The effect of growth rate on reproductive outcomes in replacement dairy heifers in seasonally calving, pasture based systems

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Introduction

An increasing body of evidence indicates that factors in the health and management of cattle in early life can have an important impact on outcomes at later stages of development. There has been limited research, however, on the effect of growth rate on reproductive performance in dairy heifers in pasture-based dairy production systems. Knowledge of how growth rate affects fertility outcomes would enable farmers to target optimum growth rates. The aim of this study was to investigate how growth rate from birth to breeding affects first breeding season fertility outcomes in Irish dairy heifers.

Materials and Methods

Four hundred heifer calves from a convenience sample of 9 commercial dairy farms were weighed at birth and at breeding. Calves were born in the spring of 2015 or 2016 and all weights were recorded by farmers using their own electronic weigh scales. Average daily gain (ADG) was calculated from birth to the start of the breeding season. All heifers were bred by artificial insemination and pregnancy diagnosis was carried out via ultrasound examination at approximately 30 days from service and again at approximately 60 days in gestation. Days from mating start-date to conception (days open) and pregnancy status at the end of the breeding season were recorded for each animal. Birth date, breed and genetic data, including economic breeding index, breeding index subindices and predicted transmitting abilities (PTA) were obtained from the Irish Cattle Breeding Federation database. Data was consolidated from all farms. An accelerated time failure survival model with a baseline survival time modelled as a log logistic distribution was developed using R. Age at MSD was forced into the final model and model predictions were used to compare the effects of different growth rates.

Results

Farm, year of birth, ADG (both as a continuous variable and categorized by quintile) and age at mating start date (MSD) were all found to have a significant effect on days open ($P<0.05$) in the univariate analysis. Breed, age at mating start date, and maintenance sub-index categorized by quintile were also brought forward to the multivariate analysis ($P<0.2$). Calving interval PTA, fertility sub-index, maintenance sub-index, month of birth, birthweight, month of mating start date, ADG categorized into 100g bins, and age at MSD categorized into quintiles were not statistically significant. In the final model, for heifers 380 days of age at the start of the breeding season, the predicted days open were 37, 22, and 16 for those with ADGs of 0.4, 0.7, and 0.9 kg/day respectively. The corresponding values were 24, 14, and 10 for heifers aged 470 days at the start of the breeding window.

Significance

Heifers with a greater ADG from birth to breeding have fewer days between mating start date and conception. When aiming for optimal reproductive performance, farmers should not attempt to restrict growth rates in replacement heifers. The economic benefit of reduced days open must be weighed against the increased cost of feed required to achieve a greater ADG.