Decision support tools – from the cradle to the grave

Donagh Berry[1], Margaret Kelleher[2], & Fíona Dunne[1]

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EAAP, Decemeber 2020

This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 727213

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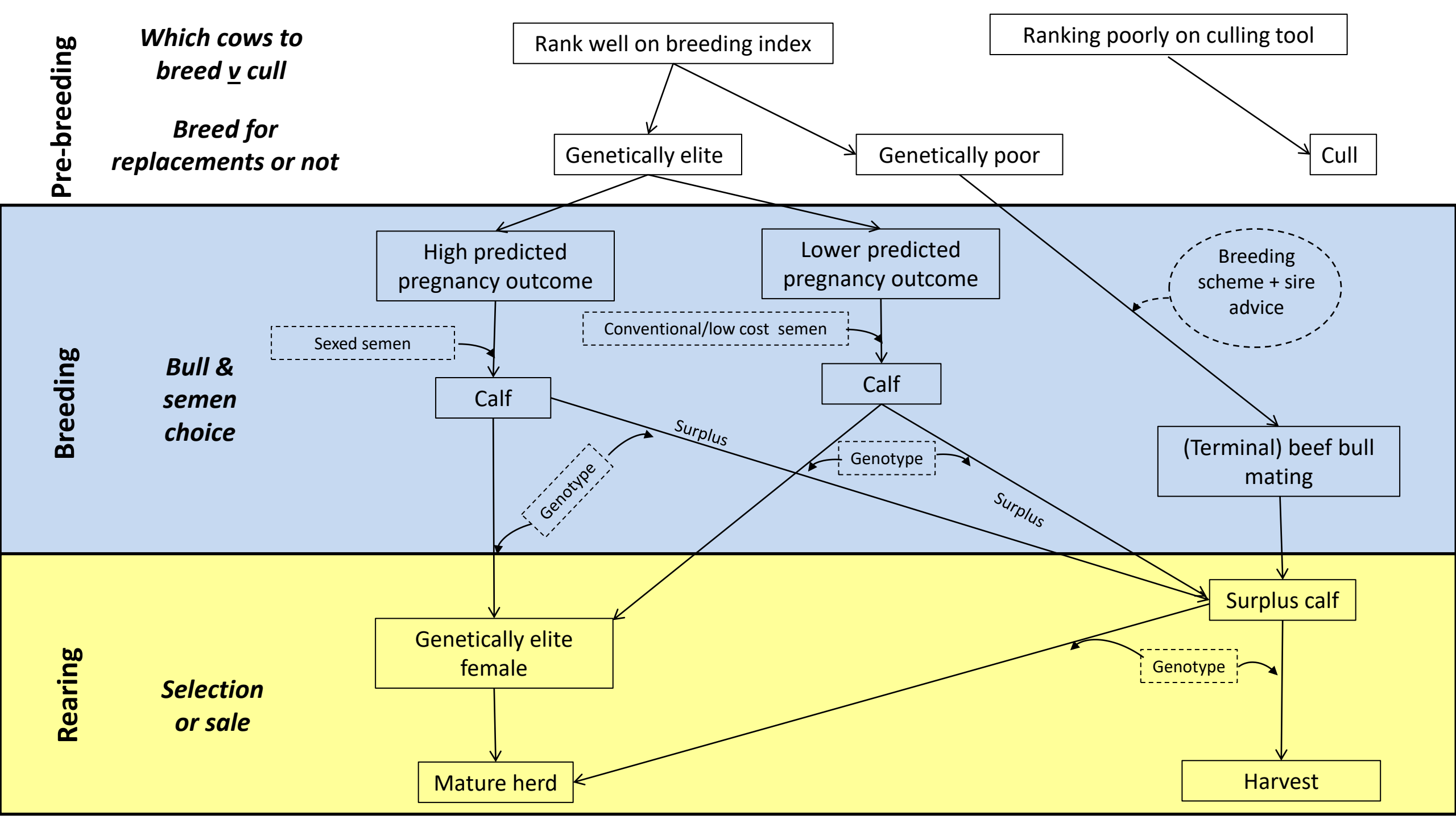
Pre-breeding
Which cows to breed v cull
Breed for replacements or not
Rank well on breeding index
Ranking poorly on culling tool
Genetically elite
Genetically poor
Cull
Breeding
Bull & semen choice
High predicted pregnancy outcome
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Breeding scheme + sire advice
Sexed semen
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(Terminal) beef bull mating
Rearing
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Mature herd
Harvest

Pre-breeding

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Breed for replacements or not

J. Dairy Sci. 101:3686–3701
https://doi.org/10.3168/jds.2017-13335

Symposium review: **Possibilities in an age of genomics: The future of selection indices**[1]

J. B. Cole[2] and P. M. VanRaden

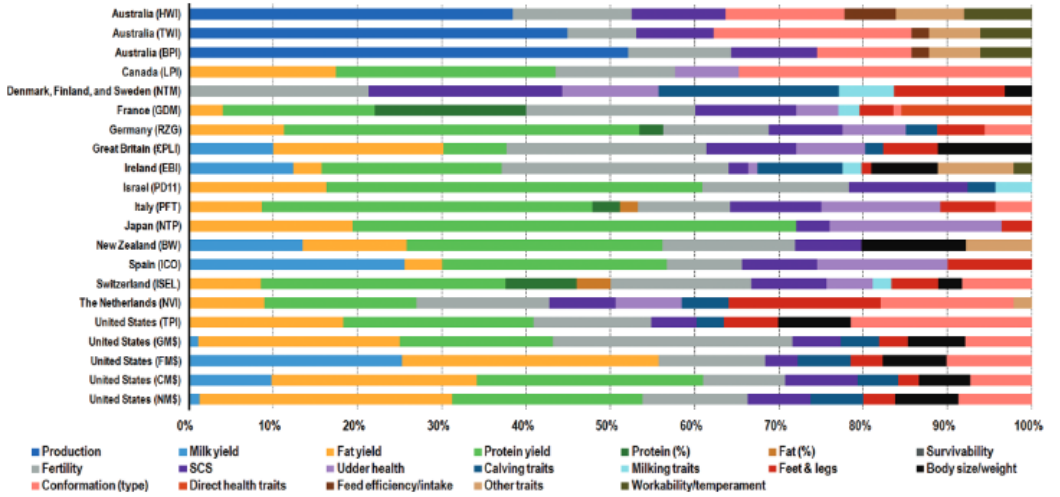
ELSEVIER

Livestock Production Science 67 (2001) 223–239

LIVESTOCK PRODUCTION SCIENCE
www.elsevier.com/locate/livprodsci

Breeding objectives for beef cattle in Ireland

P.R. Amer[a,*], G. Simm[b], M.G. Keane[c], M.G. Diskin[d], B.W. Wickham[e]



$$H = a_1 \cdot GM_1 + a_2 \cdot GM_2 + \ldots + a_n \cdot GM_n$$

$$H = \text{Sub-index}_1 + \text{Sub-index}_2 + \ldots + \text{Sub-index}_n$$

1. Must be important
2. Must exhibit genetic variability
3. Must be measureable (or correlated with a measureable trait)

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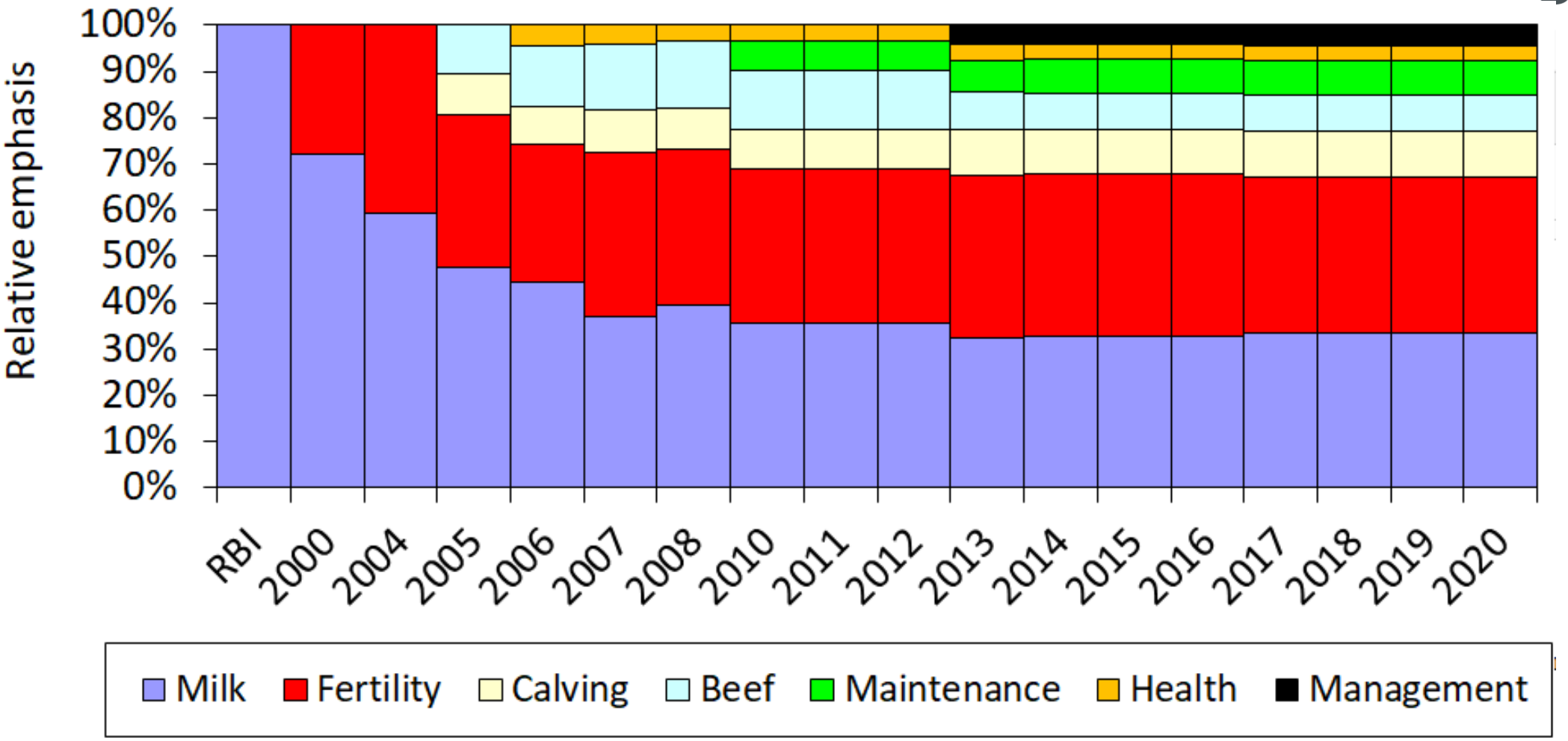
Evolution of Irish Dairy Breeding Goal (Economic Breeding Index)



