McCaughern, J.H., Bolton, M., Upton, E., Manvell, J., Ruffley, C. and Robinson, K.

**Application:** Findings from current nutrition research can be practically applied on-farm to reduce feed costs and improve beef enterprise sustainability. However, the individualistic nature of each farm case scenario needs to be taken into consideration during this process and the feed industry has a key role in facilitating such improvements.

**Introduction**: Beef production within the United Kingdom has faced considerable challenge over the last number of years, with greater volatility of input prices and an increased emphasis on the greenhouse gas emissions associated with production. Feed not only accounts for up to 75 % of the variable costs of beef production, but is also highlighted as a potential vehicle for greenhouse gas mitigation within beef production systems (Nielson *et al.*, 2013; Eory *et al.*, 2015). There is subsequently a need to examine how the practical implementation of current research can concurrently reduce feed costs whilst improving sustainability within case-specific beef production scenarios.

**Material and methods:** This work employed a positivist case-study approach to help generate a multi-faceted, in-depth understanding of how the latest nutrition research can be applied to improve the sustainability of a beef production enterprise (Crowe *et al.*, 2011). The case of study in this instance, consists of the beef production enterprise within the Future Farm (FF) at Harper Adams University. The campus itself, resides within rural Shropshire and in 2022, the Future Farm was established with a view to servicing research, teaching and knowledge exchange, whilst demonstrating best practice and an aim to achieve net-zero by 2030. A component of this change, included the establishment of an intensive dairy beef production enterprise, which finishes British Blue cross dairy steers and heifers from the Universities all-year-round calving Holstein-Friesian dairy herd. An intensive beef system was initially selected due to constraints surrounding grazing and land availability at the time. Between 2022 and 2024, stakeholders have tried to utilise the findings of the latest nutrition research within the FF beef enterprise to reduce feed costs and improve sustainability. Identified topic areas of interest for application included alternative forage-based finishing diets (maize + grass silage versus concentrate-based), forage quality (moderate versus high-quality grass silage) and low protein diets (formulated according to crude protein versus metabolisable protein). The cost implications of these dietary formulations were modelled according to AFRC (1993) in Microsoft Excel and are expressed in relation to a 550 kg steer growing at a rate of 1.45 kg per day.

**Results:** The substitution of concentrate with forage had the greatest impact on diet cost and margin over feed, with a predicted increase in margin over feed from £0.11/kg of average daily gain (ADG) to £1.35/kg of ADG when a forage-based (maize and grass silage; 673 g/kg of dry matter forage) total mixed ration was fed as opposed to a finishing concentrate. Formulating according metabolisable protein also increased predicted margin over feed from £1.35 to £1.56/kg of ADG with a decrease in dietary crude protein from 127 g/kg of dry matter to 103 g/kg of dry matter. Due in-part to restrictions on grass silage inclusion (maximum of 160 g/kg of dry matter), the substitution of a moderate quality grass silage (10.7 MJ of metabolisable energy/kg of dry matter) for an excellent quality grass silage (11.9 MJ of metabolisable energy/kg of dry matter) demonstrated the lowest potential to reduce diet costs, with a predicted increase in margin over feed from £1.31 to £1.35/kg of ADG. Consequently, all of these practices have been implemented during diet formulation at the FF beef unit, with heifers and steers finishing at 13.3 and 15.0 months of age, respectively. Indeed, the predicted farmgate greenhouse gas emissions intensity of beef produced from the enterprise is 12.00 kg of CO2-equivalent/kg of deadweight, substantially lower that the mean of 20.63 (Range = 13.8 to 26.4) kg of CO2-equivalent/kg of deadweight reported by McNicol *et al.* (2024) for Welsh lowland beef and sheep producers. Future target areas for exploration include the incorporation of feed additives, and expansion to include a high performance outdoor dairy beef production system.

**Conclusion:** The findings of current nutrition research can be practically utilised on-farm to improve enterprise sustainability whilst reducing costs of production. However, the individual characteristics and constraints of each farm need to be taken into consideration during this process, and the industry plays a key role in facilitating such change whilst improving enterprise resilience.

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