J. Dairy Sci. 97:5206–5218
http://dx.doi.org/10.3168/jds.2013-7457

Calving traits, milk production, body condition, fertility, and survival of Holstein-Friesian and Norwegian Red dairy cattle on commercial dairy farms over 5 lactations

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ABSTRACT

The objective of this study was to compare calving traits, BCS, milk production, fertility, and survival of Holstein-Friesian (HF) and Norwegian Red (NR) dairy cattle in moderate-concentrate input systems. The experiment was conducted on 19 commercial Northern Ireland dairy farms, and involved 221 HF cows and 221 NR cows. Cows completed 5 lactations during the experiment, unless they died or were culled or sold. Norwegian Red cows had a lower calving difficulty score than HF cows when calving for the first and second time, but not for the third and fourth time. At first calving, the incidence of stillbirths for NR cows was 4%, compared with 13% for HF cows, whereas no difference existed between breeds in the proportion of calves born alive when calving for the second time. When calving for the first time, NR cows had a poorer milking temperament than HF cows, whereas milking temperament was unaffected by breed following the second calving. Holstein-Friesian cows had a higher full-lactation milk yield than NR cows, whereas NR cows produced milk with a higher milk fat and protein content. Full-lactation fat + protein yield was unaffected by genotype. Norwegian Red cows had a lower somatic cell score than HF cows during all lactations. Although NR cattle had a higher BCS than the HF cows during lactations 1 and 2, no evidence existed that the 2 genotypes either lost or gained body condition at different rates. Conception rates to first artificial insemination were higher with the NR cows during lactations 1 to 4 (57.8 vs. 40.9%, respectively), with 28.5% of HF cows and 11.8% of NR cows culled as infertile before lactation 6. A greater percentage of NR cows calved for a sixth time compared with HF cows (27.2 vs. 16.3%, respectively). In general, NR cows outperformed HF cows in traits that have been historically included in the NR breeding program.

Key words: Norwegian Red, Holstein, milk production, fertility, longevity

INTRODUCTION

Until recently, selection programs within the Holstein-Friesian (**HF**) breed in many countries focused primarily on milk production, with a resultant decline in functional traits, especially fertility and health (Miglior et al., 2005). However, a much broader multitrait selection program has been in place in several Scandinavian countries for several decades. For example, traits such as health and fertility have been included in breeding programs within the Norwegian Red (**NR**) breed since the 1970s (Steine, 2005). In view of this long-established selection program, it might be expected that the NR breed could help overcome many of the weaknesses that exist within the HF breed. Indeed, evidence from Norway suggests that NR cattle are highly fertile and have a low incidence of mastitis, stillbirths, and calving difficulties (Heringstad et al., 2007; Østerås et al., 2007; Heringstad, 2010). However, as approximately 98% of dairy cows in Norway belong to the NR breed (Steine, 2005), little information exists from within Norway comparing the NR and the HF breeds.

Recent interest in the Scandinavian breeds has resulted in NR genetics being evaluated outside of Norway. For example, Heins et al. (2006a,b,c) examined milk production, fertility, and longevity of purebred Holstein and Scandinavian Red × Holstein crossbred cows in high-input systems in the United States. The results of this experiment demonstrated that Scandinavian Red × Holstein cows can produce similar outputs of milk solids to purebred Holstein cows, while having improved fertility performance and survivability. In addition, Begley et al. (2008) compared HF and NR cows in predominantly low-input grazing systems. In their study, which monitored cow performance over 2 lactations, the NR cows had lower milk yields, fat + protein yields, and SCC than the HF cows as well as having a lower incidence of mastitis and improved reproductive performance. However, much less information appears to be available on the comparative performance of pure-

Received September 4, 2013.
Accepted April 10, 2014.
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bred cows of these 2 genotypes in moderate-concentrate input systems, as are common in many parts of the world.

To address this issue, and to identify if the NR breed can have a beneficial role in more intensive dairy systems, a large-scale study was established on 19 commercial dairy farms to examine calving parameters, milk production, BCS, fertility, and survival of NR cows and HF cows across first to fifth lactations in moderate-concentrate input systems.

