



IRISH CATTLE BREEDING FEDERATION

Dairy Breeding Update; Does Genomics Work?



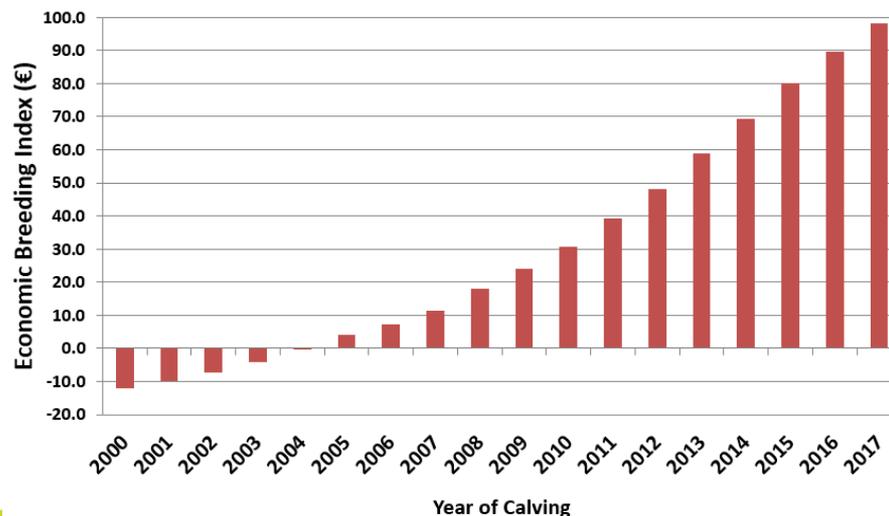
February, 2019

EBI is working at farm level. Review paper presented by Dr. Pat Dillon (Dec 2018).

Data Used in the Analysis

1. Data taken from ICBF database 2000 to 2017
2. Only spring calving herds- >90% calved Jan-June
3. Data set included: milk recorded herds (4,711,320 cow-lactations, 1,724,140 cows; 8,727 herds) non-milk recorded herds (4,874,462 cow-lactations; 1,956,072 cows; 14,680 herds)
4. If >80% of cows in herd-year were dairy breed then all records in herd-year retained
5. Relationship between increase EBI and GHG emissions plus farm profitability was calculated using the average of 2001-2003 compared to the average of 2014-2016.

EBI of Cow-Year Calved



Average EBI of first calving females has increased by €8/cow/year.

Genetic Gain In Milk Solids

Genetic and Phenotypic Trends in Milk Production-2000-2017

Year	MILKKG	FATKG	PROKG	MILK-YIELD	FAT-YIELD	PRO-YIELD
2000	-134.4	-5.5	-6.2	5,861	219	198
2001	-122.8	-5.0	-5.6	6,188	234	211
2002	-104.6	-4.3	-4.7	6,075	229	205
2003	-89.9	-3.7	-4.0	6,285	234	214
2004	-78.7	-3.3	-3.4	6,439	243	220
2005	-68.3	-2.9	-2.9	6,356	243	216
2006	-59.5	-2.5	-2.4	6,420	244	218
2007	-50.5	-2.1	-2.0	6,337	242	217
2008	-45.8	-1.6	-1.6	6,089	239	211
2009	-40.0	-1.1	-1.2	5,862	231	203
2010	-35.5	-0.7	-0.8	6,240	245	217
2011	-29.8	-0.1	-0.4	6,223	248	217
2012	-21.7	0.6	0.1	6,033	243	210
2013	-10.1	1.4	0.8	6,099	244	212
2014	0.0	2.1	1.4	6,167	250	218
2015	6.1	2.9	1.9	6,360	260	228
2016	12.6	3.7	2.5	6,227	258	221
2017	22.1	4.5	3.1	6,379	264	228
⁸ Slope	7.4	0.6	0.5	5.1	1.8	0.9

- Has resulted in average production for 2017 of 6,379 litres with 264 kg BF (4.14% BF) & 228 Kg Ptn (3.57% Ptn).
 - +75 kg milk solids (F+P) over period.
- ~40-50% of gain directly attributable to genetics. Genetic gain alone worth ~3 cpl.
- Similar gains apparent from HerdPlus & Co-op performance report

