



SAOS



The Best of Marbled Beef -

working towards predictably tasty beef, every time.

Introduction:

Despite the 'consumer eating experience' being key to selling prime beef cuts, there is currently no UK industry consensus on a metric for this. Intramuscular fat (IMF) is, however, known to have a positive influence on eating quality and a visual assessment of IMF has been successfully adopted within both American and Australian beef supply chains. This method, therefore, holds promise when serving a discerning customer base such as that of MacDuff1890. Together with its dedicated producer group and in partnership with SAOS and SRUC Research, MacDuff1890 embarked on research to test how a similar system might work within a Scottish beef producer supply chain.

Challenge:

This pilot looked to appraise the strength in relationship and suitability of alternative predictors of IMF. A consumer taste panel then assessed any preference between a high and low marbled steak. Lastly, it was noted how the project learnings could inform best practice. The intention being to generate an evidence base and better understand gaps in industry knowledge, as well as identify next steps within the realities of a commercial setting – a busy, working, supply chain – where any adopted change(s) need to have clear benefit and be implemented easily.

Method:

There were 200 cattle involved in the trial, sourced from two farms within the producer group. Cattle were ultrasound scanned on-farm; three ultrasound images per animal were taken parallel to the spine, from the last rib to 2nd lumbar vertebrae, and IMF% determined using a predefined algorithm. Subcutaneous fat depth (UFD) was also measured at the 12/13th rib. Trained assessors then graded the visual level of steak marbling in resulting carcass, at the abattoir, using the USDA beef visual marbling score cards (scoring on a scale of 1 to 6).

A slice was removed from the left loin muscle of each carcass at the 5th/6th rib and frozen, then later thawed and laboratory tested for IMF%, using a FOSS™ FoodScan Meat Analyser – this was considered the 'gold standard' IMF measurement to benchmark the on-farm and abattoir IMF predictor measures against.

Covid-19 restrictions impeded the taste-test design to a smaller sample size with fewer measures of consumer preference. Nonetheless, a home-based untrained taste panel provided final results, before statistical analysis was performed.

Results:

Timescales, scope and methodology had to adapt as the project developed. Notwithstanding a global pandemic, it does reflect on the realities of an empirical study. Nonetheless, a responsive team and an accommodating producer group ensured credible results.

It is always challenging to make definitive statements within a pilot study but encouraging signs and useful learnings do support recommendations:

1. Results suggest that ultrasound scanning for IMF on-farm, and associated algorithms, are not sufficiently accurate to rank commercial UK slaughter cattle, of different breeds/crosses, ages and liveweights, for the level of IMF present, and would not be recommended for this purpose.
2. Visual marbling score of carcasses had a moderate correlation coefficient and was found to provide a reasonable, if not perfect, fit with IMF% in the meat (as assessed by laboratory methods). This presents a practical, low-cost solution for indicating IMF% in the abattoir.
3. The majority in the home-based consumer taste panel did successfully differentiate between steaks with visibly high or low marbling, with most preferring the high-marbled steak. Although statistical analysis contrarily revealed very limited evidence discriminating between them, due to the small sample of carcasses tested.
4. There is a moderate relationship between visual marbling score and IMF% and, whilst further work is required, there are positive signs of a relationship between visual marbling score and eating experience. This ties into a body of research indicating a link between visual assessment for high marbling and eating experience.
5. Beef visual marbling score was found to be a practical, non-invasive, low-cost implementation and better than no assessment.
6. Marbling score cannot, however, be a singular selection criterion in predicting eating quality, due to significant other influencing factors such as breed, age, nutrition, and animal /carcase handling, as well as interactions between these factors. That is, there are other economic and environmental drivers to consider.
7. Unsurprisingly, a breed / genetic influence on IMF levels was recorded:
 - Within the constraints of this pilot study, Aberdeen Angus cross (AAX) cattle had significantly higher IMF levels at a fixed slaughter age than Charolais cross (CHX) or Limousin cross (LIMX) cattle. Hereford cross (HEX) and Simmental cross (SMX) were intermediate and not significantly different from any of the other breeds.
 - Slaughter age had a greater effect on IMF in this dataset than carcass weight or growth rate – fat deposition is known to increase with age. Although the level of affect differed across breeds.
8. It should be noted that taste is also subjective and open to additional variables such as post-slaughter handling, storage and cooking methods that are out with the control of the producer and (in part) processor.



Finishing cattle destined for PR Duff, awaiting scanning.



Ultrasound scanning of cattle on farm.



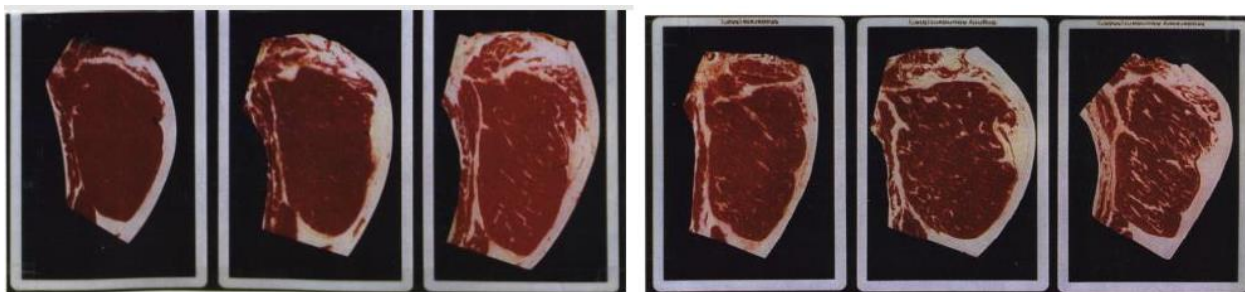
The FOSS™ meat analyser used to measure IMF%.

9. This pilot lends confidence to study a more advanced beef specification or grading system that better reflects broader quality parameters. Noting that, a larger dataset and additional analysis would be required to consider how best to integrate into specification and supply chain decision making, without impacting other important selection criteria.

For example, it is known (and reinforced within this study) that beef marbling increases with age, however, extending finishing times would have a detrimental impact on the producer group's environmental credentials. It is, however, possible to select cattle that meet breed, age, marbling, weight and grade criteria.

Conclusions:

There are many demands on farmers to produce beef that can be proudly marketed within a premium, short supply chain such as that of MacDuff1890. Although this pilot project was not conclusive, reinforced by larger studies and as evidenced in other countries, it indicated that beef visual marbling score can inform greater understanding of MacDuff1890's customers' requirements – being one indicator of eating experience. It is recommended that a database is established, with information on marbling being shared with producers, to inform decision making across the chain.



USDA Beef Quality grades. Left to right: slight, small, modest, moderate, slightly abundant, moderately abundant – levels of beef marbling. Courtesy of the USDA.



A triangular taste test was performed, with three steaks provided to each taster. Each received either one low and two high marbling scored, or vice versa. This information was not shared with the tasters to ensure an unbiased assessment.



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