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Survey of facility and management characteristics of large, Upper Midwest dairy herds clustered by Dairy Herd Improvement records

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ABSTRACT

A survey of management practices was conducted to investigate potential associations with groupings of herds formed by cluster analysis (CA) of Dairy Herd Improvement (DHI) data of 557 Upper Midwest herds of 200 cows or greater. Differences in herd management practices were identified between the groups, despite underlying similarities; for example, freestall housing and milking in a parlor. Group 6 comprised larger herds with a high proportion of primiparous cows and most frequently utilized practices promoting increased production [e.g., 84.4% used recombinant bovine somatotropin (rbST)], decreased lameness (e.g., 96.9% used routine hoof trimming for cows), and improved efficiency in reproduction [e.g., 93.8% synchronized the first breeding in cows (SYNCH)] and labor (e.g., mean ± SD, 67 ± 19 cows per 50-h per week full-time equivalent worker). Group 1 had the best mean DHI performances and followed most closely group 6 for the rate of adoption of intensive management practices while tending to outperform group 6 despite a generally smaller mean herd size (e.g., 42.3 ± 3.6 kg vs. 39.9 ± 3.6 kg of energy-corrected milk production; 608 ± 352 cows vs. 1,716 ± 1,405 cows). Group 2 were smaller herds with relatively high levels of performance that used less intensive management (e.g., 100% milked twice daily) and less technology (33.3 vs. 73.0% of group 1 used rbST). Group 4 were smaller but poorer-performing herds with low turnover and least frequently used intensive management practices (e.g., 39.1% SYNCH; 30.4% allowed mature, high-producing cows access to pasture). Group 5 used modern technologies and practices associated with improved production, yet had the least desirable mean DHI performance of all 6 groups. This group had the lowest proportion of deep loose-bedded stalls (only 52.2% used sand bedding) and the highest proportion (34.8%) of herds not using routine hoof trimming. The survey of group 3 herds did not reveal strong trends in management. The differences identified between herd groupings confirm significant variation in management practices linked to variation in overall herd performance measured by DHI variables. This approach provides an opportunity for consultants and outreach educators to better tailor efforts toward a certain type of dairy management philosophy, rather than taking a blanket approach to applying recommendations to farms simply because of their larger herd size.

Key words: cluster analysis, Dairy Herd Improvement data, management, housing

INTRODUCTION

Dairy farmers are continually striving to improve their profitability through increased production efficiency, achieved through the use of specific technologies and management practices they believe will enhance their bottom line. Measuring production performance after the adoption of such technologies or practices is essential to monitoring efficiency. This can theoretically be accomplished by different metrics of milk production, reproductive efficiency, cow health, and longevity, typically using a vast number of routinely collected DHI test-day variables. However, management decisions may affect more than one area of performance, and no single DHI variable entirely encompasses the overall performance of a herd. As previously discussed, many DHI variables are also strongly correlated with herd size and milk production and not necessarily associated with preferred outcomes of all production variables (Brotzman et al., 2015).

Because the processes and outcomes of milk production, reproduction, health, herd size, and management strategies are interconnected, the need to optimize each area simultaneously for the most efficient use of limited resources on farms for maximum profit adds a level of complexity (Enevoldsen et al., 1995; Galligan, 1999, 2006). To further complicate these decisions, there exists an ever-increasing concern among both consumers and those involved in dairy production over the social responsibilities of dairy farms that are growing in size and using more intensive management practices, including issues of animal well-being, food safety, and

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environmental impact resulting from the push to produce more milk more efficiently (von Keyserlingk et al., 2013). Indeed, 75.6% of milk produced in the United States in 2012 was produced on dairy farms of 200 or more cows (USDA-NASS, 2012) and in Wisconsin, herds of 200 or more cows are most likely to be managed in an intensive manner with freestall barns and use of a milking parlor (USDA-NASS, 2010).

Brotzman et al. (2015) further described the need to define a method for classifying herds' overall performance that is not biased toward the largest herds, the highest milk yield, or the best performance in any single variable. The approach proposed used cluster analysis (**CA**) as a potential solution, involving the recognition of patterns of DHI variables that best describe overall performance of a group of herds. Cluster analysis offers a method of dividing entities into groups based upon similarity in multiple characteristics simultaneously (Borcard, 2011). Groupings of dairy herds with similar performance characteristics were developed to categorize herds on multiple variables simultaneously, without preconceived ideas regarding the relationships among the selected variables and their association with management practices. Principal component analysis (**PCA**) was applied to mean year 2011 DHI data for 557 Upper Midwest dairy herds of ≥200 cows on test to determine the most meaningful subset of variables to describe the herds, followed by CA to categorize the herds into groups in an outcome-independent way (Brotzman et al., 2015).

The aim of this project was to subject herds in each cluster group to a survey questionnaire to gain knowledge of herd management and facility characteristics that may have influenced the CA grouping. Our hypothesis was that different management choices were associated with the grouping structure created by CA using DHI parameters, thereby identifying performance and management patterns on dairies that would be receptive to different outreach efforts. These efforts could then be targeted at specific areas in different groups with the ultimate goal of increasing overall uptake and effectiveness of management best practices, facility design, and technology use.

MATERIALS AND METHODS

Methods for PCA and CA of DHI data for year 2011 for 557 Upper Midwest herds of ≥200 cows were previously described (Brotzman et al., 2015). Data were made available from AgSource Cooperative Services (Verona, WI) and included dairies located primarily in Wisconsin but also in Minnesota, Iowa, Illinois, and Michigan. Farms were divided into 6 groups by CA using the 16 PCA-selected DHI variables (Table 1). Randomly selected herds from each group were contacted by telephone to complete a survey of management and housing practices until approximately one-third of each group had been surveyed or time and attempts to contact producers had been exhausted during the period of June through August 2012. The survey was designed to be completed by a manager, owner, or other individual who had a good working knowledge of the dairy. Goal time to complete the survey was 10 to 15 min, with the aim of improving the response rate while gathering basic information about the management of each farm, indicators of the adoption of modern technologies, housing and management practices, and the amount of labor committed to the management, care, and milking of the herd. Three individuals called producers and collected survey information from June through August 2012, each following a written script as they introduced the study and asked questions to ensure consistency. Respondents were assured that answers would be kept confidential. Information provided would not be publicly published in any way that would associate their replies or DHI data with their farm.

The survey tool sought general information about the herd, its management, and the adoption of technologies, including the predominant breed or crossbreed, whether conventional or organic management practices were primarily used, how often per lactation cows were routinely hoof trimmed, and if heifers were routinely hoof trimmed before calving. The number of ration groups for the dry period was collected, as well as information on where cows calve (individual or group pen) and how long they stay in the pen in which they calve. Regarding specific technology adoption, the survey asked which, if any, reproductive synchronization program was used routinely for the first breeding in cows (**SYNCH**), as well as the use of monensin and the proportion of cows treated with recombinant bST (**rbST**).

In regards to milk quality and harvesting, information was gathered on which types of products if any were used in the udder at dry off (i.e., antibiotic or an internal teat sealant) and what proportion of cows were treated with intramammary antibiotic at dry off. Producers were asked to answer questions on how milk was harvested on the dairy, including parlor design and size, the number of cows in the largest milking group, number of parlor turns required to milk the largest group of cows, number of times per day the high group of mature cows (around 100 DIM) was milked, frequency of milking the early-lactation cows (around 5 DIM, not including colostrum or treated cows), and whether or not treated cows were individually tested on-farm for drug residues before adding their milk into the saleable milk tank.