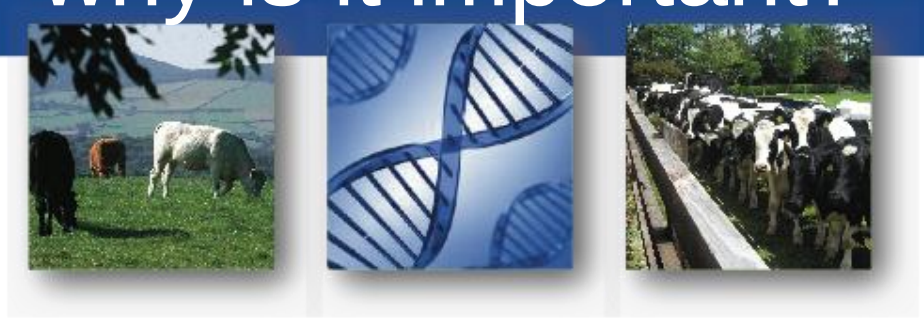
IRISH CATTLE BREEDING FEDERATION

Meat quality. What is the future and why is it important?

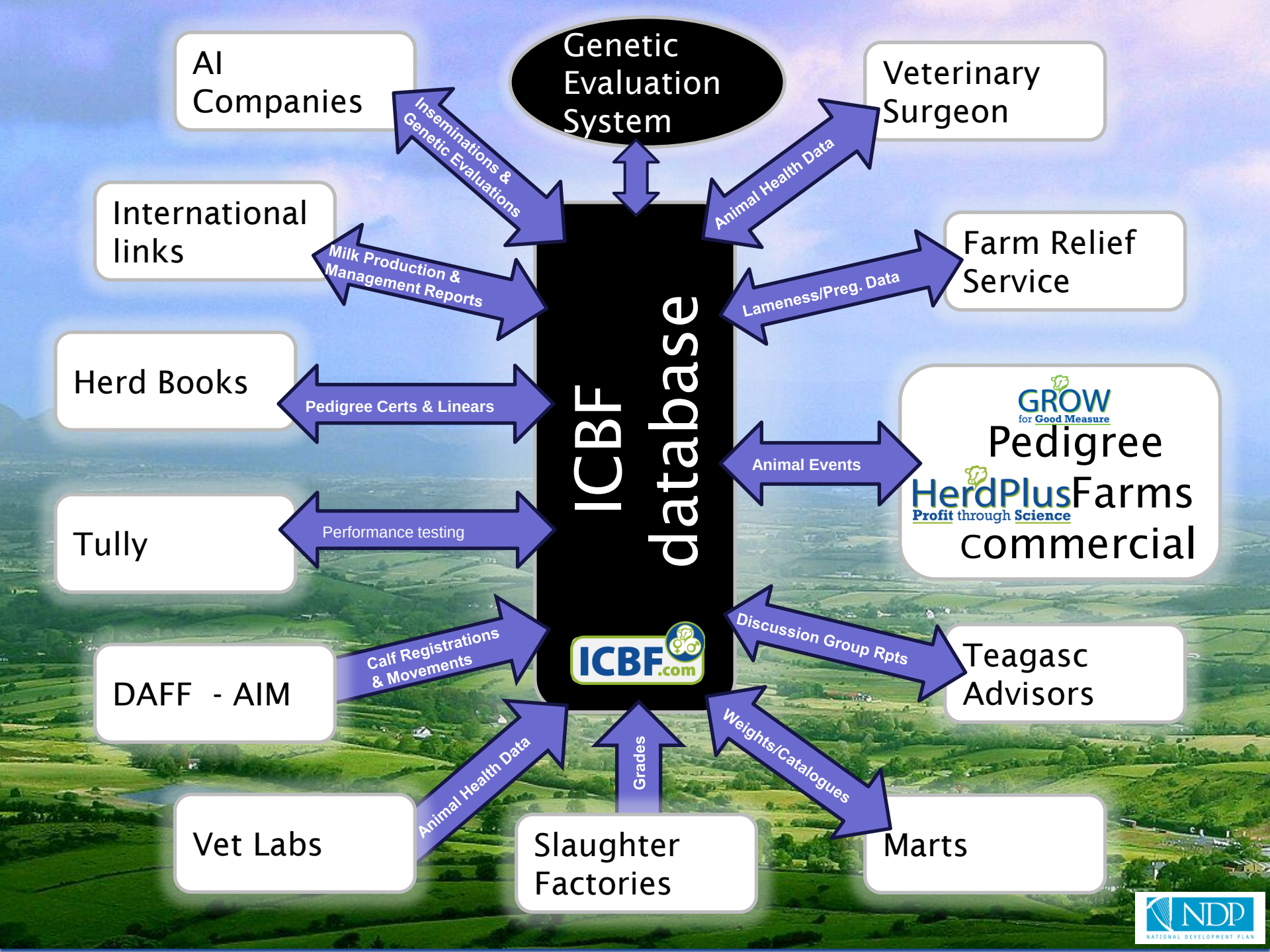


Stephen Conroy, Andrew Cromie & Thierry Pabiou (Irish Cattle Breeding Federation)

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

ICBF Background

- ICBF Formally Established in 2000.
- Membership/Board: AI companies (18%), Milk Recording (18%), Breed Societies (18%) & Farmer Organisations (46%).
- Stakeholders in cattle breeding control decision making.
- Mission: *To achieve the greatest possible genetic improvement in the national cattle herd – Dairy & Beef.*


AI Companies
Genetic Evaluation System
Veterinary Surgeon
Inseminations & Genetic Evaluations
Animal Health Data
International links
Milk Production & Management Reports
Lameness/Preg. Data
Farm Relief Service
Herd Books
Pedigree Certs & Linears
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Animal Events
GROW for Good Measure Pedigree
HerdPlusFarms Profit through Science
commercial
Tully
Performance testing
ICBF.com
Discussion Group Rpts
Calf Registrations & Movements
DAFF - AIM
Teagasc Advisors
Animal Health Data
Grades
Weights/Catalogues
Vet Labs
Slaughter Factories
Marts
NDP
NATIONAL DEVELOPMENT PLAN

Recent history of beef evaluations

2005	2007	2010	2013	2015
Within breed muscle and skeletal for LM, CH, SI 40,000 recs	Calving (200,000) and Carcass evaluations (100,000 records)	Fertility and milkability evaluations. First overall beef profit indexes	39 million pedigrees Calving 10 million Livewts 4 million Mart 2 million Carcass 7 million Fertility 4 million 50,000 foreign ebvs	750,000 genotypes
Key events	2008-2012 suckler scheme 40,000 herds	2013-2014 BDP scheme		2015-2020 BDGP scheme

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ICBF.com

How does ICBF make an impact?

