Session 3: Breeding for Resilience to Climate Change: Adaptation strategies.

S03.O-04

GENETIC ANALYSIS OF LACTATION CONSISTENCY USING DAILY MILK WEIGHTS IN U.S. HOLSTEINS

Fiona Louise Guinan[1], Robert Fourdraine[2], Francisco Peñagaricano[1], Kent Weigel[1].

[1]University of Wisconsin-Madison, Madison, United States; [2]Dairy Records Management Systems, Raleigh, United States.

The ability of a dairy cow to perform similarly across time is an interesting trait to include in dairy cattle breeding programs aimed at improving dairy cow resilience. Consistency, defined as the quality of performing as expected each day of the lactation, could be highly associated with resilience, defined as animal's ability to maintain health and performance in the presence of environmental challenges, including pathogens, heat waves, and nutritional changes. A total of 21,781,768 total daily milk weights collected from 2018 to 2023 were provided for 102,216 first parity Holstein cows from 213 herds milked three times daily in conventional parlour systems throughout 30 states by Dairy Records Management Systems (Raleigh NC). Consistency in milk production was measured from 5 to 305 days postpartum and computed as the sum of the log-transformed variance of daily deviations between observed and expected milk weights. A higher consistency indicator implies greater variation and larger deviations between the observed and expected milk weights, indicating a greater level of inconsistency in milk production. Expected values were obtained using three nonparametric regression models: 1) LOESS regression with a 0.75 span; 2) polynomial quantile regression using the median (0.5), and 3) polynomial quantile regression using a 0.7 quantile. The statistical model included age at first calving and herd-year-season as fixed effects and cow as a random effect. Heritability estimates (standard errors) of consistency ranged between 0.227 (0.01) and 0.237 (0.01), demonstrating that consistency is a moderately heritable trait. Correlations among consistency traits were high (0.99), indicating that the model used to calculate consistency does not alter the ranking of Predicted Transmitting Abilities (PTAs). Genetic correlations between consistency traits and milk PTAs were 0.42, while longevity traits included Productive Life (-0.15) and Livability (-0.27). Note that as lower consistency values are indicative of more consistent animals, negative genetic correlations with longevity traits are desirable. Our results show that cows with inconsistent milk production have lower Productive Life and Livability PTAs, meaning they have a shorter productive lifespan. Correlations between PTAs for log variance of daily milk yield and PTAs for early postpartum health traits ranged from -0.22 to -0.01, indicating that more consistent cows tended to have fewer health problems. Overall, our findings suggest that lactation consistency can be used to select animals that maintain expected milk production performance throughout the lactation. A novelty of this dataset is that it represents large commercial dairy farms and contains information about the pen location of every individual cow on each calendar day. Cows tend to be grouped by age, days in milk, milk yield, reproductive status, or health status, and information about the movement of specific cows between pens during the lactation may inform genetic evaluations of resilience and calculations of its relative economic value.