# Effect of mountain pasture versus indoor breeding system on somatic cell count in cow milk

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## Introduction, Objectives

The cattle husbandry aimed on milk and beef production is the prevailing way of farm management in mountain areas of the Czech Republic. The breeding of two most frequent dairy breeds of Holstein (H) and Czech Fleckvieh (C) relies on two feeding strategies:

(1) the seasonal pasture and fresh-cut herbage supplementation during May – October period, followed by a grass-silage feeding indoor in the rest of a year (PASTURE system)
(2) all-year-through grass and maize silage feeding without any access to pasture (INDOOR system).

The concentrates are offered to cows in milk in both the systems. Higher milk production on average use to be achieved in indoor than in pastured herds. In this study, the average milk production per standard (305-days) lactation was 7,266 and 5,846 kg (H and C breed, respectively ) in indoor herds and 6,763 and 5695 kg (H a nd C breed) in pastured herds.

The aim of this study was to examine the impact of the grazing allowance on the somatic cell count (SCC) in individual cow milk samples as a widely used udder health and qualitative milk indicator. The data on SCC from two types of breeding system mentioned above were analysed and compared. The null hypothese was no difference in SCC between both the systems.

## Study sites, herd management

Fourteen herds with access to pasture during the vegetation period (May – October) and nine herds confined all the year in stalls were selected for this study in the southern and western part of the Czech Republic. The pastured herds were located at an altitude from 500 to 896 meters above sea level (median 684 m) and the permanently confined herds from 411 to 826 meters above sea level (median 566 m). The herd size was between 12 and 314 cows (median 72) in pastured herds and between 47 and 308 cows (median 170) in confined herds in 2006.

The feed ration of pastered herds was based on a grazed herbage *ad libitum* in period between May and October and grain supplements in amount of 4 – 7 kg per cow and day offered in stalls during two milkings a day. The vegetation of the pastures appertained to *Lolio-Cynosurenion* subalIiance. Depending on a farm, supplements of a hey, straw, fresh cut herbage, corn silage, grass silage, brewery draff or beet cake were offered to cows in stalls during a milking in amount of 1 – 10 kg per cow and day. The all-year-through feed ration for confined herds and the winter feed ration for pastured herds was based on a grass silage and/or corn silage in amount of 20 – 35 kg and grain supplements in amount of 4 – 7 kg per cow and day. Depending on a farm, supplements of a hey, straw, molasses, beet cake, wheat pollard or brewery draff were additionally offered to cows in amount of 1 – 10 kg per cow and day. The supplements of minerals were added to a feed ration in all surveyed farms. The feeding technology was generally based on a total mixed ration in confined herds, whereas in many of pastured herds the components of feed were put to a manger separately.

**Statistical analysis**

The data on milk performance and reproduction recorded by the Czech Moravian Breeder's Corporation in frame of breeding-value monitoring surveys were used in this study. The cows appertained to Holstein and Czech Fleckvieh breeds. In total 103,503 records of 4,965 Holstein and 3,315 Czech Fleckvieh cows were analysed. Except three pastured herds and one confined herd all the herds contained both the breeds in different ratios. The average parity stage of cows was 3.0 in pastured herds and 2.7 in confined (indoor) herds, 29 and 32 % of lactations beeing the first lactations (pastured and confined herds, respectively), 23 and 25 % of them beeing the second lactations (pastured and confined herds, respectively) and the rest to the third and later lactations.

The GLM analysis was applied in order to evaluate the significance of BREEDING SYSTEM (Pasture = seasonally pastured, Indoor = permanently indoor) on SCC in 24-hours milk (test-day) samples collected in monthly intervals form individual cows. SCC values were log transformed before conducting the analysis. Next variables with fixed effects were also included in the model:

BREED – two levels were used, C-breed, i.e.Czech Fleckvieh with proportion of C-breed: 51 – 100 %, and H-breed, i.e. Holstein with proportion of H-breed: 50 – 100 %.