Genetic Gain In Female Fertility

Genetic and Phenotypic Trends in Fertility Traits-2000-2017

Year	CI	SURV		Sub 21	Preg 1st	Preg 42	CALVE 42
2000	-1.86	0.10					
2001	-1.66	0.10					
2002	-1.41	0.09		68	47	53	64
2003	-1.27	0.10		67	46	54	59
2004	-1.23	0.19		67	46	53	61
2005	-1.18	0.24		65	48	52	61
2006	-1.12	0.26		65	47	52	63
2007	-1.05	0.29		67	46	52	62
2008	-1.12	0.36		67	46	52	61
2009	-1.16	0.41		66	47	52	61
2010	-1.23	0.46		65	46	53	60
2011	-1.36	0.54		69	49	55	62
2012	-1.5	0.63		71	51	59	66
2013	-1.69	0.74		71	51	60	68
2014	-1.89	0.86		75	53	63	67
2015	-2.07	0.98		76	53	64	70
2016	-2.22	1.08		78	55	67	72
2017	-2.32	1.17		79	54	67	74
Slope	-0.10	0.08		0.8	0.6	1.0	1.0

- Has resulted in avg. female fertility of 79% 3-week submission rate & 74% 6-week calving rate.
- Gain of ~10% units in each metric over the period.
- ~30-40% of gain directly attributable to genetics. Genetic gain alone worth further ~2 cpl.
- Similar gains apparent from HerdPlus & Co-op performance report

Key Factors – Farmers confidence in technology (i)

High index Holstein route not the answer
Very disappointing results from three year trial

Measures of fertility needed in index

Trait	Current trial (1998-2000)	Previous trial (1995-1997)
Submitted in 1st 3 weeks (%)	88	90
Calving to service interval (days)	77	70
Calving to conception interval (days)	93	86
Pregnancy 1st service (%)	69	61
Pregnancy 2nd service (%)	42	37
Services/cow	1.67	1.58
Service rate (%)	12	23
Percentage of Holstein (%)	80	97

Teagasc Next Generation Dairy Herd.

Trait	Elite Herd	National Ave
EBI (€)	154	51
Milk Yield (litres)	5,413	5,612
Fat + Protein (kgs).	443	434
Pregnant 1 st service (%)	60	46
Final pregnancy rate (%)	92	81

- Herd established with purchase of heifer calves from dairy farms based on **genomic EBI** in 2011. Elite and National average groups of animals.
- System; Grass based, Feb calving & feeding 0.5 t conc/cow.
- Two groups of animals managed together. Only difference is genetics
- EBI predicted €206 difference/lactation. Actual was €220.



- Farmers moved from seeing genetics as “part of the problem” to being a key “part of the solution”.
- Driven by;
 - Ground-breaking research from Teagasc, Moorepark
 - Strong extension programs on ground, incl. EBI €100 competition.

EBI €100 Herd Competition.



