Ireland's Beef Data and Genomics Program; A novel way of addressing GHG & Climate Challenges.

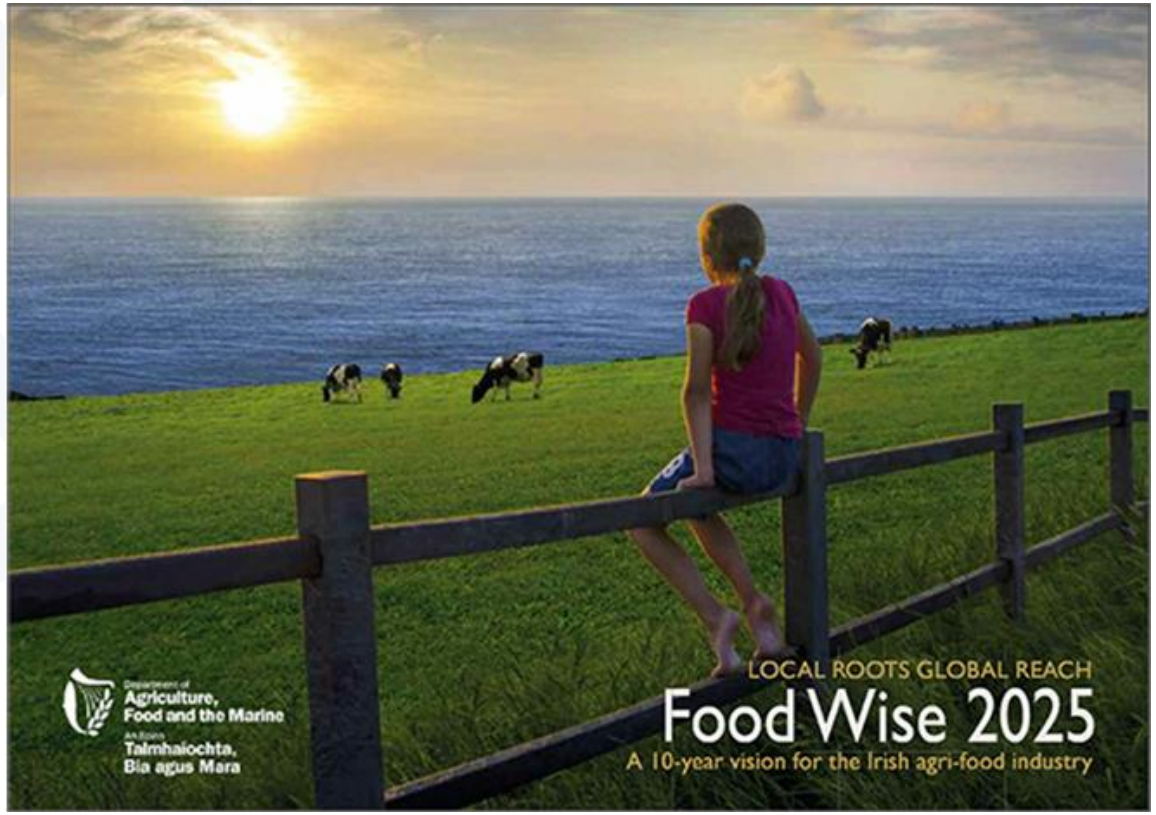
21 April 2021.

AgTech - it's in our DNA

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Irish Beef Data and Genomics Program.

- More profitable, sustainable & carbon efficient cows.
- €300m total funding 6 years (2015-2020), as part of RDP.
  - Farmers paid ~€90/cow/year to complete key actions, e.g., genotyping, data recording, replacing with 4/5 star cows & bulls.
  - ~24k farms & 550k cows. ~2.5m animals genotyped to-date.
- Supplemented with additional BEEP scheme in 2019 (BEEP-S).

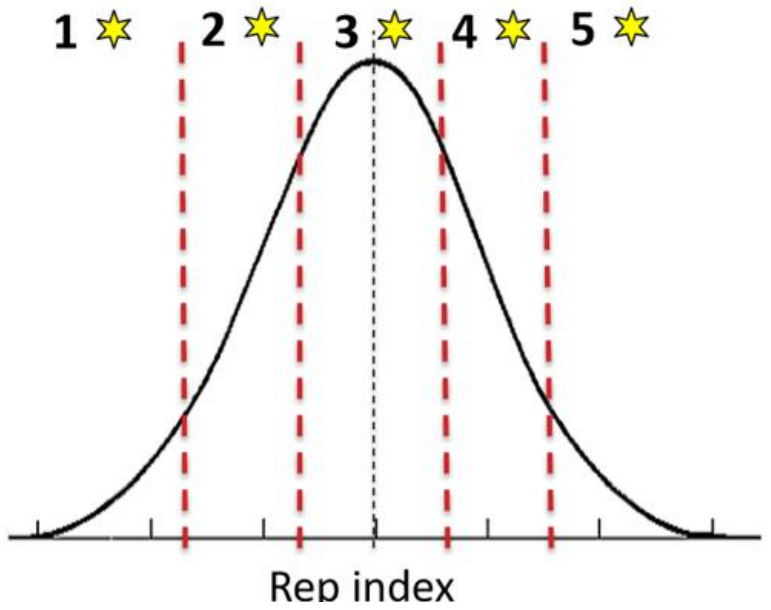


BDGP; Smart, green growth. Using the latest technology to help support an important indigenous industry.

Genetic Improvement within the Irish Suckler Beef Herd.

Euro-Star Replacement Index			
Trait	**Economic Weight (€ Unit)**	**Trait Emphasis**	**Trait Type**
Maternal Calving Difficulty	-4.98	6%	Cow Traits 71%
Age 1st Calving	-0.99	6%	
Calving Interval	-5.07	9%	
Survival	8.86	8%	
Milk	5.58	18%	
Heifer Intake	-0.76	8%	
Cow Intake	-0.55	6%	
Cow Docility	77.27	4%	
Cull Cow Weight	0.91	7%	
Calving Difficulty	-5.12	7%	Calf Traits 29%
Gestation	-2.48	2%	
Mortality	-5.87	1%	
Docility	14.72	1%	
Feed Intake	-0.07	4%	
Carcass Weight	2.1	10%	
Carcass Conformation	10.22	3%	
Carcass Fat	-5.44	1%	

- What do the star ratings mean?