This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 727213

Pre-breeding

Which cows to breed v cull

Breed for replacements or not

Rank well on breeding index

Genetically elite

Genetically poor

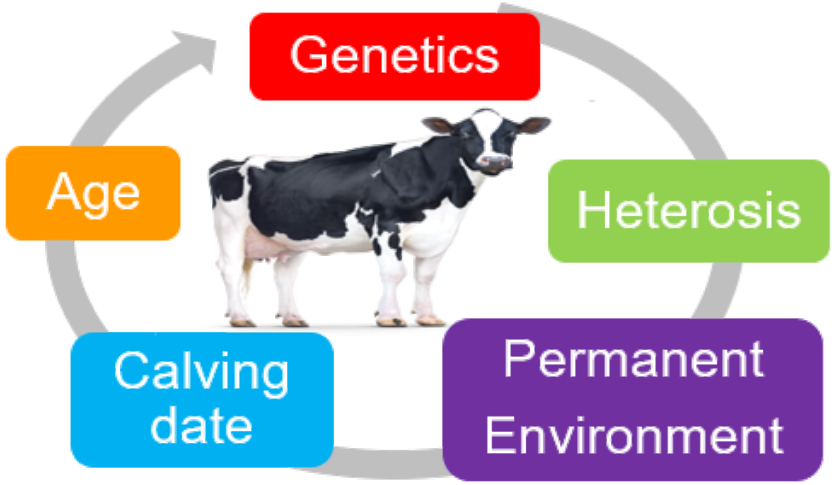
Ranking poorly on culling tool

Cull

J. Dairy Sci. 98:4225–4239
http://dx.doi.org/10.3168/jds.2014-9073

Development of an index to rank dairy females on expected lifetime profit

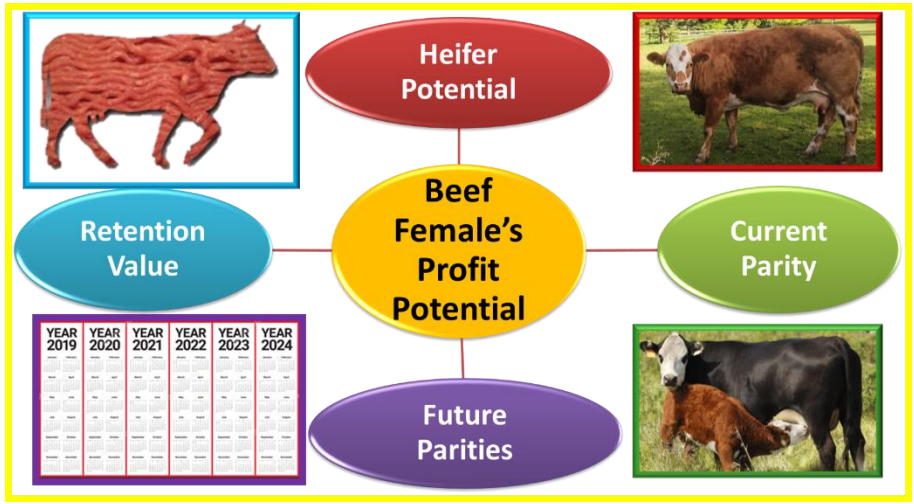
M. M. Kelleher,*† P. R. Amer,‡ L. Shalloo,* R. D. Evans,§ T. J. Byrne,‡ F. Buckley,* and D. P. Berry*[1]



An index framework founded on the future profit potential of female beef cattle to aid the identification of candidates for culling

F L Dunne, D P Berry ✉, M M Kelleher, R D Evans, S W Walsh, P R Amer

Journal of Animal Science, skaa334, https://doi.org/10.1093/jas/skaa334



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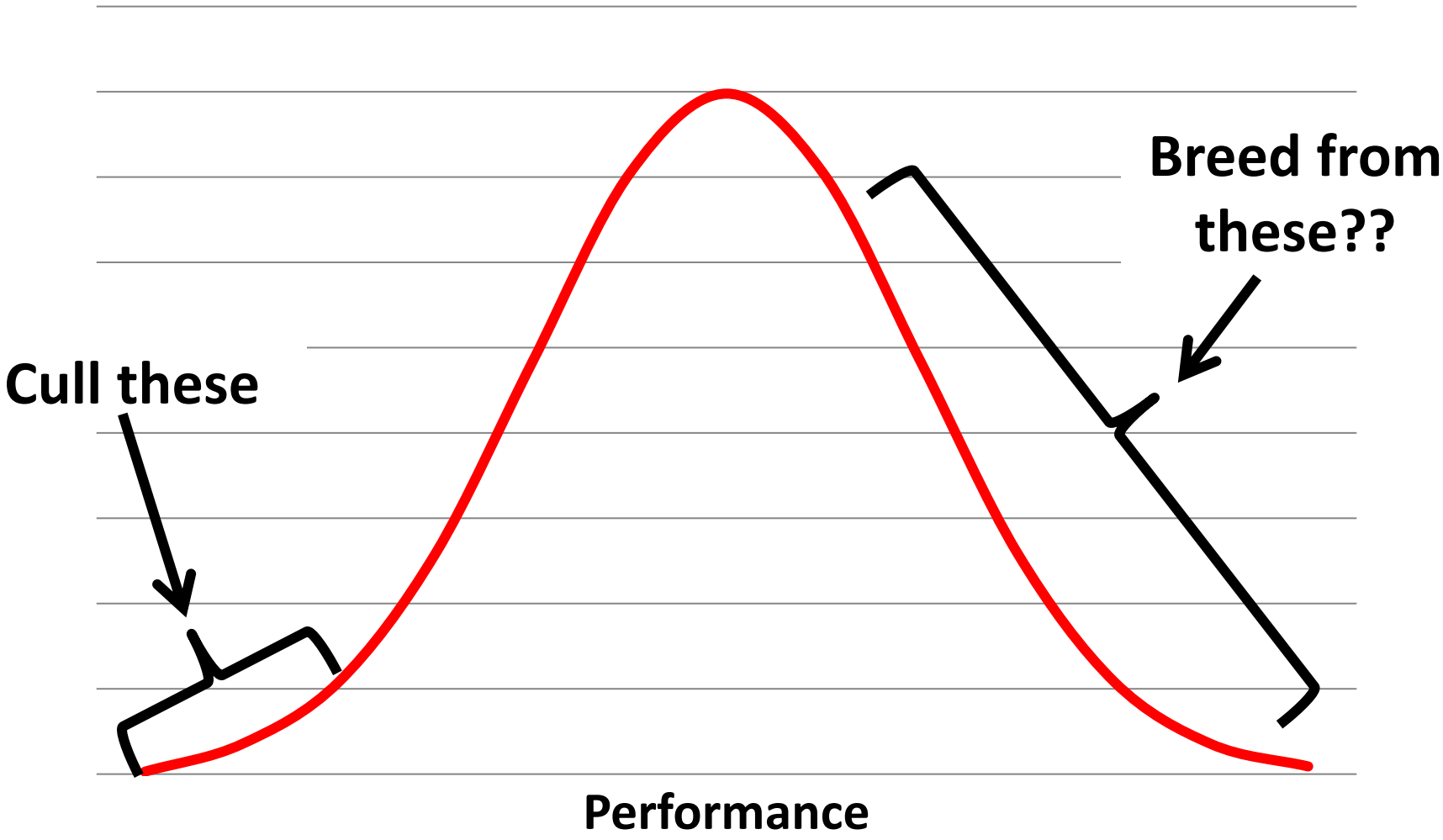
Achieving performance gains



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Performance

Phenotype = environmental effects + genetic effects + noise

Milk = parity*age + het + “herd-season” + genetics + perm. envir. + e

EBV/PTA

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Performance

Phenotype = environmental effects + genetic effects + noise

Milk = parity*age + het + “herd-season” + genetics + perm. envir. + e

Estimated Production Values (EPV)

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COW index

C.O.W

=

Current Lactation

- Production
- Management
- Health (SCC)
- Maintenance
- Fertility (calving date)

Net Replacement Cost

- Cull cow value
- Replacement cost

Future Lactations

- Production
- Management
- Health
- Maintenance
- Beef
- Fertility
- Calving
- Descendants