PARITY – three levels were used: first lactations; second lactations; third or later lactations.

YEAR of milk sample collection – 2004, 2005, 2006.

SEASON – two seasons were distinguished in each the year of observation: 'winter' one (October – April) and 'summer' one (May – September).

**Results**

Figure 1. Median and .75 *quantile* of SCC in four categories of milk samples from permanently confined (indoor) herds according the breed (H , C) and season of milk sample collection ('winter', 'summer').

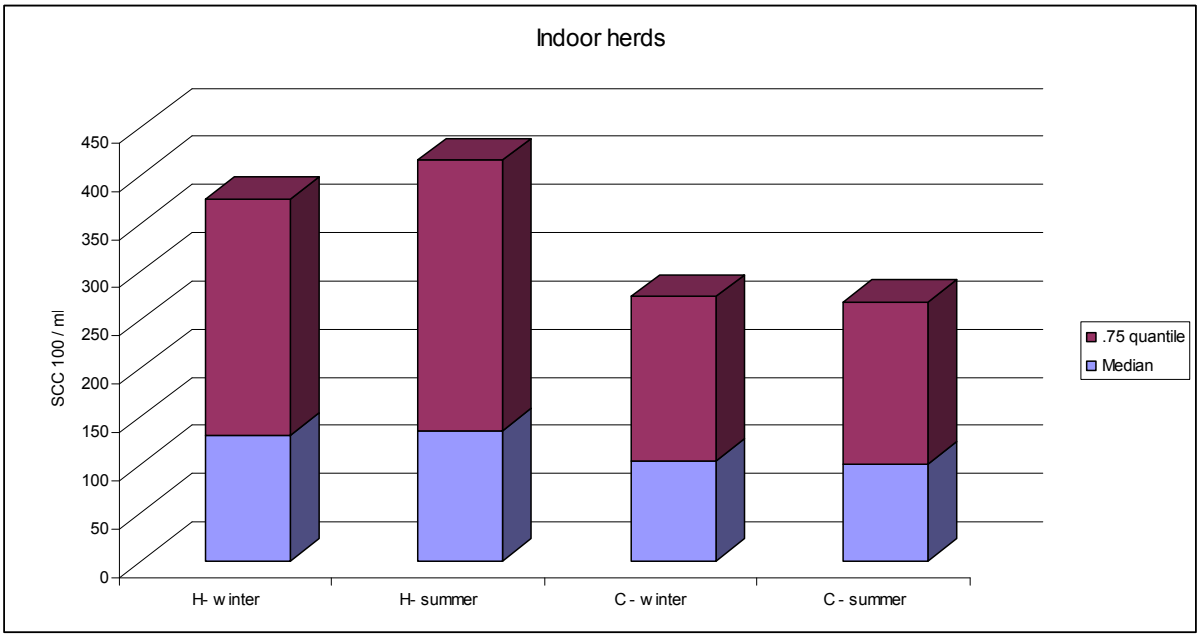


Figure 2. Median and .75 *quantile* of SCC in four categories of milk samples from seasonally pastured herds according the breed (H , C) and season of milk sample collection ('winter' = indoor, 'summer' = pasture).