- Past focus on terminal traits => deterioration of maternal traits.
- Replacement index introduced in 2014 to improve maternal traits & maintain terminal traits.

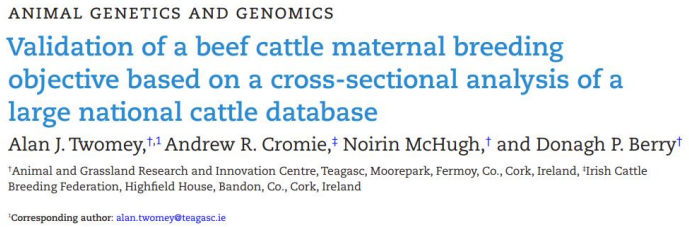
Validation; Selection on Rep Index.

Table 1. A validation comparison of suckler cows ranked on €uro-Star Replacement Index, based on key performance metrics*

Genetic Merit		Cow Traits						Calf Traits		Progeny Carcass Traits			
Group	Rep Index	Age 1st Calving Days	CI Days	Cow Lwt Kg	Surv %	Wean Wt kg	Wean Eff %	Birth Wt kg	Calv Assist %	Age at Slau Days	Carcass Wt Kg	Carc conf (1-15)	Carc fat (1-15)
Very low	€33	990	391	730	83	291.1	39.9%	44.7	0.15	745	389.4	8.29	8.15
Average	€92	986	390	702	85	292.0	41.6%	43.9	0.13	743	387.1	8.31	8.17
Very high	€153	977	389	702	87	294.8	42.0%	43.6	0.11	740	388.1	8.22	8.26

** Validation based on ¾ bred suckler cows born in 2012 & 2013, with subsequent cow and progeny performance data. All metrics corrected to equivalent performance for a 3rd parity cow (Twomey, 2020, in press).*

- Validation based on 92k commercial females, taking their evaluations at birth and establishing how well these evaluations predicted lifetime performance.
- Confident that index is taking us in the right direction; How can we go faster??



ANIMAL GENETICS AND GENOMICS

Validation of a beef cattle maternal breeding objective based on a cross-sectional analysis of a large national cattle database

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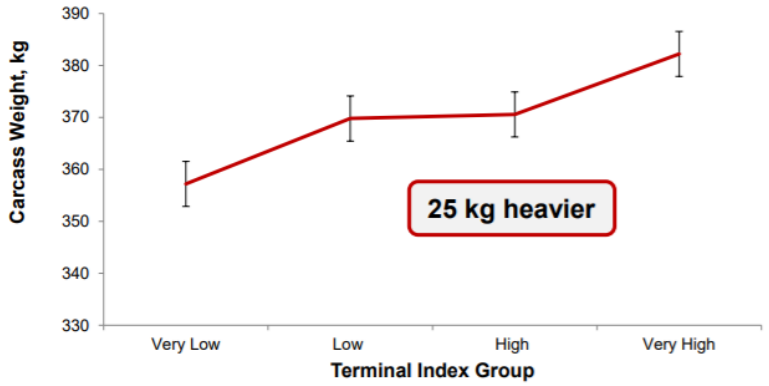
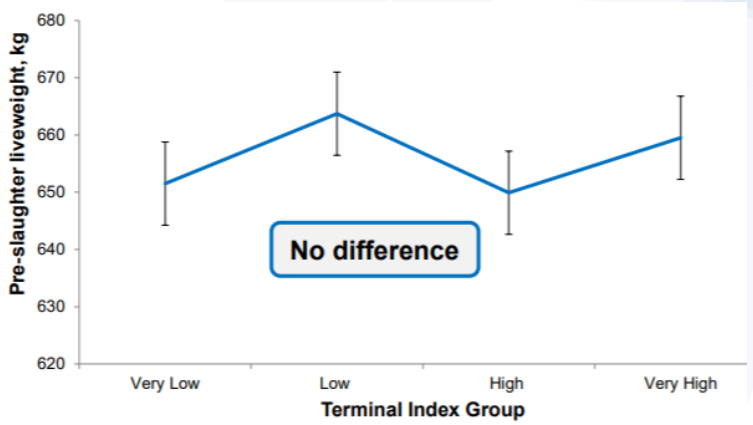
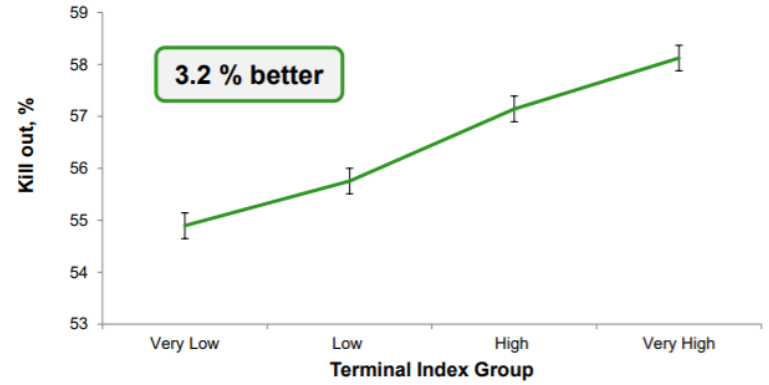
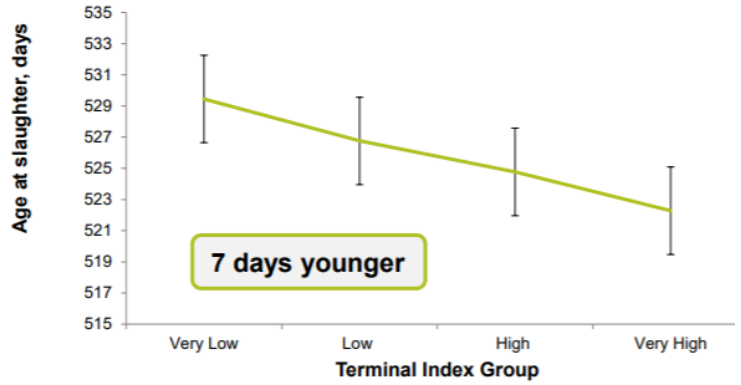
Validation; Selection on Terminal Index.