+ predictions on fertility, survival and SCC performance

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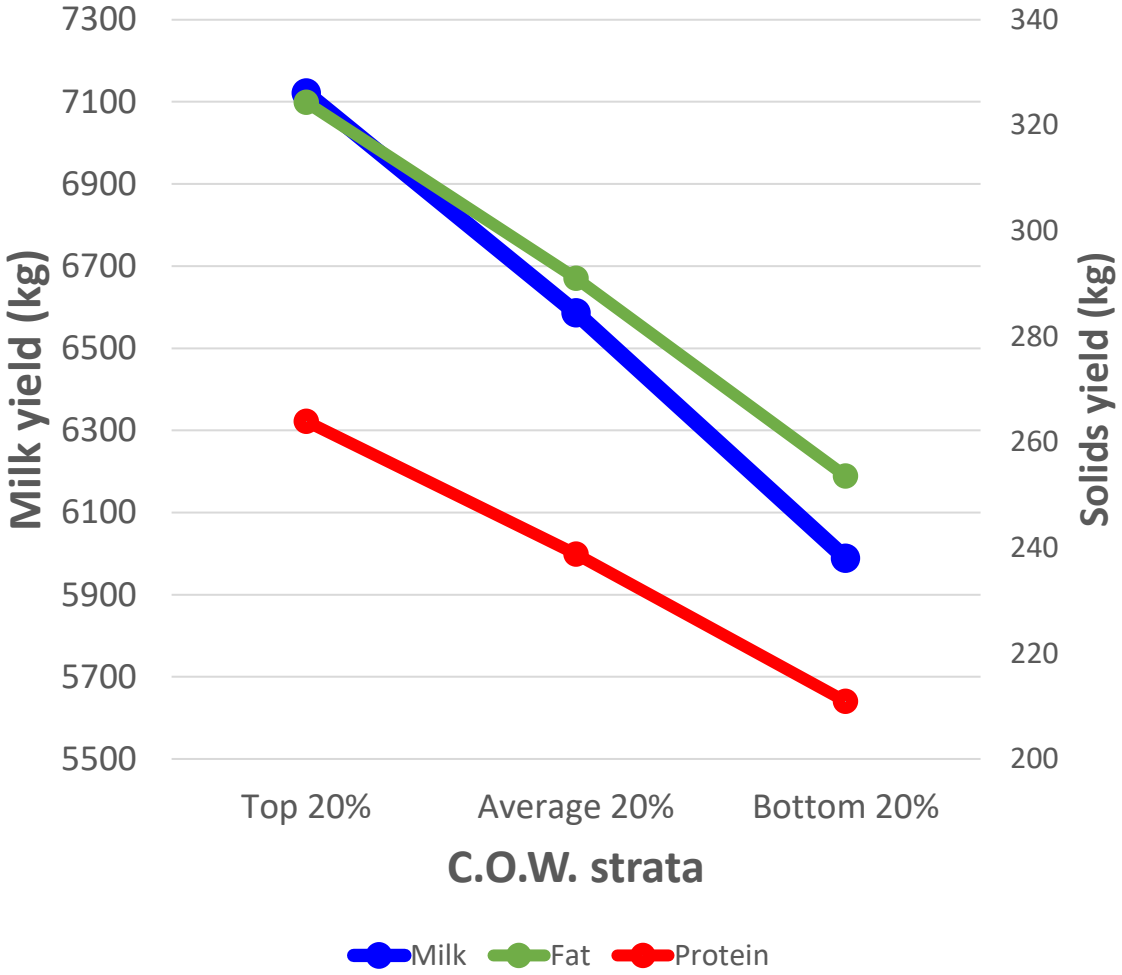
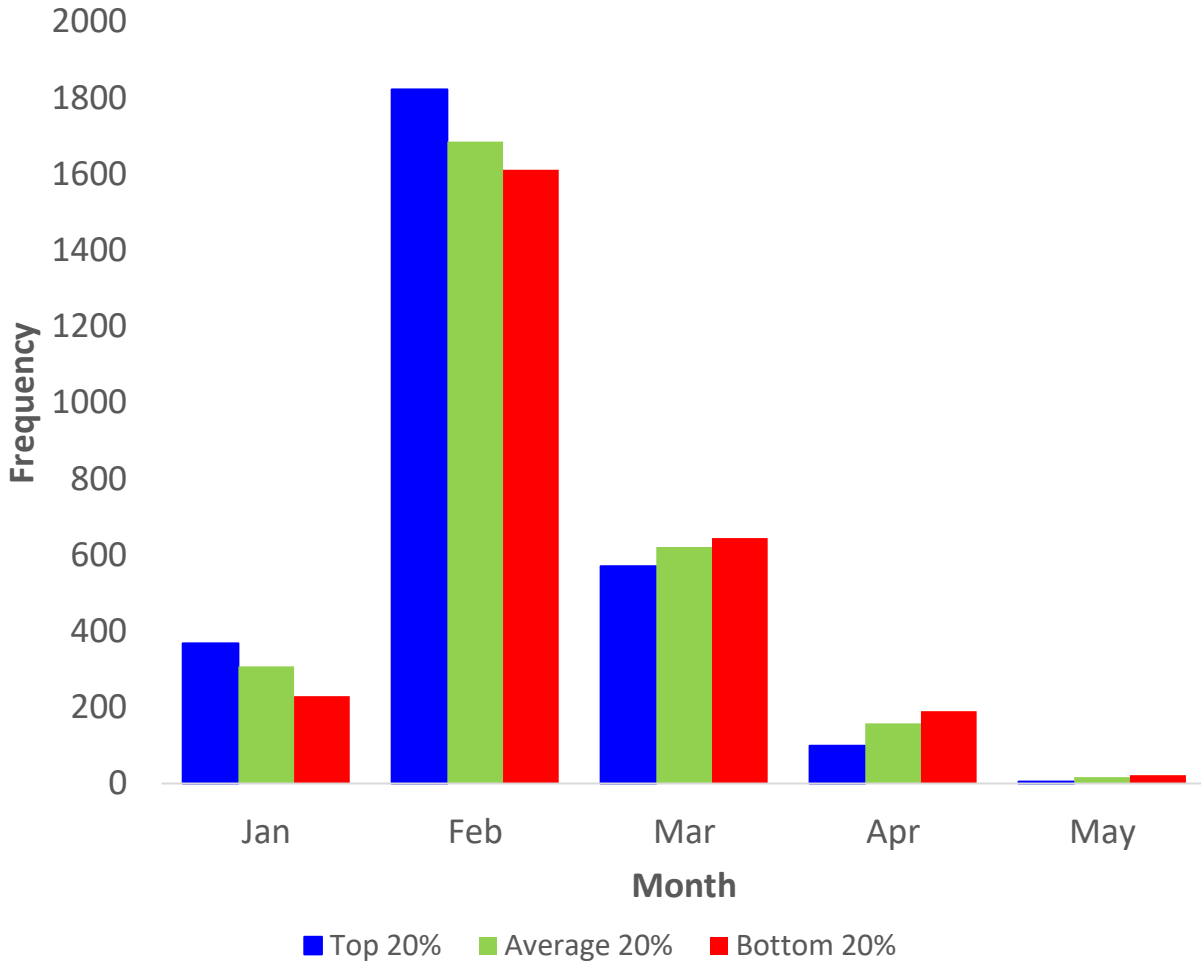
Proof in the pudding - dairy





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Deployment

C.O.W. (Cow's Own Worth) Profile Click on an Animal Number or Jumbo to view more details.

Help PDF | Help

Record Events

Missing Sire
7 Missing

Heat & AI/Serve
206 Cows Served

Pregnancy Diagnosis
211 Cows Scanned
18% Empty

Dry-Off
0 Cows

Mastitis & Lameness
0 Mastitis Case(s)
0 Lameness Case(s)

Milking Temperament
0 Scored

Mark For Culling
0 Cows Marked

PROGRESSIVE GENETICS

Eligible Animals | Missing Animals

Please ensure to record health events (particularly mastitis & lameness) to improve the accuracy of your C.O.W.

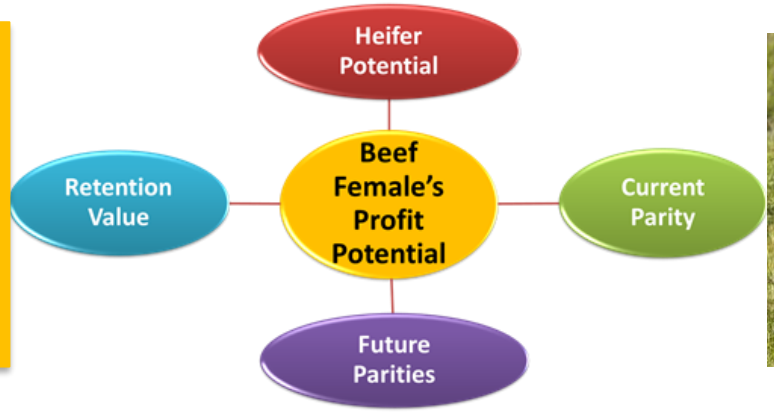
Showing 1 to 203 of 203 entries

Hide filters | Excel | PDF | Print

Rank	Animal Details			C.O.W. Components				EBI	Fertility				SCC
C.O.W. Rank	Jumbo	Animal Number	Lact	C.O.W. (€)	Current Lact Profit (€)	Future Lacts Profit (€)	Net Replace Cost (€)	EBI (€)	Last Calving Date	Preg Diag	Expected Calving Date	Marked For Culling	SCC (,000 c/ml)
1	2127	IE151721782127	2	1895	216	873	805	136	31-JAN-17	IN CALF	07-FEB-18	NO	27
2	2098	IE151721742098	2	1820	190	826	804	152	20-FEB-17	IN CALF	13-FEB-18	NO	20
3	2332	IE151721772332	1	1788	127	754	907	151	08-FEB-17	IN CALF	01-FEB-18	NO	50
4	2262	IE151721732262	1	1779	116	754	909	172	15-FEB-17	IN CALF	11-FEB-18	NO	18
5	1968	IE151721751968	3	1770	210	859	702	130	26-JAN-17	IN CALF	21-FEB-18	NO	14
6	1857	IE151721711857	3	1726	223	802	701	110	21-FEB-17	IN CALF	14-FEB-18	NO	10
7	1733	IE151721711733	4	1643	222	823	598	153	18-FEB-17	IN CALF	28-MAR-18	NO	29
8	2232	IE151721762232	1	1600	106	586	908	155	10-FEB-17	IN CALF	13-APR-18	NO	25

