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Economic values for health and feed efficiency traits of dual-purpose cattle in marginal areas

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ABSTRACT

Economic values of clinical mastitis, claw disease, and feed efficiency traits along with 16 additional production and functional traits were estimated for the dairy population of the Slovak Pinzgau breed using a bioeconomic approach. In the cow–calf population (suckler cow population) of the same breed, the economic values of feed efficiency traits along with 15 further production and functional traits were calculated. The marginal economic values of clinical mastitis and claw disease incidence in the dairy system were −€70.65 and −€26.73 per case per cow and year, respectively. The marginal economic values for residual feed intake were −€55.15 and −€54.64/kg of dry matter per day for cows and breeding heifers in the dairy system and −€20.45, −€11.30, and −€6.04/kg of dry matter per day for cows, breeding heifers, and fattened animals in the cow–calf system, respectively, all expressed per cow and year. The sums of the relative economic values for the 2 new health traits in the dairy system and for residual feed intake across all cattle categories in both systems were 1.4 and 8%, respectively. Within the dairy production system, the highest relative economic values were for milk yield (20%), daily gain of calves (20%), productive lifetime (10%), and cow conception rate (8%). In the cow–calf system, the most important traits were weight gain of calves from 120 to 210 d and from birth to 120 d (19 and 14%, respectively), productive lifetime (17%), and cow conception rate (13%). Based on the calculation of economic values for traits in the dual-purpose Pinzgau breed, milk production and growth traits remain highly important in the breeding goal, but their relative importance should be adapted to new production and economic conditions. The economic importance of functional traits (especially of cow productive lifetime and fertility) was sufficiently high to make the inclusion of these traits into the breeding goal necessary. An increased interest of consumers in animal welfare and quality of dairy farm products should probably lead to the incorporation of health traits (clinical mastitis incidence and somatic cells score) into the breeding goal. However, keeping carcass traits in the breeding goal of the Slovak Pinzgau breed does not seem to be relevant to the long-term market situation.

Key words: cattle, mastitis, claw disease, residual feed intake

INTRODUCTION

Functional traits of cattle (such as health, reproduction, and survival traits) and feed efficiency traits generally have substantial effect on profitability because they influence utilization of inputs in the production process (Sölkner et al., 2000; Williams et al., 2011; Gonzalez-Recio et al., 2014). Lower costs (mostly for veterinary and feed inputs), higher milk price and quality, health issues, and environmentally sustainable farming are also important in relation to such traits. Improving feed efficiency in cattle herds offers an opportunity to reduce the negative effects of the cattle production on the environment through lower greenhouse gas emissions and nutrient losses to the environment (Bell et al., 2013; Connor, 2015). A direct inclusion of health traits in the breeding goal is expected to bring an extra economic benefit (Sadeghi-Sefidmazgi et al., 2011). Furthermore, the noneconomic value of health traits should be taken into account, which is connected with a growing interest of consumers in socioethical aspects of animal production, such as animal welfare and product quality (Hietala et al., 2014).

Some functional traits have already been included into the breeding goals and selection schemes, and their economic values were estimated for various cattle breeds (Phocas et al., 1998; Sölkner et al., 2000; Fernández-Perea and Jiménez, 2004). To the best of our knowledge, however, economic values for claw disease incidence in dairy herds have not yet been published.

Slovak Pinzgau cattle comprise a dual-purpose breed typically farmed in mountainous regions of Slovakia.