EBI - making more money

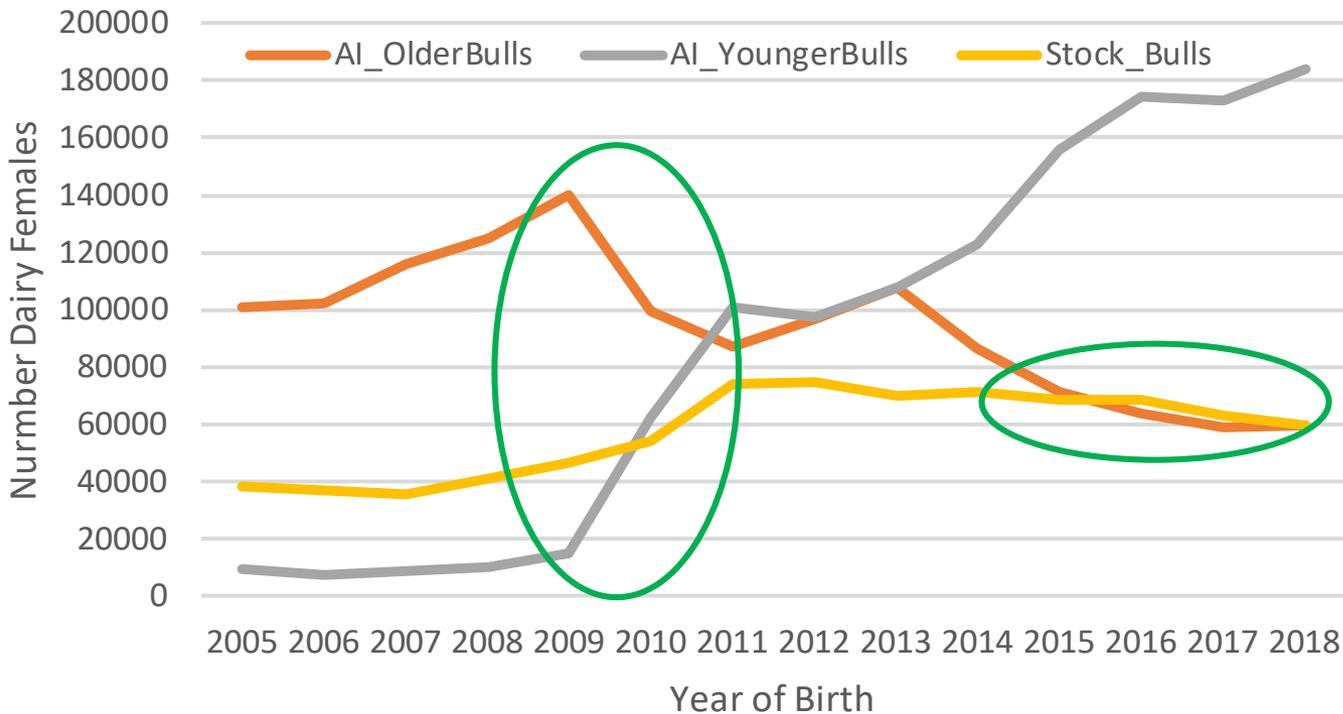
	EBI	Milk kg	Fat kg (%)	Pr kg (%)	CI	
High group	EBI €100	5,740	232 (4.05)	217 (3.75)	365	
Bottom group	EBI €34	5,730	215 (3.75)	207 (3.62)	379	
Difference	€66	+ 10	+ 17	+ 10	-14	Total
Value		- €1	€26	€52	€99	€176

• Profit difference per 40 cows is €7,040

Recommendation: Use EBI to increase farm profit

Key Factors – Farmers confidence in technology (ii)

Number of Dairy Females born, by Sire Type.



- Introduction of genomic selection technology (GS) in 2009 => immediate increase in use of younger (GS) bulls.
 - Increase in reliability of young bull proofs from 30% to 50%+ (equivalent to 30 progeny records).
- 75% of dairy AI in Ireland now to younger GS bulls.
- Older “well proven” bulls declining.
- Stock bulls also declining slightly.

Recent concerns – Role of Genomics

Questions over genomics at Greenfield



Create Value, Build Trust, Deliver Results

Home News Dairy Basics Products & Programs Beef About Alta Contact Careers

Search

Dairy Basics

Wednesday, 17 February 2016

Do genomic proofs hold up?

Seven years into it, genomics has become nearly as common of a term as AI. We're now used to the genetic technology and feel confident using genomic-proven bulls as part of a balanced breeding program.



However, you may still have questions about the difference to expect between a genomic proof and a daughter proof. Or maybe you're looking for comparisons on the genetic merit between genomic-proven and daughter-proven sires.

