IRISH CATTLE BREEDING FEDERATION

Developments in Beef Genomics.

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.*

What is ICBF?

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

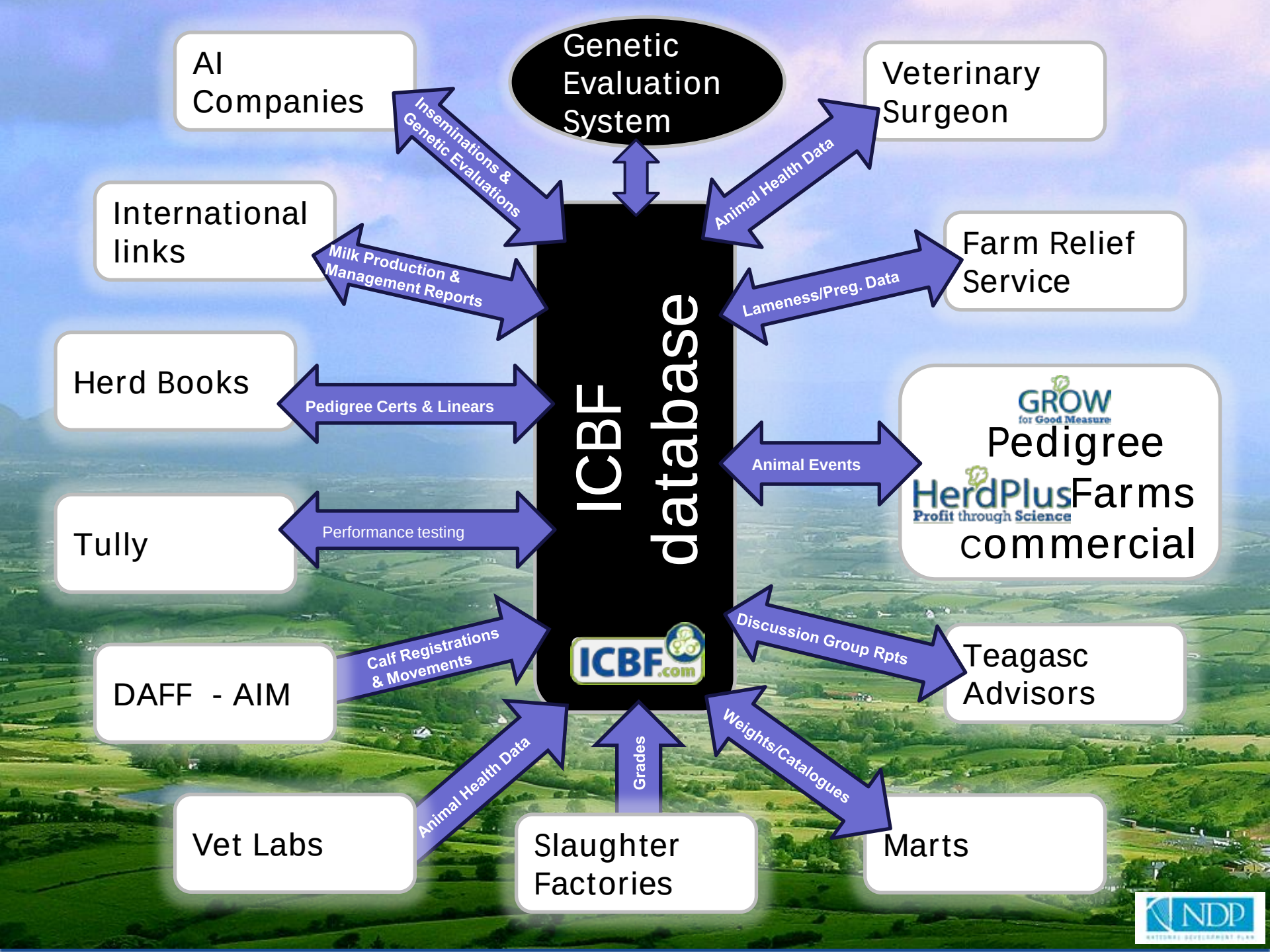
↓

Genetic Indexes

EBI

€uro-Stars

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


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
ICBF database
Animal Events
GROW for Good Measure
Pedigree
HerdPlus Profit through Science
Farms
commercial
Tully
Performance testing
Discussion Group Rpts
Calf Registrations & Movements
ICBF.com
DAFF - AIM
Teagasc Advisors
Animal Health Data
Grades
Weights/Catalogues
Vet Labs
Slaughter Factories
Marts
NDP

