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Body Condition Assessment Using Digital Images

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ABSTRACT

This project assessed the ability to assign a body condition score (BCS) to a dairy cow from digital photographs or videos. Images were taken from the rear of the cow at a 0 to 20° angle relative to the tail head. Four observers assigned a BCS to each of 57 cows at a farm visit (live, farm 1) and later from a photograph (photo). Means ± standard deviations of BCS by method and observer were as follows: live = 3.25 ± 0.51, 3.42 ± 0.49, 3.32 ± 0.58, 3.13 ± 0.62; photo = 3.36 ± 0.52, 3.32 ± 0.43, 3.44 ± 0.62, 3.14 ± 0.6 for observers 1 to 4, respectively. Body condition score means differed across observers for live (observer 2 higher and observer 4 lower, compared with observers 1 and 3) and photo methods (observer 3 lower, compared with observers 1, 2, and 3); however, within observer, the mean live BCS did not differ from the mean photo BCS. Correlation coefficients between BCS assigned live and from photos were 0.84, 0.82, 0.82, and 0.90 for observers 1 to 4, respectively. Subsequently, observer 1 visited 2 farms, assigned a live BCS, and digitally photographed 187 cows (56 and 131 cows from farms 2 and 3, respectively). Observers 2, 3, and 4 assigned a BCS from the photographs. Means ± standard deviations of BCS by observer (method) were 1 (live) 3.35 ± 0.55; 2 (photo) 3.33 ± 0.49; 3 (photo) 3.60 ± 0.54; and 4 (photo) 3.26 ± 0.62. The mean BCS for observer 3 was higher and that for observer 4 was lower than for observers 1 and 2. Correlation coefficients between observer 1 and observers 2 through 4 were 0.78, 0.76, and 0.79, respectively. Observer 1 assigned a BCS to 41 cows at a farm visit and 3 wk later assessed the BCS of cows from a video taken at a farm visit by a different individual. Cows were restrained in headlocks at a feed bunk when assessing BCS and for video production. No difference was detected for the mean BCS, for the standard deviation of the mean BCS, or in the distribution of BCS between the live and video assessments. Mean and SD for 17 groups of Holstein cows from 20 farms were used to generate 10,000 random samples of BCS. Groups of 25, 50, 100, and 150 cows were created from the random samples, and estimates of mean BCS were determined by sampling 3 to 80% of the group. Estimates of mean BCS with a sample size of 30% or more from a group of cows fell within the 95% confidence limit of the true mean more than 98% of the time. Digital photographs provide adequate imaging for assessment of BCS. Sampling 30% of a group should be adequate to assess the mean BCS. Video imaging allowed a rapid assessment of BCS but did not permit identification of individual cows.

Key words: body condition score, dairy cattle, digital imaging

INTRODUCTION

Assessment of body condition in dairy cattle is a simple, repeatable system to evaluate body fat stores and estimate cumulative energy balance (Otto et al., 1991; Ferguson et al., 1994; Komaragiri and Erdman, 1997). The score range used by most dairy management advisors applies a scale from 1 to 5, with 1 representing emaciated cows and 5 representing obese cows (Wildman et al., 1982). Edmonson et al. (1989) developed a descriptive chart to aid in assessing BCS, whereas Ferguson et al. (1994) devised a system based on statistical associations of descriptions of body regions. It is possible to separate BCS into 0.25-point increments between scores of 2 to 4; however, this degree of resolution may not be possible with BCS of <2 and >4 (Ferguson et al., 1994). It is generally recommended that cows with a BCS of >3.5 are too fat and that cows having a BCS of <2.5 are too thin (Domecq et al., 1997a,b). Extremes in BCS and BCS loss are associated with health risks and reduced reproductive efficiency (Gearhart et al., 1990; Ruegg and Milton, 1995; Domecq et al., 1997a,b).

Advisors to dairy herds may be local, providing services to dairy farm managers on a routine schedule. Local farm contacts usually include veterinarians, field staff from nutritional companies, or county extension agents. At times, local advisors seek advice from

