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Livestock Science 100 (2006) 216–230

LIVESTOCK SCIENCE

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Effects of calving age, breed fraction and month of calving on calving interval and survival across parities in Irish spring-calving dairy cows

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Received 11 March 2005; received in revised form 29 August 2005; accepted 1 September 2005

Abstract

The objective of this study was to investigate the effect of parity, age at calving, percentage North American Holstein-Friesian and calving date on subsequent calving interval and survival to facilitate the estimation of transition probabilities for month of calving. The economic value of traits that influence calving date, age distribution and survival can be assessed in models using a transition probability matrix. Such a matrix contains the probabilities that a cow of a particular age or breed calving in a particular month will calve in the same, an earlier or later month next year, or be culled. Following editing 1,046,855 calving records in spring-calving herds between the years 1990 and 2004 were analysed. Shorter calving intervals were associated with cows calving later in the calendar year. Age at first calving of <24 months resulted in longer calving intervals to second calving across all levels of Holstein percentage with cows calving for the first time at 25–26 months of age having the shortest subsequent calving interval. Age at second calving of 37–38 months and third calving of 49–50 months were optimum for shorter subsequent calving intervals. Calving interval increased with Holstein percentage across the first 5 parities. Survival rate decreased with later month of calving and with older parities. When survival rate was measured as the ability of the cow to re-calve within 500 days, the highest survival rate was found in cows calving at 25–26 months of age whereas there was a noticeable reduction in survival across all parities in the 88–100% Holstein percent category.

Keywords: Calving interval; Survival; Spring-calving; Holstein-Friesian; Age at first calving

1. Introduction

Numerous recent studies have shown declining reproductive performance in Irish dairy herds (Evans

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doi:10.1016/j.livsci.2005.09.003

et al., submitted for publication; O'Farrell and Crilly, 2001). It is hypothesised that the relative importance of fertility is higher in Ireland than many other countries because milk production is based largely based on seasonal-pasture based systems of milk production, and breeding and calving are restricted to a very limited time period of the year (Dillon et al., 1995). Almost 70% of Irish milk-recorded dairy cows calve in the months of February, March and April (Irish Cattle Breeding Statistics, 2003). Poor reproductive performance resulting in longer subsequent calving interval (CI) results in lower annual milk yield due to slippage in calving to less profitable months, fewer calves sold per year, increased number of services per cow, extra veterinary treatments and increased costs through longer dry periods. Cows failing to conceive within the time constraints of a compact breeding season are most often culled. Evans et al. (in press) showed that both the age profile of cows culled for reproductive failure and also the average age profile within herds have declined over time. Hence, economic losses accrue through higher replacement rates and also through reduced overall herd milk yield with less mature animals in the herd. Animals of higher genetic potential for milk production that fail to become pregnant will not produce replacements (Grosshans et al., 1997) resulting in loss in genetic potential through reduced selection of dams, a sometimes disregarded consequence of sub-optimal reproductive performance.

It has been suggested that replacement of the British-Friesian with the North American Holstein-Friesian (NAHF) may explain a proportion of the decline in reproductive performance (Evans et al., submitted for publication; Royal et al., 2002). Over the last 20 years in both the UK and Ireland NAHF genetics has dominated, with the proportion of NAHF in sires used increasing from 10% in 1977 to 80% in 1998 (Evans et al., submitted for publication; Simm, 1998). Aggressive genetic improvement within the NAHF for increased milk yield has resulted in a now, well documented negative effect on cow fertility (Hoekstra et al., 1994; Pryce and Veerkamp, 2001). Genetic parameters predict an antagonistic relationship between milk yield and reproductive traits (Evans et al., 2002; Hoekstra et al., 1994). The resultant slippage in CI especially in spring-calving herds has led to younger ages at first calving, which may affect subsequent CI and survival. In order to arrest this trend of declining reproductive performance the Irish Cattle Breeding Federation (ICBF), in consultation with the dairy industry, introduced CI and survival rate as goal traits in the national dairy breeding objective in 2001 (Veerkamp et al., 2002).

Goal traits included in the breeding objective are weighted according to their economic contribution. The economic value of traits that influence calving date, age distribution and survival can be assessed in models using transition probability matrices. Such a matrix contains the probabilities that a cow of a particular age or breed calving in a particular month will calve in the same, an earlier or later month next year, or be culled. Due to the unavailability of commercial herd data at the time, the transition probability matrix used to simulate a steady state calving pattern in the derivation of the national economic values was based on research herd data (Veerkamp et al., 2002). The transition probabilities used did not account for possible changes in reproduction due to factors such as age at calving, parity or breed fraction differences among animals.

The objective of this study was to investigate the impact of parity, age at calving, percentage NAHF and calendar month of calving on subsequent CI and survival in Irish spring-calving dairy herds. The results will be used to construct transition probabilities that allow a more comprehensive simulation of the effect of changing cow biological parameters on reproductive performance and survival.

2. Materials and methods

2.1. Calving interval data

Data were available from the cattle breeding central database on 3,107,475 calving records in 12,776 herds from 1990 to April 2004 for parities 1 to 5. This database is operated by the ICBF. The cows in the dataset ranged from 0% NAHF (i.e. British-Friesian) to 100% NAHF. North American Holstein-Friesian fraction was expressed in increments of 1/32 in the dataset. All records belonging to a herd were removed if the total number of recorded first parity calving dates in the herd over the 14-year period was less than 50. This helped to eliminate new herds and herds that had gone out of milk recording for various reasons during the