The body in charge of the recording and processing of all data in Irish cattle breeding.

↓

Genetic Indexes

EBI

€uro-Stars

Intended to help farmers to make more profitable and efficient breeding decisions.

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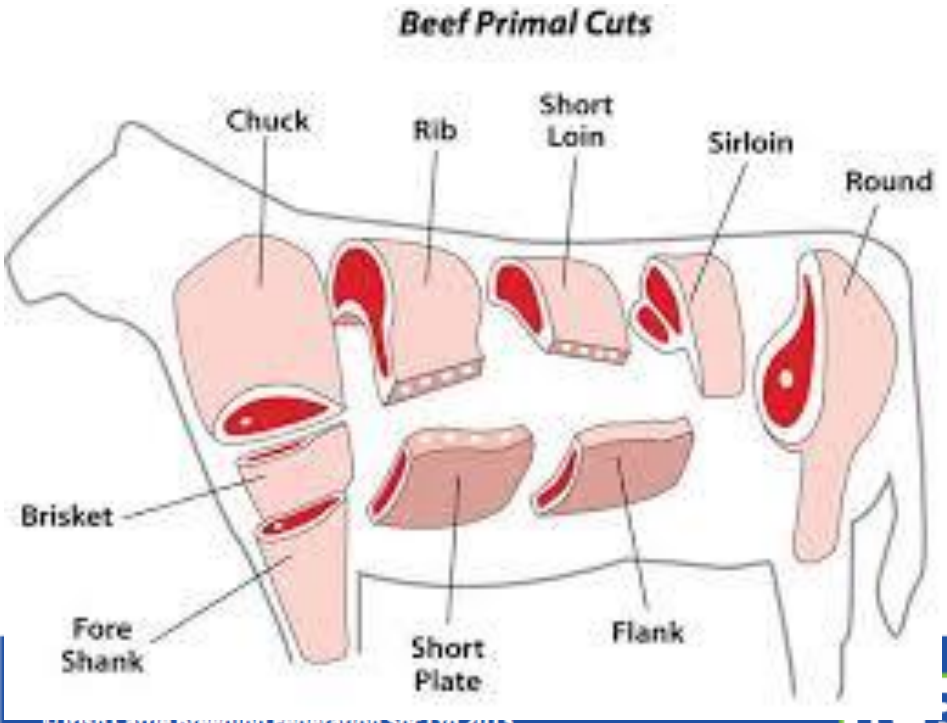
What is meat quality?

- **Meat quality** is defined by the **compositional quality** (lean to fat ratio) and the **palatability factors** such as visual appearance, smell, firmness, juiciness, tenderness and flavour.



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Meat quality – Why is it important?

- Consumer tracking data (Pelegrin Research Group, 2014; Lusk and Murray, 2015) suggest that "taste" is number 1 attribute for majority of consumers and is the primary reason consumers purchase beef when compared with other types of meat.

- Consumers want to "trade up". In the USA Certified Angus Beef®(CAB) increased by 112 percentage points between 2009 and 2014, whereas demand for commodity Choice beef declined by 2 percentage points (Zimmerman and Schroeder, 2013; Suther, 2015).

- Consumers don't buy carcasses. Consumers want to buy guaranteed meal results (Dr. Rod Polkinghorne).

- Consumers take up to 3 months to purchase beef after a bad experience.

- Finishers are generally not rewarded for eating quality apart from some breed premium schemes. Despite, recent studies showing that there is more variation within breeds for meat tenderness than between breeds (Koohamaraie etc al., 2005).

- There is a need for farmers and processers to work together to produce a more consistent product for consumers.

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Can we breed for better meat eating quality?

- Huge improvements in meat eating quality over past 10 years (e.g., animal handling, slow-chilling, hip-hanging & dry-age process).
- However, genetic influence for meat eating quality needs to be further explored as genetic improvement is cumulative and permanent.
- Breed premium schemes in place in Ireland (Angus, Shorthorn & Hereford).
- Objective: Quantify the influence of genetics on meat eating quality and identify the best sires for the trait to be used in the national breeding program.

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Data collection

- 1,508 (1168 bulls and 340 steers) animals finished at Tully test station
- Slaughtered from 2013 to present
- All progeny of AI sires – DNA verified

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Measurements obtained

- Acclimatisation period: (30 days).
  Vaccination IBR, BVD, RSV, PI3, Blackleg & other clostridia diseases.
- Diet
  - Bulls (ad-lib concentrates); Steers (8 kg concentrates & 5 kg hay freshweight)
- Performance test measures (90 day testing period).
  - Average daily gain (g/day), Feed conversion efficiency (DMI/ADG), Linear Scores, Scanned muscle and fat depth and intramuscular fat (mm) & Scrotal circumference (cm).
- Health & disease traits.
  - Recording lameness, genetic defects, pneumonia and other illnesses.
- Genomics.
  - Genotyped using customised chip.
- Age at slaughter
  - Bulls (15-18 months)
  - Steers (17-23 months of age)

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Measurements obtained at the factory

