



IRISH CATTLE BREEDING FEDERATION

Dehorning cattle via genetics

Tuesday 11th April
Portlaoise

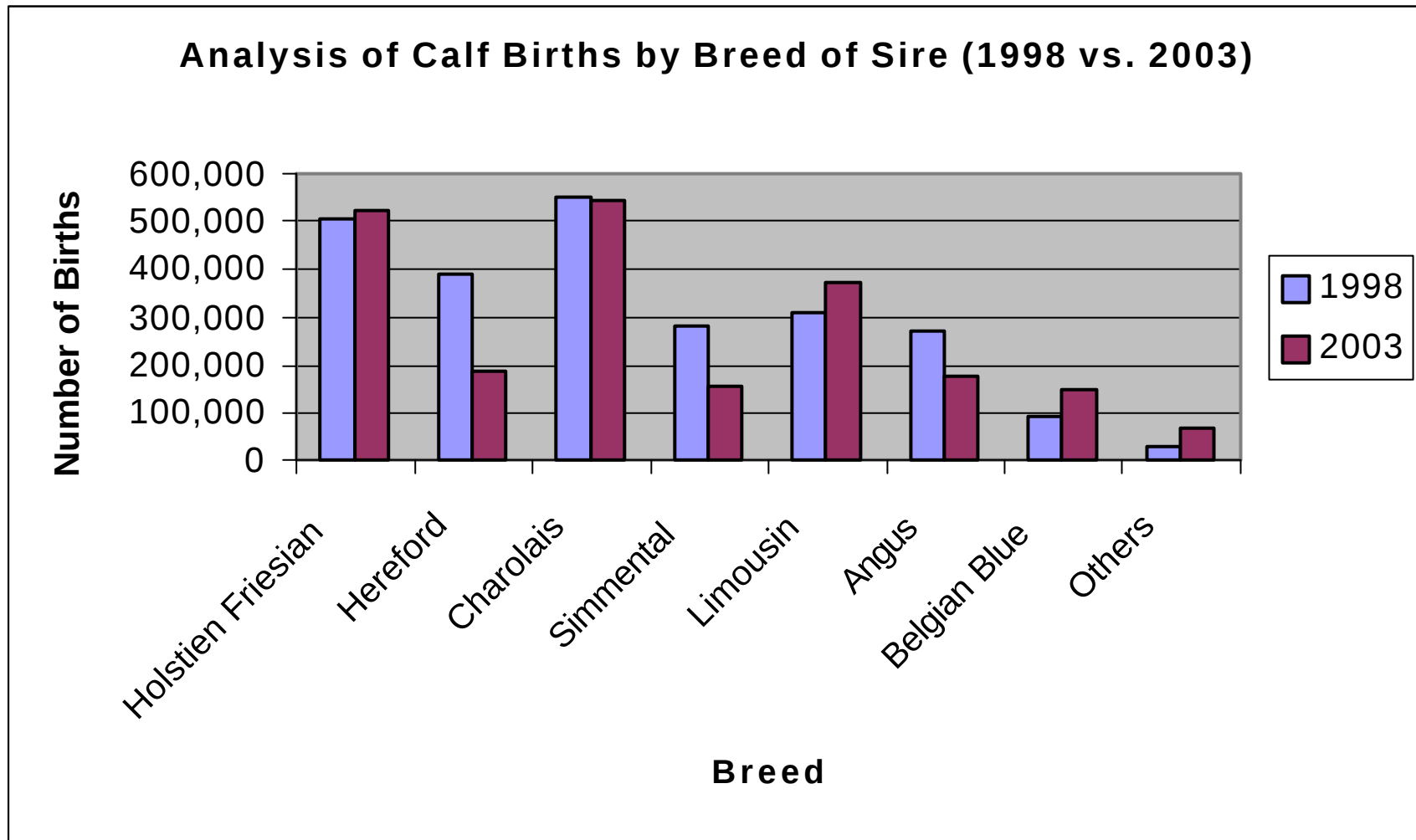
Outline

- Background
- Genetics of Polled gene
- Polled vs Horned
- How to increase Polled gene
- Breeding for the Polled gene in Ireland
- Summary

Background

- Majority of breeds are horned
 - Frequency of polled is very low
- Increasing concern over several aspects of horned animals
 - Animal welfare
 - Human welfare
 - Production – e.g. carcass damage

Background



Background

- 2.2m calves born per annum
- 140k calves born to AA cows
- 160k calves born to AA bulls
- ~300k calves born polled
- €5/head to dehorn - €10m/annum

