IRISH CATTLE BREEDING FEDERATION

Implementation and First Year Results on the use of Genomic Selection in Dairy Cattle in Ireland

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NDP National Development Plan Transforming Ireland

Teagasc Agriculture and Food Development Authority

Outline

- Estimation/Validation of genomic EBV (GEBVs) (Aug08-Feb09)
- Publication of GEBVs (Feb09)
- Uptake of GEBVs for Spring 2009
- First results for bulls marketed with GEBVs in Spring that now have traditional daughter based EBVs (Aug 09)

Estimation/Validation

- Genomic evaluations introduced in Ireland in Feb 2009 using genomic relationship matrix (VanRaden, 2008)
- Training population of ~ 1000 bulls
- Ireland, UK, NZL and Poland genotypes
- Validation done using bulls with at least 40 daughters milking in Ireland
- Correlations were of the order of 0.4-0.6
- Increases in reliability for young bulls about 10-20%

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Implementation

Active Bull List (Top 75 bulls with >2000 doses) is published in spring for main breeding season

	2007	2008	2009
EBI €	118	124	150
Milk SI €	46	52	69
Fert SI €	60	60	64
Ave Rel %	74	76	58
IRL bulls	22	17	16
Bulls <7yr	12	11	48
No. GS bulls	0	0	39

Implementation

- How to publish GEBVs for bulls??
  - As ‘team’ or individually?

- Published GEBVs for young genotyped bulls and young bulls from other countries where genotypes were provided to us

- Publish EBV where progeny information existed and reliability ≥70% for milk and ≥50% for fertility traits

Implementation

- Bulls with GEBVs were eligible for Active Bull list where reliability for EBI ≥35% and calving proof based on progeny was ≥50%
- DAFF imposed limits on use of semen from these bulls
  - <35% Rel – 3,000 doses
  - 35-50% Rel – 5,000 doses
  - 50% Rel -10,000 doses
- Farmers advised to use a minimum of 4 bulls
- AI companies marketing fresh semen rotated bulls on a daily basis to ensure farmers received multiple bulls

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Implementation

Bull Details					EBI & Proof Details				EBI Sub Indexes				
Rk	Code	Name of Bull	Sire	Hol	EBI	Rel	Range	Proof	Milk	Fertility	Calving	Beef	Health
1	OJI	O-BEE MANFRED JUSTICE	HCM	100	€250	91%	+/-€35	DP-IRL	€114	€86	€49	-€6	€7
2	RXO	RAMOS	SRH	100	€216	74%	+/-€60	DP-INT	€47	€120	€38	-€6	€16
3	HTH	HAZAEL LIGHT DETECTOR S2F	LGI	71	€198	43%	+/-€89	GS	€84	€114	€25	-€23	-€2
4	OLG	BALLIVOR OLYMPIC GOLD ET	OJI	100	€194	50%	+/-€83	GS	€127	€32	€40	-€5	€1
5	BYJ	BALLYDEHOB JUSTICE	OJI	96	€189	53%	+/-€81	GS	€90	€76	€28	-€7	€1
6	HZL	HILLSDALE LIONEL	RUU	91	€188	57%	+/-€77	GS	€71	€68	€50	-€1	€1
7	RXR	MONAMORE ROMERO ET	OJI	100	€187	54%	+/-€80	GS	€90	€72	€38	-€16	€4
8	GIO	GIBOR	GBN	97	€186	68%	+/-€68	DP-INT	€74	€81	€25	-€9	€15
9	GYK	GARRYMARTIN KEET	BWZ	78	€184	49%	+/-€84	GS	€97	€71	€31	-€9	-€6
10	HZS	HAZAEL MN SWEETDREAM*	NWorthy	100	€182	35%	+/-€95	GS	€114	€71	€17	-€12	-€8

DP-IRL – daughter proven with IRL daughters
DP-INT – daughter proven with no IRL daughters
GS- Genomically Selected bulls (Lay-off with calving evaluation ≥50%)

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Uptake of GS bulls

- 462,000 inseminations from 2009 breeding season collected via AI technician handheld
- Do-it-yourself (DIY) insemination not available (DIY ~33% of total inseminations)
- Looked at 3 categories of bulls
  - DP-IRL – proven with daughters milking in Ireland
  - DP-INT – proven with no daughters milking in Ireland
  - GS – selected on DNA and parent average

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Uptake of GS bulls

Proof	No. Bulls	Straws/bull	% Use	Bulls/Herd
DP-IRL	754	175	37	2.7
DP-INT	478	204	29	3
GS	90	1310	34	4

- GS bull accounted for 34% of all inseminations
- Mean number of bulls/herd was 4 in line with recommendations

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Why such an uptake?

- Top two bulls (Oman and Ramos) had limited availability and were costly
- Pressure on milk price, cost of production – farmers were looking for excellent genetics at a good price

	Spring 2009		Spring 2008	
Proof	Mean EBI	Mean Rel	Mean EBI	Mean Rel
DP-IRL	120	86	109	75
GS	179	55	-	-
Mean	144	66	106	64

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Why such an uptake?

- Mean difference between DP-IRL and GS bulls was €59 (one standard deviation better)
- Competitive pricing of GS bulls – range from €15-€18 euro
- AI companies marketed teams of bulls (high fertility, high protein, easy calving etc)
- Discount offered for buying bulls in teams

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GEBVs vs. EBVs

- Test bulls from 2006 marketed as GS bulls in Spring 2009
- Received their first proofs based on daughter performance
- 35 bulls with ≥ 70% reliability for production

GEBVs vs. EBVs

	Correlation			Diff in mean		
	GEBV	DGV	PA	GEBV	DGV	PA
Milk (kg)	0.64	0.65	0.63	65	50	77
Fat(kg)	0.51	0.57	0.40	2	2	3
Prot(kg)	0.59	0.65	0.53	2	1.5	2.2

Currently, DGV appear to be best predictor, followed by GEBV and finally PA

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Enhancements for 2010

- Incorporation of MACE bulls in training population (~3500)
- Inclusion of high reliability cows and natural service sires
- Genomic Service will be offered to farmers interested in getting GEBV on their animals

Further research

- Across-breed genomic evaluations (beef)
- Imputation of SNPs
  - 3k → 50k → 800k
- QTL detection
  - Calving performance?
- Impact on Breeding programs

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Conclusions

- Implementation of genomic evaluations in Ireland has been very successful with very good uptake
- Majority of farmers followed advice on using multiple bulls
- Initial results are promising
- Incorporation of genomic information will lead to accelerated genetic gain in Ireland