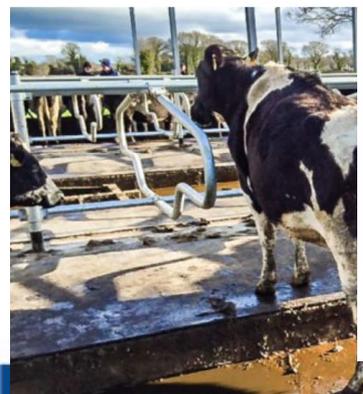
- Increasingly some farmers & industry stakeholders are questioning the role of genomics?
- Key concern is that young GS bulls are NOT performing as well as daughter proven bulls and farmers should consider reverting to using these older bulls.
- Are these concerns justified?

Looking at some of the end of the firms would have to question the type of cow long-term on the farm. So sired heifers look very different Holstein-like compared with cows on the farm. Now I

HOME » DAIRY » LESSONS LEARNED FROM GENOMIC BREEDING

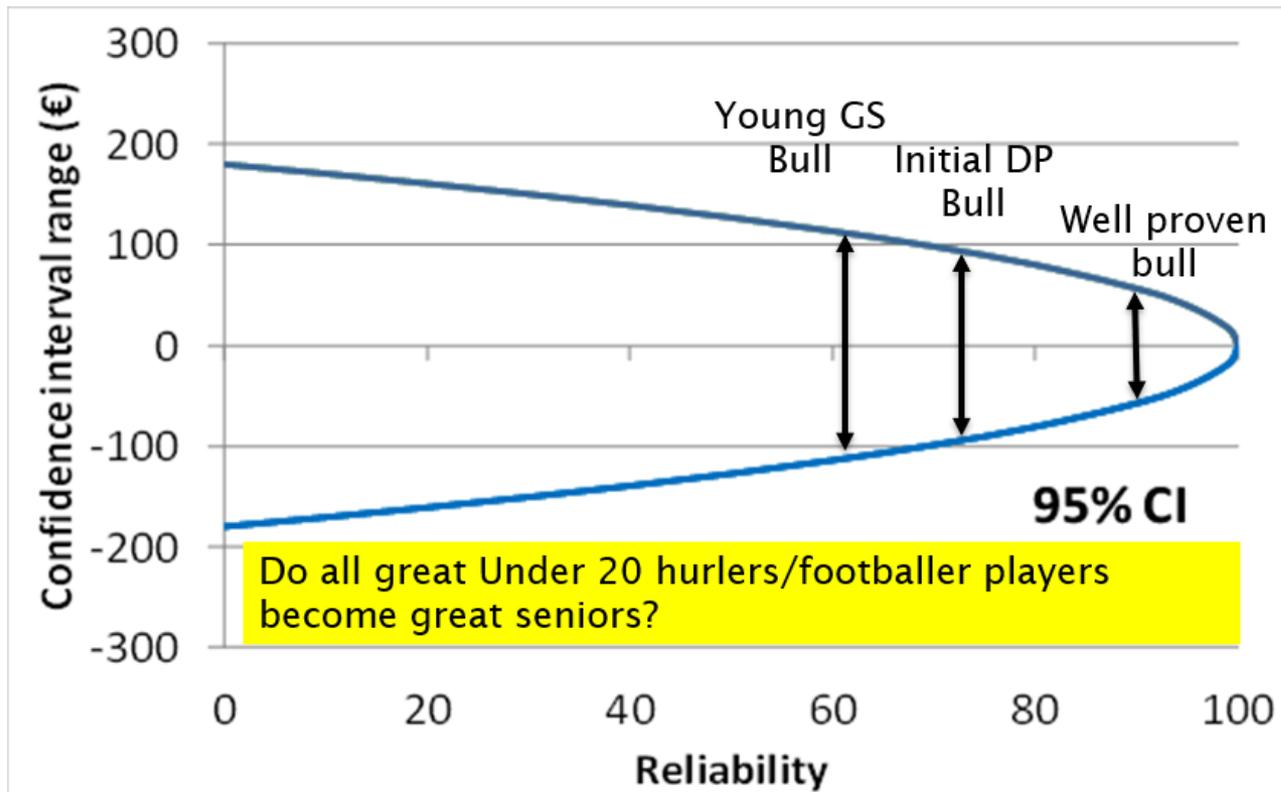
Lessons learned in breeding in N

Seán Cummins | Dec 22, 2017, 6:00am



Recap – AI Bull proofs will change

Bull proofs will change over time.



