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Associations between age at first calving, rearing average daily weight gain, herd milk yield and dairy herd production, reproduction, and profitability

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ABSTRACT

The objective of this study was to evaluate the associations of variable intensity in rearing dairy heifers on 33 commercial dairy herds, including 23,008 cows and 18,139 heifers, with age at first calving (AFC), average daily weight gain (ADG), and milk yield (MY) level on reproduction traits and profitability. Milk yield during the production period was analyzed relative to reproduction and economic parameters. Data were collected during a 1-yr period (2011). The farms were located in 12 regions in the Czech Republic. The results show that those herds with more intensive rearing periods had lower conception rates among heifers at first and overall services. The differences in those conception rates between the group with the greatest ADG (≥0.800 kg/d) and the group with the least ADG (≤0.699 kg/d) were approximately 10 percentage points in favor of the least ADG. All the evaluated reproduction traits differed between AFC groups. Conception at first and overall services (cows) was greatest in herds with AFC ≥800 d. The shortest days open (105 d) and calving interval (396 d) were found in the middle AFC group (799 to 750 d). The highest number of completed lactations (2.67) was observed in the group with latest AFC (≥800 d). The earliest AFC group (≤749 d) was characterized by the highest depreciation costs per cow at 8,275 Czech crowns (US$414), and the highest culling rate for cows of 41%. The most profitable rearing approach was reflected in the middle AFC (799 to 750 d) and middle ADG (0.799 to 0.700 kg) groups. The highest MY (≥8,500 kg) occurred with the earliest AFC of 780 d. Higher MY led to lower conception rates in cows, but the highest MY group also had the shortest days open (106 d) and a calving interval of 386 d. The same MY group had the highest cow depreciation costs, net profit, and profitability without subsidies of 2.67%. We conclude that achieving low AFC will not always be the most profitable approach, which will depend upon farm-specific herd management. The MY is a very important factor for dairy farm profitability. The group of farms having the highest MY achieved the highest net profit despite having greater fertility problems.
Key words: age at first calving, heifer rearing, herd performance, profit

INTRODUCTION

Dairy farmers face a complex dilemma in minimizing costs associated with rearing heifers while ensuring or enhancing lifetime economic productivity. Decisions about heifer management interact with underlying biological aspects of growth, thereby influencing future profitability of the herd (Mourits et al., 1999). A basic approach to reduce costs is to shorten the nonproductive period of dairy heifers, which can be accomplished by breeding heifers earlier to reduce the age at first calving (**AFC**; Abeni et al., 2000; Daniels, 2010). Many studies suggest that the optimal AFC is ≤24 mo (Mourits et al., 1999; Gabler and Heinrichs, 2003; Shamay et al., 2005; Stevenson et al., 2008). However, most of those researchers based their conclusions on milk production rather than whole economic measurements. Ettema and Santos (2004) found that only 2.7% of US Holstein dairy farms achieved the recommended targets of AFC ≤24 with liveweights ≥560 kg. Hoffman et al. (1996) concluded that the possible advantages of reduced AFC, such as decreased feed costs, greater cumulative production per month of age, shorter generation interval, and lower overhead costs, must be weighed against such possible disadvantages as lower conception rates, increased dystocia, reduced milk production per lactation, diminished longevity, and the costs of increased nutrient density in the ration. Lower feed efficiency would be expected after calving from first lactation cows that are still growing at a fast pace when coming into milk.