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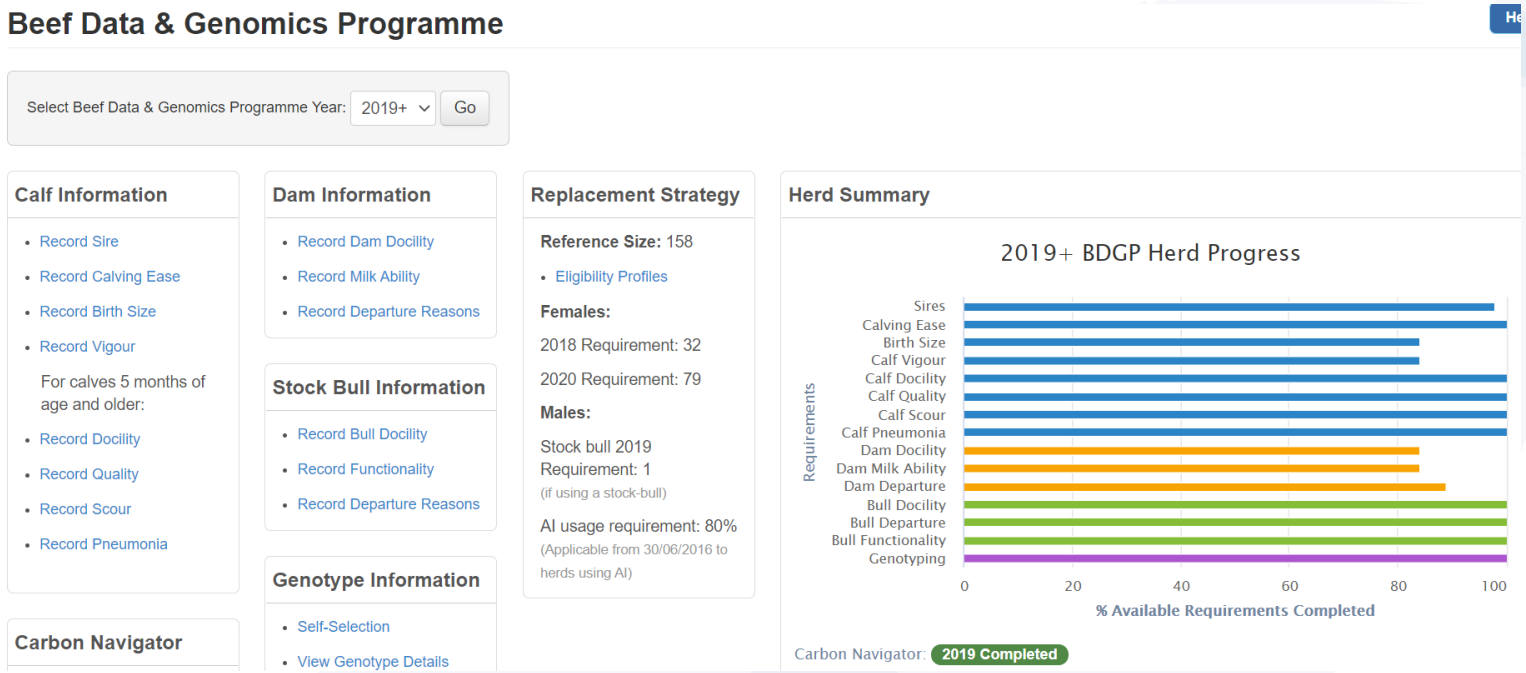
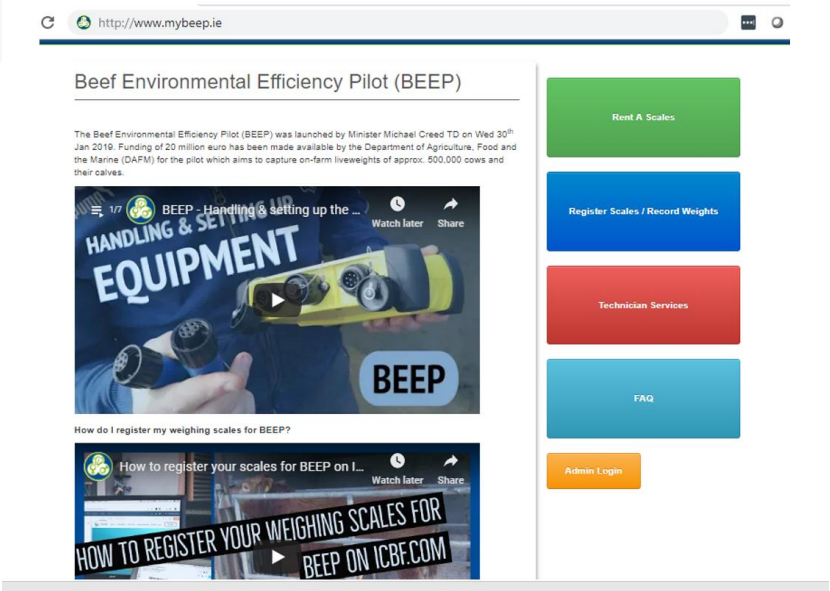
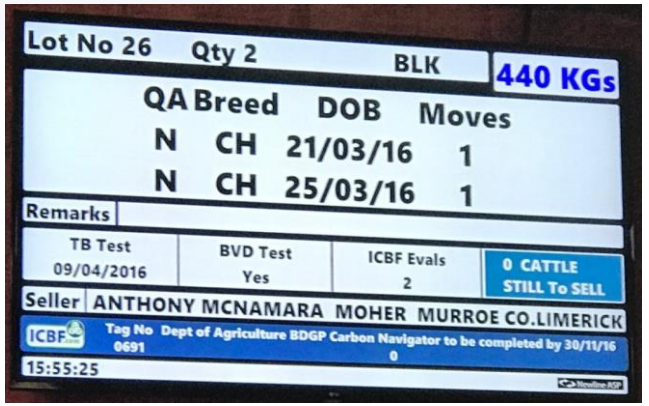
- Validation based on 92k commercial females, taking their evaluations at birth and establishing how well these evaluations predicted lifetime performance.
- Latest data from ICBF/Tully indicates that high genetic merit animals (on terminal index) are slaughtering + 25 kgs heavier at 7 days younger, in terms of days to slaughter (equivalent to ~1 month if slaughtered at same carcass weight).
- Confident that index is taking us in the right direction; How can we go faster?