- Previous work by Teagasc has indicated that proofs for individual bulls will change by;
- +/- €110 for young GS bull.
- +/- €90 for initial daughter proven bull.
- +/- €50 for a well proven bull.
- How much do bull proofs change and does this vary by category of bulls?

Analysis of ICBF Active Bull Lists (2009-2014)

Rk	Code	Bull Name	Brd	EBI	Rel(%)	Proof	Milk	Fert	Milk + Fert	Calv Recs	Avail	Price	Supplier
1	FR2460	(IG) NEXTGEN PHC EIMER 557	HO	€312	63	GS	€96	€158	€254	3563	High	18	NCBC
2	FR2239	(IG) DIAMOND ANTON	HO	€306	67	GS	€103	€133	€236	16326	High	20	NCBC
3	FR2298	(IG) OLCASTLETOWN RONALDO	HO	€296	66	GS	€101	€138	€239	13809	High	19	NCBC
4	FR4119	S-S-I SHAMROCK MYSTIC-ET	HO	€289	65	DP-INT	€108	€144	€252	212	Low	35	World Wide Sir
5	FR4021	(IG) BALLINTESKIN ARNOLD	HO	€288	61	GS	€33	€212	€245	5499	High	19	NCBC
6	FR2385	(IG) NEXTGEN YKG CANDY 593	HO	€285	64	GS	€72	€149	€221	15736	High	20	NCBC
7	JE4289	BRADENE PAS TRIPLESTAR	JE	€279	49	DP-INT	€136	€67	€203	486	High	23	NCBC
8	FR2426	CLONDROHID BLACK LIGHTNIN	HO	€278	67	GS	€67	€154	€221	3512	High	21	Eurogene/LIC
9	FR2249	COOLNASOON ART	HO	€274	67	GS	€97	€124	€221	10597	High	18	Dovea
10	JE4827	GLEN KORU BECKON	JE	€271	49	DP-INT	€164	€32	€196	232	Mediur	22	Eurogene/LIC
11	FR2226	PEAK MR. GREY	HO	€268	64	DP-IRL	€123	€74	€197	1422	High	23	Eurogene/LIC
12	FR2424	POSSEXTOWN FAITHFUL	HO	€268	64	GS	€63	€150	€213	1180	High	21	Eurogene/LIC
13	FR2053	KILDARRA MAESTRO	HO	€265	80	DP-IRL	€105	€92	€197	10575	High	21	Eurogene/LIC
14	FR4154	HAGGARD FRANKO	HO	€264	63	GS	€84	€128	€212	487	High	18	Dovea
15	JE4516	CRESCENT EXCELL MISTY ET	JE	€262	42	DP-INT	€119	€73	€192	258	Mediur	22	Eurogene/LIC
16	FR2237	(IG) MEADOWVIEW RODNEY	HO	€258	66	GS	€36	€160	€196	703	High	19	NCBC
17	FR4205	ROEFARM LAMONT CORK	HO	€257	61	GS	€115	€77	€192	703	High	14	Bova AI
18	FR2129	NODSTOWN CHAMPION	HO	€256	74	DP-IRL	€83	€134	€217	637	High	19	Eurogene/LIC
19	JE2438	BELLS CM CONRAD S2J	JE	€255	51	DP-INT	€104	€62	€166	564	High	20	Eurogene/LIC
20	FR2314	GORTGREEN SEBASTAIN	HO	€254	64	GS	€108	€97	€205	6027	High	18	Dovea

- Genomics first introduced in 2009. Six years of Active Bull Lists where subsequent progeny have milk & fertility proofs.
- Milk & fertility proofs taken from; (i) current proof run & (ii) original proof as published on relevant list.
- Base correction applied to old milk & fert proofs (as per 2016) and latest economic values used => direct comparison.

- Key questions; (i) How good was the initial M+F proof at predicting future performance, and (ii) does this vary by proof type?

