



IRISH CATTLE BREEDING FEDERATION

ICBF Dairy & Beef Genetic Evaluations Meetings.

Wednesday 21st July 2010.
Maldron Hotel, Portlaoise.



Agenda 1. Dairy Traits & Dairy Breeding Programs.

- **Agenda 1 (10 AM – 11.30).**
- 9.30 Tea & Coffee.
- 10.00 Index developments, including EBI, new labour sub-index, culling index and other traits - Andrew
- 10.20 Test-day evaluations; milk production traits – John McCarthy.
- 10.40 Dairy genomics research – Donagh.
- 11.00 Genomics operational – Francis.

Agenda 2. Dairy & Beef Traits

- **Agenda 2 (11.45 – 3.00)**
- 11.45. Female fertility traits – Ross.
- 12.30. Male fertility traits – Ross.
- 1.00. Lunch.
- 1.30. Calving traits – Francis.
- 2.15 Carcass cut data & other beef traits – Thierry.
- 2.30 AI application process – Pat.
- 2:45 Catalogues – Brian W

Agenda 3. Beef Traits & Beef Breeding Programs.

- **Agenda 3 (3.00 – 5.30).**
- 3.00 Lessons from Grange research & BETTER farms programs – Pearce Kelly
- 3.20 Linking Tully & beef industry data - John Crowley.
- 3.40 Beef linear traits – Contemporary groups – Ross.
- 4.10 Maternal weaning weight – Ross.
- 4.30 Developments in Euro-Star evaluations – Tim Byrne.
- 4.50 Beef genomics research – Donagh.
- 5:00 Beef Specialist – Brian W
- 5.15 Close of meeting.

Work-plan & recommendations.

- Interbull official evaluations.
 - 23rd August 2010.
 - 13th December 2010.
- Interbull test evaluations.
 - 7th September 2010.
- Trait improvements, e.g., fertility, calving, go through test run (7th September). If pass, then part of official evaluation (13th December).



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Index developments, including
EBI, new labour sub-index, culling
index and other traits

Andrew Cromie

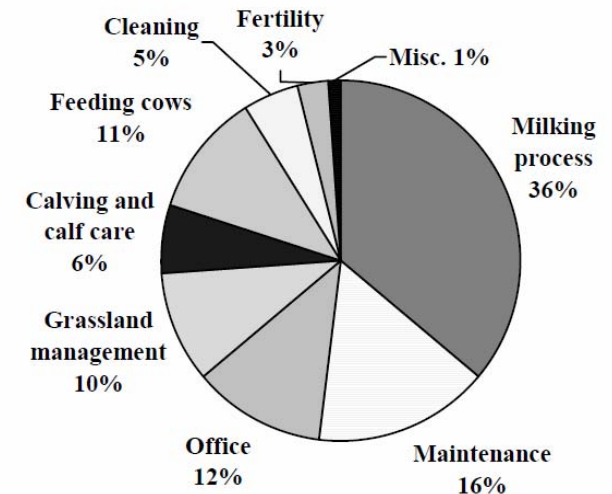
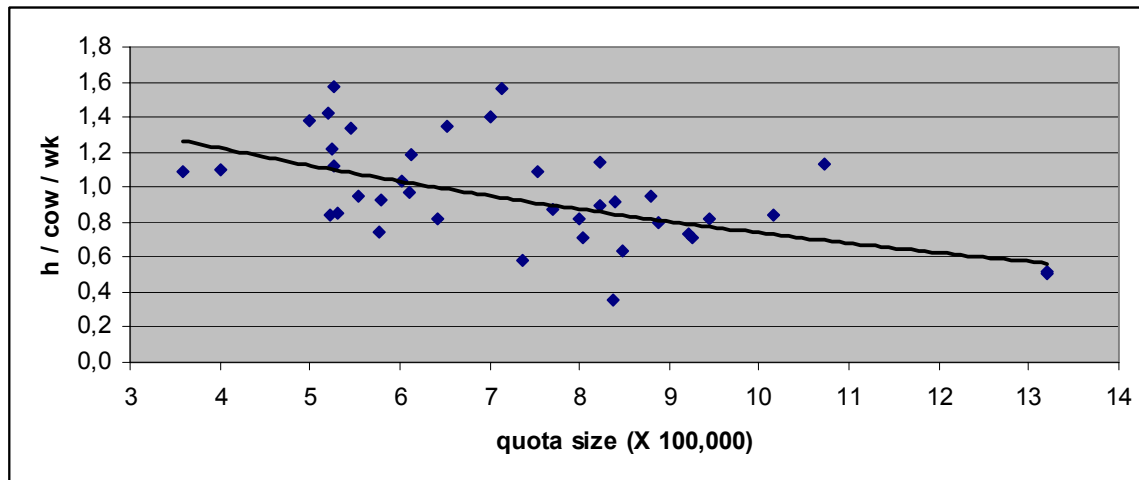
EBI Developments 2009/2010 – Review.

- Beef Sub-Index.
 - Updating income/costs for rearing replacements and surplus stock.
 - Separation of live-weight into; (i) surplus beef value, and (ii) cow maintenance.
 - Lighter animals/breeds benefited (+/- €20 in EBI terms).
- Economic Values.
 - Update all incomes & costs.

EBI Developments 2010/2011 – Work-plan.

- Economic Values.
 - Update all incomes & costs.
 - Increased focus on economics of health traits.
- New labour sub-index.
 - Currently EBI covers direct cost of health and fertility problems, e.g., cost of feed, cost of treatment, cost of withholding milk etc.
 - What about cost of labour? Time taken for; (i) milking duration, (ii) multiple serves, (iii) treatments, (iv) calving difficulty, (v) temperament etc.

New labour sub-index (i)



- Work from Netherlands (Zijlstra et. al., 2006) & Ireland (O'Brien, 2006) from dairy farms.
 - Larger dairy herds = less time for individual cows.
 - Large difference in time for individual cows (average 60 minutes per cow with SD of 30 minutes).
- With increasing scale and less labour, increasing demand for “easy-care” profitable cows.

New labour sub-index (ii)

- Project initiated with Animal Sciences Group, Wageningen (Roel Veerkamp).
- Two key questions regarding work-plan?
 - Which “labour” traits are most important?
 - Milking speed, temperament, number serves, calf health, mastitis incidence, lameness incidence...
 - How important are these labour traits relative to other profit traits in the EBI?
- Undertake survey of farmers (August/Sept)
 - Web-based survey & a meeting with “targeted farmers.
- Establish genetic differences between bulls in “labour required” for daughters.
- Present update at next industry meeting.