Genetics of Polled gene

- Absence of horns is controlled by a single major gene – Polled (P) gene
- Animals have 2 alleles for polled gene
 - P or p
 - P is dominant to p
- Three genotypes & two phenotypes for polledness

Genetics of Polled gene

Genotype		Phenotype
PP	Homozygous dominant	Polled
Pp	Heterozygous	Polled
pp	Homozygous recessive	Horned

Genetics of Polled gene

Parents	PP×PP	PP×Pp	PP×pp	Pp×Pp	Pp×pp
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Progeny					
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PP	100%	50%	-	25%	-
Pp	-	50%	100%	50%	50%
Pp	-	-	-	25%	50%

Genetics of Polled gene

- Difficult to achieve 100% P as recessive gene is “hidden” in heterozygotes
- Actual “causal mutation” for polledness has yet to be identified
- Research indicates gene resides on bovine chromosome 1
- Markers are available that are linked to the polled gene (95% successful)
- Future research will lead to discovery of the mutation – direct DNA test

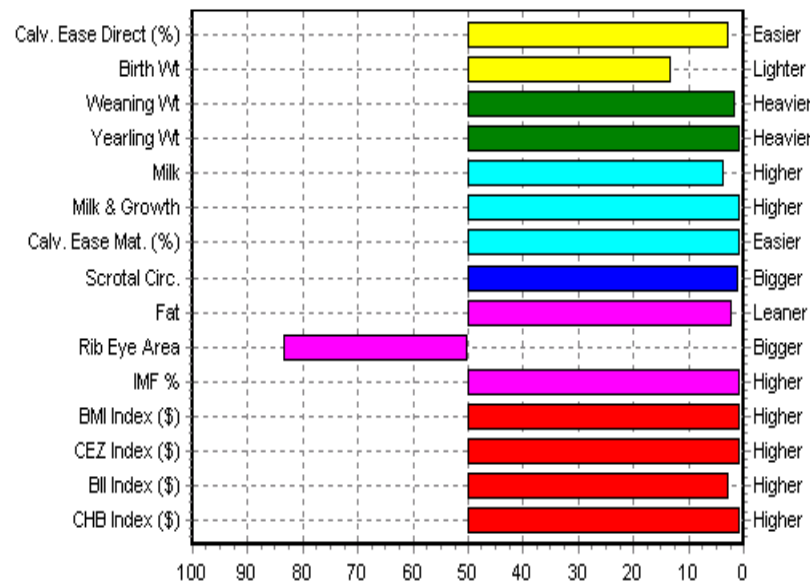
Polled vs. Horned

- Little evidence to suggest polled animals are inferior to horned
 - American Herefords (59/101 in top 1%)
 - Norweigan Reds (9/26)
 - Beef Breeds
 - Adg, yearling weight, growth, carcass, birth weight
 - Pregnancy rate, dystocia, body condition

Polled vs Horned



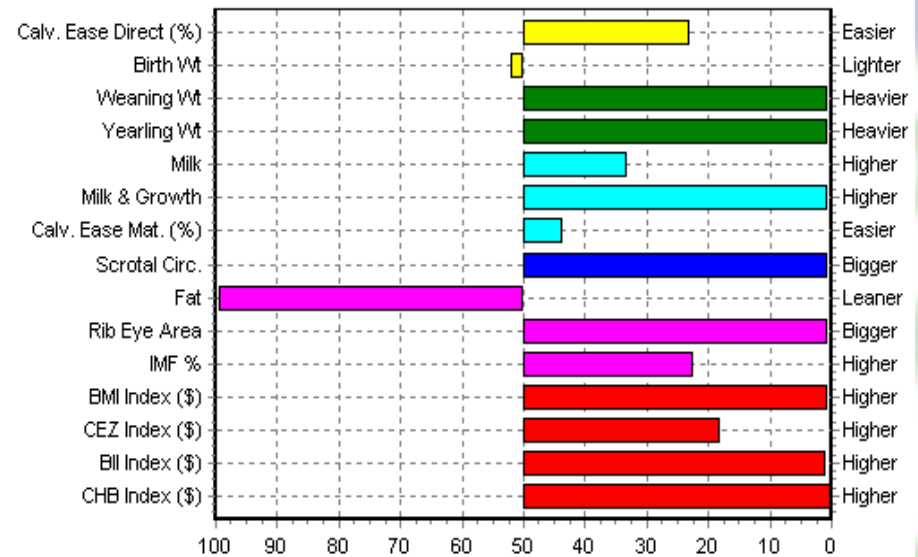
EPD Percentiles for RRH MR FELT 3008 (P23703420)
SPRING 2006 EPDS