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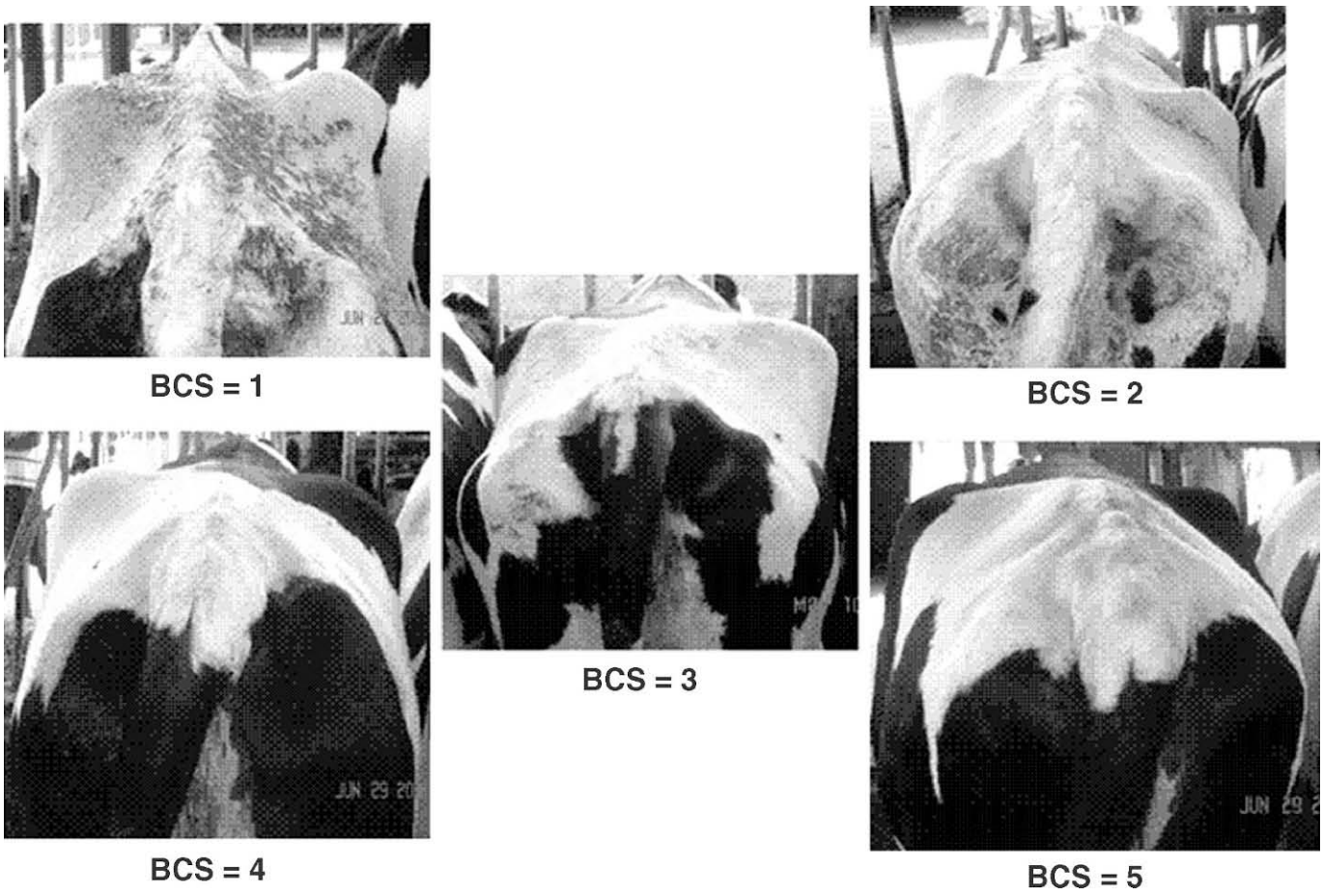

Figure 1. Images of cows assigned a body condition score of 1, 2, 3, 4, or 5.

a distant, secondary "expert" for a specific problem. Secondary advisors may be independent consultants, university faculty, or technical support staff working within the same company as local advisors. Bringing an outside advisor to the farm can be costly because experts often are not located in proximity to farms. Expert staff within a company can be overscheduled, finding it difficult to visit farms to support local advisors. In addition, herd problems may occur simultaneously at different locations that require attention, and it may not be possible to visit the farms in a timely fashion.

When consulting on production, reproduction, and health problems in dairy herds, nutritional advisors typically want information on BCS. Primary advisors can assess BCS directly from routine farm visits. Consultants may be able to obtain information on BCS from DHI records or other farm databases, but many herds do not routinely collect BCS observations. Verbal descriptions of BCS can be communicated from field staff to the advisor, but often secondary advisors desire to make their own visual assessment.

Digital photos and videos are easily accessible and transportable. Images can be easily shared through e-mail and Web sites. Secondary advisors can view these images and make assessments of farm facilities and the BCS of cows. Pictures and videos may be captured at the time of the problem, and additional images captured at an earlier time period may be provided. Providing access to digital images along with data on production, reproduction, and health may enable secondary advisors to support local advisors without physically visiting the farm, thus reducing costs. Stored video files over a 4-d period have been used to assess cow behavior (Overton et al., 2002). The purpose of this project was to assess the utility of using digital or video images to evaluate the BCS of a group of cows. Our second aim was to construct a model to determine the sample size needed to estimate the mean BCS of a group of dairy cows.