New traits – Mastitis & lameness (i).

- Health sub-index.
 - We use SCC with an assumed correlation of 0.70 to indicate mastitis.
 - We use locomotion with an assumed correlation of -0.40 to indicate lameness.
- Now starting to receive “incidence” data from commercial farmers.
 - ~100k incidence records from; (i) GENRE IRELAND herds and (ii) Discussion group herds
 - dairy efficiency program.

New traits – Mastitis & lameness (ii).

- Work from Donagh (Nov 09) indicated;
 - Incidence of 10% for mastitis, 5% heritability and rg of ~0.5 with SCC
 - Incidence of 10% for lameness, 4% heritability and rg of -0.35 with locomotion score.
 - Results compare well with international estimates.
- Develop new health evaluation system.
 - Mastitis + lameness + predictor traits.
- Update at next industry meeting.

New Culling Index

- New PhD project involving ICBF, Teagasc and Abacus Bio. Walsh fellowship secured.
- Looking at 2 stage implementation.
 - Stage 1. New fertility evaluations + output from test day evaluations + economic value work from Abacus Bio.
 - Stage 2. Refinements based on work of PhD student.
- Update at next industry meeting.



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Test Day Models for Milk Production Traits

John McCarthy.

Background

- Uses 305 day values
- Operated on contract by CRV Holland for ICBF
- Genomic data is incorporated separately to main evaluation in post-blending process
- Uses variation of tools

Background(ctd)

- 305 day model uses 1 305 day figure for milk/fat/prot/scc which summarises whole lactation
- The 305d figures are calculated using “lactation curves” software
- Change from 305 day model to test day model where all individual recordings are included in evaluation
- Use this opportunity to examine “Irish-specific” issues to include in new test-day model

Why

- More accurate estimation of environmental effects from including the influence of particular days of recording
- Optimal use of information from all test days
- Better use of records in progress
- Remove necessity of predicting 305d
- Method of choice for many dairy evaluations internationally (NZ, HOL, CAN, ...)

What

- Change from 305 day model to test day model
- Examine whether variance component structure needs to incorporate Season Calving
- Estimate Initial Genetic Parameters
- Examine Breed Effects
- Examine effect of recording method (eDIY, Technician)

What(ctd)

- Examine Heterogeneity of Variance – i.e. some herds have more variance than others
- Incorporate into overall model
- International experience has shown that there will be re-ranking, particularly on cows and young bulls

Raw Milk Production Data

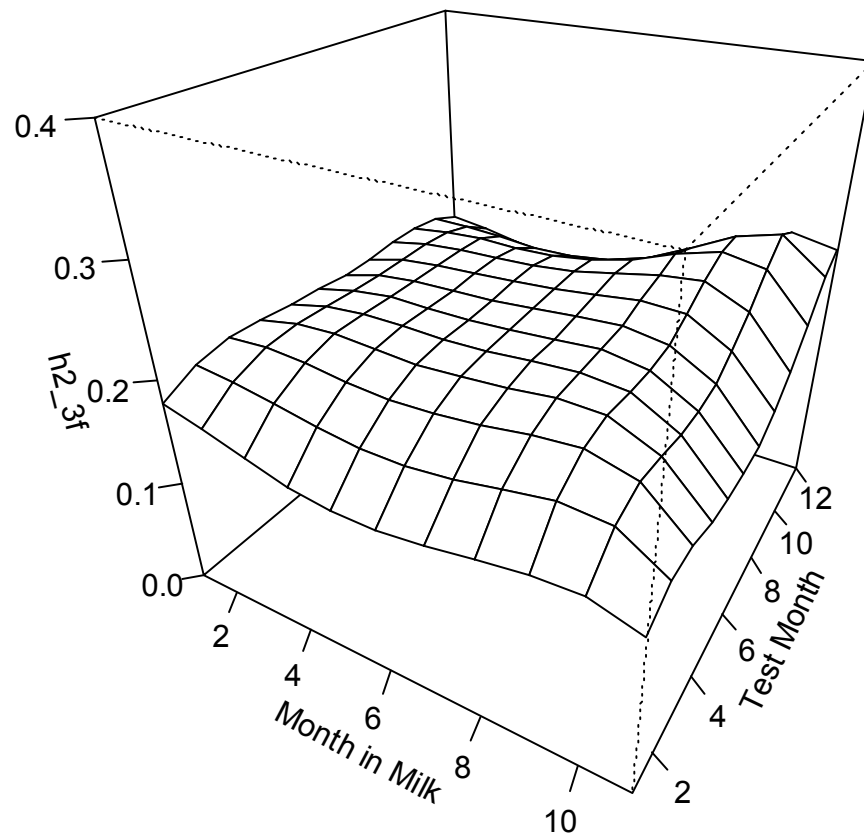
6,064,769	Num lactations in Production file
2,297,342	Num animals in Production file
35,572,153	Total number of animal tests
25,030	Number of Herds

Current Status

- Analysis of data to determine if variance component structure needs to incorporate Seasonal Calving
 - Nearing Completion – it appears there is a need for this step
- Estimate Initial Parameters
 - Follows from above

Current Status(ctd)

Heritability of milk yield



Current Status(ctd)

- Breed Analysis
 - Initial investigation of existing work by John Hickey
- Examine effect of milk recording method
 - To do

Breed Composition of Dairy Replacements born in 2009

Sire Breed

Dam Breed		FR	JE	MO	MY	NR	RB	SR	Total
	FR	250,717	5,807	1,930	241	2,052	1,169	210	262,126
	JE	2,497	1,131	15		117	22	2	3,784
	MO	3,802	162	2,570	23	132	95	15	6,799
	MY	490	11	38	388	7	54		988
	NR	443	144	3		155	6	10	761
	RB	1,682	81	74	33	78	772	14	2,734
	SR	319	80	3		20	5	41	468
Total		259,950	7,416	4,633	685	2,561	2,123	292	277,660