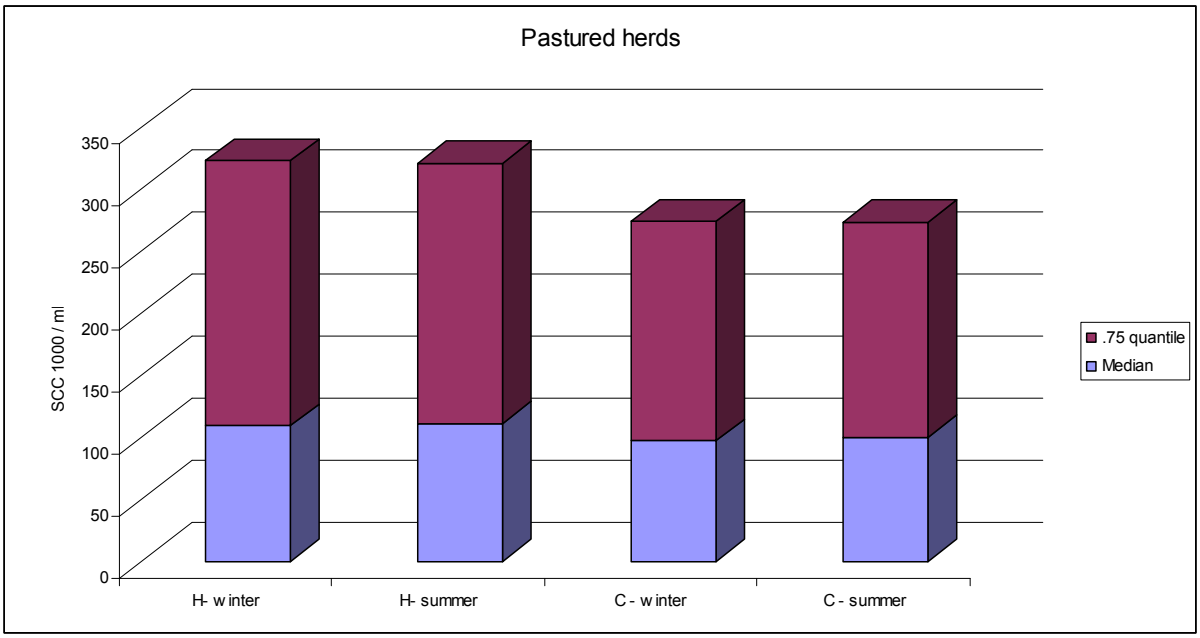


Table 1. Results of GLM analysis, P – level of significance

| **Factors** | **P** |
|---|---|
| {6}DAYS IN MILK | 0,000* |
| {1} BREEDING SYSTEM (Fig. 3) | 0,000* |
| {2} BREED (Fig. 4) | 0,000* |
| {3} YEAR | 0,695 |
| {4} PARITY | 0,000* |
| {5} SEASON | 0,049* |
| 1*2 (Fig. 5) | ,000* |
| 1*3 | ,000* |
| 2*3 | ,011* |
| 1*4 | 0,000* |
| 2*4 | 0,000* |
| 3*4 | ,000* |
| 1*5 | 0,287 |
| 2*5 | 0,217 |
| 3*5 | ,000* |
| 4*5 | ,004* |
| 1*2*3 | ,000* |
| 1*2*4 | ,000* |
| 1*3*4 | ,000* |
| 2*3*4 | ,001* |
| 1*2*5 | ,001* |
| 1*3*5 | ,025* |
| 2*3*5 | ,017* |
| 1*4*5 | 0,795 |
| 2*4*5 | 0,914 |
| 3*4*5 | 0,217 |
| 1*2*3*4 | ,000* |
| 1*2*3*5 | ,000* |
| 1*2*4*5 | 0,285 |
| 1*3*4*5 | 0,124 |
| 2*3*4*5 | 0,813 |
| 1*2*3*4*5 | 0,579 |

Figure 3. Effect of BREEDING SYSTEM on SCC.