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	

Challenges & Opportunities.

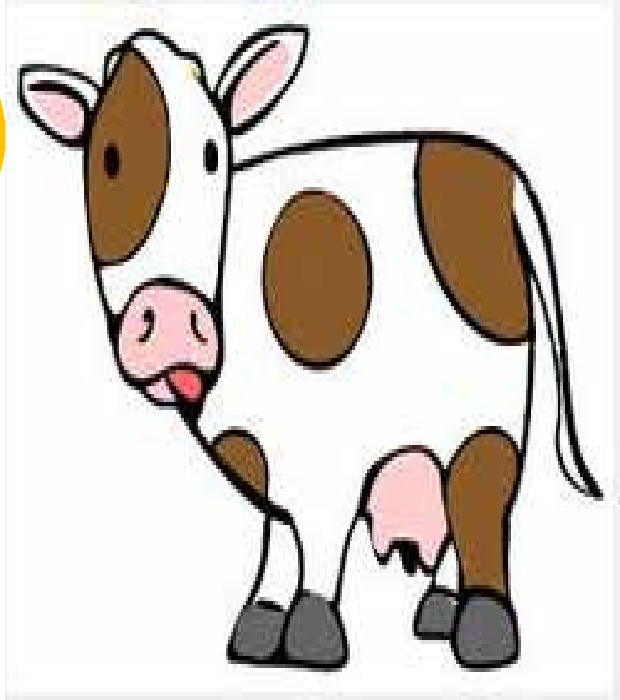
- We need to feed more people (9 billion by 2050).
- **But** in a Climate Efficient Way.
- The beef cow is highly inefficient in terms of kg CO2 output per kg protein.
- **But** she is a key part of rural infrastructure/eco-system in many countries.
- ***Can we breed a more climate efficient cow?***
- ***What is the potential role of genomics?***

Protect Climate & Environment.

- Ireland; To cut carbon emissions by 20%.
  - Agriculture currently responsible for almost 50% of total GHG emissions.

The Average Irish Suckler Cow

Calves for first time at ~31 months. 17% calve under 26 months (2015 figures)



Calves every 407 (2015) 412 days (2014)

Produces 0.79 calves per year.

Failing to wean 50% of own weight

Beef Replacements Born in 2010 (183,461)					
	Rep. Index	Age 1st Calving	Avg. Calving Int.	Survival to 3rd Calving	Weaning Weight
Top 10%	€141	910 Days (30 Months)	413 days	32%	303.7 Kgs
Bottom 10%	€12	956 Days (31.5 Months)	420 days	24%	279.5 Kgs

€uro-Star Replacement Index.

Trait	Goal	Relative wt
Calving	Less	16%
Feed Intake	Less	18%
Carcass wt (for age)	More	21%
Maternal milk	More	18%
Female fertility	More	23%
Docility	More	4%

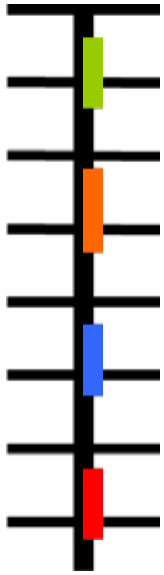
Star Rating (within Limousin breed)	Economic Indexes	€uro value per progeny	Index reliability	Star Rating (across all beef breeds)
★★★★★	Maternal	€279	83% (V High)	★★★★★
★★★★★	Terminal	€154	89% (V High)	★★★★★
☆☆☆☆☆	Dairy Beef	€	% (N/A)	☆☆☆☆☆