Beef Female's Profit Potential

Stratified animals within herd based on BFPP value



		Top 25%	50% to 75%	25% to 50%	Bottom 25%
Cows traits	Calving date	6th Apr	16th Apr	28th Apr	14th May
	Survival (0 to 1)	1.62	1.49	1.33	1.00

	Carcass	Top 25%	50% to 75%	25% to 50%	Bottom 25%
Progeny traits	Weight (kg)	398.46	398.48	396.61	394.29
	Conformation (EUROP)	7.19	7.14	7.07	6.94
	Fat (EUROP)	7.94	7.99	8.04	8.04

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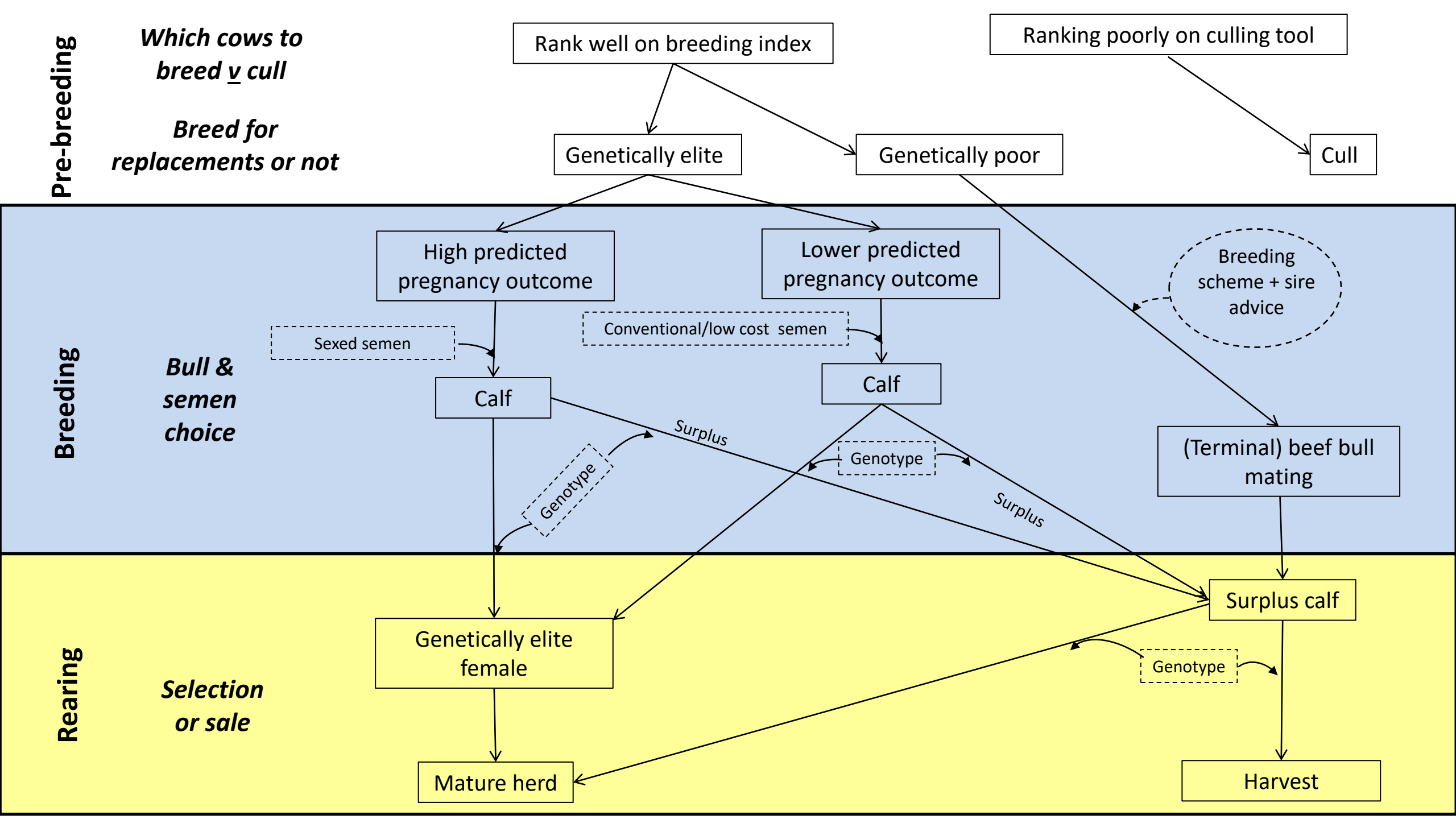
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Breeding

Bull & semen choice

Animal (2016), 10:5, pp 736–745 © The Animal Consortium 2016
doi:10.1017/S1751731115002827

animal

Genetic differences based on a beef terminal index are reflected in future phenotypic performance differences in commercial beef cattle

S. M. Connolly[1,2], A. R. Cromie[3] and D. P. Berry[1†]

J. Dairy Sci. 102:10056–10072
https://doi.org/10.3168/jds.2019-16912

A breeding index to rank beef bulls for use on dairy females to maximize profit

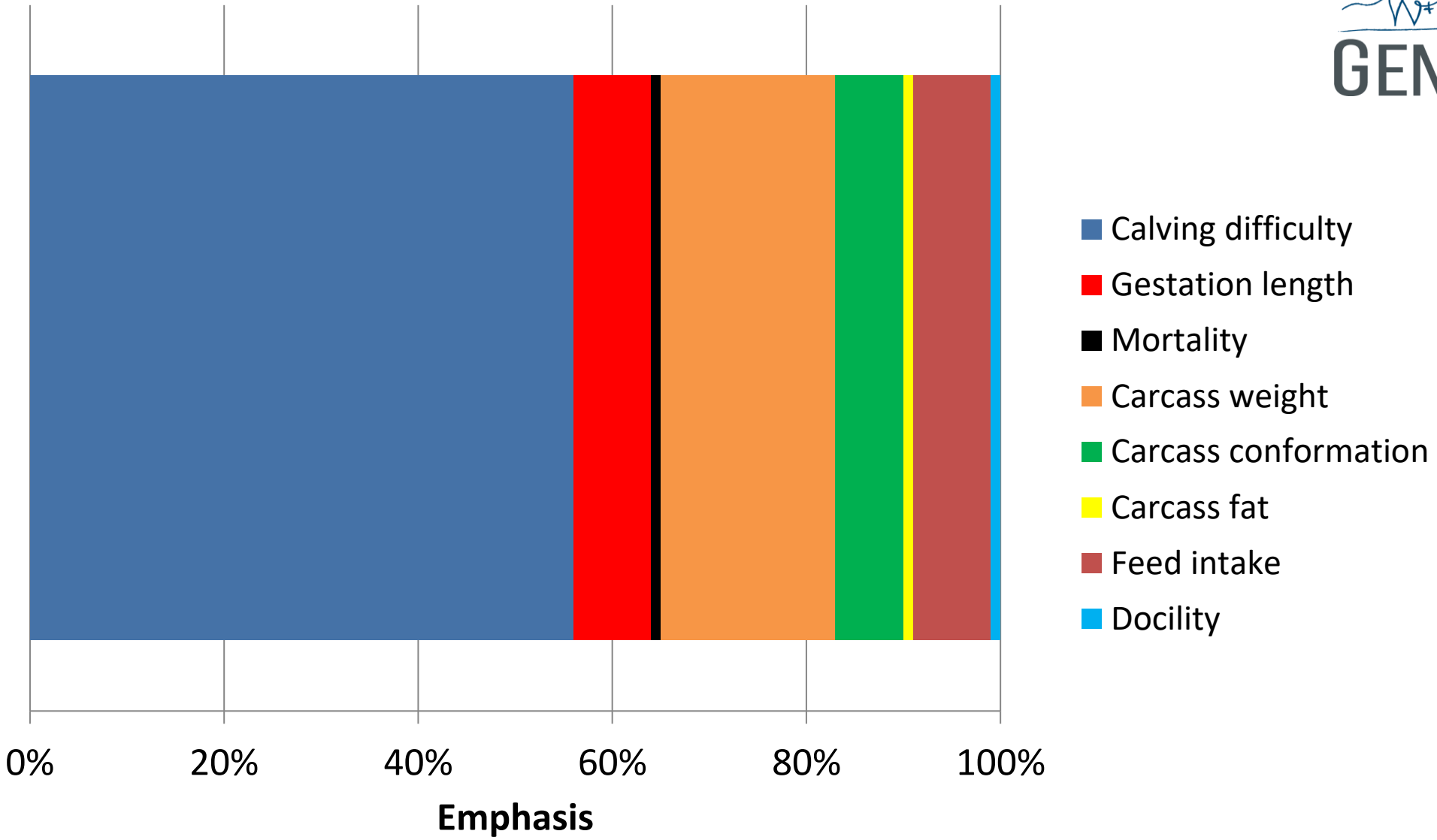
D. P. Berry,[1*] P. R. Amer,[2] R. D. Evans,[3] T. Byrne,[2] A. R. Cromie,[3] and F. Hely[2]