~10% non Black and White

Breed Composition of cows milk recorded in 2009

		Sire Breed								
Dam Breed		FR	JE	MO	MY	NR	OTH	RB	SR	Total
	FR	420,170	3,924	5,536	592	823	4,683	2,304	674	438,706
	JE	1,483	1,518	21	1	16	43	8	20	3,110
	MO	2,678	99	3,024	17	30	154	105	34	6,141
	MY	441	4	30	465		48	34	5	1,027
	NR	214	11	5		529	2	12	24	797
	OTH	2,116	100	176	20	18	1,376	55	15	3,876
	RB	1,110	65	36	6	3	36	1,121	22	2,399
	SR	151	49	9		12	10	4	89	324
	Total	428,363	5,770	8,837	1,101	1,431	6,352	3,643	883	456,380

~10% non Black and White

Next Steps

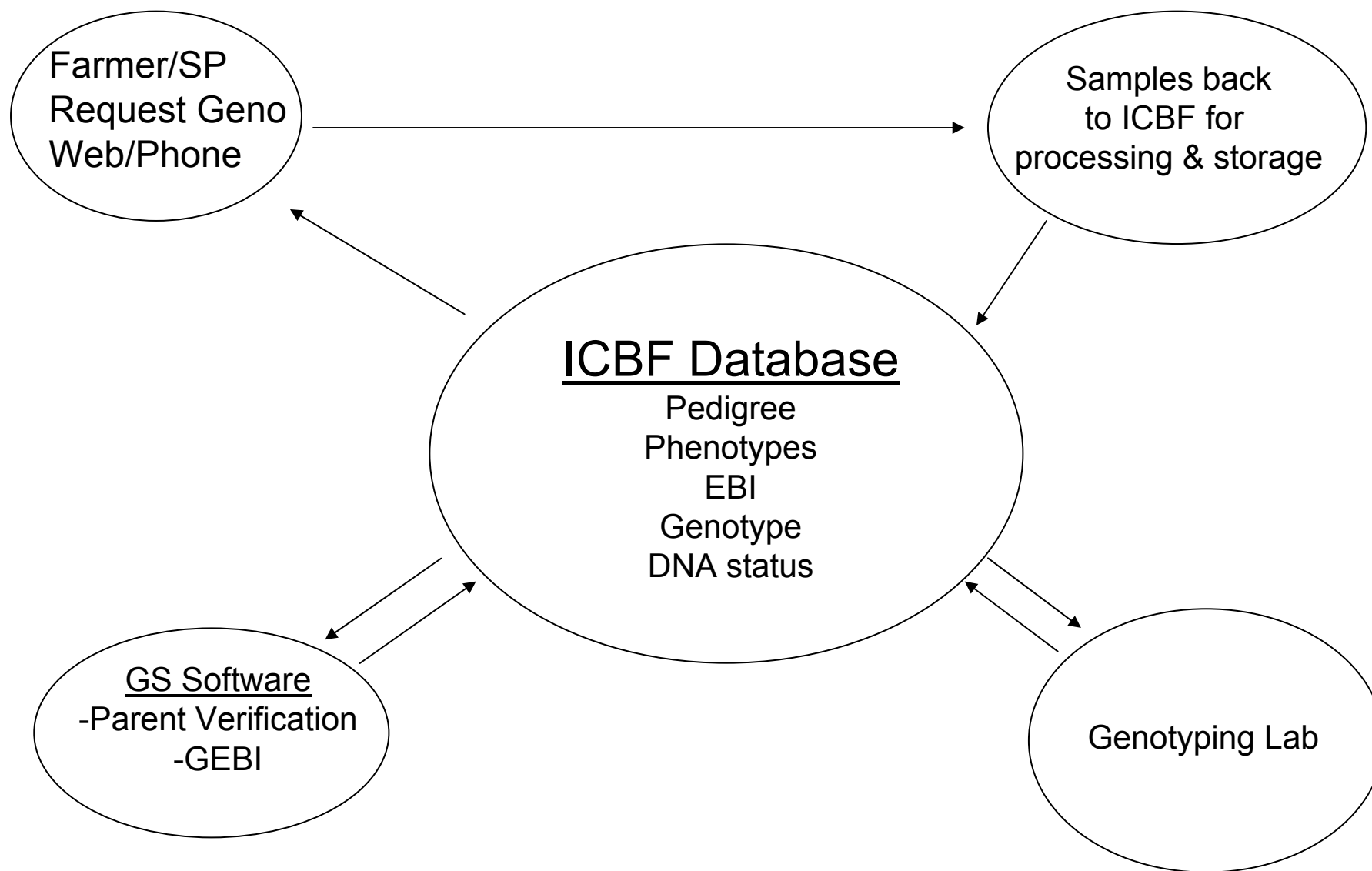
- Complete investigation of variance component structure Seasonal Calving
- Begin to examine in detail breed effects and what constitutes different genetic groups



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Genomic Service

Francis Kearney



Order Process

[HOME](#)

Genomic EBI Request

For Information on the ICBF Genomic Service [click here](#).

Listed below are animals in your herd eligible for genotyping. Select the animals you wish to test and click Next.

 Print

Total: 05 animals
Selected: 0 animals

Click Column Heading to sort by that attribute

Number of Rows Displayed: 11

[Reset](#)

FB Jumbo	Animal Number	EBI (€)	Birth Date	Sex	Breed	Sire	Dam	Request Genotype
24	IE151013741024	123	25-JAN-10	M	HO (69%), FR (25%)	GMI	IE123456731223	☒
25	IE151013751025	25	25-JAN-10	F	HO (100%)	IE123456751234	IE123456711212	☐
26	IE151013711026	123	29-JAN-10	F	HO (69%), FR (25%)	GMI	IE123456721756	Genotyped
27	IE151013721027	25	02-FEB-10	F	HO (69%)	GMI	IE123456731847	☒
28	IE151013731028	123	05-FEB-10	M	HO (80%)	GMI	IE123456741123	Requested