Star Rating (within Limousin breed)	Key profit traits	Index value	Trait reliability	Star Rating (across all beef breeds)
	Expected progeny performance			
	Calving difficulty (% 3 & 4) ⓘ Breed ave: 4.87%, All breeds ave: 4.99%	5.40%	95% (V High)	
★★★★½	Docility (1-5 scale) Breed ave: -0.07, All breeds ave: 0.00	0.00 scale	93% (V High)	★★★☆☆
★★★★★	Carcass weight (kg) Breed ave: 22.88kg, All breeds ave: 21.98kg	32kg	95% (V High)	★★★★½
★★★★½	Carcass conformation (1-15 scale) Breed ave: 2.05, All breeds ave: 1.83	2.26 scale	95% (V High)	★★★★★
	Expected daughter breeding performance			
	Daughter calving difficulty (% 3 & 4) Breed ave: 4.68%, All breeds ave: 5.19%	4%	68% (High)	
★★★★★	Daughter milk (kg) Breed ave: -0.28kg, All breeds ave: -0.01kg	8.2kg	84% (V High)	★★★★½
★★☆☆☆	Daughter calving interval (days) Breed ave: 0.78 days, All breeds ave: -0.53 days	1.33days	69% (High)	★½☆☆☆

The Irish Beef Data and Genomics Program

- 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.

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.

Requirement 1

Calving Details

- Record sires and calving ease.
- Same as old schemes
- Calf size and calf vigour added.
- Animal events book or online.

Requirement 2

Surveys

- Same as old schemes.
- Cow milk and docility, calf quality and docility etc.
- Cow and bull culling reasons added.
- Paper or online.

Requirement 3

Genotyping

- 60% of animals each year.
- Tissue tags.
- Option to switch animals.

Requirement 4

Replacement Strategy: Females

- Important dates
  - 31st Oct 2018 (20% of females >16 months are genotyped 4 or 5 star).
  - 31st Oct 2020 (50% of females >16 months are genotyped 4 or 5 star).
  - 20 cow herd needs:
    - 4 by 2018
    - 10 by 2020.

Females qualify on Replacement Index Only

Requirement 4 cont'd

Replacement Strategy: Males

- Important dates
  - After 30th Jun 2016 (80% of AI bulls used must be 4 or 5 star).
  - 30th Jun 2019 (must have at least one genotyped 4 or 5 star bull on farm)
  - 30th Jun 2020 (must have at least one genotyped 4 or 5 star bull on farm)

Bulls qualify on Replacement and/or Terminal Index

Requirement 5
Carbon Navigator

- Farmers had to complete a Carbon Navigator by October 31, 2016.
- This was carried out in conjunction with an approved advisor.
- Following initial completion of the Carbon Navigator, applicants must submit data annually to allow for updating of this navigator.

Requirement 6
Training

- Suckler farmers taking part in this scheme undertook a training course relating to the programme (Year 1)
- Applicants were paid €166 to cover the costs associated with participation in this training course

Genomics

What are the benefits?

- Guarantee traceability of Irish beef.
- Increase reliability % figures of €uro-Stars.
- Select best bulls for breeding programs.
- First country in the world to roll out a genomics scheme for commercial beef cattle.

