**Andrzej Olszewski**

**Identification of some determinants of functional longevity in dairy cows**

SUMMARY

Over the last two decades, major advances have been made in the breeding and production of dairy cattle as a result of increased profitability of milk production. Holstein-Friesian animals and bull semen began to be imported on a large scale, thus displacing cows of the native Black-and-White Lowland breed. For many years, milk yield and the content of basic components, such as protein and fat, were the only criterion for choosing bulls for the herd. Unfortunately, this one-sided selection has considerably shortened the productive life of dairy cows, in extreme cases to two lactations. Functional traits such as fertility, easy calving, health and longevity were also compromised. Not directly associated with production, these traits are important in terms of the profitability of cow production.

The scientific objective of this study was to identify genetic and environmental factors for increased functional longevity of dairy cattle as well as determining the possibility of using the leptin gene polymorphism and expression, which is responsible for cow longevity and productivity, in the selection of cows.

The study was performed during 2014-2017 at the Experimental Station of the National Research Institute of Animal Production in Kołbacz (Dębina cattle farm) using 3 groups of cows selected for the experiment: first to third lactation cows (group I), fourth to eighth lactation cows (group II), and disposed cows (group III). Analysis was made of the basic production parameters such as milk yield, fat content, protein content, level of somatic cells, and urea content during lactation. Data originated from the Obora system (which collects monthly test-day milkings of cows in different lactations), the Afifarm system (which gathers real-time milking data), pedometers (attached to the legs of the cows), the results of Afilab milk analyser, and scales. In addition, the leptin gene polymorphism was investigated and its association with milk yield was determined.

It was found in the study that highest milk production was achieved by active older cows in fourth to eighth lactation and cows disposed of in fourth lactation. Compared to disposed cows, cows in fourth to eighth lactation had a higher daily milk production by 7.12 to 10.84 kg. The largest differences in milk production between the groups were noted in warmest months (July and August), they were 5.09 kg milk per day to the advantage of fourth to eighth lactation cows. Analysis of the mean yields over 9 months for session I showed that disposed cows had the lowest yield in relation to cows in the active (live) groups. Activity tests revealed that cows from disposed groups showed similar activity to cows active in fourth to eighth lactation. However, disposed cows spent less time (by 26.12 minutes per day) on total and single resting time (by 2.93 minutes). In live cows in fourth to eighth lactation, average lying time per bout (RD) was greater than in cows disposed of in the same lactation. These values ranged from 5.56 to 15.92 minutes per bout. Analysis of behavioural data demonstrated that average lying time per bout was lower in the group of live cows (first to third lactation) compared to the corresponding group of disposed cows. The difference was up to 12.94 minutes per bout. In the group of disposed cows in fourth to eighth lactation, average age at first calving was longer by 35 days compared to active cows in the same lactations. Also in relation to the same group, disposed animals achieved a 22.97 days longer calving interval. The greatest differences were noted for the postpartum interval, which was longer by 76.48 days. It is worth noting the much more favourable parturition process in the group of older cows. The number of easy calvings averaged 77.18% in the group of active cows in fourth to eighth lactation, 89.6% in the group of disposed cows in fourth to eighth lactation, 17.87% in the group of active cows in first to third lactation, and 43% for cows disposed of in first to third lactation. The behavioural patterns of the cows had a highly significant effect on the level of milk and FCM milk production (especially in older cows) and on milking time (ACD). The age of cows (lactation group) had a highly significant effect on resting frequency (RB) and on the high correlations between cow age and resting parameters. Analysis of the leptin gene showed that cows with TT genotype of the R25C gene, which was the least frequent in the studied population (0.23 on average) produced more milk in all of the three experimental groups. The most frequent genotype in the test cows was CT, the average frequency of which was 0.41. When striving to maintain long-lived cows, the cows should be of the CT genotype.

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