T1. Comparison 2009 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	27	€30.6	€31.9	€62.5	€20.0	€35.4	€55.4	-€10.6	€3.5	-€7.1
DP-IRL	10	€17.5	€48.6	€66.1	€58.9	€53.6	€112.4	€41.4	€5.0	€46.3
GS	38	€27.6	€48.5	€76.1	€32.1	€42.4	€74.6	€4.5	-€6.0	-€1.5
Overall	75	€27.3	€42.5	€69.8	€31.3	€41.4	€72.7	€4.0	-€1.1	€2.8

T2. Comparison 2010 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	39	€55.8	€52.0	€107.8	€36.6	€60.8	€97.4	-€19.1	€8.8	-€10.4
DP-IRL	7	€54.4	€72.5	€126.9	€55.2	€77.3	€132.5	€0.8	€4.8	€5.6
GS	29	€59.9	€54.0	€113.9	€51.4	€50.8	€102.2	-€8.5	-€3.2	-€11.7
Overall	75	€57.2	€54.7	€111.9	€44.1	€58.5	€102.5	-€13.2	€3.8	-€9.4

T3. Comparison 2011 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	33	€60.2	€61.0	€121.2	€41.4	€64.7	€106.1	-€18.8	€3.7	-€15.1
DP-IRL	9	€62.9	€40.6	€103.5	€31.3	€50.6	€81.9	-€31.6	€10.0	-€21.5
GS	33	€69.6	€60.3	€129.9	€51.0	€56.6	€107.5	-€18.6	-€3.7	-€22.3
Overall	75	€64.7	€58.2	€122.9	€44.4	€59.4	€103.8	-€20.2	€1.2	-€19.0

T4. Comparison 2012 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	28	€67.4	€71.3	€138.7	€43.7	€67.1	€110.9	-€23.7	-€4.2	-€27.9
DP-IRL	14	€115.2	€12.4	€127.6	€69.7	€24.1	€93.8	-€45.6	€11.8	-€33.8
GS	33	€90.2	€54.1	€144.3	€58.3	€63.0	€121.4	-€31.9	€8.9	-€22.9
Overall	75	€86.4	€52.7	€139.1	€55.0	€57.3	€112.3	-€31.4	€4.6	-€26.8

T5. Comparison 2013 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	22	€66.5	€75.6	€142.2	€46.0	€76.0	€122.0	-€20.5	€0.3	-€20.2
DP-IRL	18	€93.1	€39.7	€132.8	€69.5	€44.8	€114.3	-€23.6	€5.1	-€18.5
GS	35	€104.1	€37.8	€141.9	€60.7	€51.4	€112.2	-€43.4	€13.6	-€29.7
Overall	75	€90.4	€49.4	€139.8	€58.5	€57.0	€115.6	-€31.9	€7.7	-€24.2

T6. Comparison 2014 vs 2019

Proof	Code	Fert_SI_Old	Milk_SI_Old	M+F_Old	Fert_SI_2019	Milk_SI_2019	M+F_2019	Diff Fert	Diff Milk	Diff M+F
DP-INT	11	€89.2	€76.5	€165.7	€52.4	€79.7	€132.1	-€36.9	€3.3	-€33.6
DP-IRL	12	€109.6	€43.1	€152.6	€72.0	€46.6	€118.7	-€37.5	€3.5	-€34.0
GS	52	€110.5	€52.2	€162.8	€71.4	€62.3	€133.7	-€39.2	€10.1	-€29.1
Overall	75	€107.3	€54.3	€161.6	€68.7	€62.4	€131.1	-€38.6	€8.1	-€30.5

- Evidence of some level of over-prediction in more recent proofs.

- But** difference is across all categories of bulls, as all have genomics still in their proofs, especially for fertility traits.

- Also, consistent with experience internationally.

- Genomics helps us identify superior animals => steady increase in EBI of lists from €72 in 2009 to €131 in 2014.

- We must accept the bias and then build systems to account for it. Current work with Teagasc.

