

The economic importance of fertility traits in beef cattle

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Introduction

During the last decades many studies on the economic importance of functional traits in dairy cattle have been carried out, and the magnitude of these traits have been emphasised and discussed extensively (Groen et al. 1997). In addition to the economic importance, there are several other reasons to include functional traits in breeding programmes, e.g. ethical considerations and consumer attitudes (Groen et al. 1997). However, when considering beef cattle breeding, there is a more limited amount of research and inclusion of functional traits in the breeding objectives worldwide. Growth traits is still the most commonly recorded traits (ICAR Technical Series No. 6 2001), and lot of emphasis is put on production traits, obviously making the selection for economic merit suboptimal.

Fertility and other reproduction traits are for obvious reasons important in beef suckler cow production as the calf in most circumstances represent the main source of income, and thus should be expected to be among of the most important functional traits. However, even though several bio-economical models for beef cattle have been published over the last two decades, they are often not developed for broad breeding goals, including only a few functional traits, making it difficult to compare the real importance of these traits. The economic importance of functional traits is influenced by management and production systems; therefore it is important to define and properly model the production system considered.

Many different production systems for beef cattle are found world wide. In Europe, two different production systems for beef cattle may be defined according to intensity of production: 1) intensive concentrate based systems and 2) extensive pasture based systems (Zjalic et al. 2006). In addition, there are production systems where some parts of the production are intensive (e.g fattening of bulls) while other parts are more extensive (e.g. the

suckler cow-calf enterprise). This production system is the basis for the present study may be referred to as semi-intensive production systems. The aim of this study was to investigate the economic importance of production and functional traits for an intensive breed kept in a semi-intensive production system.

Materials and methods

A program was written specifically for this study, as most packages already developed and available for this purpose do not deal with the factors of main interest for the present study.

The model describes a semi-intensive production system and calculates the life-time production and economic result of a purebred beef suckler cow of an intensive breed. The models follow the cow from she calves for the first time until she is culled due to age. One heifer calf is kept as replacement and followed until (but not including) first calving. According to normal practice the suckler cow is assumed to be kept inside during winter and out on pasture during summer (June 1.-September 15.). The diet during winter consists of roughage and concentrates. The heifers are calving for the first time in spring, however a shift in calving date each year occurs because the average calving interval exceeds 12 months. Most heifers are calving as two year olds. Calves are weaned at approximately 6 months of age, and thereafter enter one of the following categories: 1) replacement heifer, 2) fattening of bulls and surplus heifers.

Average production data from 2008 was obtained from recordings in the Norwegian Beef Cattle Recording System (NBCHRS) and used as the base situation (NBCHRS 2008). Average production data for the intensive breed was based on data for Charolais, Simmental and Limousin. Mean performance for the most important traits are given in table 1.

Table 1: Mean performance in base situation

Traits	HL	AFC	CI	S	T	CD	BW	GR1	GR2	GR3	CC	CF	CW	LC
Mean	83	29	13	4.5	2.8	1.11	45	1.39	1.32	1.22	7.15	5.14	365	30

HL=herd life cow (months), AFC=age at first calving (months), CI=calving interval (months), S=stillbirth (%), T= twinning frequency (%), CD=calving difficulty,

BW=birth weight of bulls (kg) GR1=growth rate bulls (kg/day) (age 0-200 days), GR2:age 200-365 days, GR3: age 365-slaughter, CC=carcass conformation score bulls

(EUROP), CF=carcass fatness score bulls (EUROP), CW=carcass weight (kg), LC=limb and claw disorders (%)

Farm revenue comes from slaughtering of fattened bulls, heifers, culling of cows due to age, and from subsidies. The included variable costs were feed, labour, veterinary costs and claw trimming. The fixed costs was used as a balance to obtain zero profit (Brascamp et al. 1985).

