

A unified Python implementation of standardized 305 day yield calculation methods

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The 305 day yield for milk, fat, and protein is a widely used metric in dairy production, and the International Committee for Animal Recording (ICAR) provides guidelines outlining approved methods for its calculation. However, a global survey of milk recording organizations revealed substantial variation in how these methods are implemented. The Test Interval Method is used by 74% of the organizations, reflecting a preference for methodological simplicity, but it comes with trade-offs in estimation accuracy. The use of the other approved methods showed wide variation in correction factors, standard lactation curves, test day definitions, minimum sample requirements, and exclusion criteria. Such inconsistencies can introduce yield variability that complicates comparisons, for example in international breeding value evaluation, and limit the metric's usefulness in universal models, such as decision support tools. Thus, the objective of this work was to reformulate the ICAR guideline section 2, procedure 2, into a unified, transparent, and accessible software implementation to improve standardization, enhance documentation, support continuous development, and increase the accuracy of 305 day yield estimation.

To achieve this, the ICAR guideline was converted into an open source, Python package that serves as the reference implementation for 305 day yield calculation, with lactation curve modelling serving as the core of the package. In addition to the methods described in the original guideline, this work further incorporates 13 lactation curve models, with both frequentist and Bayesian fitting options, and provides tools to derive characteristics such as time to peak, peak yield, cumulative yield, and persistency. These features allow the package to be imported directly into analytical workflows, enabling users to calculate 305-day yields, fit and compare lactation curves, and derive key lactation characteristics, by calling a single function. Ongoing development includes an online validation platform that will allow users to upload lactation data and compare 305 day yield estimates with reference calculations and observed cumulative yield.