Option; Abandon any bulls with genomic proofs and just focus on bulls that are daughter proven for female fertility

Breed	No data (<50%)	Unproven (50-70%)	Part proven (70-90%)	Proven (>90%)	All
Holstein	26	226	160	81	493
- DP-INT	18	42	11		71
- DP-IRL		69	149	81	299
- GS	7	115			122
Friesian	7	32	42	38	119
- DP-INT		4			4
- DP-IRL		20	42	38	100
- GS	7	8			15
Jersey	37	8	19	4	68
- DP-INT	34	2	1		37
- DP-IRL	3	6	18	4	31
Grand Total	83	278	241	127	729

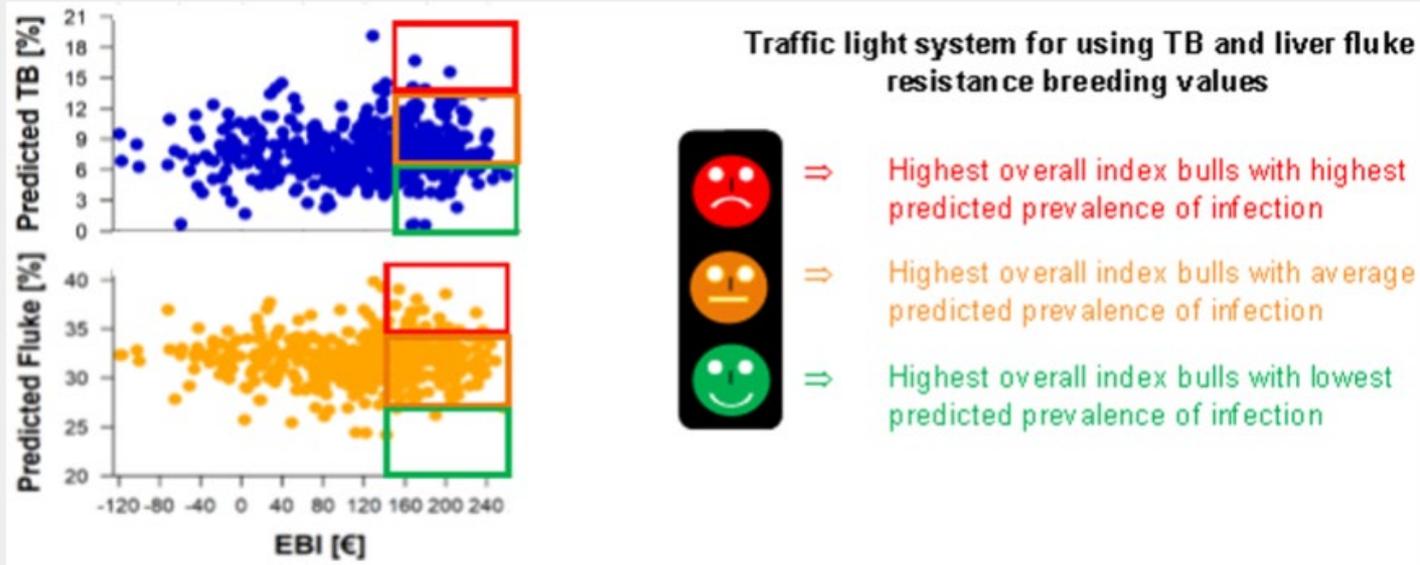
- Of the 729 dairy AI bulls active and available for widespread use, only 127 are "proven" (defined as $\geq 90\%$ reliable for female fertility).
- 83 have "no data" (effectively parent average prediction).
- Majority of DP sires (IRL or INT) are either unproven or part proven.

Option; Stick with very well proven bulls for female fertility => List of Top 20 Proven Sires Ranked on EBI

