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Kentucky Dairy Notes

February 2009

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Precision Dairy Farming

What is Precision Dairy Farming?

Precision Dairy Farming is the use of technologies to measure physiological, behavioral, and production indicators on individual animals to improve management strategies and farm performance. The trend toward group management may be reversed with Precision Dairy Farming as the focus returns to individual cows through the use of technologies. Technologies included within Precision Dairy Farming range in complexity from daily milk yield recording to measurement of specific attributes (such as fat content or progesterone) from milk samples taken at each milking. The main objectives of Precision Dairy Farming are maximizing individual animal potential, early detection of disease, and minimizing the use of medication through preventive health measures.

Potential Benefits of Precision Dairy Farming

Benefits thought to come from Precision Dairy Farming technologies include increased efficiency, reduced costs, improved product quality, minimized adverse environmental impacts, and improved animal health and well-being. These technologies are likely to have the greatest impact in the areas of health, reproduction, and quality control. Benefits realized from summarizing data and reporting exceptions are anticipated to be higher for larger herds, where individual animal observation is more challenging and less likely to occur. As dairy operations continue to increase in size, Precision Dairy Farming technologies become more feasible because of increased reliance on less skilled labor and the ability to take advantage of economies of size related to adoption of technology.

A Precision Dairy Farming technology allows dairy producers to make more timely and informed decisions, resulting in improved productivity and profitability. Real time data can be used to monitor animals and create exception reports to identify meaningful deviations from the normal pattern. In many cases, dairy management and control activities can be automated. Alternatively, output from the system may provide a recommendation for the manager to interpret. Information obtained from Precision Dairy Farming technologies is only useful if it is interpreted and used effectively in decision making. Integrated, computerized information systems are essential for interpreting the mass quantities of data obtained from Precision

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Dairy Farming technologies. This information may be incorporated into decision support systems designed to facilitate decision making for issues that require compilation of multiple sources of data.

Historically, dairy producers have used experience and judgment to identify animals that were unusual. While this skill is invaluable and can never be fully replaced with automated technologies, it is inherently flawed by limitations of human perception of a cow's condition. Often, by the time an animal exhibits clinical signs of stress or illness, it is too late to intervene. These easily observable clinical symptoms are typically preceded by physiological responses not obvious to the human eye (e.g. changes in temperature or heart rate). Thus, by identifying changes in physiological parameters, a dairy manager may be able to intervene sooner. Technologies for physiological monitoring of dairy cows have great potential to supplement the observations of skilled herdspeople, which is especially critical as more cows are managed by fewer skilled workers.

Current Status of Precision Dairy Farming

The list of Precision Dairy Farming technologies used for animal status monitoring and management continues to grow. Because of rapid development of new technologies and supporting applications, Precision Dairy Farming technologies are increasingly more feasible. Many Precision Dairy Farming technologies are already being utilized by dairy producers: 1) daily milk yield recording, 2) milk component monitoring (e.g. fat, protein, and SCC), 3) pedometers, 4) automatic temperature recording devices, 5) milk conductivity indicators, 6) automatic estrus detection monitors, and 7) daily body weight measurements. Other theoretical Precision Dairy Farming technologies have been proposed to measure jaw movements, ruminal pH, reticular contractions, heart rate, animal positioning and activity, vaginal mucus electrical resistance, feeding behavior, lying behavior, odor, glucose, acoustics, progesterone, individual milk components, color (as an indicator of cleanliness), and respiration rates. Many Precision Dairy Farming technologies measure variables that could be measured manually, while the remaining technologies measure variables that could not have been obtained previously.

Despite widespread availability, adoption of these technologies in the dairy industry has been relatively slow thus

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far. In fact, agricultural adoption of on-farm software packages, as a whole, has been much lower than predicted. The majority of information management systems available and utilized by many dairy producers have analytical capabilities that are underutilized. In practicality, their use is often limited to creating production tables, attention lists, and working schedules. Perceived economic returns from investing in a new technology are likely the main factor influencing Precision Dairy Farming technology adoption. Additional factors impacting technology adoption include degree of impact on resources used in the production process, level of management needed to implement the technology, risk associated with the technology, institutional constraints, producer goals and motivations, and having an interest in a specific technology. The most progressive producers will adopt those new technologies that appear to be profitable. When a proven technology is not adopted, the operation observes a lost opportunity cost that may lead to a competitive disadvantage.