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Although replacement heifers represent a large proportion (15 to 20%) of the total cost of milk production, heifer rearing remains one of the least understood processes (Pirlo et al., 2000). The total costs of raising dairy replacements depend on the costs directly associated with growing heifers and the number of heifers grown. The highest cost category in the rearing period is feeding (Tozer and Heinrichs, 2001). In a dairy farm production system, management decisions concerning the rearing of young stock and replacement of dairy cows strongly influence one another (de Vries and Risco, 2005). Heikkilä et al. (2008) found that variation in results from other studies regarding AFC, optimal replacement in the dairy herd, and consequently, the level of rearing costs depends upon local conditions and management on each farm. Market prices also vary, because they follow changes occurring in agricultural product markets. In most cases, however, an increase or decrease of costs and output prices by as much as 20% did not alter the optimal decisions (Heikkilä et al., 2008). Lee and Kim (2007) stated that high-producing (Holstein-Friesian) herds lose the benefit of their high production levels because of their increased morbidity and high probability for involuntary culling. Heikkilä et al. (2008) argued that the decline in fertility, which constitutes the most common reason for culling in high-producing herds, is associated with long-term selection for milk production. Mourits et al. (1999) found that genetic potential affects the growth of heifers. High-producing herds need appropriate management during the rearing period to ensure that adult cows will be healthy and strong. Lee and Kim (2007) concluded that even when cows have high levels of production, they may not provide expected economic benefits due to their overall decline in other traits such as fertility, longevity, and health of cows. All these facts should be taken into consideration when planning the overall management of dairy cattle. The objective of this study was to evaluate the associations of AFC, ADG, milk yield (**MY**), and production and reproduction traits and economics in commercial dairy herds.

MATERIALS AND METHODS

Data

Data used in this study were recorded from 33 commercial dairy farms (17 with the Holstein breed, 8 with the Czech Fleckvieh breed, and 8 keeping both breeds in their herds). Our original data set consisted of 152 farms, and from those, we selected only 33 farms—those that did not perform any significant changes in feeding management, breeding operations, breeding populations (i.e., changes in breeding goal), or technologies used (milking parlor and housing upgrades) during the last 5 yr. All other farms were disqualified from further analysis and removed from our data set. The total numbers of cows and heifers were 23,008 and 18,139, respectively. All farms were closed dairy herds and the average herd size was 577 cows (SD: ±350 cows). The farms were located in the 12 regions within the Czech Republic. The animals in selected farms were kept in freestall barns. All the calves were housed in individual hutches equipped with buckets for water and a starter mixture. The diet of the heifers and cows consisted of a TMR (a mixture of forage and grain). The diet composition differed depending on the region, breed, management of each commercial farm, and feeding company services used. Data collected for each analyzed farm included averages for production and reproduction parameters, rearing costs, and economic parameters. The independent variables were AFC, ADG, and MY (Tables 1 and 2). In terms of biological and economic parameters, we were particularly interested in an earliest AFC of approximately 24 mo and in high ADG above 0.8 kg. Most studies considered this borderline as significant for optimal performance (Abeni et al., 2000; Shamay et al., 2005; Stevenson et al., 2008). The most important group for evaluation of MY was the group with highest-production herds. In the Czech Holstein breed (http://www.holstein.cz), a milk production of approximately 8,500 kg is the average breeding goal for MY, including first-parity cows and other cows. The farms' records of BW and respective reproduction and production traits were measured within the milk recording system (ICAR, 2012). Records of BW used for ADG were collected at 6, 12, and 14 mo of age in those 33 selected farms. The other dependent parameters are listed in Tables 1 and 2.

The average of ADG, milk and milk replacer costs, total feed costs, and total costs per heifer (Tables 1 and 2) were taken from the new generation and other variables were based on the dams. Averages of AFC and MY were taken from the dams' population. Not all heifers calved at the time of the data collection, but the AFC of calved heifers did not differ more than ±1 standard deviation from average AFC of cows on analyzed farms. However, differences <1 standard deviation in AFC could still have an effect on our results. The same rearing conditions were observed for last 5 yr in 33 selected farms. Data from the 33 farms used in this study were collected and verified by the Czech Statistical Office [CZSO (http://www.czso.cz/) and the Czech Moravian Breeders' Corp. (CMSCH; http://www.cmsch.cz/)]. The CZSO and CMSCH guaranteed that no significant management changes (±1 SD) occurred in these farms within the 5 yr of data collection.