- Meat quality
- Carcass wt, fat and conformation
- Primal yields
  - British spec
  - 19 different cuts
- pH
  - Hourly and ultimate

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Measurements obtained cont'd

- Meat eating quality
- Colour of loin
- Visual marbling of the loin
- Composition analysis
  - Intramuscular fat %, protein % & moisture %
- Cook loss and shear force
- Sensory analysis

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Sensory analysis

Meat Tasting Phenotypes

3 phenotypes: **Tenderness**, **Juiciness**, & **Flavour** - Scored 1 to 9

"Extremely Tough"
"Not at all Juicy"
"Off-note"

"Extremely Tender"
"Extremely Juicy"
"Extremely flavoursome"

Meat Tasting Protocol

Longissimus thoracis muscle from right side of each carcass 2.5cm steaks and vacuum packed. Steaks were aged for 14 days before being frozen. They were then thawed at 4°C 24 hours before analysis

Grilled to a 'medium' cooking finish, allowed to rest for two minutes. Data was collected using trained panelists.

- Eolas International, Co. Cork
- 7-10 trained panellists
- http://www.eolasinternational.com

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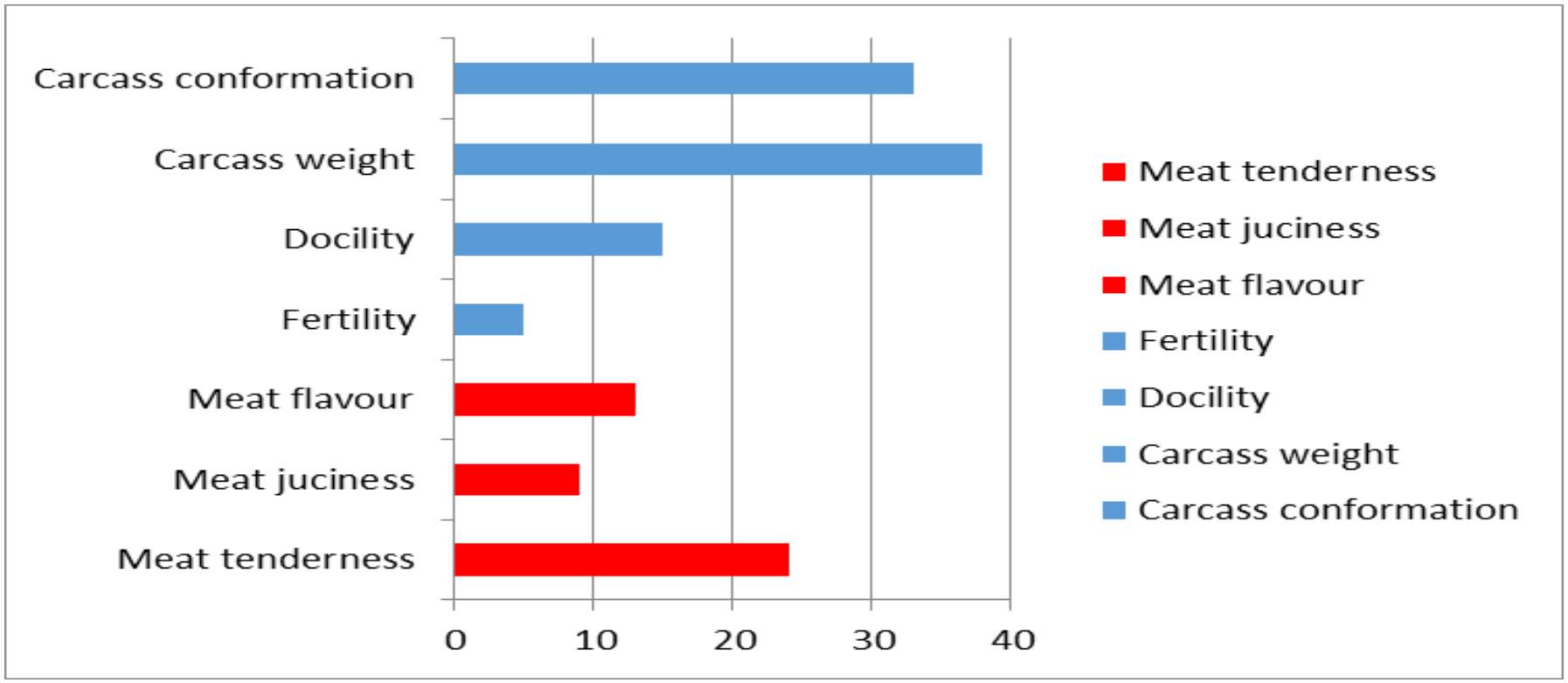
Heritability for eating quality traits

- In order to make genetic progress a trait must be heritable. A heritable trait is one that is passed from a parent to offspring.



