

## ORIGINAL ARTICLE

# Analysis of longterm trends in the performance of dairy cows on low-input mountain farms

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### Abstract

The productive and reproductive performance of dairy cows was examined on thirty-four low-input farms in the Šumava Mts. between 2000 and 2007. Milk production increased by an average of 986 kg and 948 kg per lactation by Holstein and by Czech Fleckvieh cows, respectively ( $P < 0.001$ ), while the mean number of lactations decreased from 2.7 to 2.5 in Holstein and from 3.4 to 3.0 in Czech Fleckvieh cows ( $P < 0.001$ ) in the same period. The mean number of lactations decreased also in the culled cows – from 3.2 to 2.9 by Holstein and from 4.3 to 3.5 by Czech Fleckvieh cows ( $P < 0.001$ ). A higher cow milk yield was accompanied by a deterioration in reproductive performance. Between the periods 2000–2003 and 2004–2007 the number of days open lengthened by an average of 6 and 4 days ( $P < 0.01$ ) and the calving period by an average of 11 and 6 days ( $P < 0.001$ ) in Holstein and Czech Fleckvieh cows respectively. The results indicated an increased replacement of cows in the herds examined as a coincidental feature of the steadily rising milk performance. This may have a negative impact on the rentability of low-input mountain dairy farming in the region.

**Key words:** Holstein; Czech Fleckvieh; low-input farm; milk performance; reproductive performance

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## INTRODUCTION

The depression of cow numbers in the Czech Republic in the last two decades has been accompanied by an enhancement in cow milk

yields and by a deterioration of their reproductive performance (Kvapilík et al. 2009). Because of recent low milk selling prices, management strategies based on high milk production may be counter-productive. The good health status of cows and their good reproductive performance are among the most important factors determining the rentability of dairy farming (Frelich et al. 2008). Other factors are the level of herd management – the technology of housing, feeding and milking, as well as the standard of hygiene in stalls (Cempírková 2006, 2007, Węglarz et al. 2008, Cempírková and Mikulová 2009, Cempírková et

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al. 2009, Frelich et al. 2009) and the choice of a breed well adapted to local conditions (Frelich et al. 2006, Řehout et al. 2009 a, b). The objective of this study was to examine longterm changes in the performance and culling rate of dairy cows on low-input dairy farms in the Šumava Mts.

## **MATERIAL AND METHODS**

Thirty-four herds located at altitudes from 414 to 896 m above sea level in the Šumava Mts. in the Czech Republic (‘Šumava population’) were selected for scrutiny. The data used in this study were recorded by the Czech-Moravian Breeders Corporation in the context of breeding value surveys on Holstein and Czech Fleckvieh cows. The Holstein breed refers to cows with a 50–100% deal of H-breed or R-breed (breeding groups of H1–4); the Czech Fleckvieh breed refers to cows with a 51–100 % deal of C-breed (breeding groups of C1–2).

The longterm changes in the mean number of lactations and in milk yields were evaluated according to the value of significance of the difference between two periods of calving dates: 2000–2003 and 2004–2007 (referred to as 2000–03 and 2004–07 below in the text). Data relating to lactations with a minimum length of 240 days and minimum milk production of 2,000 kg were used, and comprised data on 20,815 lactations of 9,807 Holstein cows and on 16,231 lactations of 6,466 Czech Fleckvieh cows. Four parity categories were distinguished for the evaluation of the trends in different aged cows: Parity-1 (1<sup>st</sup> lactations), Parity-2 (2<sup>nd</sup> lactations), Parity-3 (3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> lactations) and Parity-4 (6<sup>th</sup> and later lactations). The mean number of lactations of culled cows and their milk yield per lactation (precedent to the lactation when culling took place) were also analysed. Concerning the milk yields, only Parity 2–4 categories calved in 2001–2007 were used in this case, because no data on precedent lactations were available in primiparous cows and cows calved in 2000.

