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Breeding objectives for beef cattle used in different production systems 2. Model application to production systems with the Charolais breed

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Abstract

A general bio-economic model for beef cattle production was used to define breeding objectives for Charolais cattle to be utilized in a variety of linked production systems. Economic weights were calculated for 16 traits (some with both direct and maternal components) in three production systems (pure-breeding and terminal crossing with beef or dairy cows) and two marketing strategies (sale or fattening of weaned surplus calves). Economic weights for the total breeding objective were calculated as weighted averages, where weights were numbers of cows expected to be mated with Charolais bulls in each production system and marketing strategy. Results suggest that the direct component of calving performance and cow longevity were of primary economic importance in all systems. Conception rate of cows and weaning weight reached about 50% of the standardized economic weight of calving performance in purebred systems with sale of weaned calves, whereas in purebred systems with fattening the economic importance of the direct component of cow conception rate, losses at calving, mature weight of cows, weaning weight, and fattening traits were of equal importance (each approximately about 20% that of calving performance). In terminal crossing systems, weaning weight was important when calves were sold at weaning, and fattening traits were important for systems selling fattened animals. The bio-economic model performed well under the conditions of this demonstration and could easily be customized for other applications.

Keywords: Beef cattle; Charolais; Bio-economic model; Economic weight; Breeding objective

1. Introduction

A general model for the estimation of economic weights for selection in beef cattle was described in a companion paper (Wolfová et al., 2005a). The model

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may be applied to a large range of breeding and production systems as well as a broad spectrum of management, marketing, and economic conditions. It is implemented in a computer program described by Wolf et al. (2003). Economic weights, which can be calculated from the model, are necessary for the definition of breeding objectives to maximize economic return from investments in selection.

Bulls in the Charolais breed are used in purebred matings and as terminal sires for crossbreeding with dairy, dual purpose or beef cows. Wilton et al. (2002) showed that a bio-economic evaluation of purebred Charolais sires based on progeny results in a purebred population would be inaccurate if sires were to be used in crossbred production systems. The ranking of Charolais sires was found to be sensitive to average performance for traits in populations of cows to which the bulls were bred. Amer et al. (2001) calculated a three-times higher economic value for calving ease for beef bulls mated to beef cows than for beef bulls mated to dairy cows.

The objective of this study is to illustrate how the general bio-economic model mentioned above can be used to calculate economic weights for beef cattle in different production systems, using the Charolais breed as an example.

2. Materials and methods

2.1. Input data and basic description of the production systems

Model calculations were carried out for three production systems in which Charolais bulls frequently are used:

- System 1: Purebred beef cow–calf pasture system producing females and males for own replacement and for other systems. Purebred herds producing primarily breeding stock or primarily animals for slaughter both are included.
- System 3: Cow–calf pasture systems purchasing crossbred female replacements from dairy cow herds and buying beef bulls or their semen for terminal crossing.
- System 4: Dairy cow herds with milk production (indoor system) but terminal crossing a proportion of their cows with beef bulls to produce valuable progeny.

The numbering of the production systems carries over from Wolfová et al. (2005a) where a detailed description of these systems can be found. Only the basic assumptions for the production systems and parameters specific for the Charolais breed example will be described in the following text.

In System 3, purchased crossbred Charolais× Holstein cows (produced in System 4) were assumed to be used as suckler cows. In the first two systems, two possible marketing strategies (sale of calves at weaning or intensive fattening in a feedlot) were allowed for surplus calves. In System 4, these strategies held only for surplus crossbred calves. Surplus dairy calves were fattened because there was no sale demand for such calves.

The reproductive cycles of the cows on pasture were set to a length of 1 year (365 days). Climatic conditions typical for Central Europe were assumed where cows and replacement heifers are expected to be on pasture from May 1 to October 30. All calves were assumed to be weaned on October 15. The mating season for both cows and heifers started on April 10 and lasted for three oestrus cycles. In purebreeding System 1, 30% of the cows and 10% of the heifers were assumed to be inseminated with semen from elite bulls at the beginning of the mating season, followed by natural mating. In System 3, natural mating was practiced throughout.

Purebred Charolais heifers were mated after reaching a minimal live weight of 480 kg. The fraction of heifers mated in the first mating season after weaning was calculated assuming a normal distribution of live weight at mating with a standard deviation of 50 kg. Heifers that had not conceived by the end of the second mating period after weaning were culled on an average of 60 days after the mating season. All nonpregnant cows and cows past their tenth calving were slaughtered at the time of weaning of their current calf. Crossbred heifers for System 3 were purchased at 6 months of age and mated at an average age of 15 months. 20% of the weaned Charolais bull calves in System 1 were performance-tested and 70% of the tested animals were selected as breeding bulls. The test bulls were assumed to be in the possession of the herd owners until sale to the other herds or to AI