Breeding scheme + sire advice

(Terminal) beef bull mating

Surplus calf

Dairy-beef index – relative emphasis



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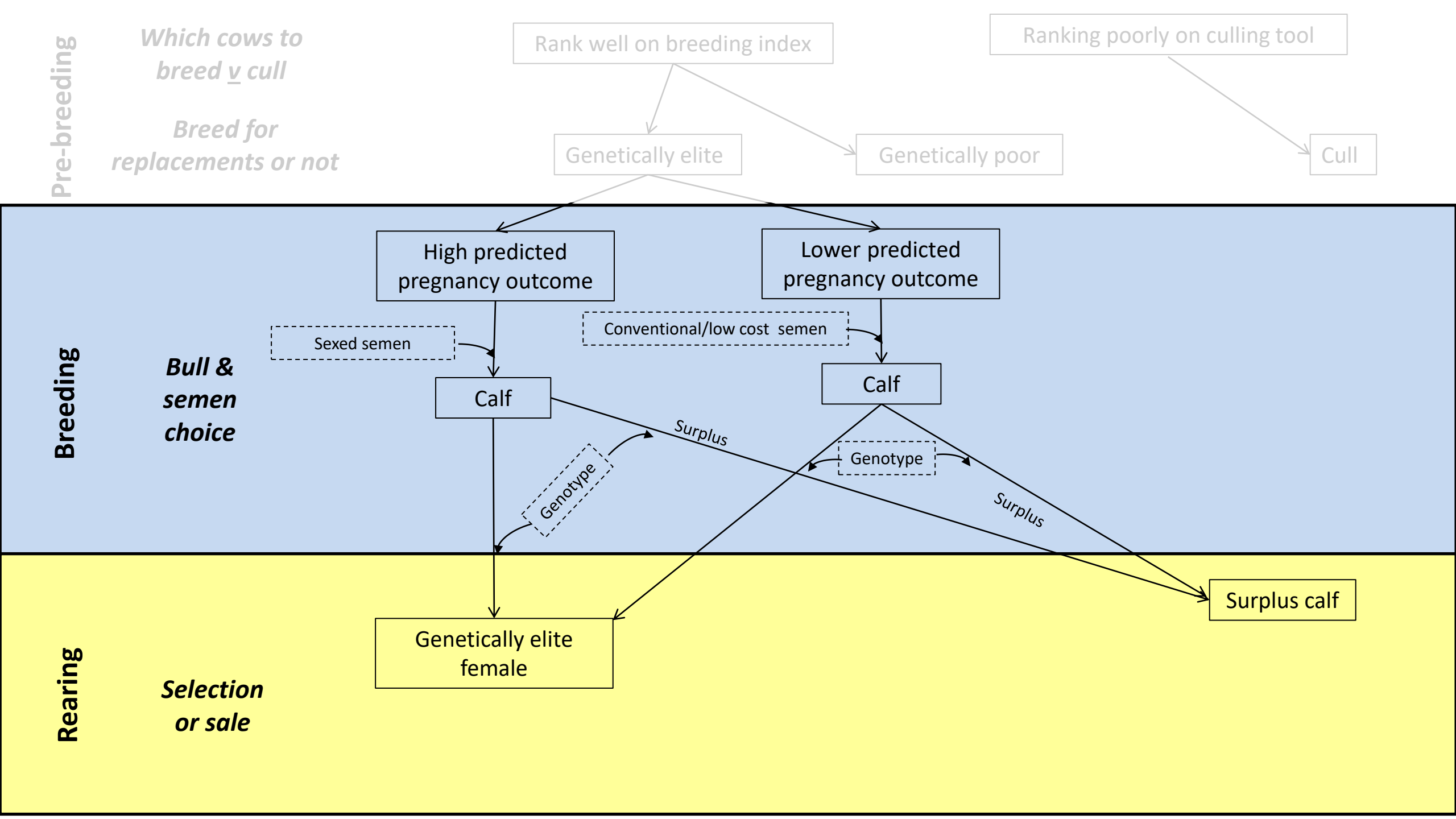
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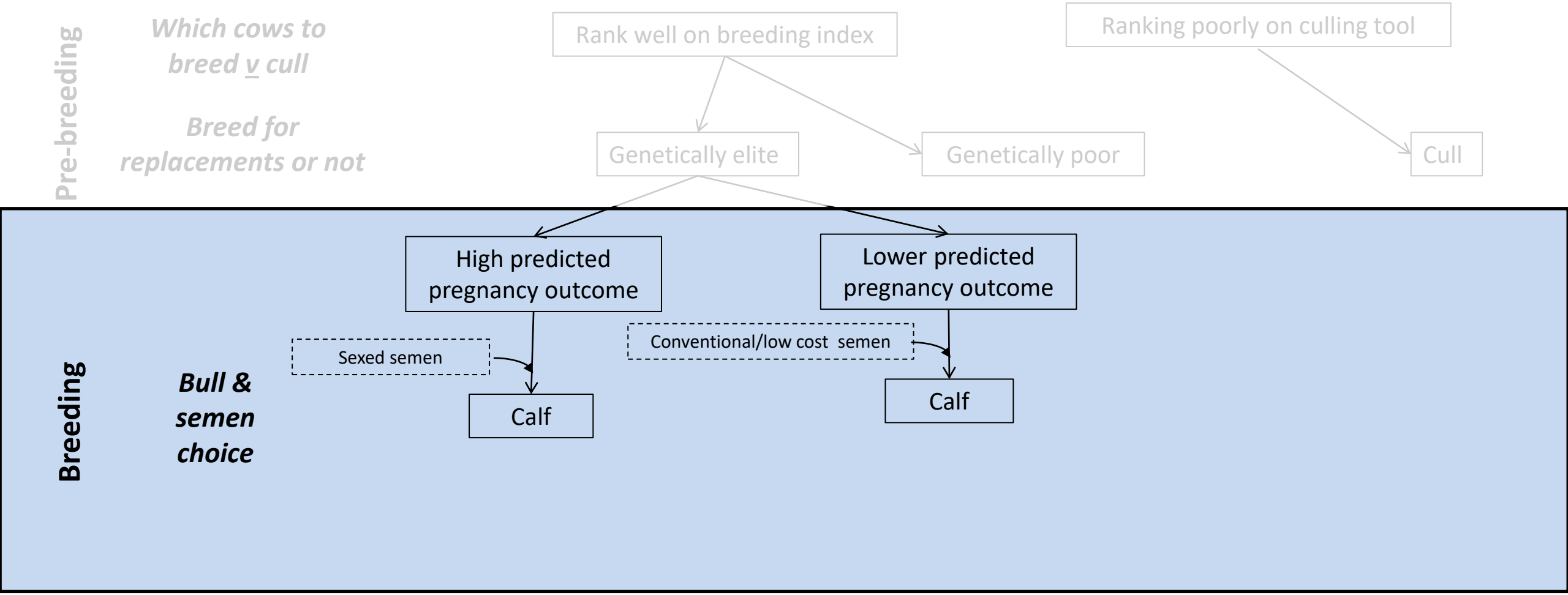


J. Dairy Sci. 101:1648–1660
https://doi.org/10.3168/jds.2016-12453

Estimating probability of insemination success using milk progesterone measurements

P. Blavy,*[1] N. C. Friggens,* K. R. Nielsen,† J. M. Christensen,† and M. Derks‡§#

J. Dairy Sci. 100:5550–5563
https://doi.org/10.3168/jds.2016-11830

The creation and evaluation of a model predicting the probability of conception in seasonal-calving, pasture-based dairy cows

Caroline Fenlon,*[1,2] Luke O'Grady,†[1] Michael L. Doherty,† John Dunnion,* Laurence Shalloo,‡ and Stephen T. Butler‡

J. Dairy Sci. 98:5262–5273
http://dx.doi.org/10.3168/jds.2014-8984

Machine learning algorithms for the prediction of conception success to a given insemination in lactating dairy cows

