

HOARD'S DAIRYMAN

A century of methane progress

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In 1924, the U.S. dairy herd consisted of approximately 21 million cows, each producing around 4,167 pounds of milk annually. At the time, the average cow consumed about 21.4 pounds of dry matter (DM) daily. Advancements in genetics, nutrition, and management have led to a dramatic improvement in intake, productivity, and efficiency today.

The U.S. dairy herd now has 9.36 million cows — a 55% reduction in herd size from 1924. Each cow now produces, on average, 24,200 pounds of milk annually and eats approximately 60 pounds of DM daily. This shift has resulted in a three-fold bump in feed efficiency, as modern dairy cows produce significantly more milk from each pound of feed.

Despite this rise in individual productivity and intake, total methane emissions have declined since 1924 due to the reduction in herd size and greater feed efficiency. This underscores the environmental progress achieved in dairy production as the industry produces more milk with fewer cows and less total methane emissions.

Using the Ellis Model, a common tool in agricultural and environmental studies, we estimated daily methane emissions for dairy cows in both 1924 and 2024 based on their dry matter intake (DMI). Methane is measured in megajoules (MJ) to reflect its energy content, as each kilogram (kg) of methane contains approximately 55.5 MJ.

The methane emissions estimate of 11.32 MJ per day provides a reasonable approximation for modern dairy cows, though it is somewhat lower than current estimates of 100 to 130 kg per year. This difference likely stems from the Ellis Model relying solely on DMI without accounting for diet composition (for example, forage versus concentrate ratios), which can influence methane production.

High-yielding cows on energy-dense diets may emit more methane than the model predicts. Nevertheless, since the same model was used for 1924 and 2024, the comparison remains valid, allowing for reliable assessment of changes in emissions over the past century.

Despite the rise in individual methane emissions in modern cows due to their greater feed intake, total emissions have dropped substantially since 1924. This change is primarily due to a reduction in the cow population. Consequently, the total emissions can be estimated to be around 106 million MJ per day, compared to 126 million MJ per day for 1924 cows. This represents a 16% decline in total methane emissions.

Methane intensity measures the amount of methane emitted per unit of milk produced, reflecting emissions efficiency relative to productivity. In 1924, methane intensity was approximately 1.16 MJ per kg of milk, with each cow producing 4,167 pounds of milk annually. By 2024, methane intensity dropped to 0.38 MJ per kg of milk as cows now produce 24,200 pounds of milk per year. This decline in methane intensity highlights improvements in feed efficiency and productivity, resulting in lower emissions per unit of milk.

While total emissions have fallen by 16%, methane intensity (emissions per unit of milk) has improved by approximately 67.2%, indicating much higher productivity efficiency relative to emissions over the century. The analysis suggests that today's dairy cows are much more efficient, producing substantially more milk with lower total methane emissions than a century ago.

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