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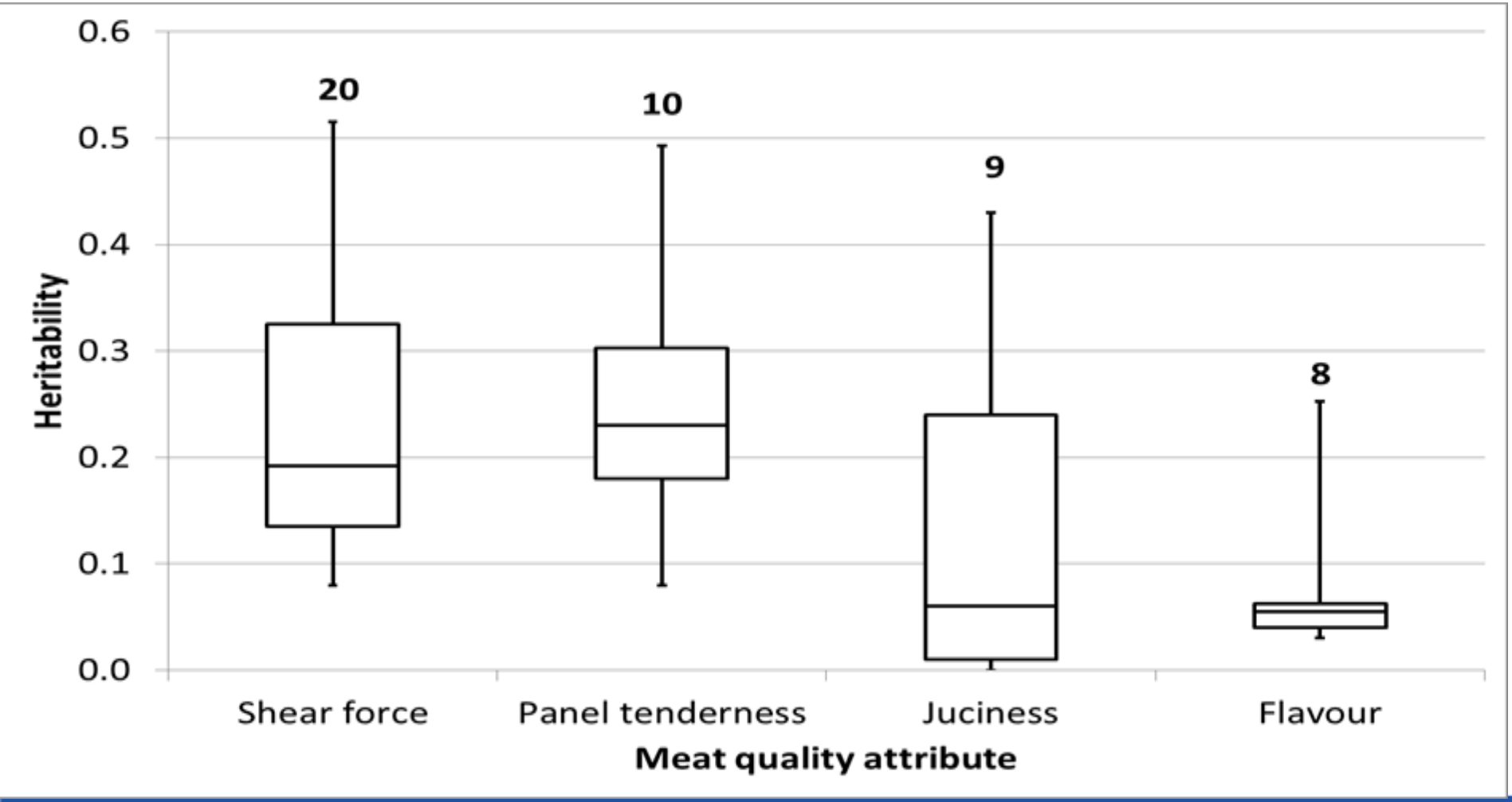
Heritability - International studies



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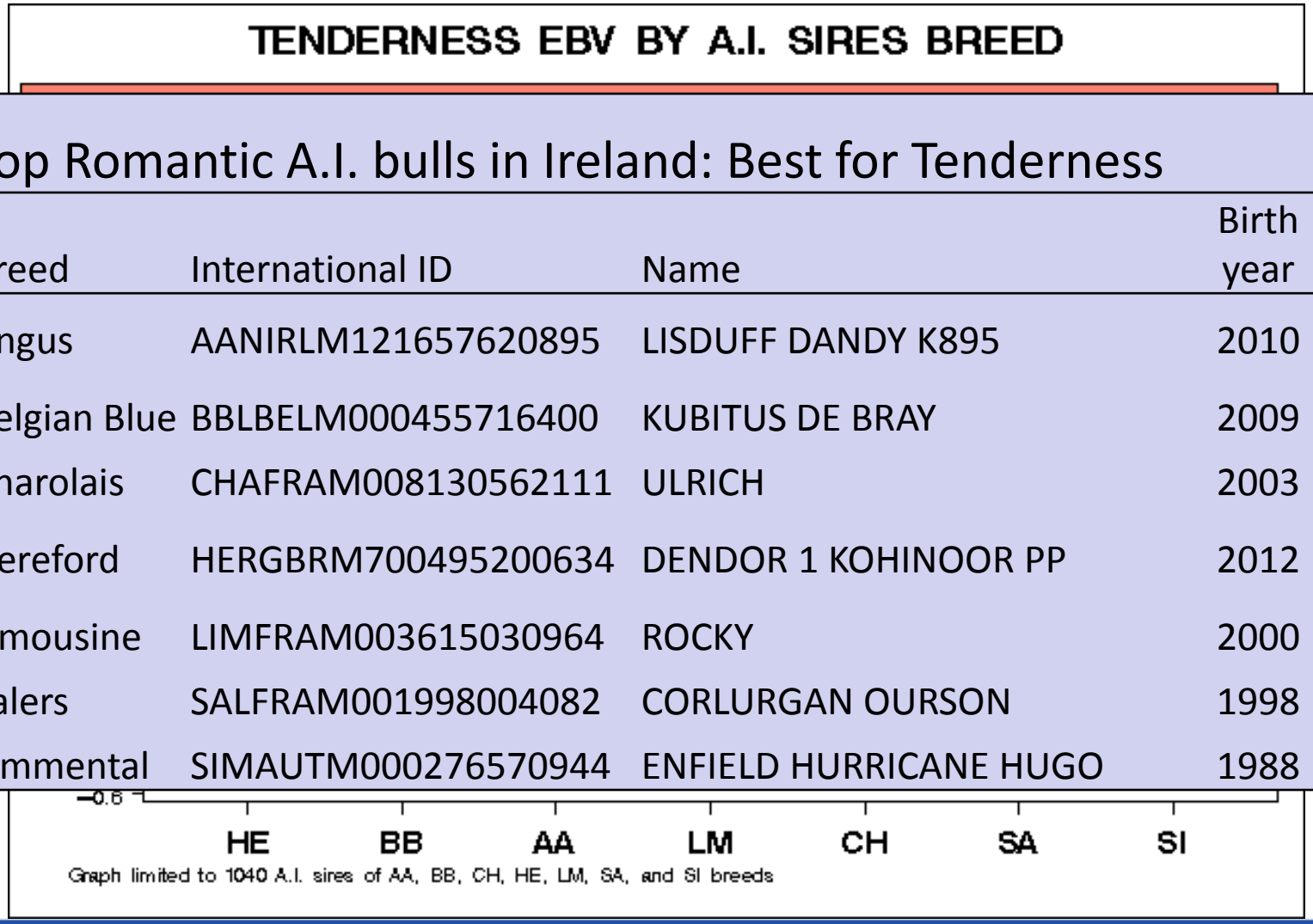
Breeds and Bulls