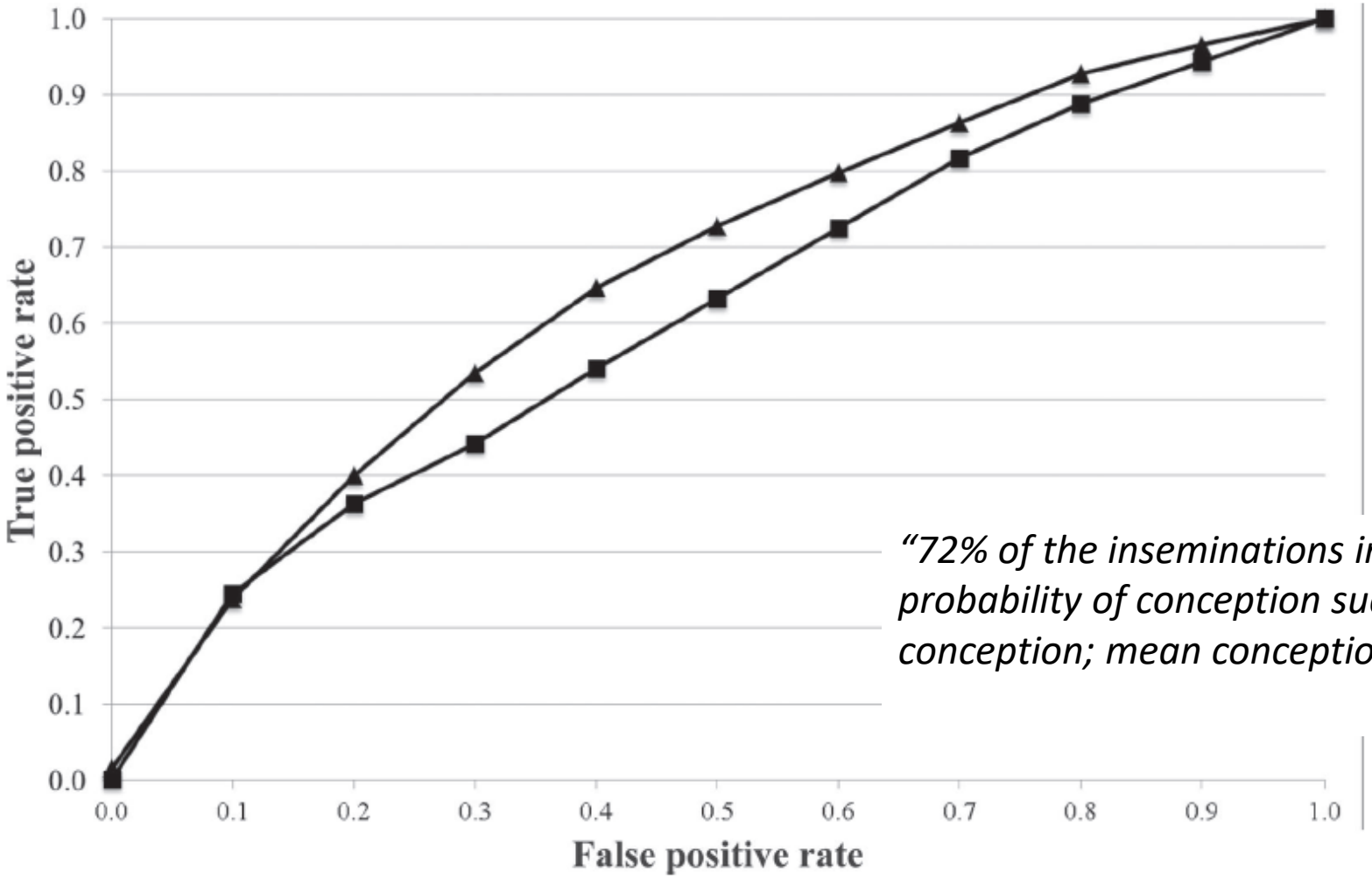
K. Hempstalk,*[1] S. McParland,† and D. P. Berry†

J. Dairy Sci. 102:10460–10470
https://doi.org/10.3168/jds.2019-16412

Classifying the fertility of dairy cows using milk mid-infrared spectroscopy

P. N. Ho,[1]* V. Bonfatti,[2] T. D. W. Luke,[1,3] and J. E. Pryce[1,3]

Can we predict pregnancy??



(Future) noise

- Technician (x time)
- Ejaculate
- Bull x cow interactions
- (Herd) temporal
- (True) cow ovulation status

"72% of the inseminations in the top 5% of predicted probability of conception success resulted in a successful conception; mean conception rate…was 54.6%."

Hempstalk et al (2015)

This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 727213

Sire advice

J. Dairy Sci. 102:8210–8220
https://doi.org/10.3168/jds.2019-16283

A mating advice system in dairy cattle incorporating genomic information

T. R. Carthy,[1]* J. McCarthy,[2] and D. P. Berry[1]

J. Dairy Sci. 102:5279–5294
https://doi.org/10.3168/jds.2018-15971

Variance of gametic diversity and its application in selection programs

D. J. A. Santos,[1,2]* J. B. Cole,[3] T. J. Lawlor Jr.,[4] P. M. VanRaden,[3] H. Tonhati,[2] and L. Ma[1]*

15:45 Prediction of gametic variance and its use in breeding programs
C. Hoze, A. Baur, S. Fritz and D. Boichard

Session 41. Thursday 15:45

Considerations

- Genetic complementarity
  - Major genes
- Coancestry (not for dairy-beef)
- Cognisance of female phenotypic features
- Homogeneity/risk

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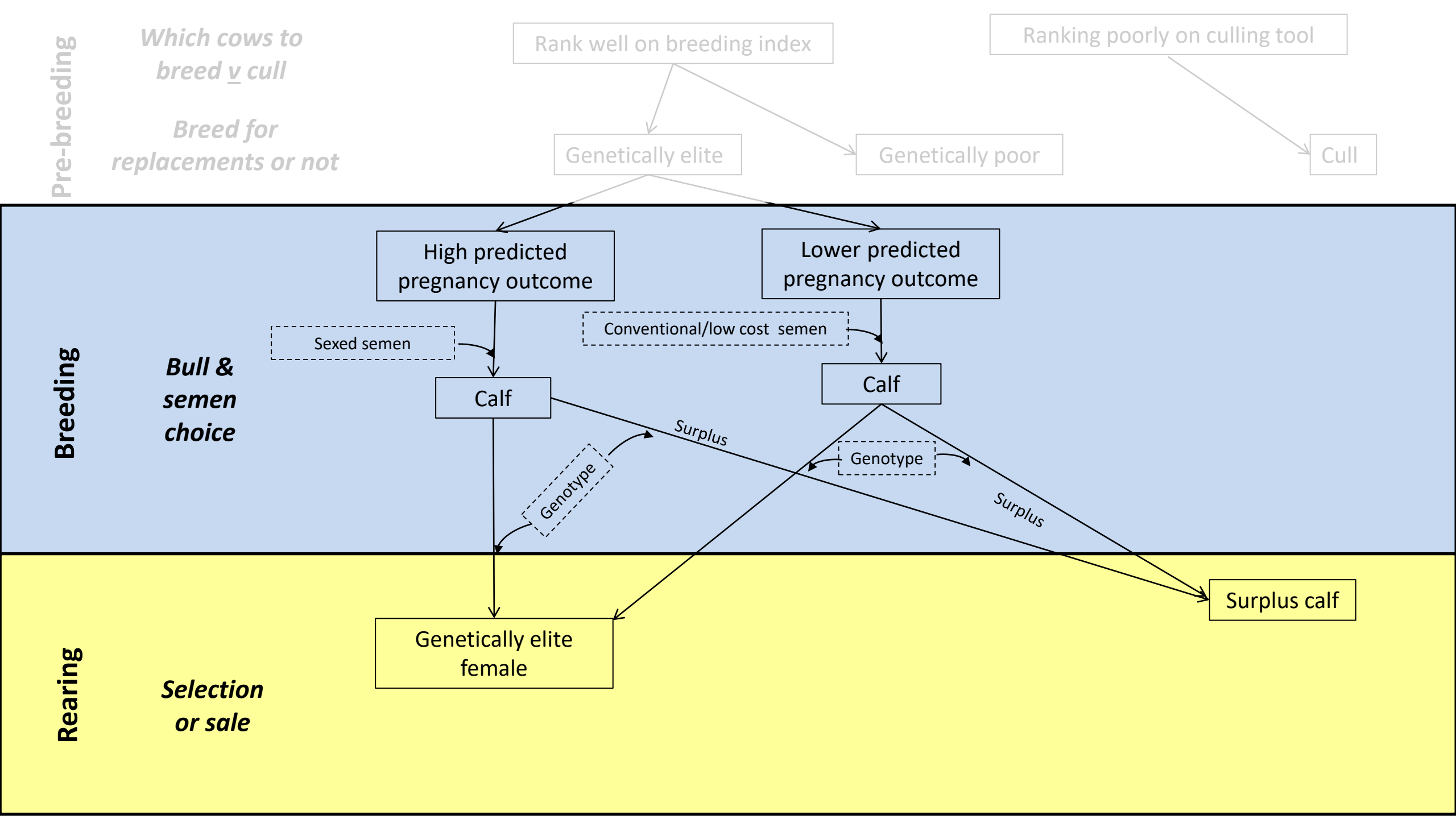
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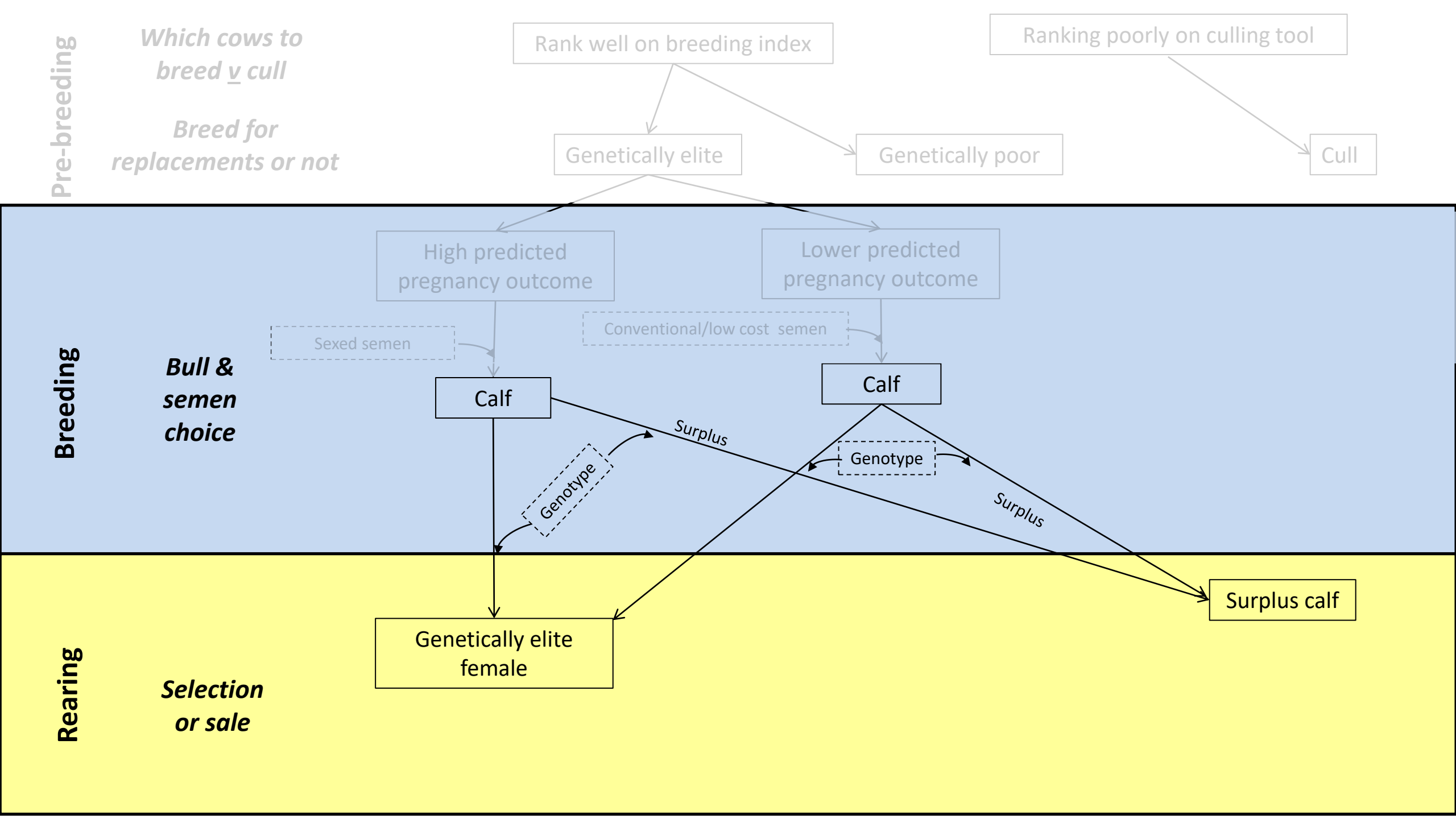
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Selection or sale
Genetically elite female