2019_Rk	Code	Name	YOB	Breed	% HO	EBI	EBI Rel	Proof	MR Da	Milk	MSI Rel	Fertility	Fert Rel	Calv Recs	Seller
50	MWW	MORTENSENS WE AWE-ET S3	2007	HO	63	€236	94	DP-IRL	578	€65	99	€104	91	1512	Eurogene/LIC
58	PSQ	PRIESTS SOLARIS-ET	2007	JE	19	€232	96	DP-IRL	2346	€65	99	€73	94	21163	Eurogene/LIC
68	LHZ	(IG) LAURAGH EVERT	2009	HO	88	€229	98	DP-IRL	17716	€66	99	€114	98	42545	NCBC
81	SPD	ST PETERS OBSIDIAN	2009	JE	13	€225	94	DP-IRL	894	€94	99	€40	90	6423	Eurogene/LIC
85	CHQ	(IG) CACANODE HAROLD	2008	HO	72	€223	97	DP-IRL	2898	€89	99	€83	94	7801	NCBC
103	HDJ	(IG) BRIDESTREAM HAROLD	2011	HO	63	€218	95	DP-IRL	3245	€76	99	€82	90	8143	NCBC
134	BGJ	BAGWORTH PF GRANDEUR S1	2009	HO	50	€211	96	DP-IRL	6097	€72	99	€75	94	17816	Eurogene/LIC
149	RPA	(IG) RHINCRUE SUPER DANO 1	2012	HO	72	€208	95	DP-IRL	5313	€89	99	€66	91	14357	NCBC
174	ZPB	BALLYOGAHA PHILIP	2011	HO	75	€203	96	DP-IRL	3294	€88	99	€57	93	9791	Dovea
175	GYK	GARRYMARTIN KEET	2005	HO	78	€202	98	DP-IRL	3683	€89	99	€47	96	8102	NCBC
178	OCP	(IG) CARRIGAUN GLEN	2011	HO	84	€202	96	DP-IRL	4110	€64	99	€65	93	10716	NCBC
184	PKR	(IG) PARKDUV MOUNT EVERE	2012	HO	91	€201	95	DP-IRL	3536	€76	99	€96	91	8712	NCBC
188	TSK	(IG) KNOCKCAIS TOSSY	2010	HO	84	€200	97	DP-IRL	5195	€77	99	€67	96	12292	NCBC
193	MJI	MORRISHEEN OJI FRANK	2007	HO	88	€199	98	DP-IRL	6517	€33	99	€115	97	15505	Eurogene/LIC
194	EKE	EIK	2005	NR	0	€199	95		2118	€62	99	€66	93	6677	Dovea
200	PBM	(IG) BALLINABORTA PRIMO	2011	HO	53	€198	98	DP-IRL	16968	€128	99	€32	96	53032	NCBC
215	BHQ	(IG) BALLYHOOLY MINSTREL	2008	JE	0	€196	95	DP-IRL	705	€53	99	€64	90	1419	NCBC
251	LCM	(IG) LAURAGH CAMELOT	2009	HO	91	€187	96	DP-IRL	2196	€85	99	€54	94	5357	NCBC
285	MJD	MAXWELLS DAN JAZZMAN S2F	2005	FR	44	€177	96	DP-IRL	1453	€94	99	€43	93	3575	Eurogene/LIC
			2009			€208	96			€77	99	€71	93		

Compared to the Top 20 Active bulls on EBI, these bulls are ~€70 lower in EBI.

Proven for Female Fertility. What about new Traits?



— Figure 2. Optimum use of breeding values for resistance to TB and liver fluke is to select cattle that have the highest overall index which also have the lowest breeding values for TB and liver fluke resistance

- Also, of the top 20 proven bulls on female fertility, several are very poor for new traits that will be in EBI in the future, e.g., PSQ is in bottom 1% for TB resistance.
- What about other new traits in the future, e.g., GHG & climate?

Summary

- EBI is delivering at farm level - €0.04 - €0.05/litre.
- 75% of AI usage is to GS bulls.
- Bull proofs will change: GS +/- €110, DP +/- €90. Use teams of high EBI bulls equally on your herd.
- Most DP-IRL bulls are not proven for fertility!
- Evidence of some level of over-prediction in GS proofs.
 - Consistent with experience from other countries.
 - More apparent with fertility. Need to move to new, more accurate measure.
- Proven bulls on average €70 behind GS bulls.
- New traits need to be incorporated into EBI.



Our Farmer & Government Representation



Our AI & Milk Recording Organisations



Our Herdbooks



Acknowledging Our Members