 CONTINUE

Order Process

Jumbo	Animal Number	DOB	Sex	Breed	Name	Sire	MGS	EBI €	
855	IE151013740855	20-MAR-05	F	HO (94%) FR (3%)	PARKDUV IRIS 25	HRZ	ELC	118	☐
1135	IE151013741135	15-APR-08	F	HO (91%) FR (9%)	PARKDUV SNOWDROP 19	HFL	ESZ	95	☐
1136	IE151013751136	17-APR-08	M	HO (97%) FR (3%)		SAO	RMB	45	☐
1137	IE151013761137	20-APR-08	F	HO (97%) FR (3%)	PARKDUV NANNYBREEZE 41	KES	ESZ	80	☐
1138	IE151013771138	18-SEP-08	M	HO (100%)		RUU	GMI	112	☐
1139	IE151013781139	22-SEP-08	F	HO (91%) FR (9%)	PARKDUV NANNYBREEZE 43	KWA	AHD	119	☐
1140	IE151013711140	24-SEP-08	F	HO (97%) FR (3%)		RUU	FAL	92	☐
1141	IE151013721141	24-SEP-08	F	HO (97%) FR (3%)	PARKDUV ROSE 13	KWA	RMB	117	☐
1142	IE151013731142	02-OCT-08	F	HO (100%)	PARKDUV DAISY 15	KWA	QUR	95	☐
1143	IE151013741143	06-OCT-08	M	HO (97%) FR (3%)		OJI	RUU	192	☐
1144	IE151013751144	06-OCT-08	F	HO (97%) FR (3%)	PARKDUV ROSE 12	OJI	RUU	198	☐
1145	IE151013761145	07-OCT-08	M	HO (94%) FR (3%)		OJI	RUU	205	☐
1146	IE151013771146	08-OCT-08	F	HO (97%) FR (3%)	PARKDUV MARIA 33	RUU	GMI	109	☐

Total Animals

13

Cost Animal

€ 75.10

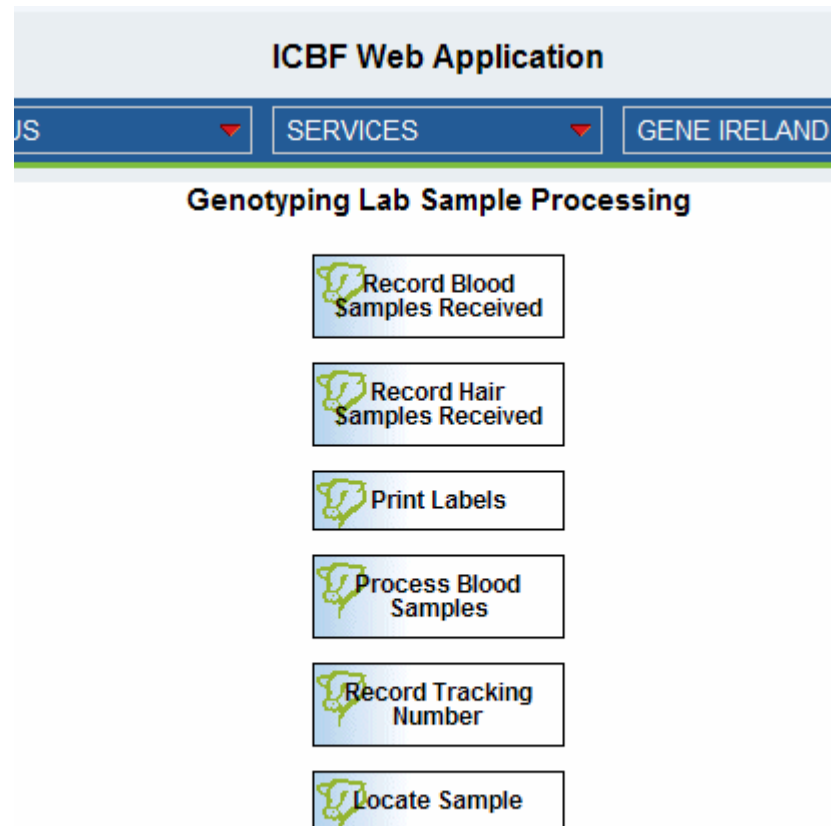
TOTAL (Incl. VAT)

€ 976.30

 MODIFY ORDER

 CONFIRM THE ORDER

ICBF Processing



Tracking

ICBF Web Application

Logged in at: 18-1

HOME

Genotype Request Tracking

Print Download

Total: 05 animals

Click Column Heading to sort by that attribute

Number of Rows Displayed: 5

[Reset](#)

					Show All	Show All
Date Requested	Herd ID	Owner	Animal Number	Breed	Sent to Lab	Genotype Results Loaded
10-Mar-2010	IE1510137		IE151013741024	FR	01-JAN-2010	
10-Mar-2010	IE1510137		IE151013751025	HO	01-JAN-2010	01-MAR-2010
10-Mar-2010	IE1510137		IE151013711026	FR	01-MAR-2010	
10-Mar-2010	IE1510137		IE151013721027	HO	01-JAN-2010	01-MAR-2010
10-Mar-2010	IE1510111		IE151013731028	FR		