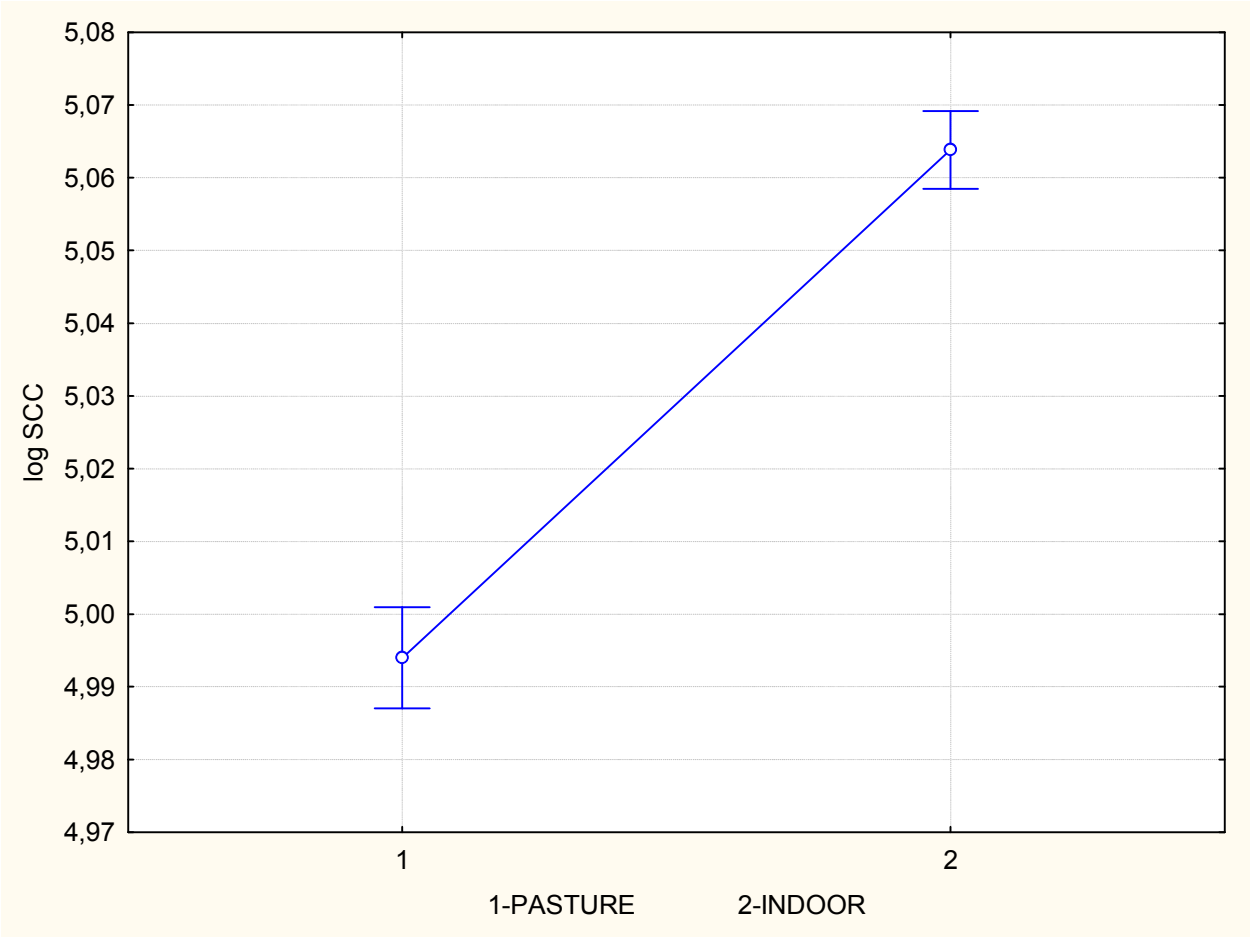


Figure 4. Effect of BREED on SCC.