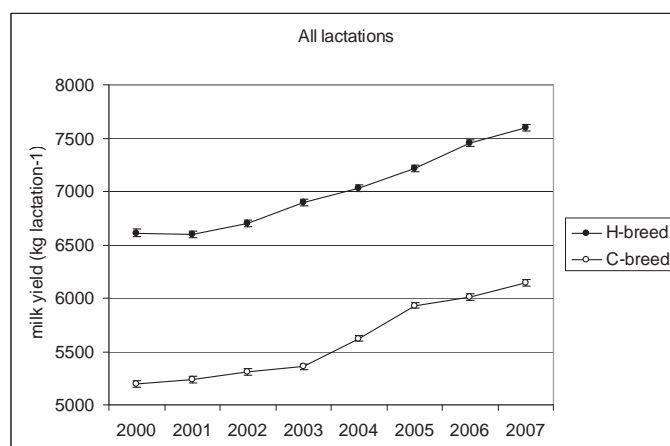
The difference in the mean number of lactations between 2000–03 and 2004–07 periods was evaluated by the Mann-Whitney test (StatSoft CR s r. o. 2008) for each breed separately. The difference in milk yields per lactation, open days and calving interval was evaluated for each breed separately by the t-test and by the Analysis of variance (ANOVA; StatSoft CR s r. o. 2008) with factors of period (2000–03, 2004–07) and number of lactation (Parity 1–4 categories).

## **RESULTS**

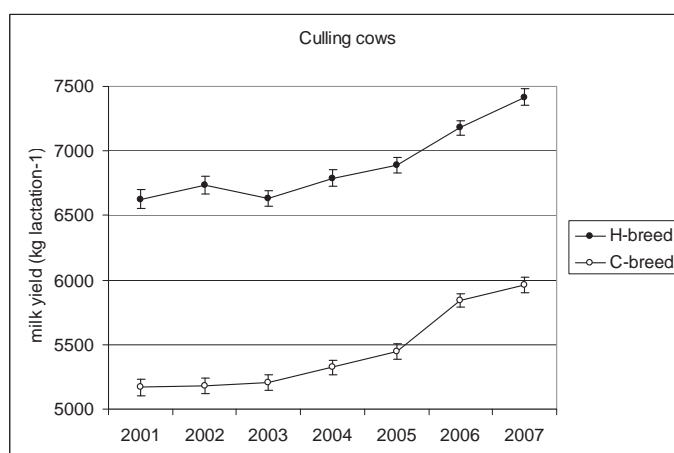
Milk yields increased between 2000 and 2007 in both breeds (Fig. 1). In the Holstein, the milk production per lactation increased from 6,613 kg in 2000 on average to 7,599 kg in 2007 on average (by 986 kg). In the Czech Fleckvieh, it increased from 5,195 kg in 2000 on average, and to 6,143 kg in 2007 on average (by 948 kg). The difference between 2000–03 and 2004–07 was significant in all the parity categories of both breeds (in Parity 1–4;  $P < 0.001$ ). The interaction between the parity category and the period was not significant in the Holstein ( $P > 0.05$ ), but it was significant in the Czech Fleckvieh ( $P < 0.001$ ). In the Holstein, milk yields increased by averages of 583, 685, 630 and 469 kg per lactation between 2000–03 and 2004–07 in Parity-1, Parity-2, Parity-3 and Parity-4 categories, respectively. In the Czech Fleckvieh, milk yields increased by averages of 692, 789, 598 and 587 kg per lactation between 2000–03 and 2004–07 in Parity-1, Parity-2, Parity-3 and Parity-4 categories, respectively.

Milk yields by the culled cows increased also between 2001 and 2007 (Fig. 2). In the Holstein, the milk production per lactation precedent to the culling increased from 6,628 kg in 2001 on average to 7,417 kg in 2007 on average (by 789 kg). In the Czech Fleckvieh, it increased from 5,170 kg in 2001 on average to 5,963 kg in 2007 on average (by 793 kg). The difference between the 2000–03 and 2004–07 periods was significant in all the parity categories (Parity 2–4;  $P < 0.001$ ) and the interaction between the parity category and the period was not significant ( $P > 0.05$ ). In the Holstein, the milk yields increased by averages of 476, 417 and 259 kg per lactation between 2000–03 and 2004–07 in Parity-2, Parity-3 and Parity-4 categories, respectively. In the Czech Fleckvieh, they increased by averages of 554, 520 and 357 kg per lactation between 2000–03 and 2004–07 in Parity-2, Parity-3 and Parity-4 categories, respectively.