50th Percentile is the Breed Avg. EPDs for 2004 Born Calves



EPD Percentiles for BB 9131 DOMINO 1065 (42173637)
SPRING 2006 EPDS



50th Percentile is the Breed Avg. EPDs for 2004 Born Calves

Number	Name	TMI	Colour	Horned/Polled
5277	ULSAKER	24	Red	Horned
5313	FAAREN	23	Black	Horned
5777	BAKKEN	23	Red	Horned
5780	SALTE	19	Red	Horned
5706	BERGE	18	Red	Polled
5621	ELVEVOLL	17	Black	Polled
5814	BJERKENGEN	17	Black	Horned
5198	AUNE	17	Red	Horned
5339	RØRMARK	17	Red	Horned
5734	DVERGSNES	16	Red	Horned
5647	KROKSTAD	16	Black	Horned
5654	OLSTAD	16	Red	Polled
5723	ØLBERG	15	Red	Horned
5664	LANGVATN	15	Red	Horned
5769	TUFT	15	Red	Horned
5682	METLI	14	Red	Horned
5704	NJØLSTAD	14	Red	Polled
5633	HAUSKE	14	Red	Horned
5399	DRUGLI	14	Black	Horned
5749	LØFALD	13	Black	Horned
5451	GRØDALAND	13	Black	Horned
5620	GJERLAUG	13	Black	Polled
5613	KVALBEIN	13	Red	Polled
5614	BOBERG	13	Black	Polled
5656	ORMHAUGEN	13	Red	Polled
5576	TURLINGEN	13	Red	Polled