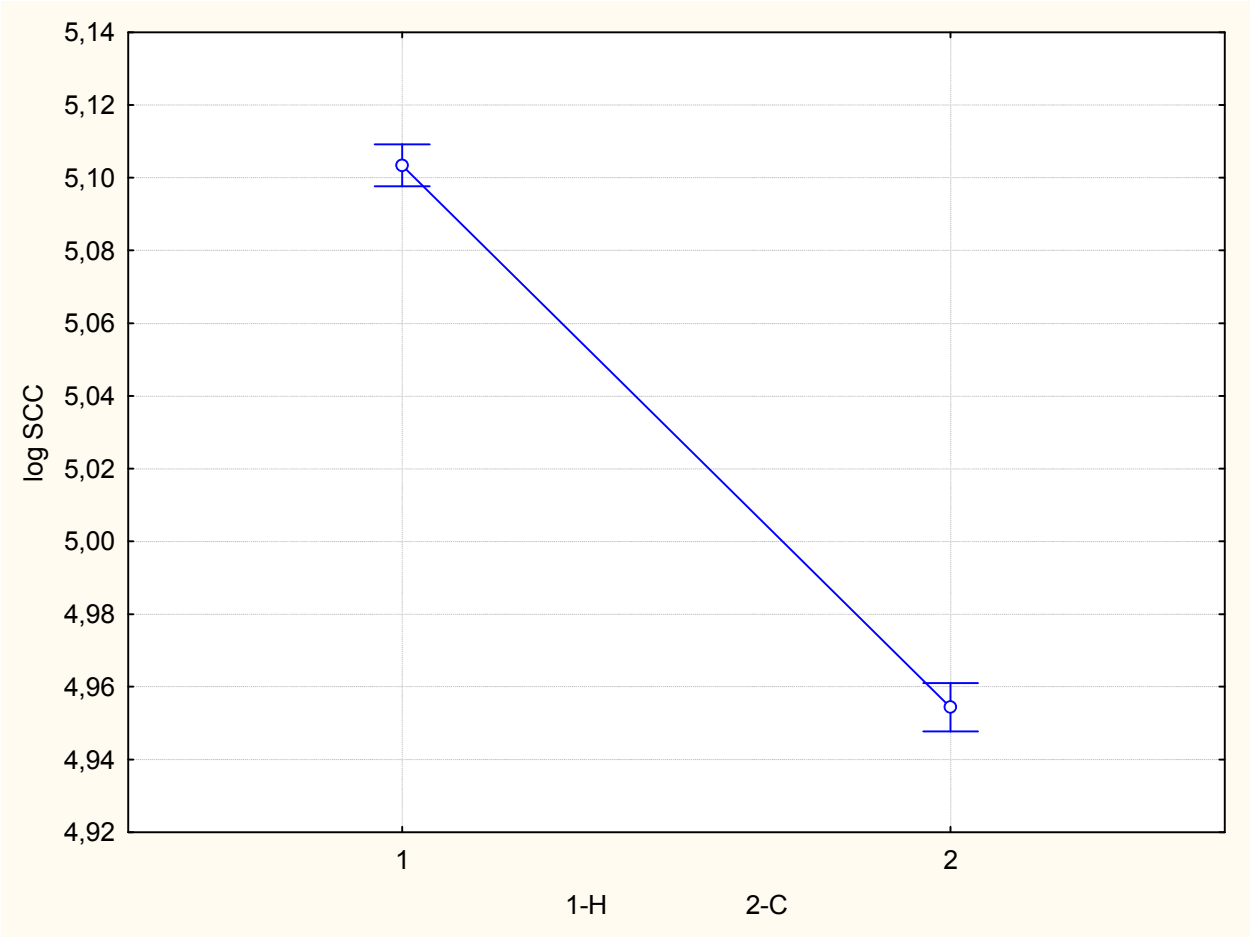
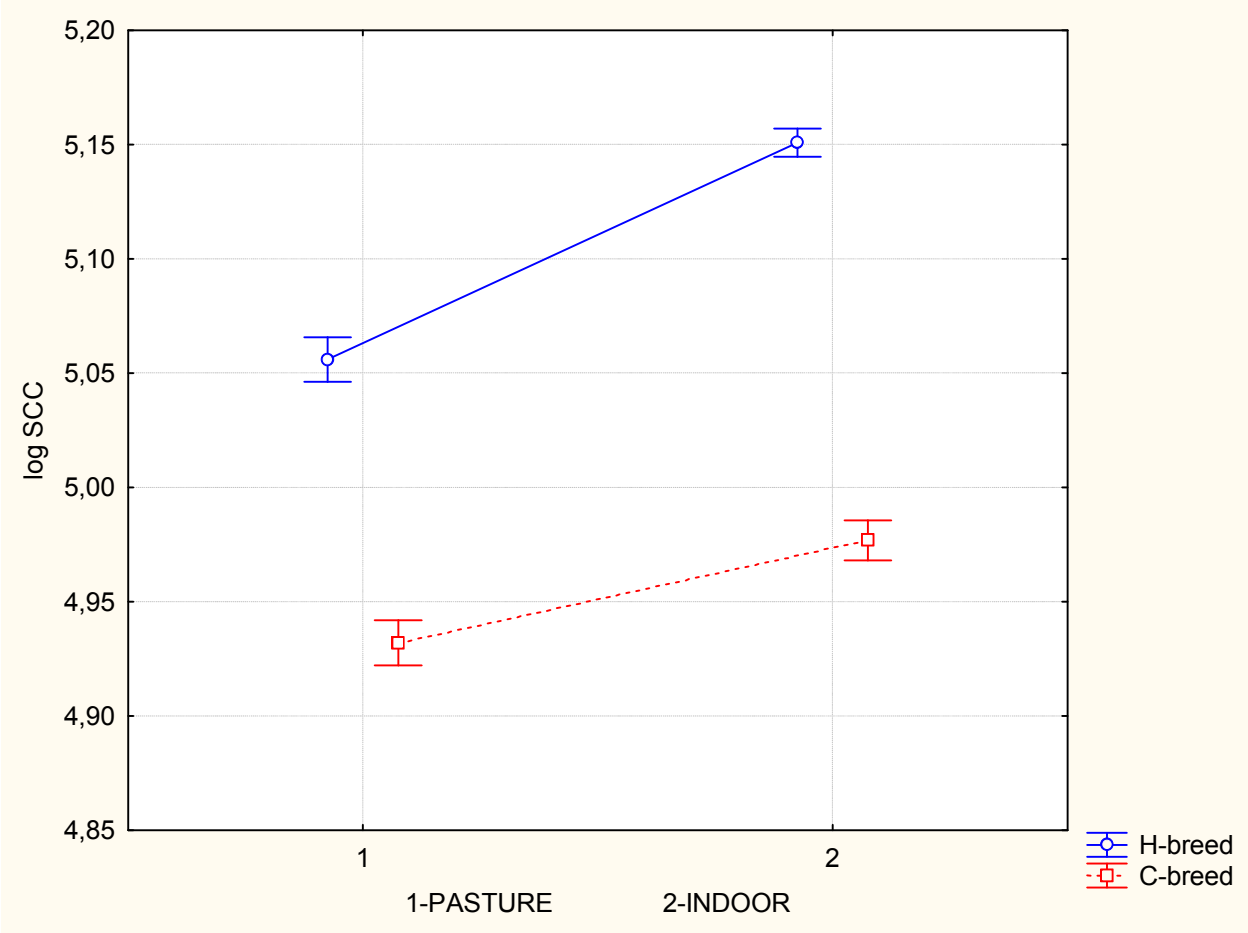


Figure 5. Interaction between BREEDING SYSTEM and BREED factors.




Conclusions

Higher somatic cell counts (SCC) were found in milk produced by permanently confined herds than in seasonaly pastured herds. Higher SCC was found in Holstein than in Czech Fleckvieh cows. A more pronounced effect of Indoor breeding system on enhancement of SCC was identified in Holstein than in Czech Fleckvieh breed. These results indicated that the seasonal pasture applied on low-input farms did not deteriorate the udder health of cows and milk quality in comparison to the permanently confined herds. In opposite, the results suggested tendency to even better values in pastured herds:

- median: SCC 97 – 109 thousands $ml^{-1}$ in pastured *vs.* 100 – 135 thousands $ml^{-1}$ in indoor herds (Fig. 1,2);
- .75 *quantile*: SCC 173 – 214 thousands $ml^{-1}$ in pastured *vs.* 168 – 280 thousands $ml^{-1}$ in indoor herds (Fig 1,2).

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