Top Romantic A.I. bulls in Ireland: Best for Tenderness

Breed	International ID	Name	Birth year
Angus	AANIRLM121657620895	LISDUFF DANDY K895	2010
Belgian Blue	BBLBELM000455716400	KUBITUS DE BRAY	2009
Charolais	CHAFRAM008130562111	ULRICH	2003
Hereford	HERGBRM700495200634	DENDOR 1 KOHINOOR PP	2012
Limousine	LIMFRAM003615030964	ROCKY	2000
Salers	SALFRAM001998004082	CORLURGAN OURSON	1998
Simmental	SIMAUTM000276570944	ENFIELD HURRICANE HUGO	1988

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5 star versus 1 star comparison

- Analysis on 1000 bulls

	Terminal €uro-Star index		
	One star	Five star	Difference (€)
Total feed consumed (kg)	1302	1250	14
Av. age at slaughter (days)	496	481	30
Carcass weight (kg)	394	408	56

	Terminal €uro-Star index	
	One star	Five star
Conformation score	U-	U+
Total meat (kg)	314	324
Tenderness (scale 1-9)	5.87	6.24
Juiciness (scale 1-9)	5.81	6.28
Flavour (scale 1-9)	5.74	6.08

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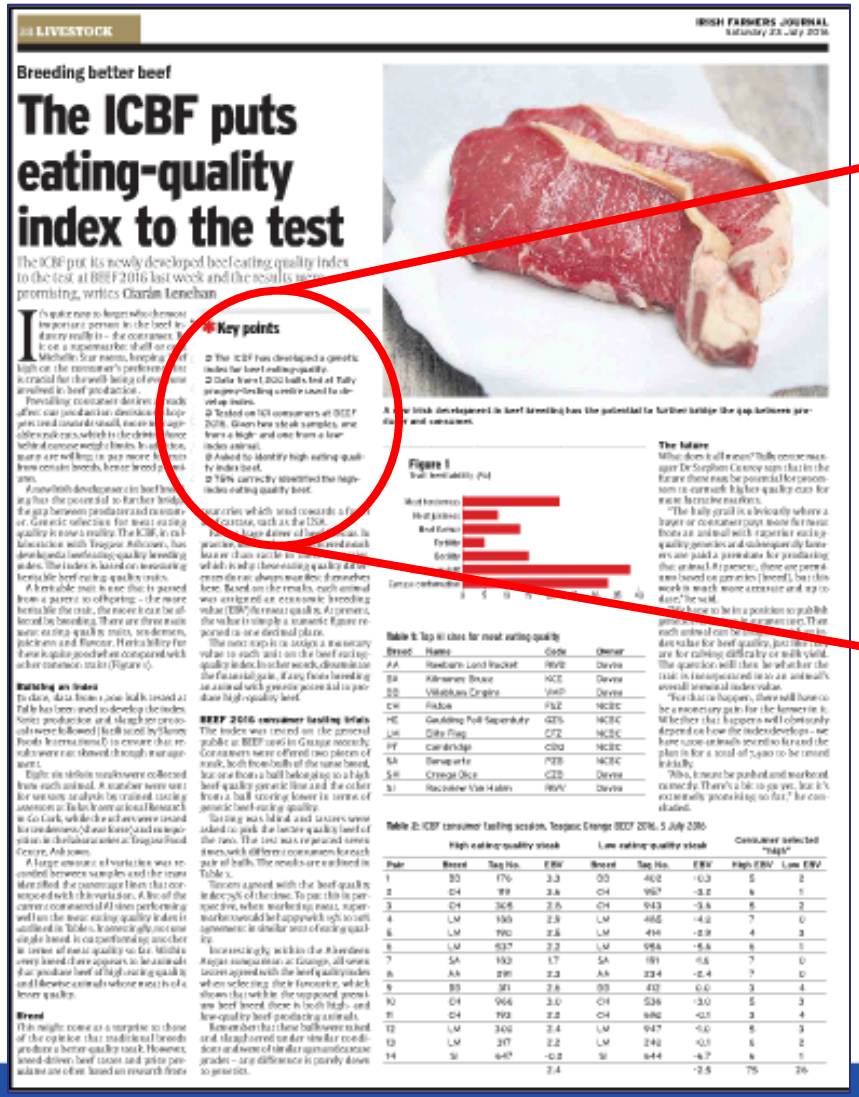
Consumer Validation



LIVESTOCK

IRISH FARMERS JOURNAL

Breeding better beef

The ICBF puts eating-quality index to the test

The ICBF put its newly developed beef eating quality index to the test at BEEF 2016 last week and the results were promising, writes Ciarán Lenehan

Key points

- The ICBF has developed a genetic index for beef eating-quality.
- Data from 1,200 bulls fed at Tully progeny-testing centre used to develop index.
- Tested on 101 consumers at BEEF 2016. Given two steak samples, one from a high- and one from a low-index animal.
- Asked to identify high eating-quality index beef.
- 75% correctly identified the high-index eating quality beef.