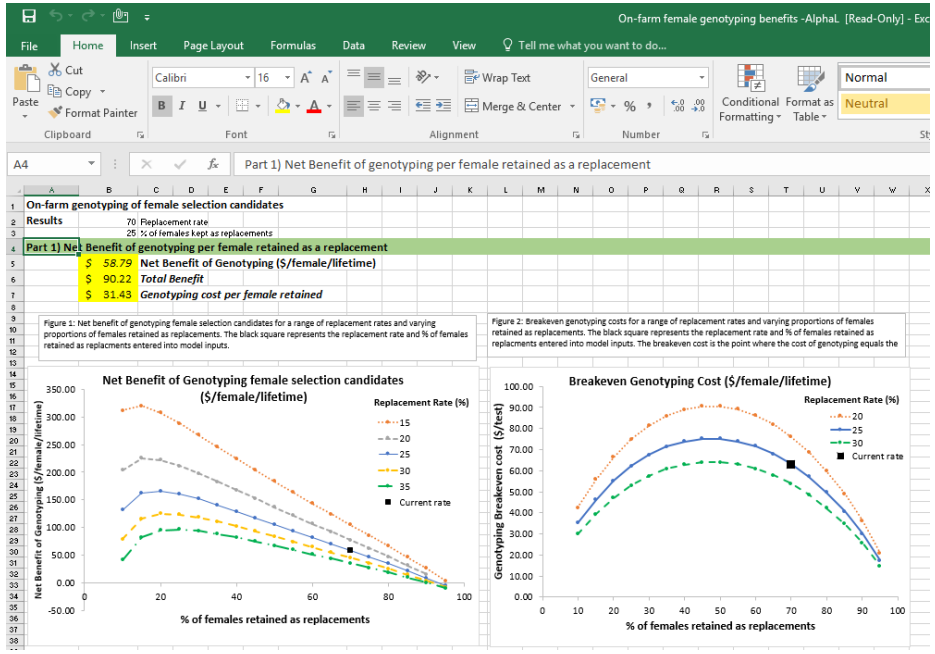
Return on investment for genotyping

Animal, page 1 of 11 © The Animal Consortium 2020
doi:10.1017/S1751731120000208

animal

On-farm net benefit of genotyping candidate female replacement cattle and sheep

J. E. Newton and D. P. Berry†



Model inputs
Proportion of female progeny kept as replacements
Replacement rate
Reliability of genomic test
Sire parentage error rate
Reliability of traditional estimated breeding values
Heritability of index
Genomic test cost - per female
Actual standard deviation of index

Model outputs
Net Benefit of Genotyping ($/female/lifetime)
Breakeven cost of genotyping

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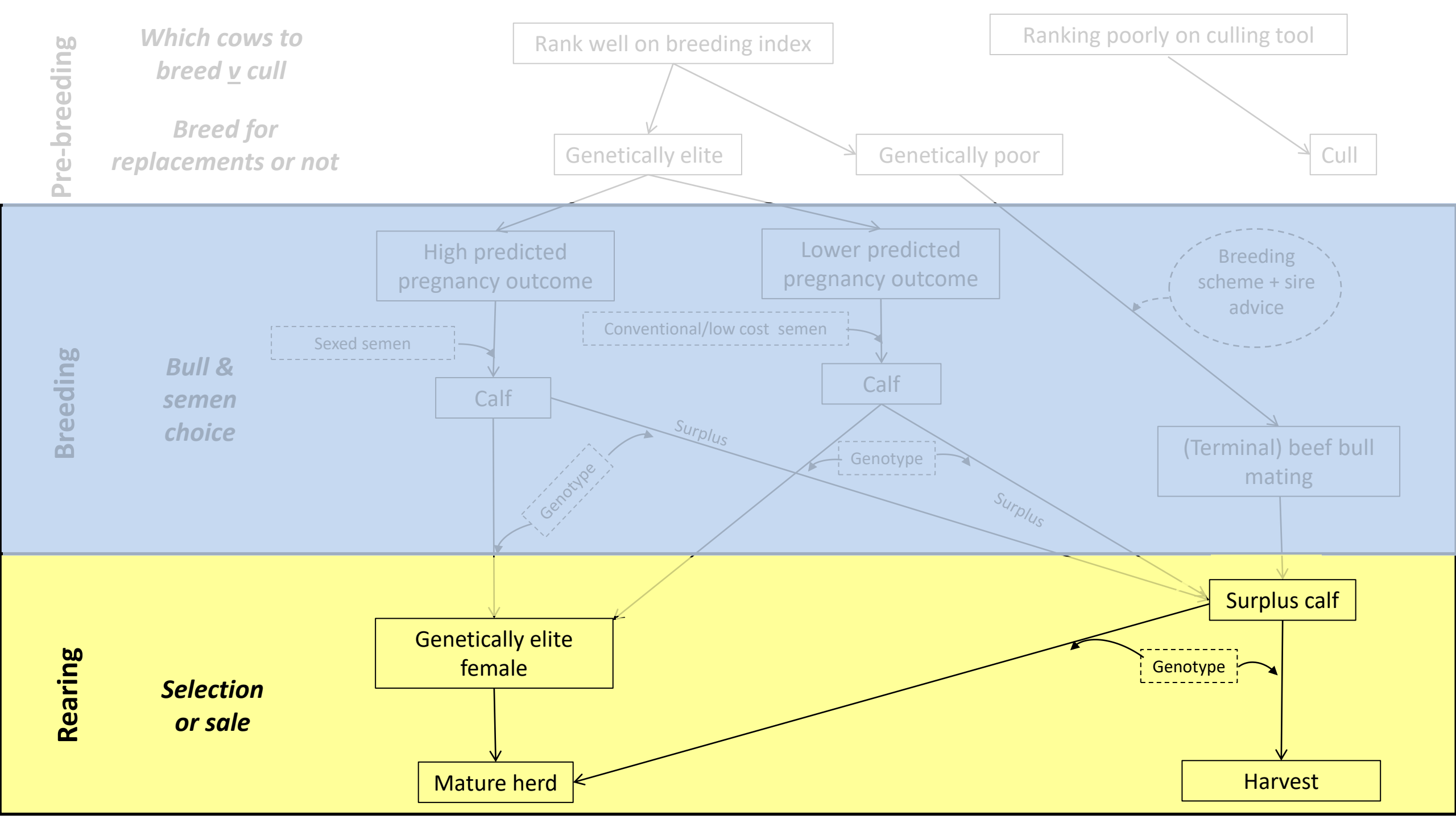
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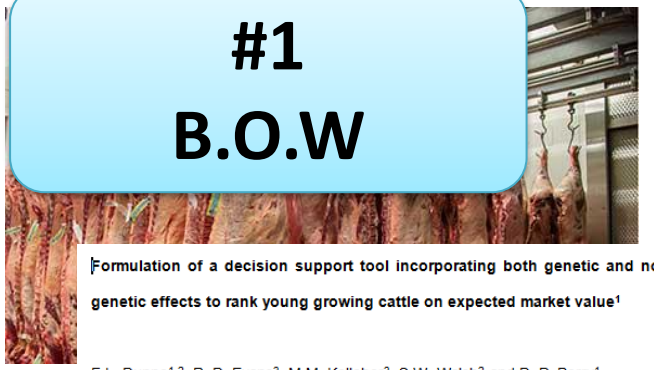
F1 dairy crossbreds

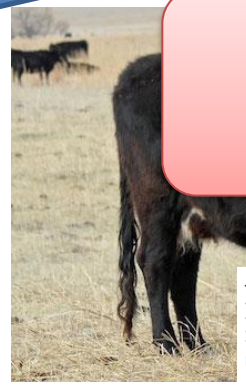
#1
B.O.W



Formulation of a decision support tool incorporating both genetic and non-genetic effects to rank young growing cattle on expected market value[1]