Results - Profile

Jumbo	Animal Number	DOB	Sex	Lact	Sire	EBI€	Milk€	Fert€	Calv€	Beef€	Maint€	Health€	Milk Kg	FatKg	ProtKg	Fat%	Prot%	CalvInt	Surv%	Genomic
200	IESNYH0200Q	21-OCT-97	F	9	ASI	109	40.8	68	13	-25.8	10.4	2.8	95	5.5	7	0.04	0.07	-4.4	1.3	Y
441	IE151013730441	29-MAR-00	F	7	AHD	46	70.1	-17.3	3.9	-5.7	-4	-1.2	387	14	14.5	-0.01	0.03	2.2	0.7	N
467	IE151013740467	09-OCT-00	F	7	MFX	110	69.8	31.8	13.4	-13.6	5.5	3.5	63	6.5	11	0.08	0.17	-1.5	1.2	N
487	IE151013780487	19-NOV-00	F	6	QUR	134	95.8	8.4	32.3	-7.4	7.6	-2.5	142	14.5	15	0.17	0.19	-0.8	-0.1	N
504	IE151013780504	10-FEB-01	F	8	AHD	80	6	65.6	8.5	7.2	-3.6	-4.1	-113	-1	-0.5	0.07	0.07	-3.8	1.7	N
550	IE151604920550	25-MAR-06	F	3	RUU	131	48.6	77.6	14.9	1.1	-11.8	0.6	23	13	6	0.23	0.1	-4.7	1.8	N
562	IE151013790562	17-NOV-01	F	5	MFX	24	43.7	-20.5	4.8	-2.6	-1.4	-0.4	28	8.5	6	0.14	0.1	2.3	0.5	N
566	IE151013740566	09-DEC-01	F	5	MFX	88	76.9	0	15.8	-10.5	5.5	0.8	144	11.5	12.5	0.11	0.14	0.5	0.5	N
568	IE151013760568	26-JAN-02	F	6	FAL	73	63	0.2	8.6	-0.8	5.7	-3.9	226	5	12.5	-0.07	0.09	0.4	0.4	N
569	IE151013770569	26-JAN-02	F	6	FAL	48	29.5	10.8	12.5	-3.2	3.8	-5.1	95	3.5	5.5	0	0.05	-0.6	0.3	N
590	IE151013740590	03-MAR-02	F	6	ESZ	76	56.8	17.5	15.1	-10.2	-4.7	1.7	271	6	12	-0.08	0.06	-0.5	1	N
605	IE151013710605	06-SEP-02	F	6	MFX	42	67.3	-21.4	3.1	-8.6	-0.5	2.4	403	9.5	15	-0.1	0.03	2.4	0.5	N
633	IE151013750633	29-OCT-02	F	4	HRZ	65	68.1	-10.7	8.9	-9.5	3.8	4.5	259	13	12.5	0.06	0.07	2.4	1.5	N
651	IE151013770651	15-JAN-03	F	5	ESZ	90	58.6	34.9	8.6	-11.5	0.2	-0.4	215	9	11	0.02	0.07	-1.9	1	N
673	IE151013740673	12-FEB-03	F	4	GMI	93	54.1	48.2	10.5	-33.6	15.8	-1.5	137	13	8.5	0.15	0.08	-1.7	2.4	N
675	IE151013760675	16-FEB-03	F	5	GMI	91	65.6	7.8	28.2	-10.3	1.9	-2.1	212	9.5	12	0.03	0.09	0.5	1.1	N
690	IE151013750690	02-APR-03	F	6	LLO	89	56.6	33.5	11.6	-10.1	-2.5	0	238	6	11.5	-0.06	0.07	-1.3	1.5	N
699	IE341460380699	28-JAN-06	F	3	RUU	130	21.9	82.6	28.6	6.5	-12.6	2.8	20	8	2.5	0.14	0.04	-4.3	2.6	N
702	IE151013780702	07-OCT-03	F	4	RGK	-7	49.4	-36.7	-3.2	-13.4	2.9	-6.2	45	9.5	7	0.15	0.11	1.6	-1.5	N
706	IE151013730706	09-OCT-03	F	4	ESZ	44	59.1	-8.8	7.9	-17.4	3.4	0	222	7	11.5	-0.03	0.08	0.7	0	N
721	IE151013720721	16-NOV-03	F	5	ESZ	81	45.8	44.2	1.8	-7.3	-0.8	-2.3	111	2.5	8.5	-0.03	0.09	-2.7	1	N
728	IE151013790728	24-DEC-03	F	5	AHD	79	67.8	9.1	5.7	4.6	-4.9	-3.4	385	8.5	15	-0.1	0.04	-0.3	0.5	N
752	IE151013790752	02-FEB-04	F	4	AAP	35	-4	40.6	16.3	-11.2	-0.5	-6.7	1	-7	0.5	-0.14	0.01	-2.4	1	N
761	IE151013710761	13-FEB-04	F	5	AHD	112	65.5	36.1	14.5	0.5	-2.6	-2.1	143	12.5	10.5	0.13	0.11	-2.4	0.6	N
764	IE151013740764	18-FEB-04	F	4	ESZ	74	49.3	20.4	7.7	-0.1	-0.9	-2.6	231	10.5	9.5	0.03	0.04	-0.7	1	N
769	IE151013790769	25-FEB-04	F	5	AAP	123	42	66.7	29.2	-20.1	8.5	-3	198	6.5	8.5	-0.02	0.04	-4	1.6	N
772	IE151013740772	28-FEB-04	F	4	GMI	69	47.1	11.3	15.4	-6.7	4.4	-2.3	223	4.5	10	-0.07	0.05	0.3	1.3	N
781	IE151013750781	05-APR-04	F	3	DCD	68	52.6	9.1	19.6	-1.5	-8.6	-3.4	205	11.5	9.5	0.07	0.05	-0.9	-0.2	N
784	IE151013780784	22-SEP-04	F	4	RMB	77	72.8	9.4	9.6	-6	-8.3	0	196	9	13	0.03	0.12	-0.9	-0.1	N
785	IE151013790785	25-SEP-04	F	3	RMB	42	43.2	6	5.3	3	-9.5	-5.7	202	8	8.5	0.01	0.04	0.3	0.8	N
789	IE151013740789	01-OCT-04	F	4	RMB	44	55.5	-0.5	-2.3	-2.7	-6.7	1.1	-33	5.5	7.5	0.13	0.17	0.7	0.6	N
791	IE151013770791	03-OCT-04	F	4	QUR	38	40.3	-7.4	14.3	2.4	-8	-3.4	304	5	10	-0.11	0	0.4	-0.2	N

Results - Individual

Genomic Evaluation Report						
Jumbo	802			Lact. No	0	
Tag	IE123456789802			Sex	F	
Name	ICBF			Sire	GMI (€100)	
Date of Birth	28-Jun-10	0y 1m		Dam	IE123456788111 (€95)	
Breed	HO 100%			Dam's Sire	OJI (€246)	
Date of Evaluation	28-Jun-10					
Index	Official Genomic Evaluation	Reliability %	% Weight on Genomics	Change in Evaluation from Parent Average	Reliability Increase with Genomics %	Direct Genomic Value
gEBI €						
Milk Sub Index €						
Fertility Sub Index €						
Calving Sub Index €						
Beef Sub Index €						
Maintenance Sub Index €						
Health Sub Index €						
Milk Sub Index						
Milk (Kg)						
Fat (Kg)						
Prot (Kg)						
Fat (%)						
Protein(%)						
Fertility Sub Index						
Calv Int (Days)						
Survival (%)						
Calving Sub Index						
Dir. Calv Diff (%)						
Mat. Calv Diff (%)						
Gest Len (Days)						
Calf Mort (%)						
Beef Sub Index						
Cull Cow Weight (Kg)						
Carcass Weight (Kg)						
Carc Conf (Grade)						
Carcass Fat (%)						
Maintenance Sub Index						
Cull Cow Weight (kg)						
Health Sub Index						
Lameness (Locomotion)						
Udder(SCC)						

Current Status

- Work almost complete on Lab screens
- Development of other screens on-going
- Implement imputation
- Turnaround time ~4/5 days