Figure 1

Table 1: Top 10 sires for meat eating quality

Breed	Name	Code	Owner
AA	Rawburn Lord Hacket	RWB	Devine
BB	Kilnaney Bruce	KCE	Devine
BB	Villabluey Cinglins	VMP	Devine
CH	Fidus	FSZ	NCBC
HE	Gaulding Poll Superduty	GDS	NCBC
LM	Dilly Flag	CFZ	NCBC
PF	Cairnbridge	CDG	NCBC
SA	Benquerie	PZB	NCBC
SH	Crioga Dice	CZS	Devine
SI	Raceview Van Halen	RNV	Devine

Table 2: ICBF consumer tasting session, Teagasc Grange BEEF 2016, 5 July 2016

Pair	High eating-quality steak: Breed	Tag No.	EBV	Low eating-quality steak: Breed	Tag No.	EBV	Consumer selected "High": High EBV	Low EBV
1	BB	176	3.3	BB	402	-0.3	5	2
2	CH	199	3.6	CH	987	-3.8	6	1
3	CH	3618	3.6	CH	943	-3.6	6	2
4	LM	1161	2.9	LM	466	-4.0	7	0
5	LM	1190	2.6	LM	496	-2.9	4	3
6	LM	1537	2.2	LM	956	-5.6	6	1
7	SA	1163	1.7	SA	191	-0.6	7	0
8	AA	2181	2.3	AA	2314	-2.4	7	0
9	BB	381	2.6	BB	412	0.0	3	4
10	CH	966	3.0	CH	536	-3.0	5	3
11	CH	1193	2.2	CH	1692	-0.1	3	4
12	LM	3610	2.4	LM	947	-1.0	5	3
13	LM	217	2.2	LM	2242	-0.1	6	2
14	SI	6417	-0.2	SI	644	-6.7	6	1
			2.4			-2.5	75	26

Key points

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Consumer validation cont'd

ICBF consumer tasting session, Teagasc Grange BEEF 2016, 5 July 2016								
	High eating-quality steak			Low eating-quality steak			Consumer selected "high"	
Pair	Breed	Tag No.	EBV	Breed	Tag No.	EBV	High EBV	Low EBV
1	BB	176	3.3	BB	402	-0.3	5	2
2	CH	119	3.6	CH	957	-3.2	6	1
3	CH	305	2.8	CH	943	-3.6	5	2
4	LM	188	2.9	LM	485	-4.0	7	0
5	LM	190	2.5	LM	414	-2.9	4	3
6	LM	537	2.2	LM	956	-5.6	6	1
7	SA	183	1.7	SA	191	-1.6	7	0
8	AA	291	2.3	AA	234	-2.4	7	0
9	BB	311	2.6	BB	412	0.0	3	4
10	CH	966	3.0	CH	536	-3.0	5	3
11	CH	193	2.2	CH	680	-0.1	3	4
12	LM	300	2.4	LM	947	-1.0	5	3
13	LM	317	2.2	LM	240	-0.1	6	2
14	SI	647	-0.2	SI	644	-6.7	6	1
			2.4			-2.5	75	26

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Role of genomics

- Ireland recently rolled out a Beef data genomics program (BDGP)
- Focused on breeding more profitable, sustainable and carbon efficient cows.
- Funded from EU Rural Development Program.
  - Under article 28 (Climate + Environment).
  - Co-funded by Irish government (DAFM).
- €300m total funding 6 years (2015-2020)
  - Farmers paid ~€90/cow/year to complete 6 actions
- ~2.5m animals will be genotyped during period of scheme.

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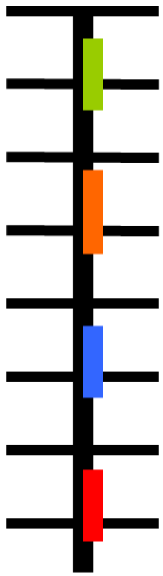
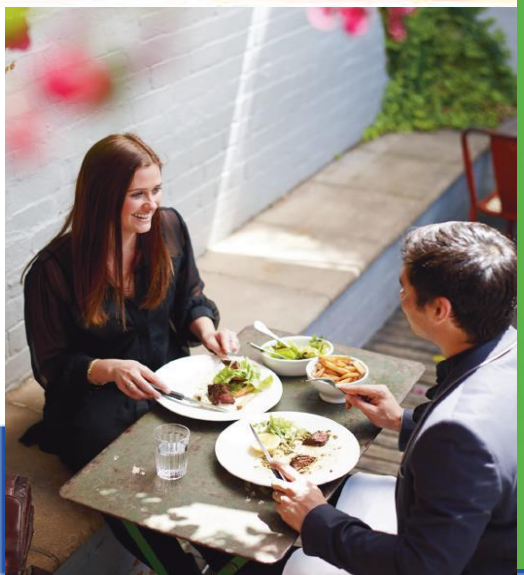
What is Genomics?



- The use of DNA information to predict how good an animal might be. Important tool in accelerating genetic gain
- Up to know we relied on parentage information on young animals
- We then need to wait until they have progeny to see how good they 'breed'
- DNA gives an extra 15-30% in terms of reliability.
- This is added to the existing €uro-Star indexes of the animal => more accurate evaluation.

Role of genomics for eating quality

- Genetic evaluation using genomics will allow for more accurate accurately identification of the the best bulls for eating quality



LISDUFF DANDY ZFL

EURO-STAR INDEX (ICBF - April 2014)

Star Rating within Angus breed	Economic Indexes	Euro Value	Index Reliability	Star Rating across all beef breeds
★★★★½	Replacement	€198	48% (Ave.)	★★★★★
	Maternal Cow Traits	€109	33%	
	Maternal Progeny Traits	€88	62%	
★★★½☆	Terminal	€52	60% (High)	★½☆☆☆

EXPECTED PROGENY PERFORMANCE

Star Rating within Angus breed	Key Profit Traits	Index Value	Trait Reliability	Star Rating across all beef breeds
	Calving difficulty (% 3 & 4) Breed ave: 2.28%. All breeds ave: 4.99%	5.00%	93% (V.High)	
★½☆☆☆	Docility (1–5 scale)	–0.04	67% (High)	★★☆☆☆
★★★★★	Carcass weight (kg)	14 kg	53% (Ave.)	★★½☆☆
★★½☆☆	Carcass conformation (1-15 scale)	0.81	40% (Ave.)	★☆☆☆☆