Parentage verification

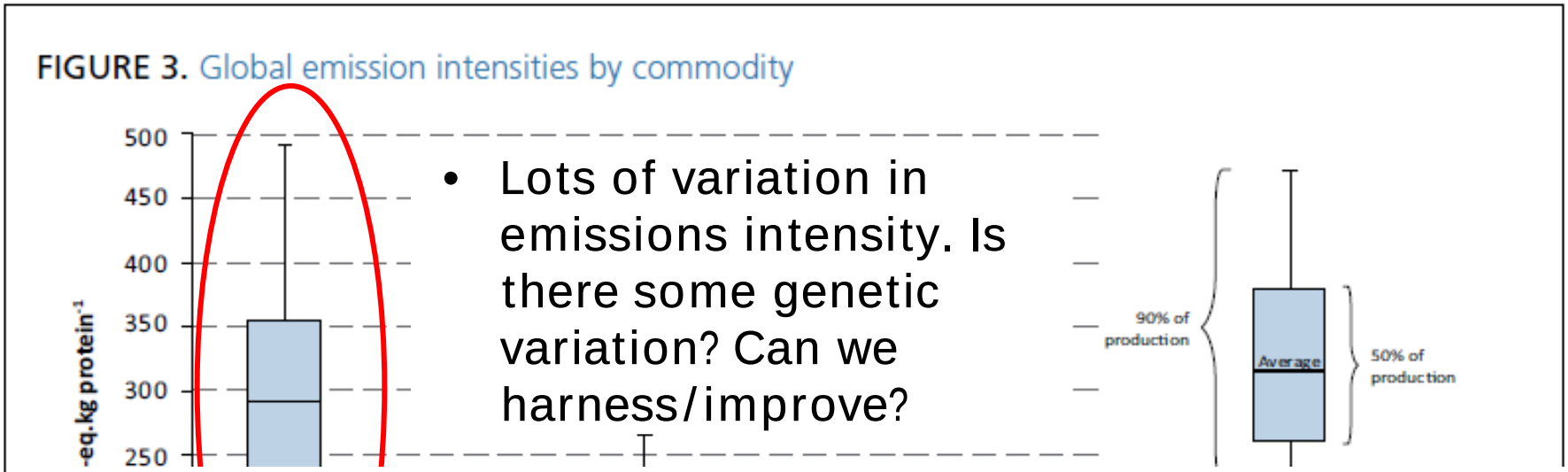
- Sire recording is the most significant piece of data on any animal.
- Without a sire record, an animal's performance cannot be used to its full potential in genetic evaluations.

	2007 (Pre SCWS) Beef born animals with a sire recorded	2015 Beef born animals with a sire recorded
Calves Born	17%	76%
Dams of Calves Born	15%	76%

Still approximately 237,000 suckler calves born in 2015 with no recorded sire!

Sire error rate = 9.5%
5% in pedigree herds
130,000 sires predicted using 800k Parentage prediction & discovery panel