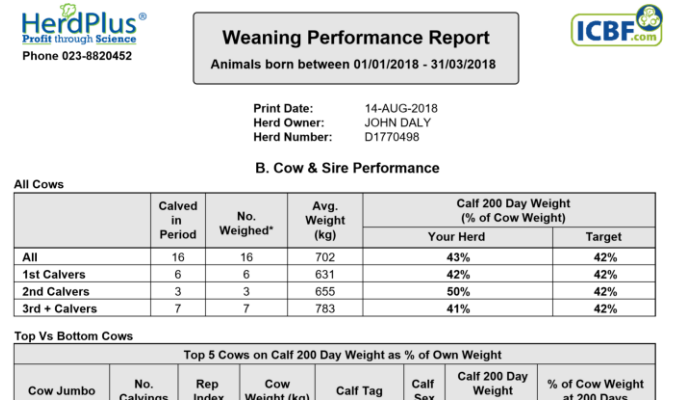
BDGP & BEEP-S; Implementation.





- Range of "enablers" introduced to support implementation of programs on the ground.
  - Includes systems to support action-based payments to program participants.
- Have the programs delivered?





IRISH FARMERS JOURNAL

BEEF DAIRY SHEEP AGRIBUSINESS MACHINERY TILLAGE PEDIGREE BUILDINGS

Farmer uproar over BDGP

Anger erupts at Claremorris farmer meeting

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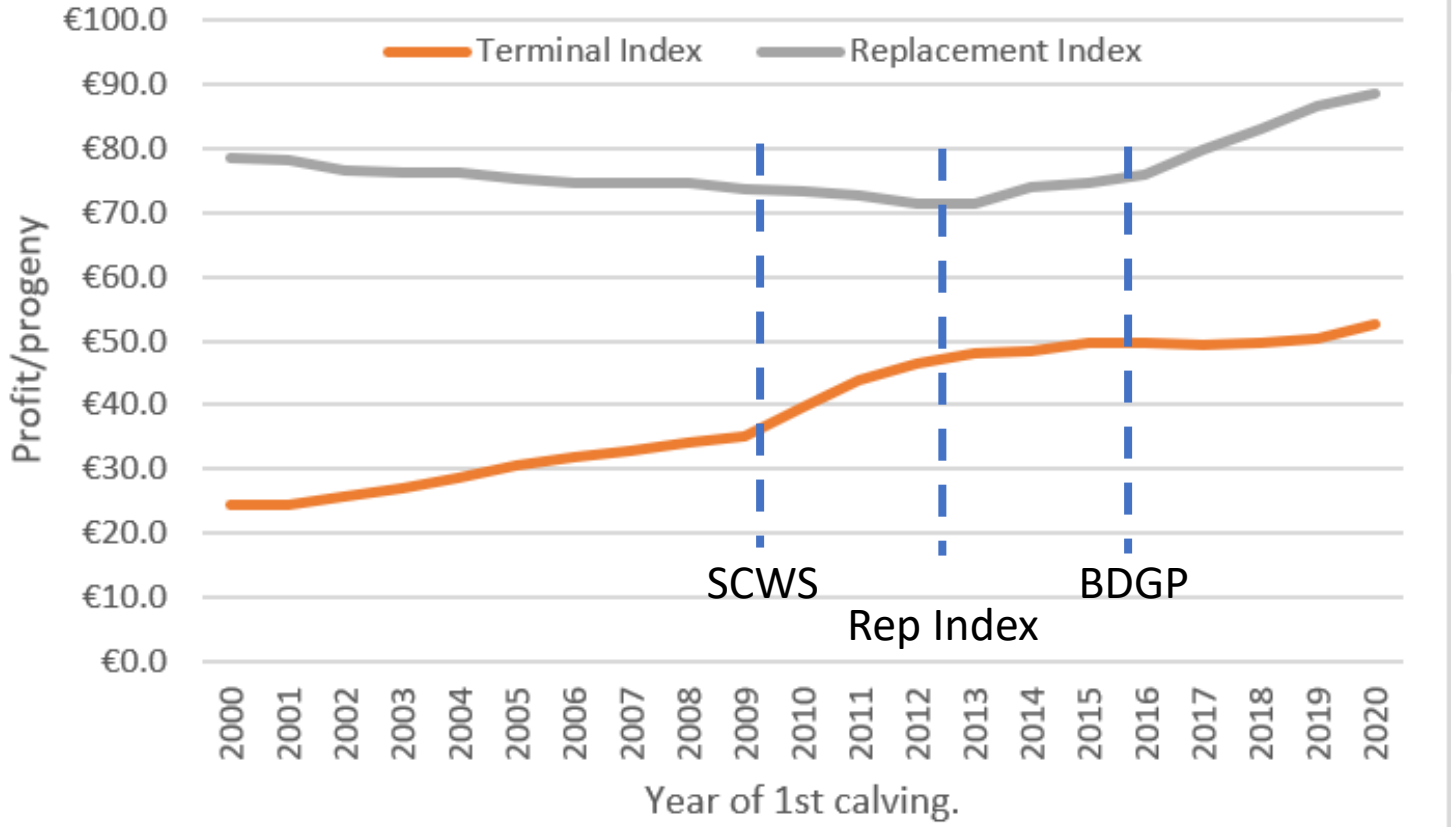
Brian Farrel

One thousand farmers left a meeting on Tuesday night frustrated and disappointed after Minister for Agriculture Simon Coveney announced that no changes