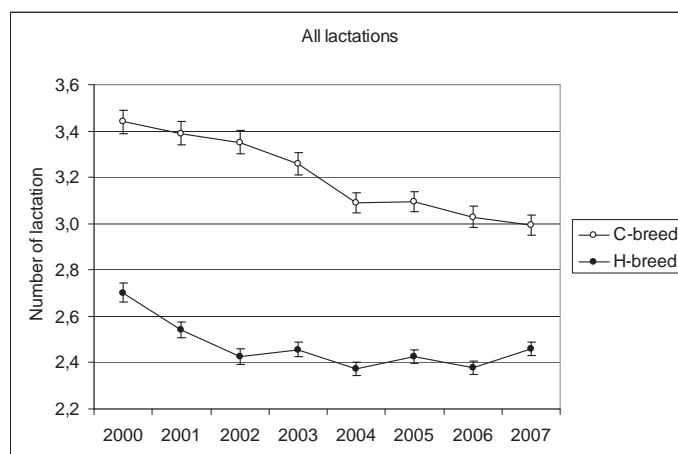
The mean number of lactations decreased between 2000 and 2007 (Fig. 3). In the Holstein, it decreased from 2.7 to 2.5 and in the Czech Fleckvieh from 3.4 to 3.0. The difference between 2000–03 and 2004–07 was significant in both the breeds ( $P < 0.001$ ). The mean number of lactations decreased also in the culled cows between 2000 and 2007 (Fig. 4). In the Holstein, it decreased from 3.2 to 2.9 and from 4.3 to 3.5 in the Czech Fleckvieh. The difference was significant between 2000–03 and 2004–07 in both the breeds ( $P < 0.001$ ).



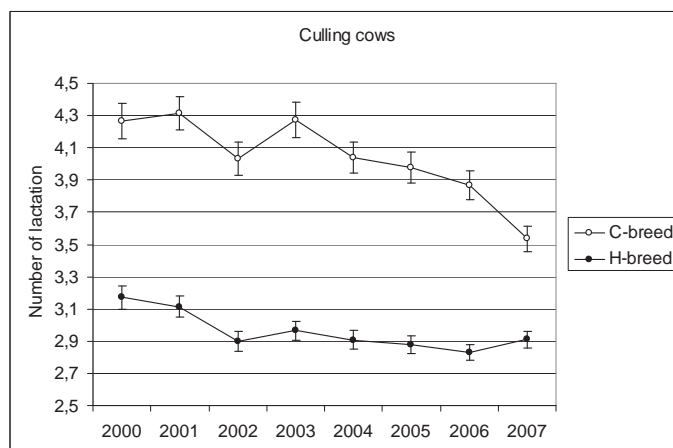
**Fig. 1.** The mean milk production per lactation and standard error of mean of Holstein and Czech Fleckvieh cows in thirty-four examined herds in 2000–2007



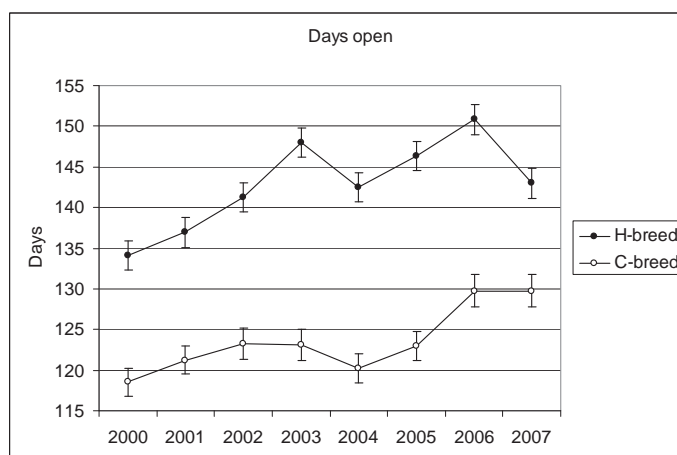
**Fig. 2.** The mean milk production per lactation and standard error of mean of Holstein and Czech Fleckvieh culled cows in thirty-four examined herds in 2000–2007



