Effect of environmental factors on Non Return Rate in Italian Holstein-Friesians

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Abstract

A total of 2,959,470 first inseminations from 1990 to '95 in 1,426,224 Italian Holstein-Friesian cows were analyzed. The effect of environmental factors on the non return rate at 56 days was investigated. The fixed model included the interaction effect of year by month of insemination, the age of the cow, the herd where the insemination was performed and the AI Center that handled the semen. All effects were statistically significant at $p<0.0001$. The environmental factors identified will be included in the mixed model analysis for the genetic evaluation of bulls, using a sire-maternal grand sire model.

1. Introduction

Fertility evaluations are employed in order to validate semen processing and handling techniques, to evaluate inseminator performance and to estimate the relative fertility of bulls (Reurink et al., 1990 ; Schaeffer, 1993).

The non return rate can be adopted as an indirect indicator of fertility, as the results may be quickly obtained at a reasonable cost for data collection. The non return rate (NRR) is defined as the proportion of cows that is not subsequently re-bred within a specified period of time after an insemination. The observed non return rate may be influenced by many factors including herd, technician, age of the cow and month of insemination (Guaita et al.,1996). Other factors not related to fertility may affect non return rates, among these, misidentification of the cow at subsequent service, inaccurate heating detection and recording (Rycroft and Bean, 1991). NRR may be considered a reliable indicator of fertility if all these effects can be quantified or are random. The efficiency of a NRR system is dependent on the accuracy of data collection. In Italy, most of the inseminations are performed by herdsman technicians. The objective of the present study was to investigate the effect of some environmental factors on NRR at 56 days in Italy, to identify the environmental effects to be included in future genetic evaluations for fertility in the Italian Holstein-Friesian population.

2. Materials and methods

A total of 2,959,470 first inseminations performed in 15,788 herds between 1990 to 1995 were analysed. Inseminations were performed on 1,426,224 Italian Holstein-Friesian cows with doses belonging to 2550 different bulls.

Only bulls having a minimum of 10 inseminations and herds with at least 5 records were considered. Data included cow and service sire identification, date of service, age of the cow at insemination, herd code and AI Centres handling the semen. Service intervals of less then 280 days were considered repeat services. The success or failure of a single insemination was coded as 1 or 0, respectively. Non return rates within 56 days were calculated. For the estimate of environmental effects, first inseminations of each cow within parity were analysed using PROC GLM of SAS®. The model included the following fixed effects: the interaction of year by month of insemination (72 levels), age of cow (109 levels, from 12 to 120 months), AI Centre (14 levels) and herd code (15,788). Equations for the herd effect were absorbed.

3. Results and discussion

The overall mean of NRR at 56 days was 65.4% with a standard deviation of 47.6%. The total variance explained by the model was equal to 10.2%. All effects included in the model were significant ($p<0.0001$).

Figure 1 shows the distribution of inseminations by month. In Italy there is no seasonality of calving, although fewer inseminations are carried out in the hot summer months of July and August. Higher frequencies were observed in April and September. Figure 2 plots the NRR trend by year and month of insemination. The pattern of seasonal effects is similar throughout the six-year period: June and July had a higher NRR than average, while August and September had a lower NRR. Year 1994 was an exception, having a positive peak also in the month of February. Overall, NRR has decreased by nearly 4% with the negative trend starting at the end of 1994.

Figure 3 shows the effect on NRR of age of cow at insemination. Heifers (12 to 24 months of age) had an evident higher NRR, about 20% more than older cows. The decreasing trend is less steep for second parity and older cows.

In Figure 4, the effects of different AI Centres on NRR are shown. Most of the AI Centres were within a close range of 1.6% of NRR, with the other four remaining AI centres having a lower NRR. Effects of AI Centres may be smaller, after the inclusion of the sire effect in the model.