The economic values were estimated as the increase in profit as a result of 0.1 % increase in the mean of the trait of interest while keeping all other traits constant. The economic values were standardized by multiplying the economic value by the additive genetic standard deviation for each trait. The genetic standard deviations were obtained from literature (Boelling et al. 2008; Eriksson et al. 2003; Heringstad et al. 2007; Holtsmark 2010; Interbull 2006; Karlsen et al. 2000; Martinez et al. 2005; Teixeira et al. 2002).

Economic values for the categorical traits calving difficulty, calving interval, EUROP carcass conformation and fatness was calculated using the approach described by Meijering (1986).

The considered traits were divided into three groups; 1) fertility and other reproduction traits, 2) production and 3) other functional traits. The fertility and other reproduction group consisted of 6 traits: stillbirth, calving interval, calving difficulty, twinning frequency, age at first calving and birth weight. Production traits considered were carcass weight, EUROP carcass conformation fatness and growth rate. The group other functional traits consisted of herd life of cow and limb and claw disorders.

To investigate the economic values' sensitivity to changes in production conditions, the effect of a 20 % increase and decrease in the price of the input factors roughage, concentrates and labour were investigated.

Results and Discussion

The relative importance of the three groups of traits in the basic situation and their sensitivity to changes in productions conditions are given in table 2.

Table 2: Relative economic values and their sensitivity to productions conditions for the considered groups

Trait	basic	rou+20 %	rou-20 %	con+20 %	con-20 %	labour+20 %	labour-20 %
Fertility	75.02	73.88	73.58	70.90	78.38	73.66	76.84
Production	23.41	24.52	24.80	27.42	20.14	25.12	22.04
Other	1.57	1.61	1.62	1.68	1.48	1.23	1.11

Rou=roughage price/kg, con=concentrates price/kg, labour= NOK/hour

The table shows that the most important group of traits is obviously fertility and other reproduction traits, being more than three times as important as the production traits. In general, the relative economic values were little affected by the change in conditions, with the exception of price of concentrate. When concentrates were inexpensive, the production traits become less important and vice versa. The production traits are mainly associated with the

fattening animals. These animals have the largest amount of concentrates in their diet, and this is probably the main reason why the price of concentrates influences the importance of production traits.

The relative economic values of the fertility and other reproduction traits and their sensitivity to different production circumstances are given in table 3.

Table 3: Relative economic values for fertility and other reproduction traits and sensitivity analysis

Trait	Basic	rou+20 %	rou-20%	con+20 %	con-20 %	labour+20%	Labour -20 %
S	70.79	70.08	69.82	68.28	72.61	69.93	71.50
AFC	14.26	14.69	14.80	15.94	13.01	14.55	14.00
CI	5.95	6.09	6.12	6.27	5.72	6.00	5.91
T	5.27	5.21	5.28	5.08	5.40	5.20	5.32
CD	3.73	3.93	3.98	4.40	3.23	4.28	3.25
BW	0.00	0.00	0.00	0.03	0.02	0.02	0.02

For abbreviations; see table 1.

The most important traits in the group fertility and other reproduction traits were stillbirth followed by age at first calving, calving interval, calving difficulty and twinning frequency. Birth weight was of little economic importance. As before the economic values were little affected by the different production conditions, with the exception of the price of concentrates. Stillbirth, age at first calving and calving interval were especially influenced by the price of concentrates. This is probably because these traits will influence the number of fattened animals, and thus the cost of fattening. If concentrates is inexpensive more is to be gained by improving these traits, because of the increase in cost of fattening will be less than if concentrates is expensive. Calving difficulty were sensitive to the price of labour. This is probably due to the fact that calving difficulty is labour intensive, and when the price of labour is high, more is to be gained by improving this trait and vice versa.

Conclusions

The result of this study shows fertility traits are the most important traits to consider in a breeding objective for beef cattle. The fertility traits stillbirth, age at first calving, calving interval, calving difficulty and twinning frequency are economically important traits that should be, to a much larger extent than at present, included in breeding goals for beef cattle.

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