EXPECTED DAUGHTER BREEDING PERFORMANCE

	Daughter calving difficulty (% 3 & 4)	4.6%	23% (Low)	
★★★★★	Daughter milk (kg)	15.64 kg	28% (Low)	★★★★★
★★★★★	Daughter calving interval (days)	–7.85 days	34% (Low)	★★★★★

PEDIGREE

Sire: Aynho Rossiter Eric B125 AYR

Dam: Lisduff Della C448 IE121657690448

MGS: Dalrene Cruz 11F DAZ

- *Dandy is Ireland's No.1 Angus bull for commercial suckler farmers.*
- *Progeny are truly superb exhibiting consistency, length, style, muscling and character.*
- *High index Terminal (5 Star) and Replacement Index (5 Star).*

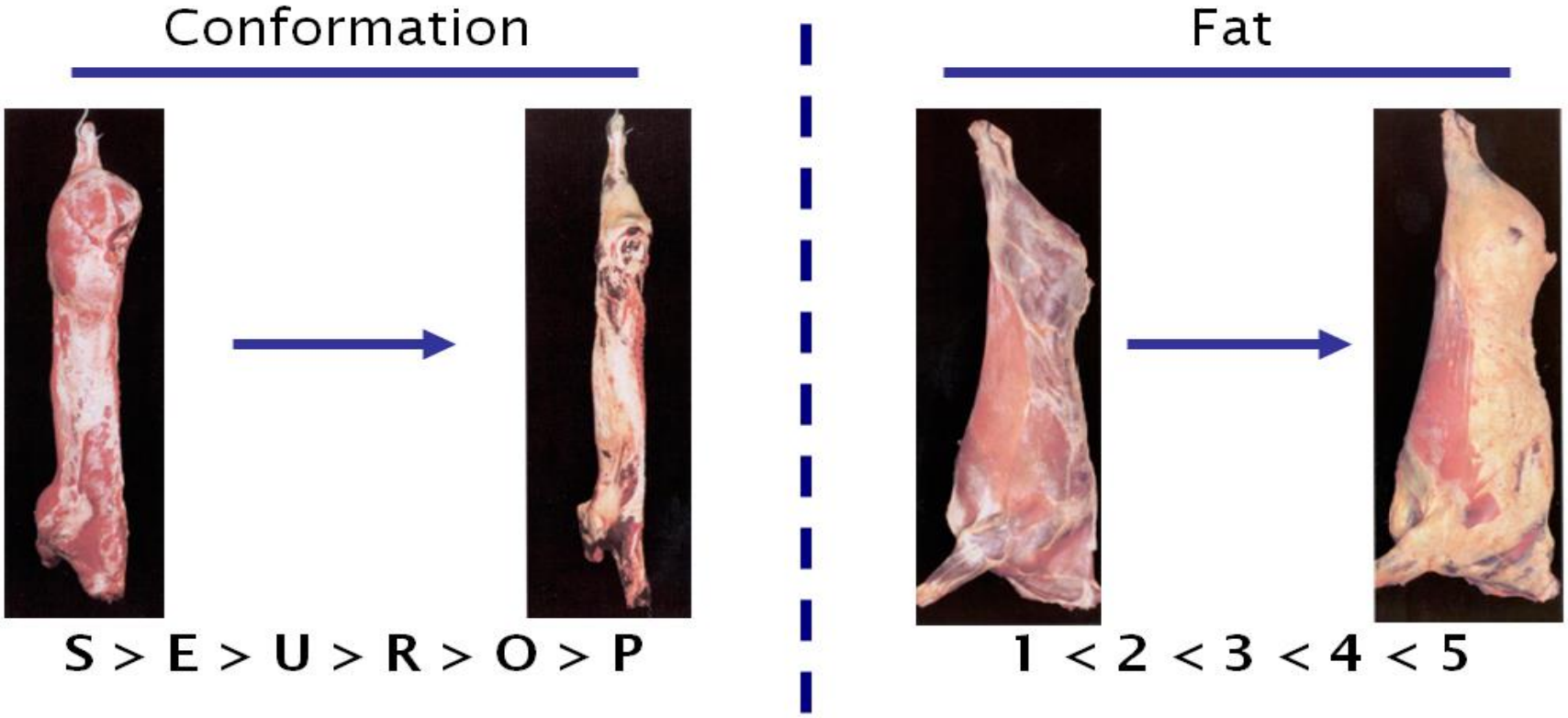
Semen available from:

Dovea GENETICS
Thurles, Co.Tipperary, Ireland
Tel: 0504 21755 • Fax: 0504 22768
E: info@dovea-genetics.ie
W: www.dovea.ie

Meat quality. What next?

