IRISH CATTLE BREEDING FEDERATION

Improving Bull Selection

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ICBF

NDP
NATIONAL DEVELOPMENT PLAN

Genetic Improvement

Factor	Description	Genetic Gain
Accuracy Selection (Reliability)	· Heritability · Amount of information · Genetic Evaluation	Higher accuracy · accurate information (calving, AI records, MR) · accurate genetic evaluation
Genetic Variation	· Amount of variation that exists (e.g., spread in bull proofs)	More variation is better Biological, therefore no control
Generation Interval	· Average age of parents when offspring are born	Shorter intervals are better Dairy cattle 6 yr due to progeny testing
Selection Intensity	· Difference between the selected animals and average of pop	High intensity leads to more gain

Selection Intensity

- Dairy cattle - 4 paths that contribute to genetic progress
  1. Sires to produce sires (sire of sons)
  2. Sires to produce dams
  3. Dams to produce future sires (bull dam)
  4. Dams to produce future dams
- G€N€ IR€LAND® - objective is to maximise selection intensity of paths 1 and 3
- Farmer controls 2 and 4 when making breeding decisions

Top Cows

Top Bulls

Mixture of progeny
Good on average

Elite Cows

Fall through system

Young Test Sires

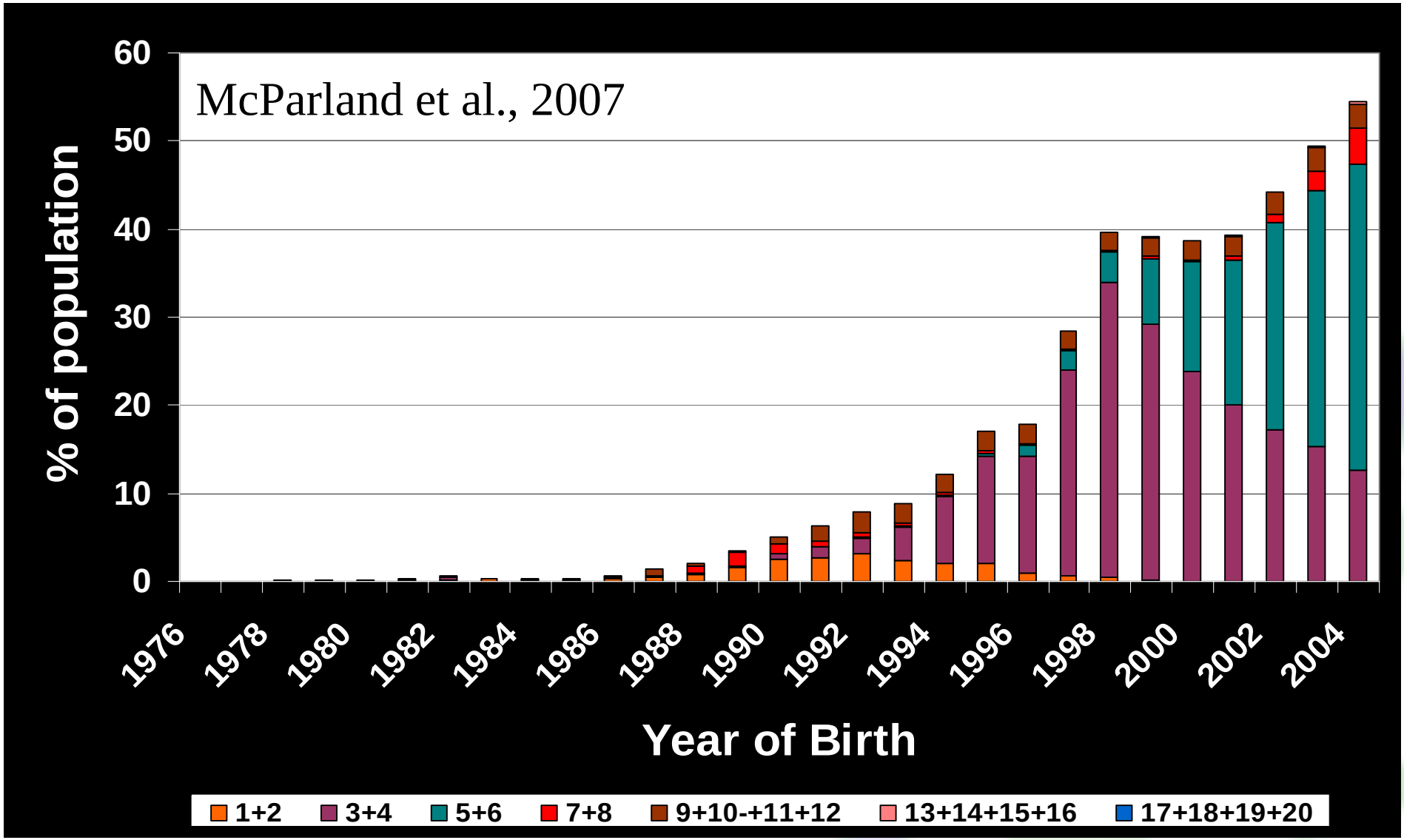
Selection Intensity

- Several constraints to maximising selection intensity
  - Inbreeding
  - Reliability of sires/dams
  - Minimum bull dam requirements

