Identifying critical management decision points in the heifer rearing process using individual animal-based bioeconomic modelling

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Replacement dairy heifers should have minimal mortality, with an age at first calving (AFC) of 24 months currently recommended. Recent focus in UK dairy herds has been on the economic impact of youngstock losses and delayed AFC. A reduction in reproductive efficiency, increasing calving intervals and high replacement mortality rates have all contributed to a decreasing availability of dairy heifers and a tightening in heifer replacement prices. Producers are therefore reluctant to remove replacements that show poor growth, repeated incidences of disease or suboptimal fertility. Most current models of dairy farm production systems are single component models primarily focusing on the milking herd. Multi-component models that include the replacement herd, or those specifically constructed to model an aspect of the replacement herd fail to incorporate the fundamental economic elements of the rearing period. Neither do they account for the effect of management decisions and genetic selection on the underlying biology of the heifer and the effect this has on herd dynamics and profitability. Our replacement herd model was developed in Microsoft Visual Basic with Microsoft Access as the database management system and user interface. It models individual heifers through stages of growth and development over a decision horizon of birth to first calving. This allows factors such as bodyweight, age and genetic merit (which impact on subsequent production, longevity and reproductive success) to be evaluated under UK conditions and practices. The model identifies critical decision points based on biology, health and genetics allowing the producer (1) to determine the likelihood of that replacement heifer reaching her AFC target; and (2) to estimate her longevity and milk production potential. This provides the producer with an evidence base for decision making on youngstock rearing production and health management and the monitoring and evaluation of the system.