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An assessment of producer precision dairy farming technology use, prepurchase considerations, and usefulness

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ABSTRACT

An online survey to identify producer precision dairy farming technology perception was distributed in March 2013 through web links sent to dairy producers through written publications and e-mail. Responses were collected in May 2013 and 109 surveys were used in statistical analysis. Producers were asked to select parameters monitored by technologies on their farm from a predetermined list and 68.8% of respondents indicated technology use on their dairies (31.2% of producers not using technologies). Daily milk yield (52.3%), cow activity (41.3%), and mastitis (25.7%) were selected most frequently. Producers were also asked to score the same list of parameters on usefulness using a 5-point scale (1 = not useful and 5 = useful). Producers indicated (mean ± SE) mastitis (4.77 ± 0.47), standing estrus (4.75 ± 0.55), and daily milk yield (4.72 ± 0.62) to be most useful. Producers were asked to score considerations taken before deciding to purchase a precision dairy farming technology from a predetermined list (1 = not important and 5 = important). Producers indicated benefit-to-cost ratio (4.57 ± 0.66), total investment cost (4.28 ± 0.83), and simplicity and ease of use (4.26 ± 0.75) to be most important when deciding whether to implement a technology. Producers were categorized based on technology use (using technology vs. not using technology) and differed significantly across technology usefulness scores, daily milk yield (using technologies: 4.83 ± 0.07 vs. not using technologies: 4.50 ± 0.10), and standing estrus (using technologies: 4.68 ± 0.06 vs. not using technologies: 4.91 ± 0.09). The same categories were used to evaluate technology use effect on prepurchase technology selection criteria and availability of local support (using technologies: 4.25 ± 0.11 vs. not using technologies: 3.82 ± 0.16) differed significantly. Producer perception of technology remains relatively unknown to manufacturers. Using this data, technology manufacturers may better design and market technologies to producer need.

Key words: producer perception, survey, parameter, precision dairy farming technology

INTRODUCTION

Precision dairy farming has been defined as, "the use of information and communication technologies for improved control of fine-scale animal and physical resource variability to optimize economic, social, and environmental dairy farm performance" (Eastwood et al., 2012). Parameters monitored by these technologies include daily milk yield, milk components, step number, temperature (in various places and forms on and within the cow), milk conductivity, automatic estrus-detection monitors, and daily BW measurements (Bewley, 2010). In addition to the parameters already monitored, many other parameters have also been proposed. Proposed parameters include 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), infrared udder surface temperatures, and respiration rates (Bewley, 2010). Through the use of precision dairy farming technologies, producers strive to improve farm performance. Technology use becomes important as dairy farmers refine their management practices with emphasis on farm efficiency (El-Osta and Morehart, 2000).

The decision to purchase and implement a precision dairy technology represents a significant investment for a producer, who often faces the challenge of choosing a technology that will serve their needs for several years. Dairy producers tend to plan for the long-term consequences of their decisions, mapping responses to a series of long-term occurrences (Boehlje and Schiek, 1998), and in making decisions must account for many different factors, such as financial scale, demographic, and other considerations (Khanal et al., 2010). The effect of an unproductive investment could be severely detrimental to a dairy farmer and, accordingly, investments are approached with caution. In contrast, decisions may not always be as predictable, as advice and direction is drawn from many sources

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in making management decisions. Trained professionals (i.e., veterinarians, nutritionists, consultants, extension specialists, and so on), family members, other dairy farmers, written publications, and even gut feeling may be considered in the decision-making process (Russell and Bewley, 2013).

As precision dairy farming technologies have evolved, new parameters and monitoring methods have been created. As a result, dairy farmers encounter many choices in the type of precision dairy farming technology they may implement and many dairy farmers are simply unaware of the technologies currently available to them (Russell and Bewley, 2013). Systems are available for monitoring animal activity, rumination, resting time, temperature, and many other events associated with animal well-being (Nebel, 2013), but little is understood concerning producer technology adoption, perception of individual technologies, or opinion of the parameters they measure. Gathered information is limited to technologies used in or around dairy parlors (Jago et al., 2013). Producers implementing technologies experience increased financial opportunity, and understanding the process by which producers become aware of and adopt new technologies is of interest to the private sector, researchers, and policymakers alike (Pierce and Nowak, 1999; Daberkow and McBride, 2003). This contrasts the current trend in precision dairy farming where, despite being the end users, dairy farmers are typically excluded from technology development (Huirne et al., 1997). As a result, technologies may not fulfill on-farm needs, keeping technology adoption relatively low (Huirne et al., 1997; Gelb et al., 2001). The objectives of the current study were to identify the parameters currently measured on farms, find the considerations a farmer takes when selecting precision dairy farming technologies, and determine the parameters perceived by producers as most useful.

MATERIALS AND METHODS

In March 2013, an 8-question survey was created made available through SurveyMonkey (SurveyMonkey Inc., Palo Alto, CA). Online methods were chosen to reach the maximum number of respondents across a wide population of dairy farmers. A test survey was made and links were sent to extension specialists and producers (n = 5). Appropriate revisions were made based on test survey respondent feedback regarding survey content and organization. Following revision, the survey was made accessible to the general public for 2 mo. Dairy producers were identified as the target audience of this survey, with no specific conditions being specified for respondents to be eligible to complete the survey. The survey was sent to potential respondents through uniform resource locator (**URL**) links distributed by dairy-related email list serves, as well as internet publications and print magazines volunteering to distribute the URL.

Electronic methods of URL distribution were the preferred medium of distribution because respondents had the ability to click on the actual URL, taking them directly to the survey. Respondents seeing the URL in print had to copy the address and enter it directly into their web browser to access the survey, so the electronic method was thought to be easier for the respondent. The survey consisted of 7 close-ended questions. Additionally, 1 open-ended question in which respondents could express their thoughts, suggestions, and opinions was included. Responses to the open-ended question were not included in analysis, but relevant responses were included within results.

Respondents were asked to disclose the country and state or province where their farm was located (question 1), their age (question 2), their current herd size (including dry cows; question 3), and their role on the farm (question 4). Age and farm role were presented to respondents in categories, whereas country and state or province and herd size required users to input values. Age categories were predefined at <30, 30 to 40, 41 to 50, 51 to 60, and >60. Five options for on-farm role were provided to respondents: (1) owner, co-owner, or partner; (2) president or vice president; (3) manager, supervisor, or herdsman; (4) general employee; or (5) other. Respondents indicating roles outside of an on-farm role or a directly related title were excluded from further analysis. Additionally, respondents were asked to identify the parameters currently measured on their farm by precision dairy farming technologies from a predetermined list (question 5; Table 1). Parameters from the predetermined list were generated from previous literature (Bewley, 2010), producer input, and from the input of extension specialists. Parameters used to determine the general health of the mammary system were combined into the mastitis option within this survey, as they were considered potentially confusing. One option within the list allowed farmers to answer "not applicable" if they did not currently use technologies on their farm. Depending on the answer to this question, producers were sorted into one of 2 categories: (1) producers using technologies or (2) producers not using technologies.

A Likert (1932) scale assigned numerical values to the responses of the final 2 questions. Producers were asked to score considerations made in deciding to purchase precision dairy farming technologies from a predetermined list (question 6; Table 2) similar to that used by Russell and Bewley (2013). Additions and modifications were made to the list in the same method as parameters