Issues

- Results sent to person who pays for genotype in advance
- Results made official at next evaluation (weekly, bi-weekly, monthly, 3 times/year)?
- How to handle duplication?
 - Not an issue where contract exists
 - Dropped calves – request from multiple sources

Recommendation

- Proceed with development work
- Update at next Industry meeting

Imputing genotypes from low-cost, less dense genotype arrays

Donagh Berry
Teagasc, Moorepark

donagh.berry@teagasc.ie

Motivation

- Currently costs ~€150 per genotype with 50,000 SNPs
- Genomics will dictate selection decisions
 - Heifers as replacements
 - Bulls as test bulls or stock bulls
- Parentage testing is a form of genotyping but in current form is not useful for genomic selection

→ reduce the cost of genomic selection

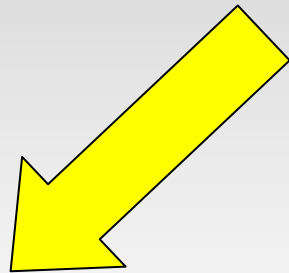
State of the art in genotyping platforms

Currently 54,001 SNPs

*1,661 discarded
2,269 new*

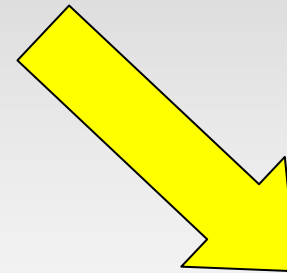
New version 54,609 SNPs

50k chip



2,900 SNPs

3k chip



~790,000 SNPs

*HD chip
High Density chip*



Imputation

Sire

....TCACCGCTGAG....

....CAGATAGGATT....

....??G?????A??....

....??T?????T??....

Offspring

Imputation

Sire

....TCACCGCTGAG....

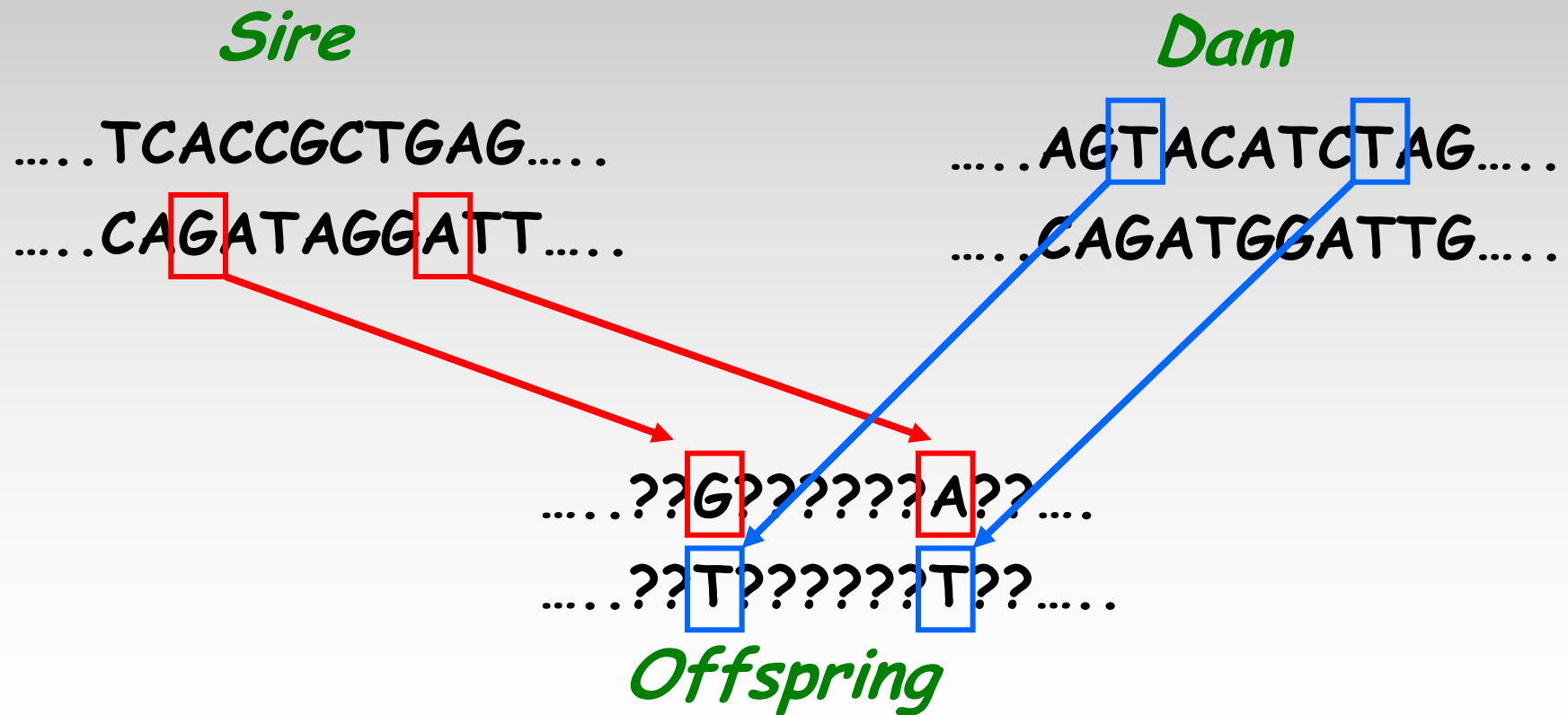
....CAGATAGGATT....

....CAGATAGGATT....

