The Association of Level of Milk Production with Reproductive Performance in Dairy Cattle

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Introduction

There is debate about possible antagonism between high milk production and reproductive performance in dairy cattle. However, many studies have used biased measures of reproduction or inappropriate statistical methods. The objectives were to examine the association of the level of production with reproductive performance at the herd and individual cow levels.

Materials and Methods

Annual summary cross-sectional data were extracted from all 6,326 herds on DHI milk recording in Ontario and western Canada. There were 3,297 herds with complete artificial insemination (AI) and pregnancy data for the year 2005, to which herd demographics, production, milking frequency, and housing type were added. Herd pregnancy rate was modeled with multivariable mixed linear regression with a random herd effect.

Individual data (production from at least the first three test days [TD]) were available for 103,060 Holstein cows in 2,706 herds. Times to first AI and to pregnancy were modeled with multivariable survival analysis with a random herd effect. Production was described by kilograms of milk and 305-day projections at TD 1, 2, and 3, and later lactation 305-day projection, each of which had a significant univariable association with shorter time to pregnancy. Cows were also classified by intra-herd quartile of production at TD1.

Results

Herd annual mean (standard deviation) 21-day pregnancy rate (PR), insemination rate (IR), and conception risk (CR) were 12.5 (4.7), 33.9 (10.5), and 37.2 (9.9), respectively.

Herd level: Accounting for herd size, parity distribution, breed, and housing, each 1,000 kg of herd mean mature equivalent milk was associated with an increase of 0.7 points of PR ($P < 0.0001$).

Individual level: Increased milk yield at TD1 was associated with slightly earlier first AI. In the final model accounting for parity, season of calving, and days-in-milk (DIM) at TD, there was a small association of increased milk yield at TD1 with longer time to pregnancy (hazard ratio [HR]) = 0.997 per kg, $P = 0.02$) and in the same model increasing 305-d projection at TD3 was associated with shorter time to pregnancy (HR = 1.07 per 1000 kg, $P < 0.0001$). Cows in the highest quartile of production relative to herdmates in early lactation became pregnant 5% sooner ($P < 0.0001$) than cows in the lowest quartile.

Significance

Herd pregnancy rate was significantly higher in higher producing herds, and for individual cows there were significant but conflicting and practically small effects of level of production on time to pregnancy. These results suggest that managing to provide for high production can be compatible with good reproductive performance.