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Effects of cold stress on the submission and conception rates of New Zealand dairy cows

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Abstract

In the seasonal, pastoral-based dairy system of New Zealand, it is important for herds to achieve consistently high reproductive performance. A large amount of research has been conducted into the adverse effects of high temperatures on the fertility of dairy cows. However, similar studies quantifying the effects of cold conditions in grazing systems have not been carried out. In New Zealand, farmers regularly blame the weather for low submission rates and conception to artificial insemination. This is because cows that appear to be cycling well, prior to the planned start of mating (PSM), then appear to stop cycling during the mating season, commonly in conjunction with adverse weather conditions, such as exposure to short or extended periods of cold, wet and windy conditions. Therefore, the aim of the current study was to investigate the effects of cold, wet and windy conditions on the reproductive performance of dairy cows, in order to support or refute this farmer perception.

Calving, mating, lactation and pedigree records were provided by CRV Ambreed for the 2013 season, as well as calving records for the 2014 calving period, for 6664 cows from 20 herds throughout New Zealand. Climatic variables for the same time period were obtained from NIWA and used to calculate a cold stress index, which was analysed against the reproductive performance of each herd. The mean 21-day submission rate (SR21) of all 6664 cows was 77% and the mean 21-day in-calf rate (21d-ICR) was 45%. The average cold stress index (CSI) during the mating period was 967.4 $kJm^{-2}h^{-1}$.

The results from this study showed that there was a linear and quadratic effect of CSI on both SR21 and 21d-ICR, with an increase as the conditions began to cool, followed by a decrease in both submission and conception rates as the CSI reach levels above 1000 $kJm^{-2}h^{-1}$. This pattern may indicate a survival mechanism which allows the cows to produce more heat, but once CSI levels reach around 1000 $kJm^{-2}h^{-1}$, cows are no longer able to maintain body temperature and sustain production, and fertility suffers.

Further investigations should focus on the specific threshold level for the decline of SR21 and 21d-ICR, as well as the length of exposure and mechanisms which cause the decline in submission rates and conception rates.

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