4. Conclusion

A preliminary study on the effect of environmental factors on NRR has been carried out for the Italian Holstein-Friesian breed. All factors have been found to be significant. Age of cow was very important showing differences close to 20% of NRR between heifers and cows. Different seasons within year also caused an evident effect on NRR, with a decreased rate of 12% from July to August. The year effect was small with the exception of 1995, which had a rate 4% lower than previous years. Differences of NRR for the AI Centres, that handled the semen, were small.

The environmental effects, identified in this study, will be included in a subsequent investigation that will compute variance components and estimate breeding values for NRR at 56 days, using a sire-maternal grand sire model.

References

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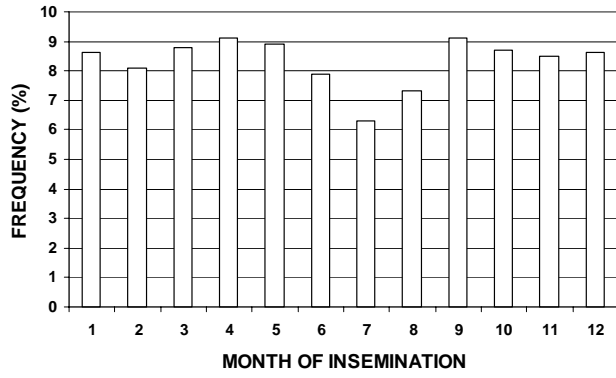
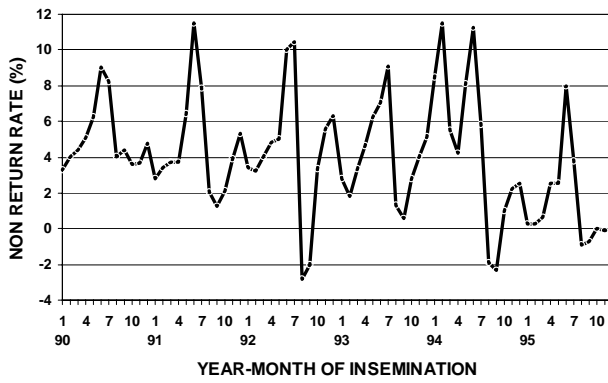*Figure 1.* Frequency of inseminations by month

Figure 2. Trend of Non Return Rate (%) by year and month of insemination
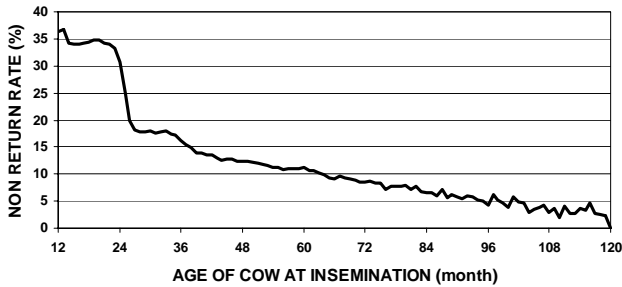

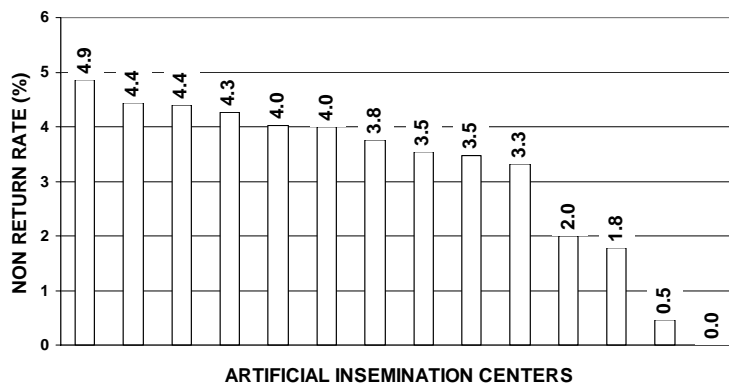*Figure 3.* Effect of age of cow (month) at insemination on Non Return Rate (%)

Figure 4. Effect of AI Centres on Non Return Rate (%)