

Many Definitions of Efficiency...

- ▶ How does one define efficiency?
 - Feed efficiency?
 - Reproductive efficiency?
 - Economic efficiency?
- ▶ Reproductive Efficiency
 - Stayability / Longevity
- ▶ Feed Efficiency
 - Mature Cow Maintenance Energy / Feed Intake

Reproductive Efficiency

» Stayability

Stayability

- ▶ Stayability Defined
 - Probability of surviving to a specific age given the opportunity to reach that age.
- ▶ Initial Impetus
 - Cows need to remain in production to generate enough revenue to offset the costs of development and maintenance.
 - 5 calves → 6 years of age
- Herd profitability
 - Cows remaining past their break even age must compensate for those culled.
 - 53 – 77% of the value of maternal indexes

What is needed for a useful EPD?

- ▶ Can useable data be found / collected?
- ▶ Appropriate evaluation methods
- ▶ Heritable
- ▶ Variation
- ▶ Economically Relevant

Evaluation of Stayability

- ▶ Data collection
 - Relatively easy
 - Collection of calf information
- ▶ Contemporary grouping
 - Breeder of the cow
 - Breeder of each calf
- ▶ Observations – 0 vs 1
 - Threshold model
 - Resulting predictions are expressed as a probability
- ▶ Sire A, EPD of 0 vs Sire B, EPD of 10
- ▶ $h^2 = 0.12$

Simulation

Base Herd			Gelbvieh		
retention=	0.795	Wtd. Age	retention=	0.85	Wtd. Age
2	100.00	200.00	2	100.00	200.00
3	79.50	238.50	3	85.00	255.00
4	63.20	Stay	4	72.25	Stay
5	50.25	0.50	5	61.41	0.61
6	39.95	239.67	6	52.20	313.20
7	31.76	222.30	7	44.37	310.59
8	25.25	201.97	8	37.71	301.72
9	20.07	180.64	9	32.06	288.52
10	15.96	159.56	10	27.25	272.49
11	12.69	139.54	11	23.16	254.78
12	10.08	121.02	12	19.69	236.25
13	8.02	104.23	13	16.73	217.55
14	6.37	89.23	14	14.22	199.14
15	5.07	76.01	15	12.09	181.36
		LF			LF
		5.29			6.06

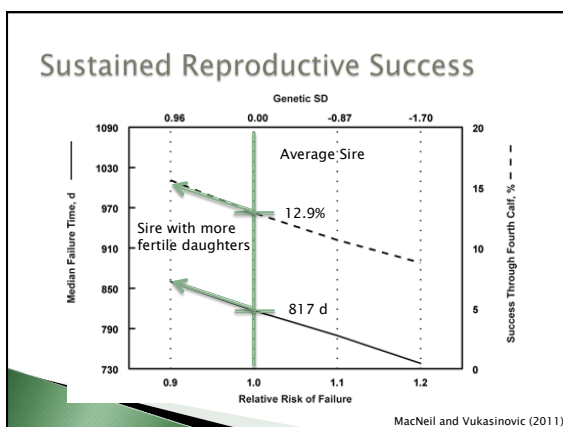
Increase of 0.77 years

Reproductive Efficiency

» Sustained Reproductive Success

- ### Sustained Reproductive Success
- Reproductive success correlates to longevity
 - Longevity drives production efficiency
 - More mature cows → Income is increased
 - More mature cows → Expenses reduced
 - Similar to stayability
 - Prototype evaluation was developed for the Hereford breed (MacNeil and Vukasinovic, 2011)
 - Survival Analysis was used.

- ### Survival Analysis
- Used to examine length of time an individual survives, or until a part failure
 - Traditional evaluation of longevity has issues
 - Expression late in life
 - Censoring
 - Non-normality of data
 - Survival analyses
 - Allow for censored records
 - Allow for dynamic CG
 - Allow for partial observations
 - Have problems with an animal model.



Feed Efficiency

» Mature Cow Maintenance Energy

Why Maintenance Energy?

- ▶ The amount of metabolizable energy required for maintenance referred to as Metabolizable Energy for Maintenance (ME_m)
 - Point of zero energy balance for net energy gain or loss
- ▶ Mature cow maintenance requirements account for 70% of total ME requirements (NRC, 1996)
 - 35% of a growing animal's energy expenditure
 - 65% for whole herd

Making a Genetic Prediction

- ▶ NRC, 1996 presents an equation to calculate the net energy for maintenance
 - They account for the base requirement, and then adjust for differences between animals
 - Below is the base maintenance energy equation presented in the NRC guidelines

$$NE_m = a_1 (BW^{.75})$$

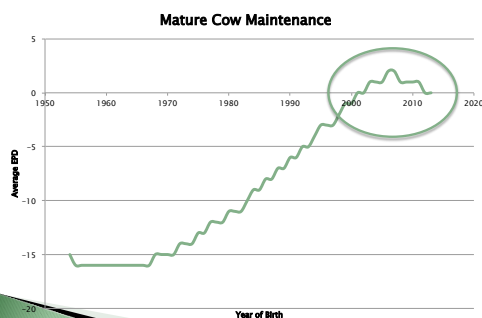
Maintenance Energy Prediction

- ▶ Mature Weight Genetic Prediction
 - Analyzed as metabolic body weight (MWT^{0.75}; pre-adjusted to body condition score 5)
 - Random Regression of weight on age
 - Intercept and Linear solutions for age
 - Age groups 205d WW, 1, 2, 3, 4, 5, 6, 7-9
 - Best Linear Unbiased Prediction (BLUP)
 - 5 year h² = 0.65
- ▶ Index Mature Weight and Milk EPDs
- ▶ Expressed in MCAL / Month

Genetic Trend



Genetic Trend



In Conclusion

- ▶ Three different "Efficiency" predictions
 - Two of which are currently being used at the breed association level.
- ▶ Economically Relevant
- ▶ Data relatively easily collected
- ▶ Heritable
- ▶ Variation among resulting EPD