Though Precision Dairy Farming is in its infancy, new Precision Dairy Farming technologies are introduced to the market each year. As new technologies are developed in other industries, engineers and animal scientists find applications within the dairy industry. More importantly, as these technologies are widely adopted in larger industries, such as the automobile or personal computing industries, the costs of the base technologies decrease making them more economically feasible for dairy farms. Before investing in a new technology, a formal investment analysis should be conducted to make sure that the technology is right for your farm's needs. In the future, Precision Dairy Farming technologies may change the way you manage your dairy herd. Certainly, the potential is exciting!

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The Influence of Herdmates on Heat Detection

University of Kentucky researchers studied heat detection in detail several years ago. For three years we had dairy cows under 24 hour surveillance from the time they calved until they were pregnant again, using time lapse video recordings. One interesting part of this research was studying the influence of a cow's reproductive status on how she will interact with a cow in heat.

It is common knowledge more interaction occurs if two or more cows are in heat at the same time. We wanted to know how much more interaction? We also wanted the answers to other questions. What is the chance a pregnant cow will interact with a cow in heat? Does the stage of the estrous cycle influence the chance a cow will interact with a cow in heat? This research did yield some answers, and the results are summarized in the table.

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Influence of stage of estrous cycle on the percent chance a herdmate will mount a cow in heat		
Herdmate's Stage of Cycle	Number of Observations	% Chance the Herdmate Will Mount a Cow in Heat
Herdmates with ovarian cycles, but not seen in standing heat		
Estrous Cycle Day ^a		
-1 to 1	34	32
2 to 10	58	13
11 to 19	62	16
Herdmates which had been seen in standing heat		
Estrous Cycle Day ^a		
-1 to 1	91	62
2 to 10	82	25
11 to 19	68	5
Pregnant Herdmates		
	101	12

^aDay of standing heat or lowest milk progesterone is day zero.

The herdmate's reproductive status does influence the chance she will interact with a cow in heat. If a cow is in standing heat or was in heat yesterday or will be in heat tomorrow, she is the most likely herdmate (62% chance) to mount a cow in standing heat. If a cow is cycling but has not had a standing heat since calving and her ovarian cycle is in the same stage as cow in heat \pm one day, she is the second most likely herdmate (32% chance) to mount a cow in standing heat. A cow who has been in standing heat and is in the first half of her estrous cycle (days 2 to 10) is more likely to mount a cow in heat than a cow who is in the second half of her cycle (days 11-19, 25 vs. 5% chance). Pregnant cows and cows which have not been seen in heat since calving and are

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on ovarian cycle days 2 through 19 are not very interested in mounting a herdmate in heat.

Practical implications of this research

These results show the percentage of cows detected in heat is influenced by the varying percentage of herdmates who are near or in heat, pregnant, in the first half of their cycle, in the last half of their cycle, in postpartum anestrus, etc. The number of herdmates or "groupmates" in these reproductive states is influenced by herd size, number of groups per herd and seasonal breeding. Heat detection should always receive high priority. The practical implication is if groups/herds are small or a small percentage of the group is "sexually active", heat detection becomes an even more difficult job and deserves increased attention by management.

Another extremely practical application of this information relates to artificial insemination of heifers. If you are breeding a group of 10 to 15 heifers, it usually is not a problem to get all but two or three "stragglers" pregnant. With a high percent of the group pregnant, the chance you will catch the remaining heifers in heat decreases. One must realize that over time the effort devoted to heat detection with the same group of heifers must increase not decrease. A helpful management practice is to place the two or three open heifers with a younger group of non-pregnant cycling heifers.

Synchronizing estrus is a good way to get heifers and cows to come in heat at about the same time. Many synchronization methods are available.

Utilizing an androgenized animal involves having an animal in the herd which has been given male hormones. This animal is always interested in interacting with cows in heat which improves the chance of catching a cow in heat. This technique has worked well in many herds.

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Mark Your Calendars!

Kentucky Dairy Partners Meeting

The second annual Kentucky Dairy Partners Meeting will be held March 3 & 4, 2009. This event will be held at the Cave City Convention Center again this year. Registration will be \$25 per person and all registrations will be taken at the door. Dairy farmers do receive free registration courtesy of the Kentucky Dairy Development Council.

There will be exhibits and lots more for everyone involved or interested in the dairy industry. This event is brought to you by the Kentucky Dairy Development Council, Kentucky American Dairy Association/SUDIA, Kentucky Department of Agriculture and the University of Kentucky. Please watch for more information about this dairy event.

Kentuckiana Dairy Exchange Trip

The Kentucky- Indiana Dairy farmer exchange trip will be July 28 & 29, 2009. This year Kentucky dairy farmers will be travelling to Indiana to visit with dairy farmers and exchange ideas. For more information contact Dr. Jeffrey Bewley.

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