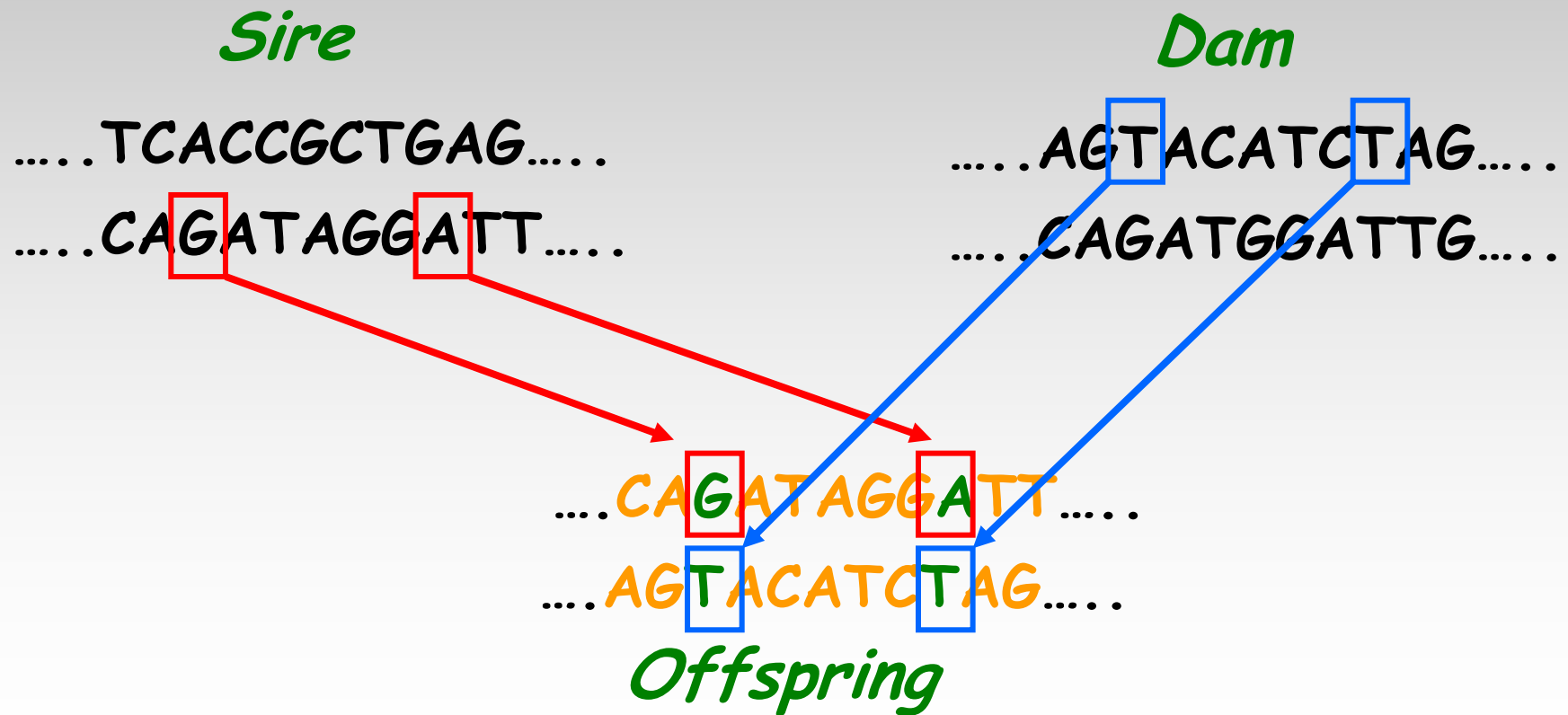
....??T?????T??....

Offspring

Imputation



Imputation



Imputation

Sire

....TCACCGCTGAG....

....CAGATAGGATT....

Dam

....AGTACATCTAG....

....CAGATGGATTG....

....CAGATAGGATT....

....AGTACATCTAG....

Offspring



Imputation

Population

MG-Sire

....AGTACATCTAG....AGTACATCTAG....
....CAGATGGATTG....CAGATGGATTG....
....AGTCGTGACTG....
.....

Sire

Dam

....TCACCGCTGAG....
....CAGATAGGATT....

....?????????????....
....?????????????????....

....??G?????A??....
....??T?????T??....

Offspring



Imputation

Population

MG-Sire

....AGTACATCTAG....

....AGTACATCTAG....

....CAGATGGATTG....

....CAGATGGATTG....

....AGTCGTGACTG....

.....

Sire

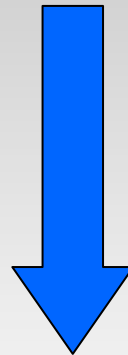
Dam

....TCACCGCTGAG....

....?????????????....

....CAGATAGGATT....

....?????????????....



....CAGATAGGATT....

....AGTACATCTAG....