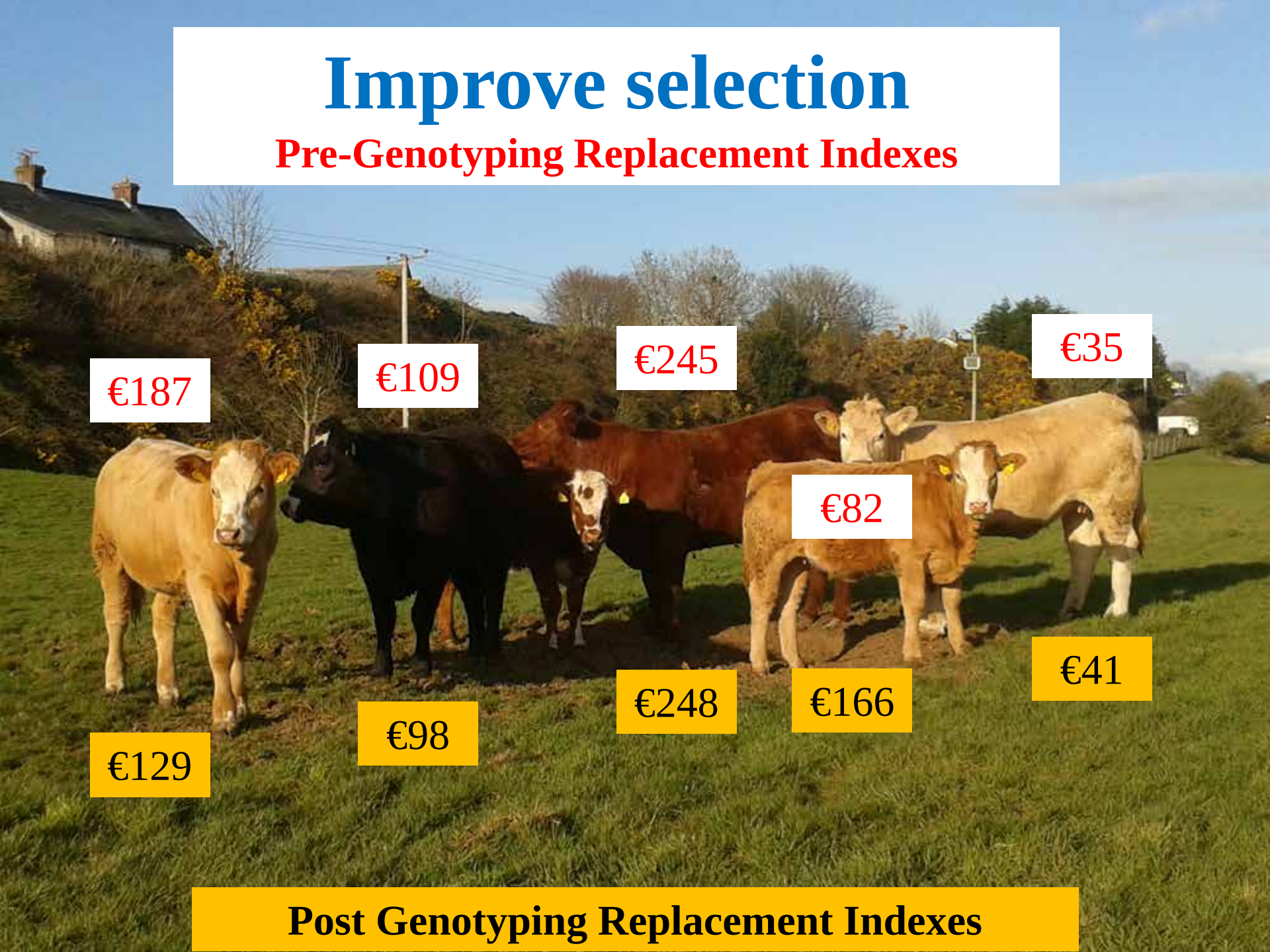
Breed a more efficient beef cow?



De Haas et al. JAM 2016. Methane emission h2 of 0.35 “it is possible to decrease the methane production of a cow by selecting more-efficient cows, and the genetic variation suggests that reductions in the order of 11 to 26% in 10 yr are theoretically possible, and could be even higher in a genomic selection program”

Improve selection

Pre-Genotyping Replacement Indexes



Post Genotyping Replacement Indexes

5 Star Cows Leaving More Profit....

All Suckler Cows

Cow Details				Milk Performance		Fertility Performance			Progeny Carcass Performance		
Star Rating	No. of Cows	Replacement Index	% Still Alive	Calf Weaning Weight (kg)	Cow Milk Score (1-5)	Age 1st Calving (months)	Calving Interval (days)	No. of Calvings	Carcass Weight (kg)	Carcass Value	Age at Slaughter (days)
« « « « «	33,493	€108	83%	336	4.08	30.2	403	2.69	358	€1,474	697
« « « «	24,317	€76	80%	324	3.87	30.9	407	2.56	356	€1,469	712
« « «	21,644	€60	79%	319	3.74	31.3	411	2.47	356	€1,470	715
« «	20,908	€43	76%	315	3.61	31.5	416	2.40	357	€1,475	721
«	23,911	€12	72%	309	3.36	32.1	423	2.25	357	€1,477	726
Difference 5 Star V's 1 Star		**+€96**	**11%**	**27kg**	**0.72**	**-1.9 months**	**-20 days**	**0.44 calves**	**0kg**	**€-2**	**-29 days**

Performance of all suckler females, born in 2011, when ranked on new genomic test proofs


Thank You!