Inbreeding

- Increase in inbreeding can have some deleterious consequences
  - Affect traits such as production, fertility etc
  - Increase genetic disorders (e.g., CVM, BLAD etc)
  - Reduce genetic variation
- Over representation of few elite sires has caused an increase in inbreeding
  - Narrow selection goals, especially production traits

Descendents of Carlin M Ivanhoe Bell



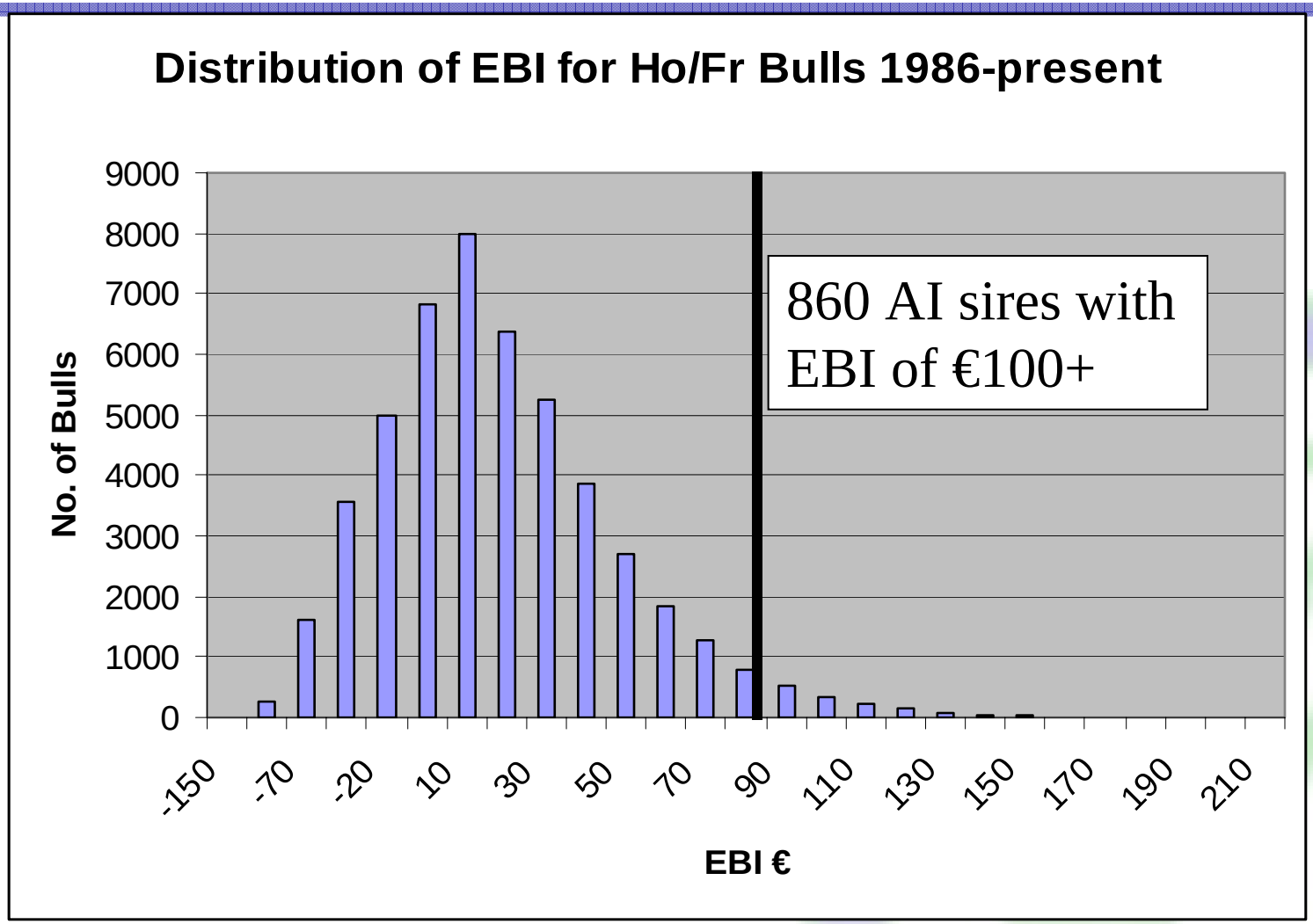
Selection vs. Inbreeding

- G€N€ IR€LAND® needs to strike a balance between intense selection and inbreeding
- Historically – no new "top bull" each year
  - Many daughters of few bulls
  - Implications for testing bulls and availability of bull mothers

