Striving for environmental efficiency with Jerseys

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As the effects of climate change generate headlines around the world, increasing attention is focused on reducing greenhouse gas emissions while maintaining productivity. The dairy industry faces the delicate challenge of continuing to increase productivity while limiting resource consumption. Advancements in the dairy industry over the last 70 years have already drastically altered the environmental footprint associated with milk production. The carbon footprint (measured in CO_2 equivalents) associated with the production of 1 billion kg of milk in 2007 was only 37% of the footprint to produce the same quantity of milk in 1944, and while the CO_2 equivalents produced per cow doubled from 1944 to 2007, the CO_2 equivalents per kg of milk produced have been reduced by over 60% (Capper et al., 2009). The biggest driver for these improvements in environmental efficiency is the increase in milk yield per cow, which gives rise to the "dilution of maintenance" effect, namely that while energy required for maintenance is the same for low producing and high producing cows of similar size, high producing cows require less energy for maintenance per kg of milk, which reduces the carbon footprint for each kg milk. There are several factors that have influenced the increase in productivity, chiefly advances in genetics and management, which has shifted from pastoral based systems to the feeding of carefully balanced total-mixed rations.

The Jersey breed has a distinct advantage for efficiency because a higher percentage of energy intake is used for production and less energy is lost for processes such as maintenance. Though milk yield for Jerseys is lower compared to Holsteins, energy intake is also significantly lower, and kg of energy-corrected milk (ECM) per kg of dry matter intake and kg of ECM per kg of liveweight are significantly higher for Jerseys (Kristensen et al., 2015). When examining the breed effect on the carbon footprint associated with cheese production, the three most important factors are body weight, milk yield and milk composition, with lower body weight, higher milk yield and higher components being favourable. In a comparison of Jerseys and Holsteins for cheese production which accounted for the different requirements of each breed in metrics such as the number of animals and land mass required, as well as amount of waste produced, it was estimated that using Jersey to produce cheese would reduce the carbon footprint by 20% (Capper and Cady, 2012). The efficiency advantage that the Jersey breed has could be due to anatomical differences,

whereby the weight of the gastro-intestinal tract as a proportion of total body weight is higher in Jerseys than in Holsteins (Beecher et al., 2014). This indicates that a higher percentage of a Jersey cow's bodyweight is tied to the digestive process and would explain why Jerseys are able to consume a higher percentage of their bodyweight in feed and could explain why Jersey need less energy for maintenance as a proportion of total energy requirement. Interestingly, the weight of the heart and lungs as a percentage of total bodyweight is also higher for Jerseys in a manner similar to that of high-performance athletes.

As we keep an eye on carbon emissions, it is important to be aware of strategies for further improvement, with continued increases in production and feed efficiency being obvious goals. A growing body of research suggests that Jerseys are a suitable choice in the search for environmentally friendly dairy cows due to their smaller frame size, higher milk component percentages and unique anatomy.

Table 1. Selected variables pertaining to efficiency for which significant differences were observed between breeds (adapted from Kristensen et al., 2015).

Variable	Holstein	Jersey
Milk Yield (kg ECM)	30.4	27.4
Total energy requirement as a percent of total energy intake	95.6	97.8
kg of ECM per kg of DMI	1.35	1.46
kg of ECM per 100 kg LW	5.06	6.65
kg of ECM per MJ of CH_4	1.12	1.26

ECM = energy-corrected milk; DMI = dry matter intake; LW = liveweight; MJ = megajoule; CH_4 = methane