

A multi criteria method for conforming homogeneous groups of cows for experimental purposes

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INTRODUCTION

A crucial aspect for a comparison of different treatments in a trial with animals is the conformation of the animal groups. This aspect will decide the quality of the experiment and its results. The situation is even more complicated if the researcher makes experiments with milk cows, which differ in several productive and reproductive aspects.

The aim of this study was to select 24 dairy cows from a herd for a trial using a multi criteria method.

PROCEDURE

For a trial at the Institute of Animal Science of the Lithuanian Veterinary Academy, 24 Lithuanian Black-and-White dairy milking cows had to be selected from a larger group of 131. At the start of the experiment, the animals will be allocated to two groups of twelve, with each group having a similar mean age, lactation number, date of calving and therefore lactation time, present milk yield and last year milk yield, milk fat, milk protein content and live weight.

The cows should be selected according to their proximity in the average values in each parameter. For this purpose, the data were collected from the data base available in the farm, and a matrix with the whole information was made. The parameters were very variable (Figure 1).

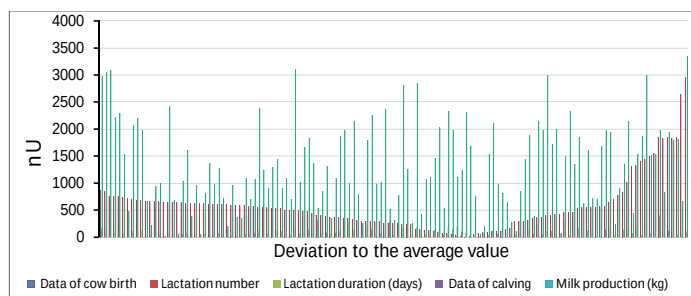


Figure 1: Deviations to the average value in 5 selected parameters

Therefore a cluster analysis was done. Nevertheless, the results were not convincing enough since the groups were still very heterogeneous and far from the desired number of cows (24) to be selected (n = 39; 13; 77 and 2).

That is the reason why the research team decided to use a multi criteria method.

1- The first step was to calculate the average values of each parameter and the deviations from the average (Table 1).

Table 1: Average values and deviations from the average (example with 5 cows)

Cow identification number	Data of cow birth	Deviation from the average age of birth (days)
4027704	12.10.2006	869
4027690	10.09.2006	837
4027646	22.06.2006	757
4027640	18.06.2006	753
4027638	11.06.2006	746

2- A second step was to calculate the maximal values of the deviations and to divide each deviation by the maximal value for the parameter, obtaining a coefficient for each parameter (Table 2).

Table 2: Coefficient for each parameter under study (example with 5 cows)

Cow identification number	Data of cow birth	Deviation from the average age of birth (days)	Coefficient (Deviation/maximum)
4027704	12.10.2006	869	0,30
4027690	10.09.2006	837	0,29
4027646	22.06.2006	757	0,26
4027640	18.06.2006	753	0,26
4027638	11.06.2006	746	0,25

This second intermediary step was done in order to avoid numerical differences in magnitude like, for example, milk production (from 2000 to 7000 liters) and number of lactation (from 1 to 8).

3- In a last step, the obtained values after the steps 1 and 2 were averaged for each milk cow a multi criteria index (MCI) conformed, using the following formula which include each coefficient [C(x)] calculated in the step 2 (Table 3):

$$MCI = C(\text{age}) + C(\text{live weight}) + C(\text{lactation number}) + C(\text{date of calving}) + C(\text{lactation time}) + C(\text{present milk yield}) + C(\text{last year milk yield}) + C(\text{milk fat}) + C(\text{milk protein content}) + C(\text{live weight})$$

Table 3: Multi criteria indexes (example with 5 cows)

Cow identification number	Multi criteria index (MCI)
4027704	0.36
4027690	0.38
4027646	0.41
4027640	0.33
4027638	0.34

Finally the cows were ordered upward and the first 24 animals with the lowest MCI (lowest differences to the group average) selected for the trial (Figure 2).

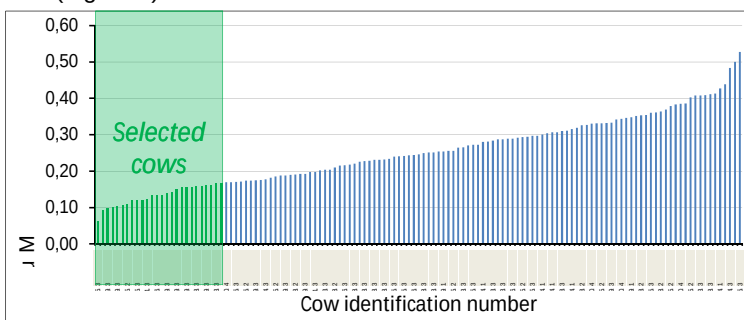


Figure 2: Upward ranking of the cows according to their MCI

CONCLUSIONS

The multi criteria method is an adequate tool for conforming homogenous groups of animals, which strongly differ in productive and/or reproductive parameters.