **7**:141–148.

Gwazdauskas, F. C., Nebel, R. L., Sprecher, D. J., Whittier, W. D. and McGilliard, M. L. 1990. Effectiveness of rump-mounted devices and androgenized females for detection of estrus in dairy cattle. *J. Dairy Sci.* **73**: 2965–2970.

Halsey, D. 1978. Every morning Ed Fletcher locks ‘emup and chalks‘em. Dairy Herd Mgt. 15:

Heat Watch User’s Manual. 1992. ABS Global, De Forest, WI. P. 4.5, 4.8.

Hurnick, J. F., Webster, A. B. and DeBoer, S. 1985. An investigation of skin temperature differentials in relation to estrus in dairy cattle using a thermal infrared scanning technique. *J. Anim Sci.* **61**: 1095-1102.

Rodenburg, J. and Murray, B. 2007. Pedometry to Improve Reproduction. Order No. 07-071 AGDEX 410/20.

Jane, A. P., Jamie, E. L. and Rhonda C. V. 2010. Estrus (Heat) detection in cattle. Mississippi state university extension service.

Kiddy, C. A. 1977. Variation in physical activity as an indication of estrus in dairy cows. *J. Dairy Sci.* **60**:235–243.

Liu, X. and Spahr, S. L. 1993. Automated electronic activity measurement for detection of estrus in dairy cattle. *J. Dairy Sci.* **76**: 2906–2912.

Maatje, K., Loeffler, S. H. and Engel, B. 1997. Predicting optimal time of insemination in cows that show visual signs of estrus by estimating onset of estrus with pedometers. *J. Dairy Sci.* **80**:1098–1105.

Schon, P. C., Hamel, K., Puppe, B., Tuchscherer, A., Kanitz, W. and Manteuffel, G. 2007. Altered Vocalization Rate during the estrus Cycle in Dairy Cattle. *J. Dairy Sci.* **90**: 202–206.

Pankowski, J. W., Galton, D. M., Erb, H. N., Guard, C. L. and Grohn, Y. T. 1995. Use of prostaglandin f2α as a postpartum reproductive management tool for lactating diary cows. *J. Dairy Sci.* **78**: 1477–1488.

Pecsok, S. R., McGilliard, M. L. and Nebel, R. L. 1994. Conception rates. 1. Derivation and estimates for effects of estrus detection on cow profitability. *J. Dairy Sci.* **77**: 3008–3015.

Piggott, S. M., Fitkin, D. R., Steffen, A. J. and Timms, L. L. 1996. Evaluation of accuracy and characterization of estrus activity as monitored by an electronic pressure sensing system for estrus detection in dairy cows and heifers. *J. Anim. Sci.* **74**(Suppl.1):70. (Abstr.)

Rorie, R. W., Bilby, T. R. and Lester, T. D. 2002. Application of electronic estrus detection technologies to reproductive management of cattle. *Theriogenology*. **57**:137-148.

Sprecher, D. J., Farmer, J. A., Neel, R. L. and Mather, E. C. 1995. The educational implications of reproductive problems identified during investigations at Michigan dairy farms. *Theriogenology*, **43**:373–380.

Stevenson, J.S. 2000. A review of estrus behavior and detection in dairy cows. Anim.Sci (in press).

Van Eerdenburg, F. J. C. M. 2006. Estrus detection in Dairy Cattle: How to beat the bull. Vlaams Diergeneeskundig Tijdschrift **75**: 61-69.

Kamar heatmount detectors. www.kamarinc.com, accessed: 15-6-2014