MATERIALS AND METHODS

Overview

An experiment involving 221 HF dairy cows and 221 NR dairy cows was established on 19 commercial dairy farms in Northern Ireland (**NI**) in 2000. The NR cows were imported from Norway, whereas the HF cows were born on the participating farms. Unless they died, or were culled or sold, cows completed 5 lactations during the experiment, and remained in the experiment until the time of their sixth calving.

Selection of Participating Farms and HF Cattle

The 19 participating farms were selected to represent a range of geographical locations within NI, a range of calving systems (winter and spring calving systems), and a range of concentrate inputs. Farms selected met the following criteria: (1) predominantly HF herds with more than 60 cows, (2) involved in an official milk recording scheme, (3) rearing their own replacements, (4) pedigree registered or with ancestry available for the past 2 generations. At the start of the experiment, the average herd size on the 19 farms was 120 cows (70 to 300 cows).

On each of the 19 farms, experimental HF cows were selected from the farmers' own home-bred stocks using the following criteria: (1) animals of similar ages to those being imported from Norway (born between September 1998 and February 1999, or born between September 1999 and February 2000); (2) animals with as high a pedigree index as possible, or in the case of non-pedigree herds, sired by bulls with as high a pedigree index as possible; and (3) animals that were fit and healthy, based on a visual inspection.

For cows that were not pedigree registered, their genetic potential was calculated using sire and maternal grandsire genetic information (December 2012 proof run) using the following formula:

$$\text{Genetic index} = (0.5 \times \text{sire genetic index}) + (0.25 \times \text{maternal grandsire genetic index}).$$

The genetic index of 6 HF cows could not be determined due to insufficient information on their parentage. The remaining Holstein-Friesian cows had a mean PTA for milk yield (kg) of −67.2 kg, and a mean profitable lifetime index of −£12 (December 2012 proof run). Whereas this group of cows was within the top 25% of Holstein cows in the United Kingdom at the time of their birth, they currently rank within the bottom 25% of the United Kingdom Holstein population.

Selection of NR Cattle

Two-hundred twenty-one nulliparous NR cows were sourced from 187 different farms in Norway (from the areas surrounding Trondheim, Hamar, and Stavanger). Animals were identified from a computer database maintained by Geno (Hamar, Norway; the Norwegian cattle breeding organization), based on the following criteria: (1) an appropriate age (1 of 2 age groups); namely, born between September 1998 and February 1999, with approximately half of these animals (September to December born) confirmed pregnant, or born between September 1999 and February 2000; (2) daughters of at least 5 different proven sires within each age group, and a maximum of 30 daughters per sire; (3) animals within the top 10% of the NR cattle population in terms of total merit index (**TMI**); and (4) animals with a fertility score and an udder score of >95 and >100, respectively.

Following a visual inspection (to ensure suitable overall type appearance), animals were tested to ensure that they were free from *Brucella abortus*, bovine tuberculosis, Johne's disease, enzootic bovine leucosis, bovine virus diarrhea, infectious bovine rhinotracheitis, and *Neospora caninum*. The 221 animals selected were sired by a total of 26 NR sires and had an average TMI of −10.5, and an average fertility and mastitis index of 86.5 and 87.6, respectively (2013 basis; values calculated by Geno, May 2013). With regard to TMI, although this group of cows would have been within the top 10% of the NR population at the time of their birth, they are currently within the bottom 25% of the NR population.

All animals were transported overland to NI, and on arrival were inspected by a veterinarian, and weighed. Animals were subsequently allocated to each of the 19 farms, with each farm receiving either 5 or 6 NR cows from each of the 2 age groups described above. Animals within each age group were matched as closely as possible to the ages of the home-bred Holstein animals on each farm. In addition, NR animals allocated to each of the 19 farms were, as far as possible, balanced for TMI. Animals were delivered to the 19 participating farms after a rest period of approximately 48 h. On average,