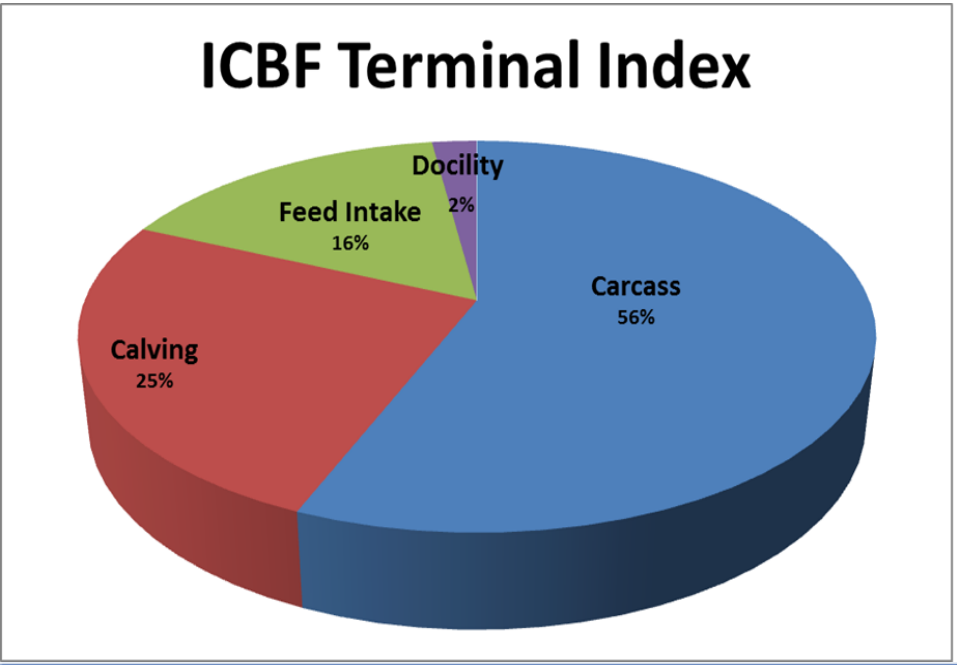
- In Ireland carcasses are graded mechanical carcass grading has replaced visual grading
  - ✓ Video imaging analysis (VIA) system

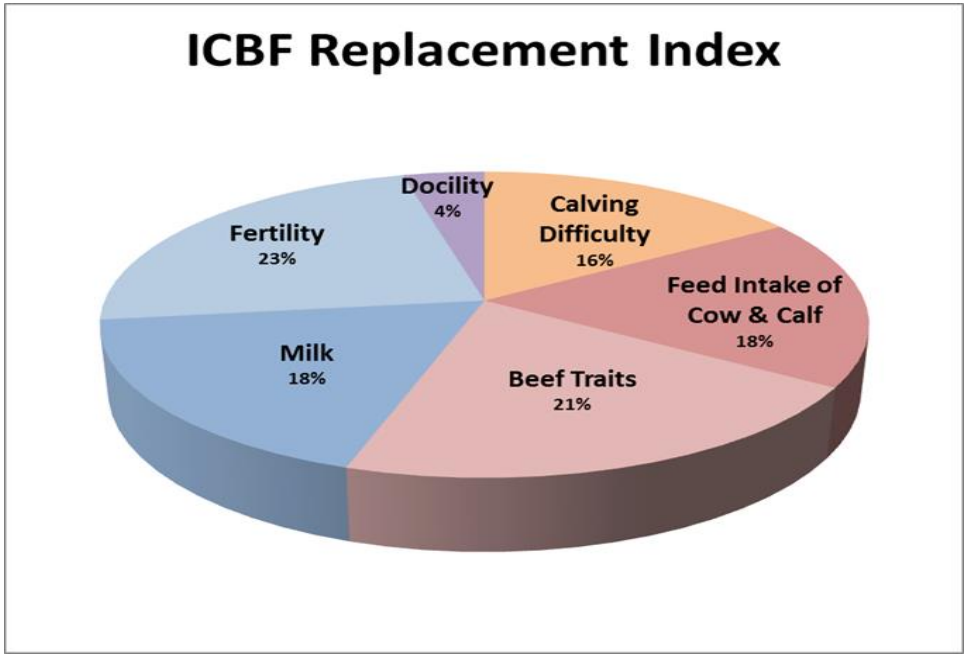
- **EUROP Classification to grade carcasses**



€uro-Star indexes

- Currently we use carcass weight, conformation and fat score as part of our genetic evaluations for terminal and replacement €uro-Star Indexes.





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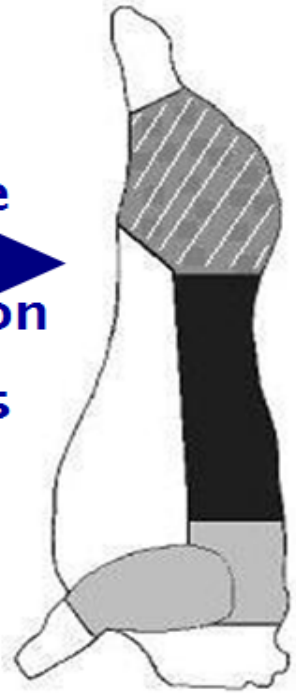
Predicting cuts using VIA images

- 8% of carcass weight accounts for over 30% of carcass value (Drennan et al., 2008)

- Converting images into cut weights

Multiple Regression Analysis



Lower value cuts

Medium value cuts

High value cuts

Very high value cuts

Also available on steers:

- Total meat weight
- Total fat weight
- Total bone weight

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Validation results

	Carcass weight (CCW)	CCW plus EUROP	CCW plus VIA
Total meat	0.91	0.97	0.97
Total fat	0.33	0.74	0.77
Total bone	0.66	0.79	0.81
Lower Value Cuts	0.97	0.89	0.92
Medium Value Cuts	0.74	0.79	0.86
High Value Cuts	0.75	0.89	0.93
Very High Value Cuts	0.74	0.85	0.84

T. Pabiou et al. / Livestock Science 137 (2011) 130–140

- Since 2007 ICBF have being storing 1.6 million VIA images per year.
- Further develop and validate the prediction equations for VIA images across genders using 81630 carcasses.

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Conclusions

- Meat eating quality exhibits genetic variation. No differences between breeds.
- Need to collect more data - Excellent industry engagement in the collection of relevant phenotypes.
- Look more closely at more routinely available predictors (pH, shear force, image data…..)
- Assign a monetary value for each unit increase in eating quality with a view to publishing a genetic index for eating quality.
- Genomics is going to play an important role in identifying elite sires for meat quality.
- VIA are an important tool to predict carcass cuts and composition.
- All stages of the food chain can effect meat quality. Therefore everyone has to work together to ensure consumers consume more beef and are willing to pay appropriately in order to return a profit to all involved.

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Thank You!