F.L. Dunne[1,2], R. D. Evans[3], M.M. Kelleher[3], S.W. Walsh[2] and D. P. Berry[1]

#2
BFPP



An index framework founded on the future profit potential of female beef cattle to aid the identification of candidates for culling

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Journal of Animal Science, skaa334, https://doi.org/10.1093/jas/skaa334

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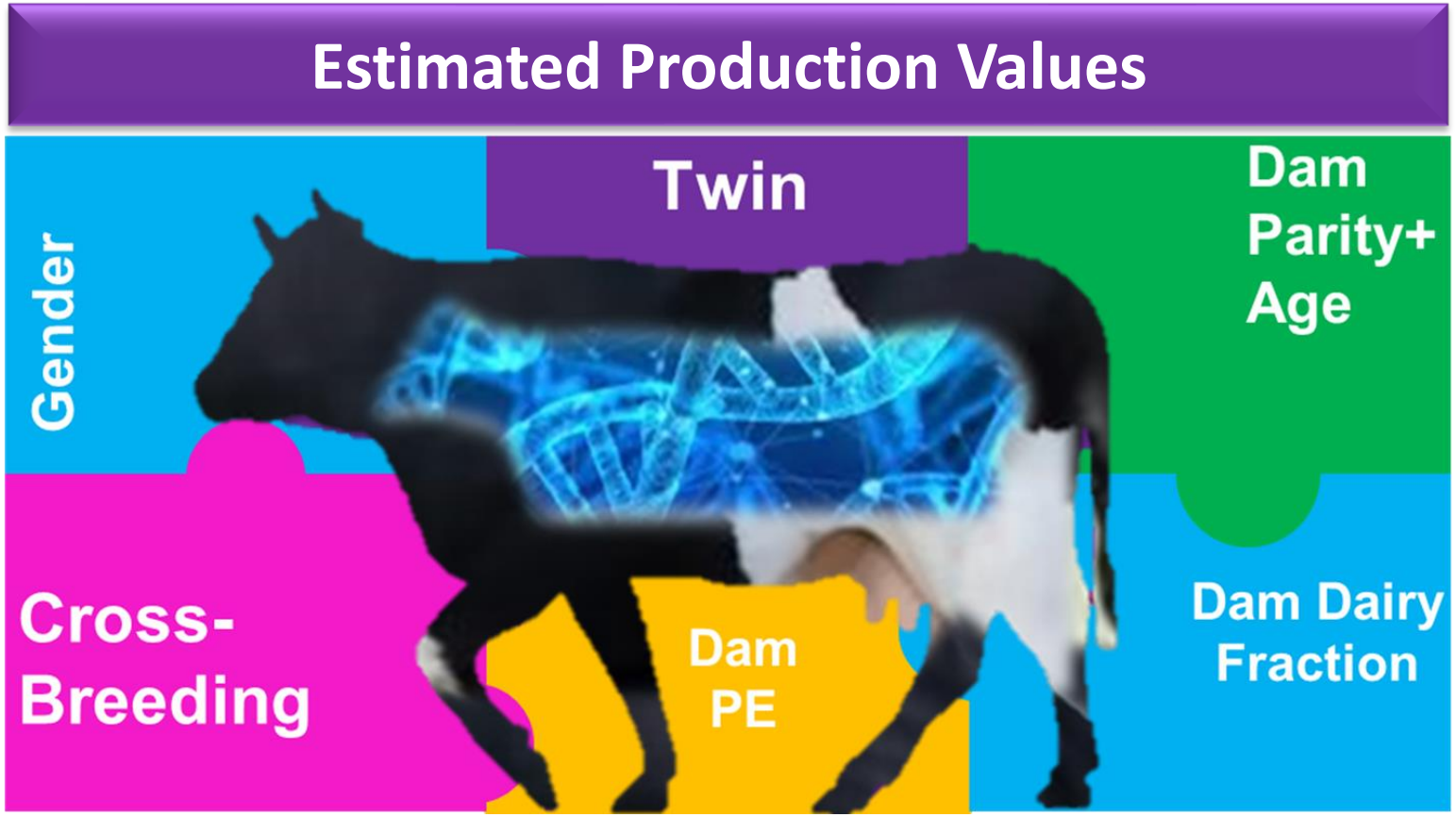
Beef's Own Worth (BOW)



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Beef's Own Worth (BOW)

Traits included:

1

2

EUROP Classification

Fat	E+	E=	E-	U+	U=	U-	R+	R=	R-	O+	O=	O-	P+	P-
1-	442	436	4											352
1=	442	436	4											352
1+	442	436	4											352
2-	442	436	430	424	418	412	406	400	400	382	376	370	364	352
2=	436	430	424	418	412	406	400	400	382	376	370	364	358	352
2+	436	430	424	418	412	406	400	400	382	376	370	364	358	352
3-	436	430	424	418	412	406	400	400	382	376	370	364	358	352
3=	436	430	424	418	412	406	400	400	382	376	370	364	358	352
3+	436	430	424	418	412	406	400	400	388	382	376	370	364	358
4-	436	430	424	418	412	406	400	400	388	382	376	370	364	358
4=		430	424	418	412	406	400	400	388	376	370	364	358	352
4+		424	418	412	406	400	394	394	382	376	370	364	358	352
5-		406	400	394	388	382	376	376	364	358	352	346	340	334
5+	412	406	400	394	388	382	376	376	364	358	352	346	340	334

Conformation

Fat

EUROP

3

4

5

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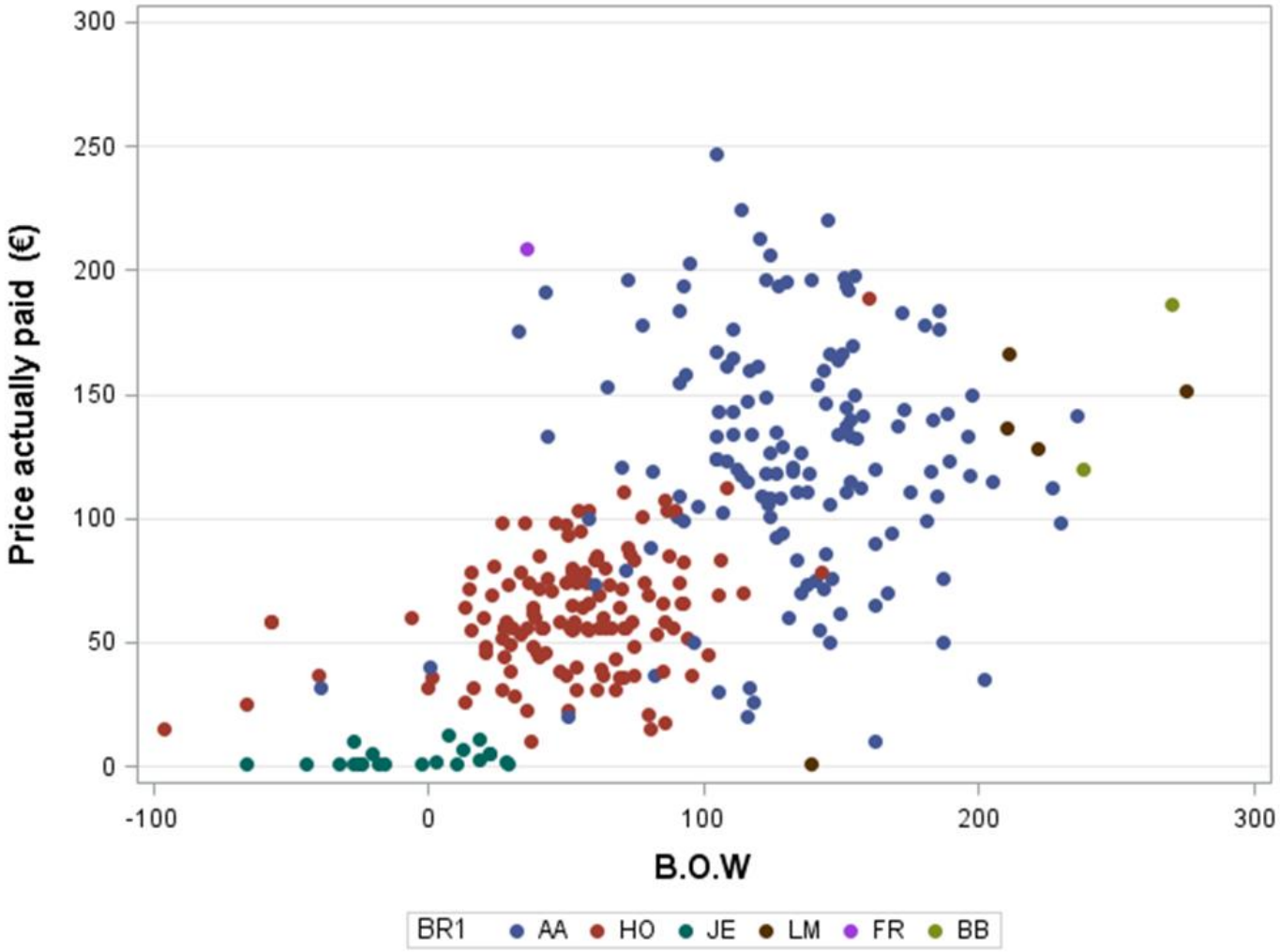
BOW in practice



Data

Irish auction sales 2019

Calves 10 to 42 days old

Number of animals = 439

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Decision support tools

- Modular framework
  - Selection index theory (familiarity)
- Exploits currently available data sources
  - Augmented with additional data
  - Free-notypes
- “Cross compliance” across tools
- Use of herd BLUEs to make more bespoke

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