Potential to improve product quality

Michelle Judge[1], Sinead Mc Parland[1], David A. Kenny[1], Jessica Coyne[1] and Thierry Pabiou[2]

[1]Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork; [2]Irish Cattle Breeding Federation, Bandon, Co. Cork

Summary

- Large genetic variability exists for milk quality.
- Up to 16% of the differences in meat quality are due to genetics.
- Up to 18% of the variability between cattle achieving the desired factory carcass specifications is due to genetics.

Introduction

The consumer desire for quality over quantity is intensifying. While significant improvement has occurred in both milk and meat quality in recent decades, through a combination of breeding, management and processing, considerable additional gains are still possible. In this paper, product quality refers to detailed milk quality metrics (e.g. concentration of different fatty acids and total omega-3 levels), meat sensory characteristics (tenderness, flavour and juiciness), and also carcass specifications.

Variability in detailed milk quality parameters

The cost of generating detailed milk quality parameters using gold-standard approaches on a sufficiently sized population to enable genetic evaluations is prohibitively expensive. All milk samples collected for milk recording are subjected to analysis using infrared light; the pattern of light absorption is used to predict fat, protein and lactose concentration. Research at Moorepark has also revealed that these patterns can also be used to predict individual fatty acid, protein components and processability. Large inter-animal variability has been detected for saturated fatty acid content (Figure 1).

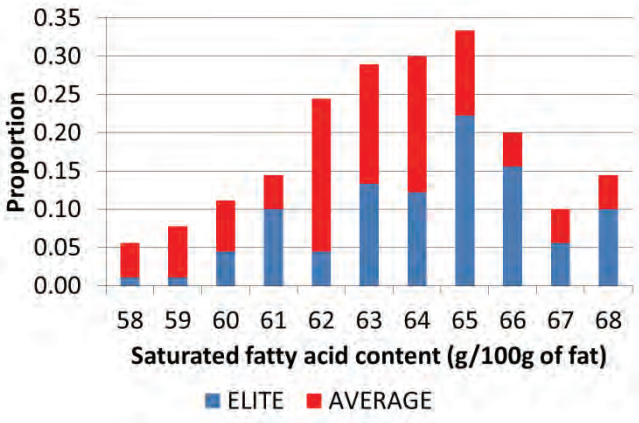

Figure 1. *Distribution of the variability in saturated fatty acid content for the national average (red) and elite (blue) Holstein-Friesians cows from the next generation herd.*

Potential of breeding to increase meat quality

Ireland currently has the largest meat sensory database in the world; data on meat tenderness, juiciness and flavour are available on over 4,000 Irish cattle. Table 1 summarizes the heritability of the meat quality traits; the *heritability* of a trait is the proportion of the phenotypic difference between individuals that is attributable to genetics. Large variation exists in genetic merit for meat quality traits among Irish sires (Table 1). This means that the meat from the progeny of some sires is expected, on average, to be of superior quality (maximum (positive) breeding value) than the meat from the progeny of other sires (minimum (negative) breeding value).

Table 1. The heritability and range in genetic merit for Irish sires

Trait (Scale 1–10)	Heritability	Genetic merit	
		Minimum	Maximum
Tenderness	16%	-0.35	0.30
Juiciness	9%	-0.41	0.30
Flavour	14%	-0.36	0.22

Carcass specifications

The grading of beef carcasses for carcass weight, fat and conformation provides an indication of carcass quality, and is the basis for the payment system that incentivises the supply of carcasses with desirable yield and quality specifications. These desired specifications comprise of carcass weights between 270 kg and 380 kg, fat scores from 2+ to 4=, conformation scores of O= or better, and an age of slaughter ≤30 months. On average, only 40% of dairy-beef cattle achieved all specifications at slaughter. The ability to achieve the desired specifications is influenced by genetics (Table 2); 18% of the variability in the simultaneous achievement of all carcass specifications is due to genetics.

Table 2. Prevalence and heritability of the achievement of the desired carcass specifications in dairy-beef bulls, heifers and steers

Carcass metric	Prevalence (%)			Heritability
	Bulls	Heifers	Steers	
Weight (>270 kg)	83	53	93	5%
Conformation (≥ O=)	78	87	70	12%
Fat (2+ to 4=)	61	83	87	11%

Conclusions

Excellent product quality is critical for retaining customer loyalty and ensuring future markets for important Irish produce. Generating data from sufficiently large dairy and beef cattle populations to enable accurate genetic evaluations and derive appropriate weightings on these traits within selection indexes is essential for continued improvement.