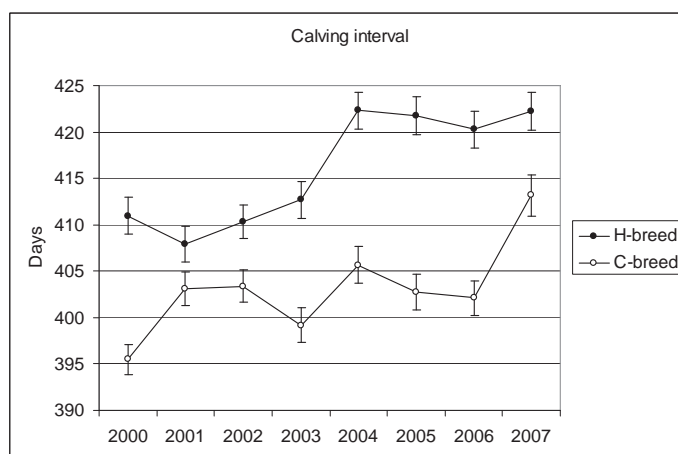
**Fig. 3.** The mean number of lactation and standard error of mean in Holstein and Czech Fleckvieh cows in thirty-four examined herds in 2000–2007



**Fig. 4.** The mean number of lactation and standard error of mean in Holstein and Czech Fleckvieh culled cows in thirty-four examined herds in 2000–2007



**Fig. 5.** The mean days open and standard error of mean of Holstein and Czech Fleckvieh cows in thirty-four examined herds in 2000–2007



**Fig. 6.** The mean calving interval and standard error of mean of Holstein and Czech Fleckvieh cows in thirty-four examined herds in 2000–2007

The days open period and the calving interval lengthened in both the breeds between 2000 and 2007 (Figs 5, 6). In the Holstein, the days open period lengthened from 140 days to 146 days on average ( $P<0.001$ ) and the calving interval lengthened from 411 days to 422 days on average ( $P<0.01$ ) between 2000–03 and 2004–07. In the Czech Fleckvieh, the number of open days increased from 122 days to 126 days on average ( $P<0.01$ ) and the calving interval lengthened from 400 to 406 on average ( $P<0.001$ ) between 2000–03 and 2004–07. This difference was significant in all the parity categories ( $P<0.001$ ) and the interaction between the period and the parity category was not significant ( $P>0.05$ ).

## DISCUSSION

A significant enhancement of the milk yields was found among both the Holstein and Czech Fleckvieh cows in the thirty-four herds examined. This however was accompanied by a deterioration in their reproductive performance. The same tendency has been reported also in the Czech Republic population (Kvapilík et al. 2009) and in dairy herds abroad (Etherington et al. 1996, Seegers et al. 1998, Lotthammer 1999, Moore and Thatcher 2006). Increased demands for higher production have resulted in low pregnancy rates and higher rates of embryonic mortality in high-producing cows. The decrease in the mean number of lactations indicates a shorter productive life of cows in Šumava herds. This trend was evident also in the culled cows, whose age (parity) at the time of culling decreased, while their milk production (in the lactation precedent to the culling) coincidentally increased. Similar tendencies were recorded in the Czech Republic population, where the mean number of lactations of culled cows decreased from 3.9 in 2003 to 3.7 in 2007 (Kvapilík et al. 2009). In this study, the mean number of lactations decreased from 3.5 to 3.2 in culled cows in the same period.

These results indicate a higher culling rate in parallel with an increase in milk production in Šumava herds. Indeed, the proportion of cows culled for zootechnical or health reasons to the total number of lactations increased from 29.3% in the period 2000–2003 to 32.2% in 2004–2007 in the herds examined, which is near to 30% of the cows culled for health reasons in the Czech Republic population in 2007 (Kvapilík et al. 2009). Replacement in the Šumava herds thus increased between 2000 and 2007 and the

cows were culled in earlier lactations. In the Czech Republic population, the mean number of lactations decreased from 2.6 in 2003 to 2.4 in 2007 (Kvapilík et al. 2009) reflecting a similar evolution of this herd characteristic in the Czech Republic and in the Šumava population (the mean number of lactations in the Šumava population decreased from 2.8 to 2.7 in the same period). One of the reasons for the increased replacement of cows may have been the increase in the milk production of primiparous cows reflecting the intensive breeding for milk performance. This has resulted also in a high proportion of cows compulsorily slaughtered in the Czech Republic (24.7% in 2007), which has had a negative impact on the economy of livestock breeding (Kvapilík et al. 2009).

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