Sires of Sons

- Bulls that are likely to produce sons that perform well under Irish conditions
- High EBI
- Range of reliabilities – manage risk
- Range of pedigrees – manage inbreeding
- International breeding objectives are now similar to EBI

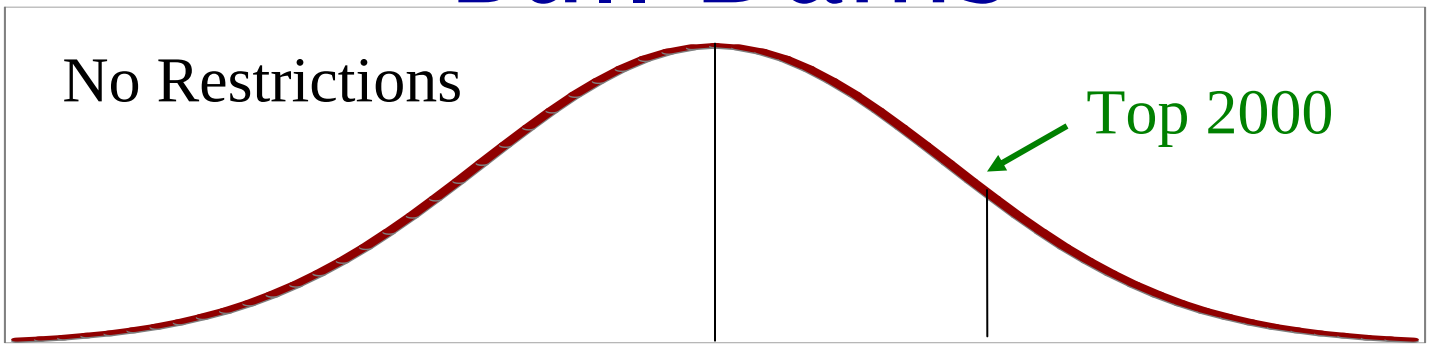
Sires of Sons



Bull Dams

- Minimum criteria for bull dams
  - Ancestry requirement – at least 2 complete generations on dam
  - High EBI
  - Milk recorded
  - Others as deemed appropriate by AI company (e.g., calving interval records, good functional feet & legs, udder, protein % etc)

Bull Dams



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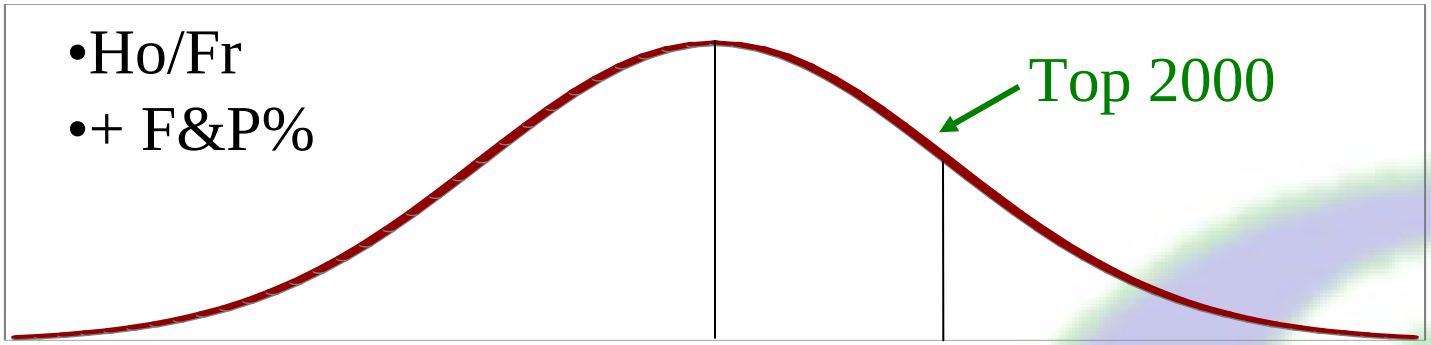

