Effect of season on fertility of dairy cows in four US regions

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Introduction

In dairy cows, severe environmental conditions, such as heat stress during late gestation and early lactation, have been related to reduced subsequent milk yield and reproductive performance. Although these associations are supported by previous research, studies comparing the effect of season in multiple US regions are scarce. Here we analyze the association among season of calving and multiple indicators of fertility in multiple farms located in 4 US regions.

Materials and Methods

A total of 11,733 cows calving in 16 farms located in 4 regions (Northeast [4 herds], Midwest [6 herds], Southeast [1 herd], and the Southwest [5 herds]) were enrolled at parturition and monitored weekly for multiple reproductive events, including resumption of ovarian cyclicity (ROC; assessed via transrectal ultrasonography at 40±3 and 54±3 d postpartum), pregnancy at first (PAI1) and second (PAI2) postpartum AI (ultrasonography on d 32±3 d after AI, reconfirmed at d 60±3 of gestation), and pregnancy loss between d 32 and d 60 after AI1 and AI2 (PLAI1 and PLAI2). Multivariate logistic regression was used for testing potential associations between season of calving, region and their interaction with multiple reproductive variables, including ROC, pregnancy, and pregnancy loss at first and second AI. Parity and season were included as fixed effects, and farm as random effect in the models.

Results

Overall, frequencies were ROC 71.5%, PAI1 36.7%, PAI2 37.0%, PLAI1 10.0%, and PLAI2 8.7%. Resumption of OC was similar in cows calving in winter (72.0%) and in summer (71.0%; $P<0.23$); however, a Season*Region interaction for ROC was detected. The odds for ROC were lower for cows calving in summer than winter for Northeast (OR = 0.82 [0.69-0.98]) and the Southwest (0.81 [0.68-0.96]); whereas odds for ROC by season of calving did not differ in the Northwest and Southeast. Pregnancy at AI1 was lower for summer calvings (35.1%; $P=0.001$) compared to winter calvings (38.2%). The effect of season on PAI1 was only significant in the Southwest region (lower odds of pregnancy for summer calvings; OR = 0.83 [0.70-0.99]). Pregnancy at AI2 tended to be lower for summer calvings (36.0%) compared to winter calvings (38.0%; $P=0.09$). Overall the occurrence of PLAI1 was greater for summer calvings (12.1%) compared with winter calvings (8.3%; $P<0.0001$). However, the effect of season on PLAI1 was only significant in the Midwest and the Southwest regions (greater odds of pregnancy loss for summer calvings; OR = 1.52 [1.04-2.20] and 1.87[1.30-2.70], respectively). No difference was detected for PLAI2 by season (summer = 9.58% and winter = 7.88%; $P=0.14$), and a season by region interaction was not identified.

Significance

Overall, season of calving had an effect on cyclicity, pregnancy, and pregnancy loss. However, this effect depended on the geographic region. In general, the effect of season of calving was more evident in the Southwest. As manifest in pregnancy and pregnancy loss at second AI, the magnitude of the effect of season of calving decreased as the lactation progressed.