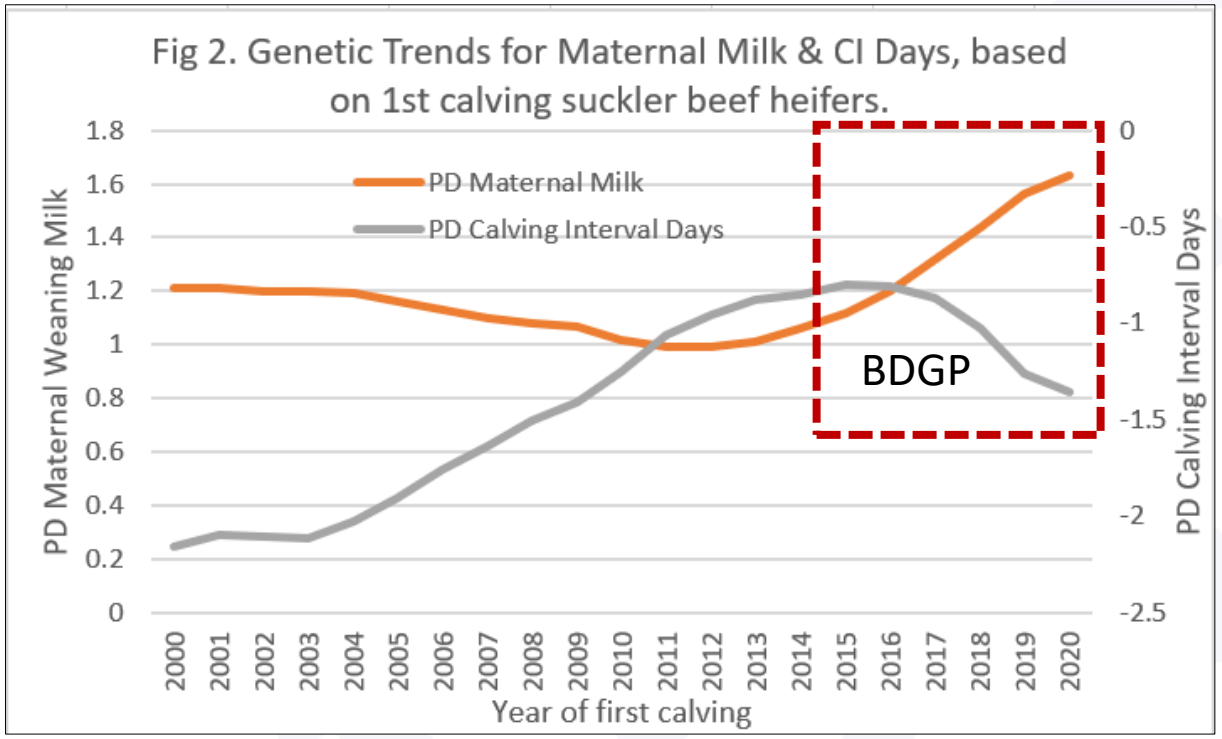
Genetic Trends within the Suckler Beef Herd (i).

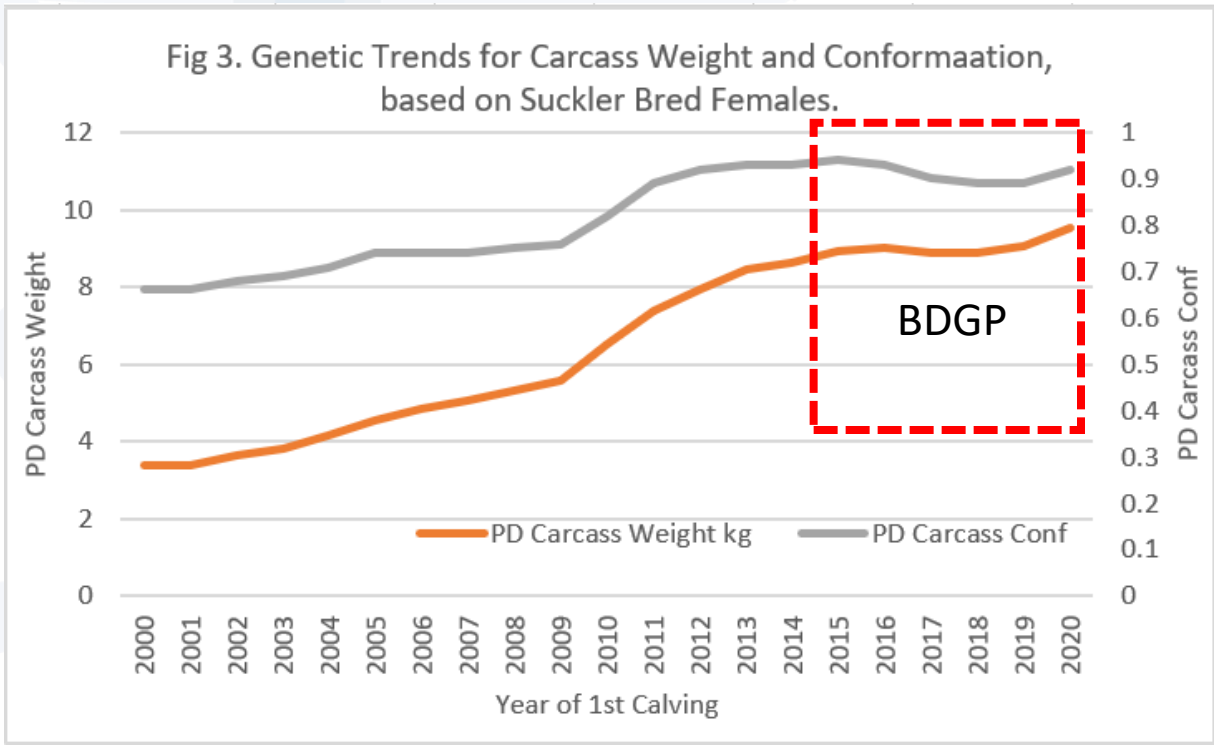
Fig 1. Genetic Trends for Replacement & Terminal Index, based on 1st Calving Suckler Beef Females.



- Genetic Improvement in the Suckler Beef Herd defined by three significant events;
  - 2007. Introduction of Suckler Cow Welfare Scheme (SCWS). Resulted in increased sire recording => more accurate evaluations & faster genetic gain for terminal traits.
  - 2011. Establishment o the Replacement Index (Rep Index) => Shifting emphasis away from terminal traits towards maternal traits.
  - 2015. Beef Data and Genomics Program (BDGP) =Utilizing genomics + better data recording to accelerate genetic gain for maternal traits.

Genetic Trends within the Suckler Beef Herd (ii).





- Impact of BDGP most pronounced => now accelerating gains in milk and fertility traits, whilst holding carcass weight and conformation traits constant.

Trends in Slaughter Performance.

T1. Trends in average performance of steers (<30 months), based on breed group (2010-2020).