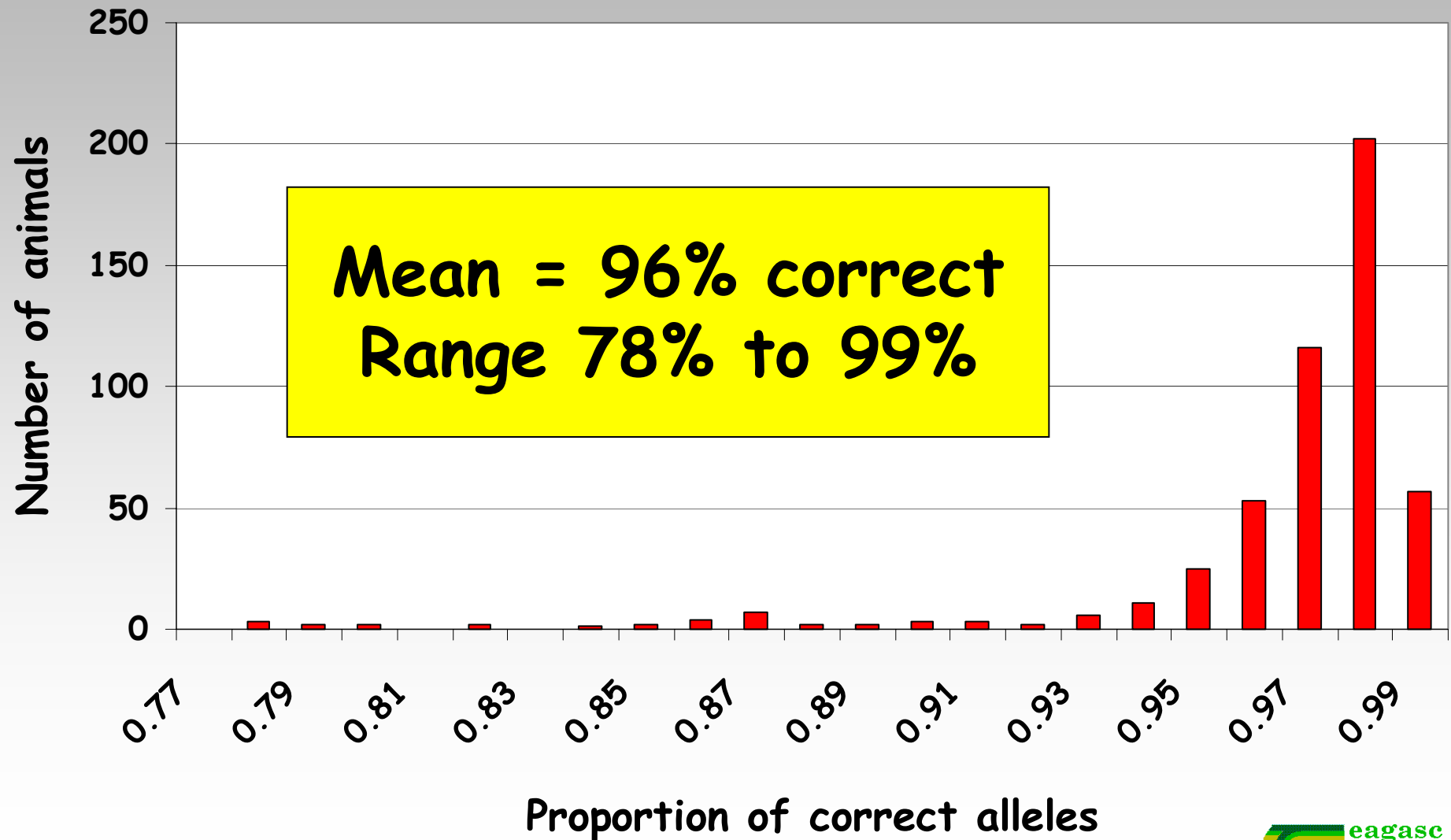
Offspring



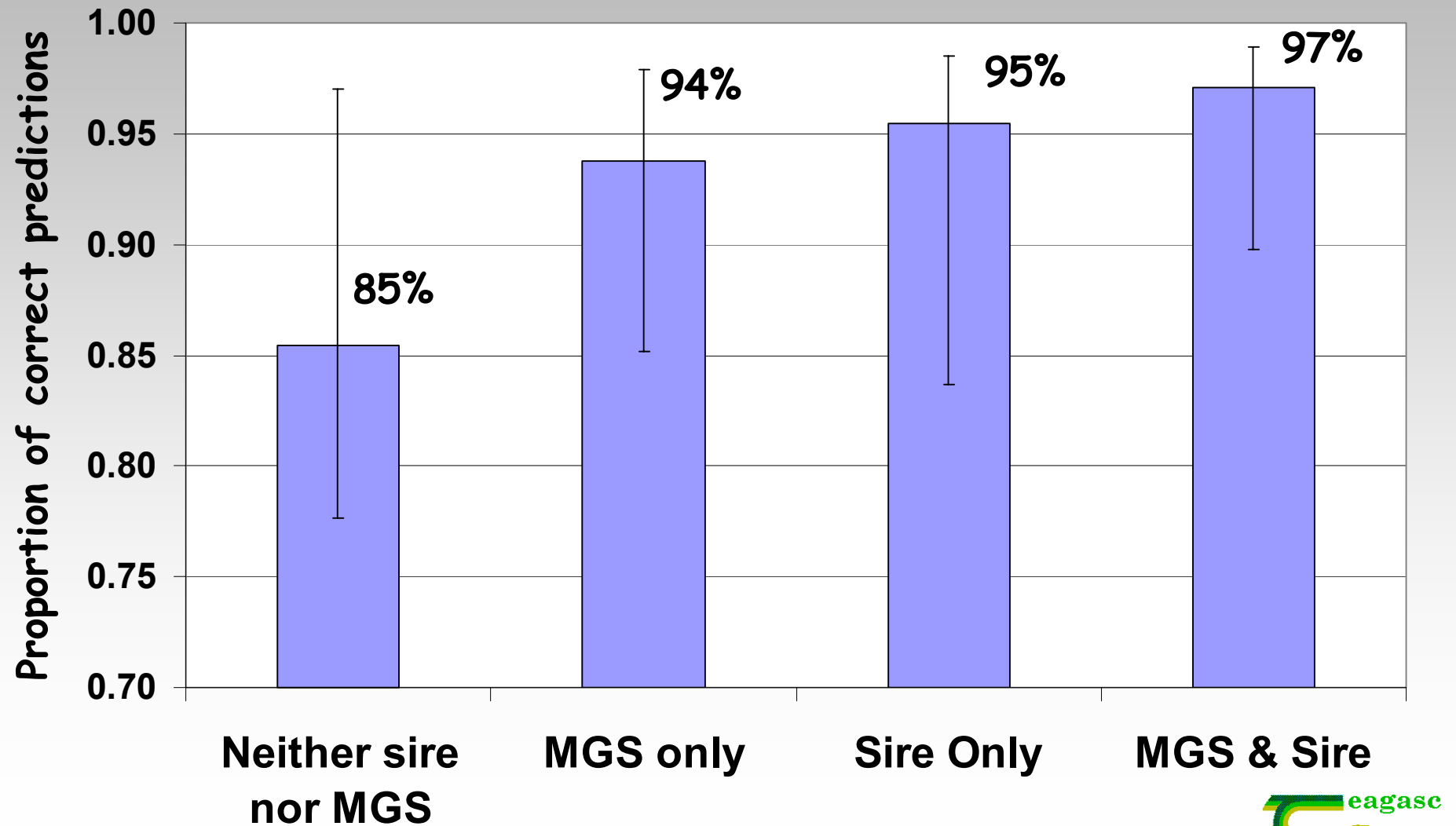
Testing

- 5,732 animals with genotypes on 54,000 SNPs
- 505 animals born since 2007 assumed to be genotyped only on smaller 3,000 SNP chip
 - Had their 54,000 genotypes so knew the "answer"
- Accuracy
 - Percentage correct alleles (A,B)

Accuracy per animal



Accuracy by pedigree genotyped



Implementation

- 3k chip can also be used for parentage testing
- Computing time : ~24 hrs for imputation

Genomics and other breeds

- Key for successful genomic prediction is representation of the *DNA signature* in the training population
 - Breed (HO, FR, JER, MO, NO...) must be genotyped
 - Animals must have a traditional proof
- Also vital for imputation

Conclusions & recommendations

- Accuracy of imputation is high particularly with back pedigree is genotyped
- Only impute where sire and MGS genotypes are available
- Bulls used in AI must have 54,000 SNPs genotyped
- Continue research in imputation

Other genomic research

- Breeding programs (Noirin)
- Multi-breed genomic evaluation (Holsteins versus Friesians)
- Cows/stock bulls in training population
- Sharing of genotypes