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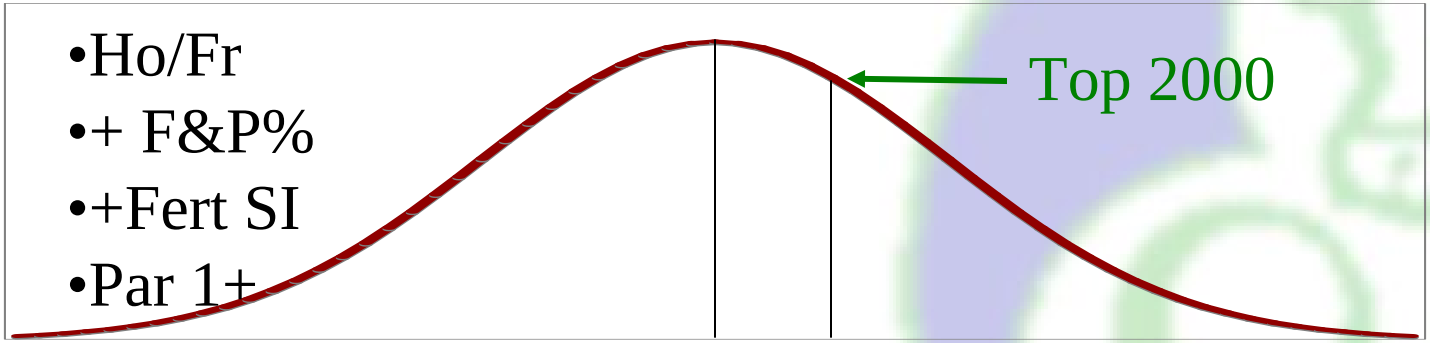

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Bull Dam Listings

- To help both AI companies/breeders with bull dam information, plan to make available a list of top X cows for each bull that has high EBI

AI Code	EBI	Milk SI	Fertility SI	Min EBI	Max EBI
AAP	108	62	41	100	124
BWZ	116	55	51	111	126
GMI	133	69	51	125	151
HFL	122	42	59	114	140
LBO	118	48	63	111	143
LLO	122	51	67	111	155
MAU	127	57	53	123	146
NHS	111	74	32	106	123
RUU	152	47	79	146	167
TIH	129	31	89	122	147
UYC	129	69	56	124	139

Contract Mating

- Contract mating confers several advantages
  - More control over mating of best cows to best bulls
  - More control over resultant EBI of offspring
  - More control over inbreeding
  - Potentially more control from disease perspective

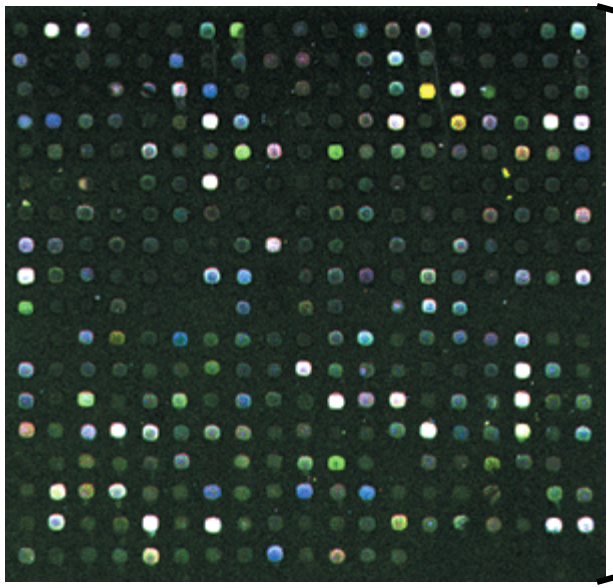
Contract Mating

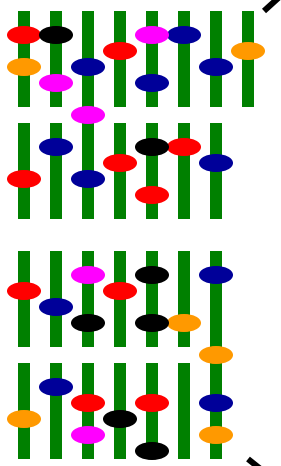
- Disadvantage – Cost & Work involved
  - ~700 contract mating required to get 100 bulls
    - 350 pregnancies
    - 175 bull calves
    - Mortality, health tests, semen
  - More planning required
  - Who pays??

Genomic Selection

- Set to revolutionise dairy cattle breeding???
- Estimate EBI for a young bull based on a DNA profile

Genomic Selection





- Genes associated with production
- Genes associated with fertility/survival
- Genes associated with calving
- Genes associated with health
- Genes associated with beef

GS EBI € = Sum(all genes associated with traits in EBI)*EV

Genomic Selection

- Current progeny test bulls are selected based on parent average (reliability ~ 35%)
- A genomically selected yearling bull would have a reliability of ~60%
- Faster genetic progress through higher accuracy of selection and a shorter generation interval
- Technology is currently unproven

Key Messages

- Maximising the genetic progress in EBI is key to increasing profitability

- ***Identifying*** and ***accurately testing*** top quality young bulls is necessary to ensure availability of high EBI bulls to farmers in the future

Key Messages

- Contract mating offers more control of the progeny testing programme but at extra cost

- Some tradeoffs between gain and maintaining genetic variation are necessary to sustain long-term progress