	Beef*beef					Beef*Dairy					Dairy*Dairy				
Year	N	Cwt	Conf	Age	Gain/day	N	Cwt	Conf	Age	Gain/day	N	Cwt	Conf	Age	Gain/day
2010	157,559	361.2	8.00	794.8	0.45	98,664	322.9	5.94	804.5	0.40	70,598	308.5	4.25	791.6	0.39
2011	145,398	370.9	8.18	790.5	0.47	81,130	332.1	6.09	801	0.41	63,181	316.4	4.41	790.9	0.40
2012	130,767	376.0	8.20	782.2	0.48	74,404	336.3	6.02	795.3	0.42	57,050	318.7	4.38	767.9	0.42
2013	150,015	367.9	8.34	766.7	0.48	81,020	321.8	5.87	787.2	0.41	96,611	302.5	4.15	761.3	0.40
2014	160,931	369.5	8.19	800.4	0.46	94,697	328.6	5.85	801.1	0.41	113,444	311.9	4.12	793.1	0.39
2015	189,453	380.7	8.42	793.1	0.48	103,650	333.9	5.92	787.5	0.42	117,111	315.7	4.16	783	0.40
2016	197,856	380.8	8.32	790.0	0.48	130,759	334.3	5.76	784.6	0.43	112,091	316.9	4.06	780.7	0.41
2017	207,709	380.6	8.20	793.3	0.48	160,843	333.6	5.62	787.4	0.42	136,843	311.7	3.88	775.3	0.40
2018	178,599	379.4	8.23	794.2	0.48	161,794	326.9	5.48	780.8	0.42	133,207	307.9	3.79	775	0.40
2019	157,853	385.5	8.35	795.8	0.48	161,648	333.7	5.71	783.1	0.43	103,658	313.4	3.99	776.2	0.40
2020	202,958	389.5	8.40	791.9	0.49	192,116	337.9	5.66	785.7	0.43	118,129	318.9	3.99	782.4	0.41

- No decline in performance/efficiency of suckler beef herd. Significant increase in number of <30 month suckler bred steers now being slaughtered (+45k).

Trends in Maternal Performance.

Table 1. Impact of BDGP; Key maternal replacement stats across industry*

	2015	2016	2017	2018	2019	2020
Calves/cow/year	0.85	0.86	0.88	0.86	0.86	0.87
% calved at 22-26 mths	19.0%	22.0%	27.0%	25.0%	23.0%	25.0%
CI days	396	388	390	393	397	392

** Calving stats are based on the period 1 July to 30 June for each year (in line with calving pattern). For example, 2020 figures are based on 14,610 suckler beef herds with >=10 suckler beef calvings in the period 1 July 2019 to 30 June 2020.*

- Genetic trends for female fertility only started to move in the right direction in 2017/2018 (see slide 9 and figure 2).
- Effecting improvement in maternal traits will take time, i.e., these are more influenced by seasonality differences (e.g., weather, prices etc).
- Confident that with the turnaround in genetic trends, these maternal will continue to improve in the future. This will have a direct impact on the animal inventory, through having fewer older and unproductive animals, e.g., heifers calving at 30 months+ and/or cows with no calves in a given year.

Key performance & sustainability metrics.

T1. Impact of Herd Replacement Index on key performance & sustainability metrics*

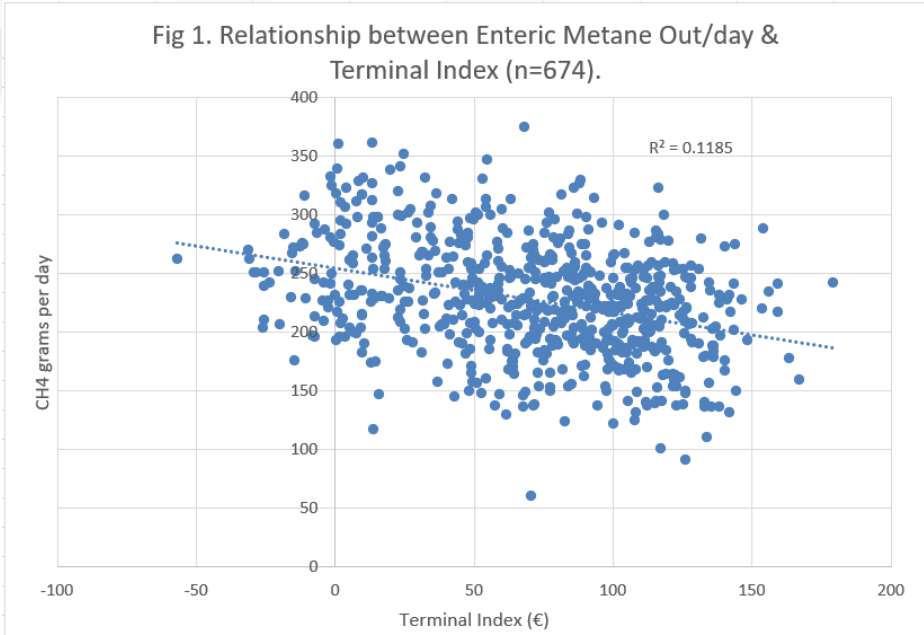
		Replacement Index €urostars					
Herd Average Trait	Source	SD	Btm 20%	Btm 21-40%	Average	Top 21-40%	Top 20%
Average Replacement Index	ICBF/BDGP		€42	€63	€80	€96	€122
Cow Liveweight (All parities; kg)	BEEP	56.0	688.8	669.5	664.3	655.5	651.6
Calf 200 day Liveweight (kg)	BEEP	34.8	279.7	280.1	284.9	286.3	287
Weaning Efficiency (%)	BEEP	5.5	40.8	42.0	43.0	43.9	44.3
Calving Interval (days)	ICBF	28.7	399.1	394.2	389.8	384.6	387.7
Calves/cow/year	ICBF	0.12	0.85	0.88	0.89	0.91	0.91
Profit/livestock unit	Teagasc		€207	€219	€238	€244	€262
Carbon Footprint (GHG/kg)	Bord Bia	1.82	13.16	12.97	12.82	12.42	11.91

David Kelly, PhD, Teagasc.

- Analysis based on 3,150 herds with valid carbon footprint, BEEP, and genetic merit data from 2020 for analysis

Direct measurement of Methane Output.

- To date, 674 animals have direct measurement of growth, feed intake & methane output/day from Tully. Clear breed & gender differences.
- Indexes are moving us in right direction => validation of BDGP.
- Also clear evidence of genetic variation in traits (15-20%), above what we can predict from biological models *(as part of DAFM funded GreenBreed project)*



T1. Animal performance, by breed & gender for key performance & climate metrics.