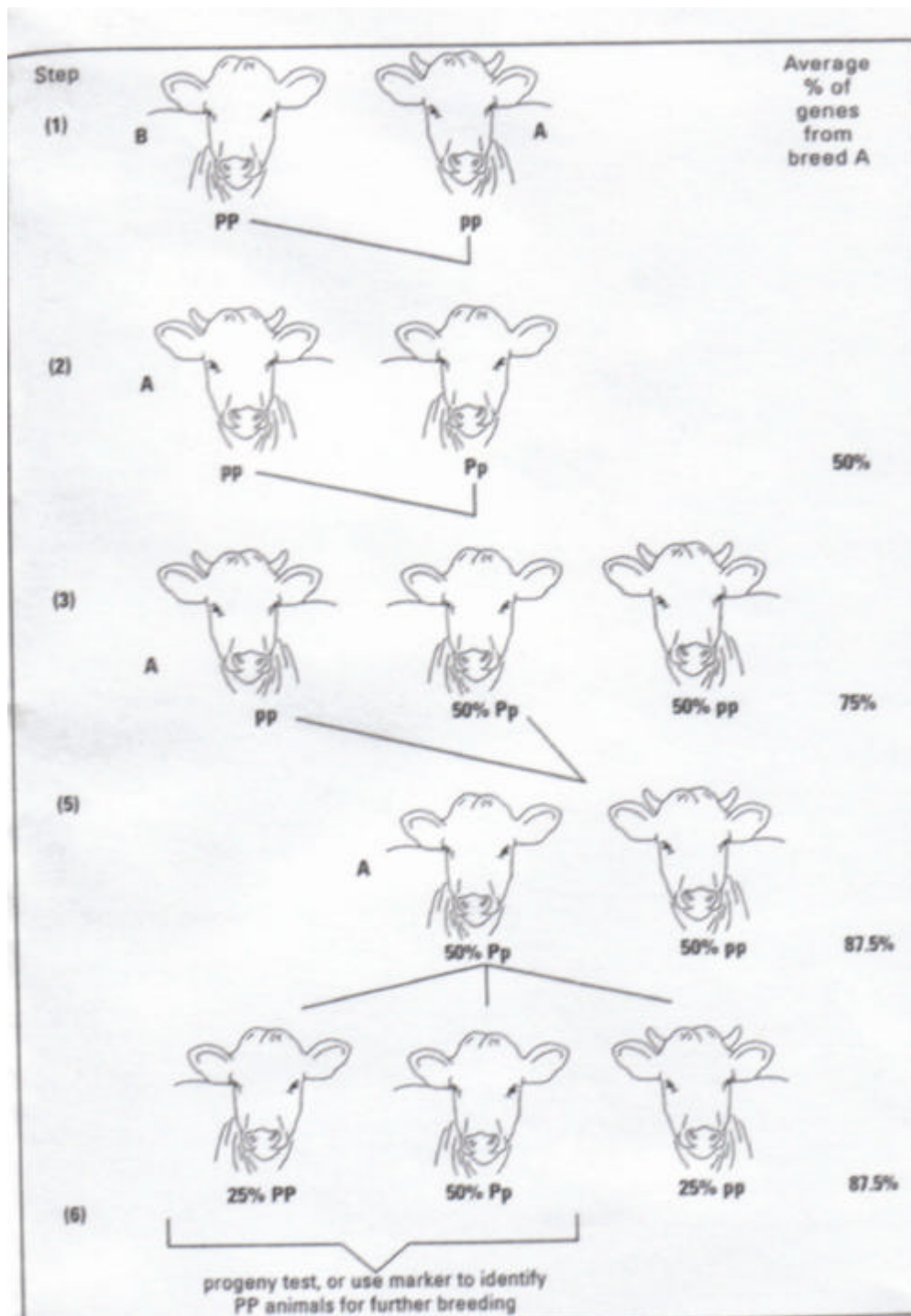
Polled vs. Horned

- Evidence to suggest use of Polled bulls is increasing - % registrations (Canada)

Breed	1989	1999
Limousin	18	49
Simmental	14	32
Charolais	38	65

Breeding as a tool

- Breeding can be used to eliminate the need to dehorn
 - Use of polled bull results in all polled offspring
- Gene introgression
 - Introduce the polled gene from polled breed into horned breed
- Marker assisted selection
 - Useful for introgression and when polled animals in horned breed are identified



Step 1: Mate horned cows of preferred breed A to polled breed B – 100%Pp

Step 2: F1 females to preferred breed A
50% - Pp, 50% - pp | 75% A 25% B

Step 3: Backcross Pp animals to breed A
50% - Pp, 50% pp | 87.5% A 12.5% B

Step 4: Repeat 3 until desired proportion of genes of preferred breed is achieved

Step 5: Mate graded up Pp
25% - Pp, 50% - Pp, 25% - pp

Step 6: Progeny test polled bulls – mate to horned cows

PP will never produce polled calves

Pp will produce 50% (N=7, 99% rel)

Gene Introgression

- Step 6 – Time consuming and costly
 - Could be abolished using genetic markers
- Important to determine whether the economic benefits at the end of the programme are likely to exceed those if conventional selection was followed
- Genetic Lag – reduction in performance in the crossbred population because the donor line may be inferior for traits that have been selected for many generations in the recip

Gene Introgression

- Example: Introgression of polled gene from Friesian into Holstein-Friesian (Wall, 2002)
 - 3 backcross generations
 - 16 years to complete
 - ~ genetic lag of 12% for kg Milk (8250kg vs. 7385kg)
 - 50 PP bulls required at the end, 400 cows need to be maintained during backcross phase

Gene Introgression

- Critical Requirements
 - Large representative sample of animals from the horned breed should be used to ensure the polled strain has as much genetic variation as the horned breed
 - If selection on other traits is desired a large population of carriers at each backcross generation is required

Marker Assisted Selection

- Can make use of the naturally occurring mutations in horned breeds to increase the frequency of the polled gene
- Identify offspring of Polled sires and use in progeny testing
 - Markers can be used to distinguish between carriers and polled

Marker Assisted Selection

- Advantages
 - Within breed, no need for backcrossing etc
 - No loss in performance
- Disadvantages
 - Polled gene at low frequency



Marker Assisted Selection

- Critical Requirement
 - Polled animals need to be of sufficiently high genetic merit to ensure their widespread use
 - Once achieved it may be possible to increase frequency of the polled gene quickly in the population

Breeding for the Polled gene in Ireland



Breeding for the Polled gene in Ireland

Breeder demand/requirement



Breed Associations/AI companies



Increase frequency of Polled gene

Breeding for the Polled gene in Ireland

- Recent consolidation of some AI companies in Ireland
- Formation of the National Cattle Breeding Centre (NCBC)- PG & Dairygold
- Control of the progeny testing programme of beef and dairy

Summary

- Several advantages to increasing Polled gene
 - Animal & Human perspective
- Various ways in which breeding can be used as a tool to eliminate the need to dehorn
- Economics will be the key driver
 - Initially from breeders?