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The breed has been registered by the Food and Agriculture Organization of the United Nations as threatened with extinction and classified as an animal genetic resource since 1994 (Kadlečík et al., 2008). Considering the actual population size, with almost 10,500 live animals and 2,860 cows registered in the herd book (ASPB, 2015), the breed contributes approximately 1% to overall milk production and the same proportion to overall beef production in Slovakia. The general aim of the breeding goal is at developing more productive dual-purpose (milk and meat) cattle suitable for mountainous regions, albeit without detailed specification of target-trait levels other than those for milk yield (5,500 to 6,500 kg per lactation), growth rate in fattening (1,200 to 1,300 g/d), and dressing percentage (up to 58%; ASPB, 2015). At present, breeding values and economic values for milk carrier, milk fat, and milk protein yield of cows (Candrák and Lichanec, 2007) along with breeding values for live weight of calves at 210 d of age are the key breeding parameters in the Slovak Pinzgau population. Kasarda et al. (2014) developed, for the first time, a total merit index based on economic and breeding values for milk yield, productive lifetime, and live weight at 210 d of age for Slovak Pinzgau cattle with the aim of using the index in a simulation study. The economic values applied in that study had been calculated previously by Krupová et al. (2009) and Krupa et al. (2011). Since that time, the production and economic conditions of the breed have changed substantially and, mainly due to reasons of economic insufficiency, the population has been reduced (Kasarda et al., 2014). Moreover, economic values for health traits such as clinical mastitis and incidence of claw disease, as well as feed efficiency traits, have not previously been calculated for this breed.

The objective of the present study was to acquire information on the economic importance of the health and feed efficiency traits for a future breeding goal in Slovak Pinzgau cattle. For this purpose, the economic values for all production and functional traits are herein jointly estimated for both dairy and cow–calf populations of the breed using a complex bioeconomic model.

MATERIALS AND METHODS

Basic Characteristics of Production Systems

Economic values of traits were calculated for the Slovak Pinzgau breed farmed partially in dairy and partially in cow–calf (so-called suckler) production systems. Both production systems were treated as self-reproducing (breeding and commercial herds together), with rearing of breeding females and males for their own replacement. A classical indoor farming system with loose housing of cows, selling (exporting) of surplus calves at weaning, and selling of surplus pregnant breeding heifers was assumed for the dairy population. A traditional pasture management system with winter calving and selling (exporting) of surplus calves at autumn weaning was in use for the cow–calf population. Pasture covered the period from May 1 to October 30, and indoor feeding was used during the rest of the year. In this system, natural mating and integrated intensive indoor fattening of bulls and extensive fattening of steers were practiced. Surplus breeding heifers were sold before mating.

The structures of dairy and suckler herds in their steady state were generated using a Markov chain approach as described by Wolfová et al. (2007). The main input parameters for both dairy and cow–calf herds used in our study corresponded to the average values obtained for the Slovak Pinzgau population from our own investigations on farms and from the databases of the Breeding Service of the Slovak Republic over the 3-yr period from 2011 to 2013 (unpublished data).

Profit Function

The economic efficiency of the evaluated production systems was expressed as the present value of total profit (TP) per cow entering a reproductive cycle and per year as follows:

$$\mathrm{TP} = \mathbf{rev}' \times \mathbf{NDE}^{(\mathbf{rev})} - \mathbf{cost}' \times \mathbf{NDE}^{(\mathbf{cost})}, \quad [1]$$

where $\mathbf{rev}'$ and $\mathbf{cost}'$ are row vectors of revenues and costs and $\mathbf{NDE}^{(\mathbf{rev})}$ and $\mathbf{NDE}^{(\mathbf{cost})}$ are column vectors of the number of discounted expressions connected with revenues and costs occurring in the individual cattle categories within the herd (Wolfová et al., 2007). An annual discount rate of 1.0% (estimated as the difference between the average annual investment rate and inflation rate valid in Slovakia in the evaluated time period) was applied to account for the delay in expression, and associated time value of money, of traits that influence revenues and costs in the life of the animal.

Revenues were derived from milk and breeding heifers sold in the dairy system, from fattened bulls and steers in the cow–calf system, and from calves sold at weaning; slaughtered cows and heifers; manure; and subsidies in both production systems. Revenues from milk were a function of milk amount, fat and protein content, and SCC. Revenues from slaughtered animals were a function of live weight at slaughter, dressing percentage, and the average price per kilogram of carcass weight, defined on the basis of the distribution of carcasses across fleshiness and fat-covering classes within the SEUROP grading system. Direct subsidies paid in