	Suckler Steer	Suckler Heifer	Suckler Young Bulls	Dairy Beef Steers	Dairy Steers
Records	206	245	90	92	*Under test*
Beef merit index (€/animal)	€167	€167	€175	€14	*Under test*
ADG (kg/day)	1.40	1.32	2.00	1.83	*Under test*
Carcass weight (kg)	362	310	393	342	*Under test*
Age at slaughter (mths)	18.9	16.7	16.3	21.2	*Under test*
Carcass daily gain (cwt/day)	0.63	0.61	0.79	0.53	*Under test*
Feed intake (DMI kg/day)	11.1	10.2	12.6	14.0	*Under test*
Methane output (g/day)	242	220	153	282	*Under test*

- Tully now the largest site globally measuring methane output in cattle.
- Can we expand on this and other sites?
  - Genetics, role of additives, indoor vs outdoors.
- Goal of having genomic predictions for methane traits by 2022. Accuracy will depend on number of phenotypes.

High Impact Traits; Age at Slaughter.

The voice of Ireland's farming industry

IRISH FARMERS JOURNAL

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IRISH COUNTRY LIVING

'Slash suckler herd' – climate report

HANNAH QUINN-MULLIGAN
NEWS CORRESPONDENT

Drastic measures to cut the Irish suckler herd by as much as 53% have been recommended by the Government's Climate Change Advisory Council.

It assessed three scenarios of cutting the suckler herd by 15%, 30% and 53% to reduce overall agricultural emissions.

Suckler cow reductions of between 304,000 and 536,000 are favoured by the chair of the council, Prof John Fitzgerald. This would mean a 30% or 53% cut to the current suckler herd.

Agriculture accounts for 32.1% of Ireland's greenhouse gas emissions, the highest of any sector.

The country will miss its 2030 target unless agriculture emissions are reduced.

Increasing forestry and adopting low-emission slurry spreading would not be enough to meet 2030 targets without reducing cattle numbers, Fitzgerald said.

The report recommends an "extensification" process be included in the next CAP.

Farmers would be guaranteed their full direct payment from CAP for reducing numbers, the report says.

It also suggests cutting the payments of more intensive farmers to pay suckler farmers who opt to reduce numbers.

"We're not trying to wipe out a sector," Fitzgerald told the *Irish Farmers Journal*. "What we're suggesting is a steady [herd] reduction over the next 12 years."

He also questioned future expansion for the dairy herd.

"We really need to stop expanding the dairy herd," Fitzgerald said.

"If there is any increase in the dairy herd then we need a bigger reduction in the suckler herd."

See pages 8-9

Tullamore Farm open day

Farm manager Shaun Diver and Irish Farmers Journal tillage editor Andy Doyle talk to a section of the 4,500-strong crowd at the Tullamore Farm beef and sheep open day in association with FBD Insurance on Wednesday. The sheep system was the shining light on the farm in 2018, delivering a net margin of €560/ha when ANC and ewe payments are included.

See more on page 3

Philip Doyle

T1. Overview of prime cattle killed from the National herd in 2020.

Gender	Num	%	Cwt	Age days	Age mths
Heifer	506,055	38.4%	317	796	26.2
Steers	679,199	51.5%	358	848	27.9
Young Bulls	134,074	10.2%	378	592	19.5
Overall	**1,319,328**	**100.0%**	**345**	**802**	**26.4**

T2. Impact of reducing age at slaughter on GHG output. Expressed per 1 month reduction.

Potential reduction in age at slaughter from genetic/systems.	**30**
CH4/day (kg/day at Tully based on GreenFeed machines)	0.25
Convert to CH4 to GHG/CO2 eq (factor is 25)	6.25
GHG (CO2 equivs) saved per animal, expressed in tonnes/month	0.1875
GHG (CO2 equivs) saved per animal, across all prime beef cattle (tonnes/month)	**247,374**

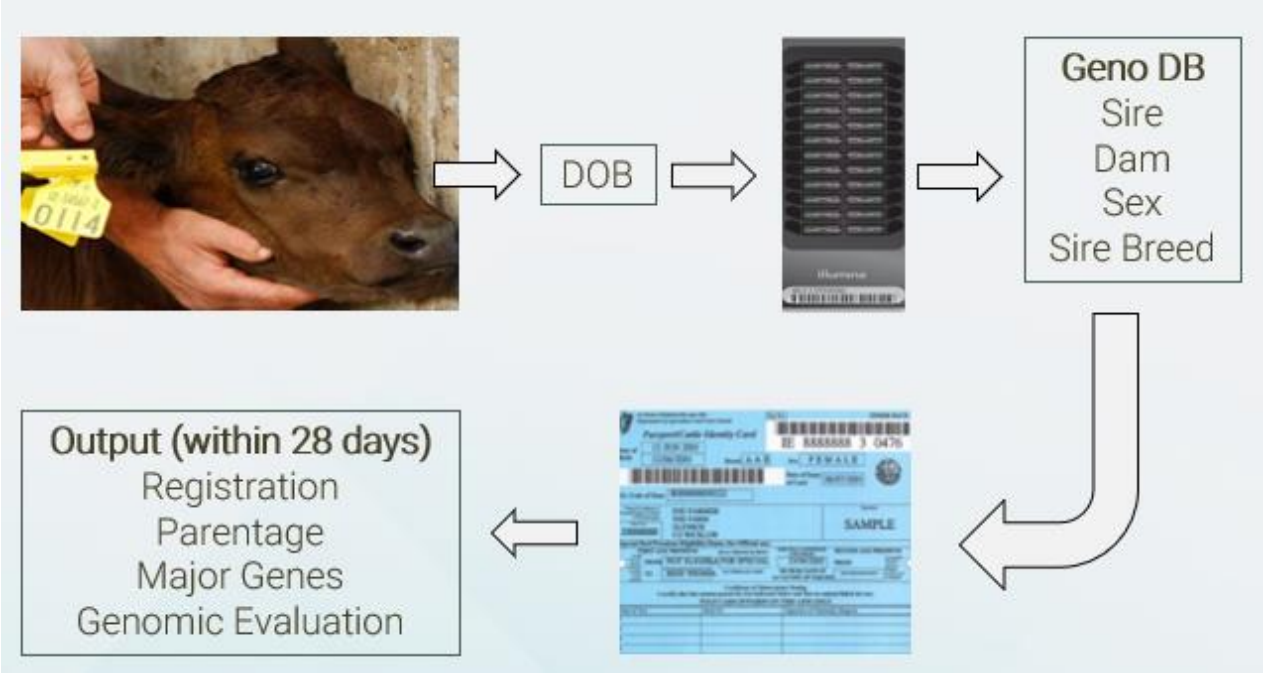
T3. Impact of reducing age at slaughter on GHG output, expressed in cow numbers, per 1 month reduction.

Current herd - Count cows (dairy & beef).	2,500,000
GHG output per cow (expressed/tonne/year)*	2.55
Total GHG (CO2 equivs) national cow herd	6,375,000
One month reduction in slaughter age in cow eqiuvalents (%)	3.88%
Expressed as a % of National Cow Herd	**97,009**

** Blended figure of 2.55 tonnes/cow/year, based on dairy and beef cow figures (as per EPA, 2020).*

- Taking current prime cattle kill (of 1.32m cattle in 2020), each 1 month reduction in age at slaughter, has potential to remove 247 KT of GHG. Equivalent to NOT having to cull 97k cows from the National herd.
- A very positive outcome for farmers and industry => can we get alignment around this as a proposition?

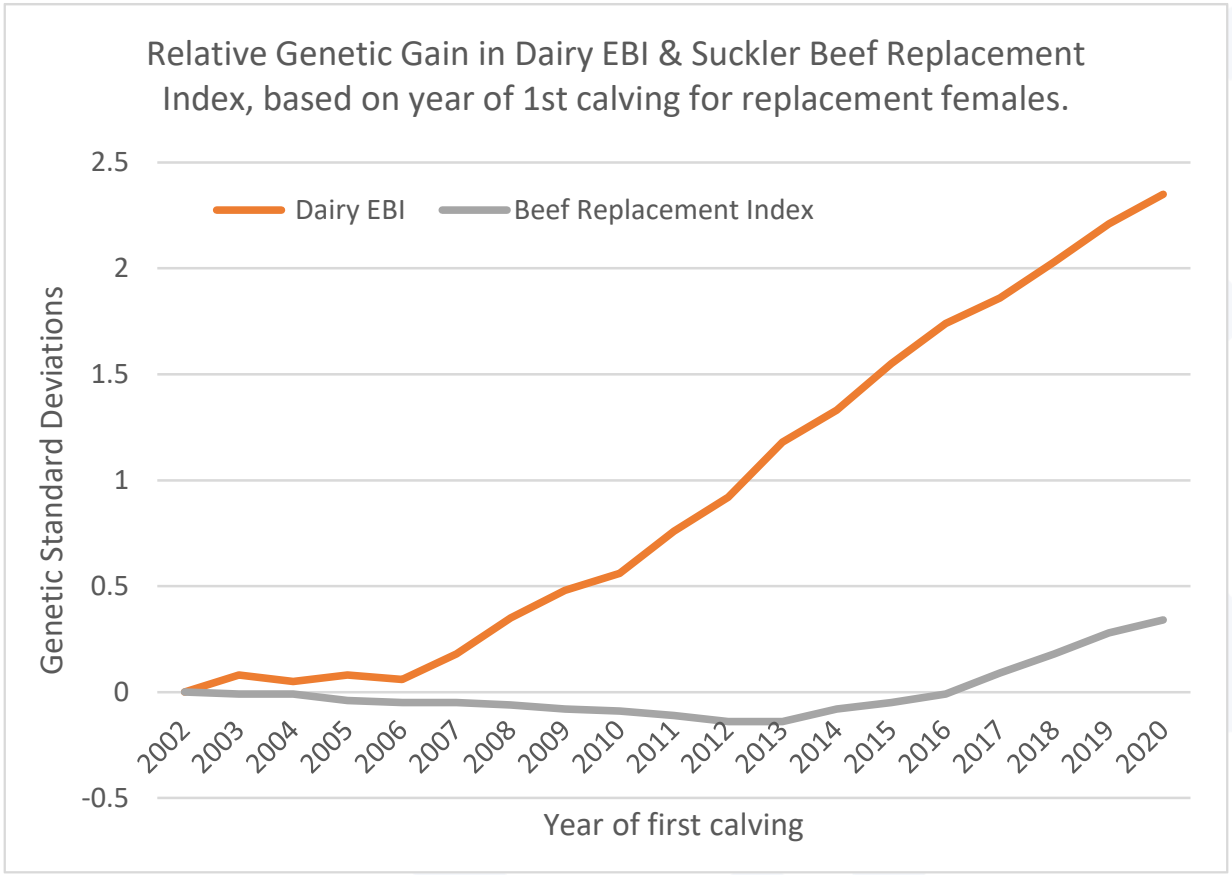
High Impact Strategies; DNA every Calf.



- Opportunity to be world leaders in the use of science & technology to help support an important indigenous industry.

- Current pilot project with DAFM and 400 herds, where cow herd is fully genotyped and then registering resultant calves at birth based on DNA.
  - Farmer tags calf and submits DNA (from tissue tag), database works out parents!
- Cost of genotyping is €20 & decreasing.
- Can we transition our National cattle herd to DNA based calf registration over next 5 years?
- A key part of AgClimatise strategy.
- Real benefits associated with genetic gain, traceability, labour saving, R&D, market point of difference (world first) etc.
- How do we ensure an equitable approach to cost and benefit sharing? A single approach or across many different programs, e.g., BDGP?

BDGP; Challenges and opportunities.



- As a result of BDGP, we are in a very strong position re: continued investment in suckler beef programs for the future.

- One of the initial objectives of BDGP was to "mimic" the genetic gain achieved in dairy, into suckler beef.
- A massive undertaking given; (i) low levels AI, (ii) many breeds, (iii) small herd size, (iv) low profitability, (v) part time farming……
- Goal of using genomics as a new technology to help kick start change.
- Program has been hugely successful in achieving this. Rates of gain have turned around in beef and are akin to dairy.
- Also, clear evidence that increases in genetic merit will result in greater sustainability and carbon efficiency for the industry.
- How do we now build on this momentum and help accelerate gains in GHG traits in the future => genotyping, align BEEP, 2 year calving?, faster gain?, carbon audit? additional KT….?