Are There Sacrifices in the Chase for Carcass Merit?

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Overview

- Industry targets:
  - How much marbling is needed?
- Additive genetic relationships between traits
- Single trait selection, multi-trait response
- Value assessment: changes in net merit
- Other trade-offs: Heterosis

Question 1

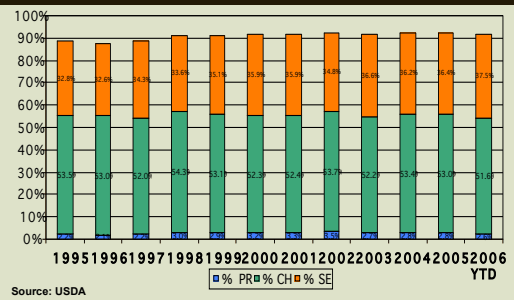
What is the average marbling score required for a pen of cattle to grade 80% Choice and Prime?

A. Small 20
B. Moderate 00
C. Small 66
D. Modest 25

Carcass Merit Selection Motivators

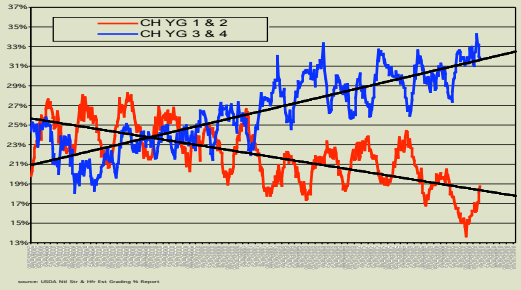
- Value Based Marketing Systems
  - Especially those that significantly reward USDA Quality Grade
  - Individually price beef carcasses on:
    - Yield Grade, Quality Grade, Conformance
- National Beef Quality Audit
  - Top 10 Challenges:
    - inappropriate carcass size and weight, inadequate tenderness, excess external fat cover, insufficient marbling and inappropriate USDA Quality Grade mix.

USDA % Grade

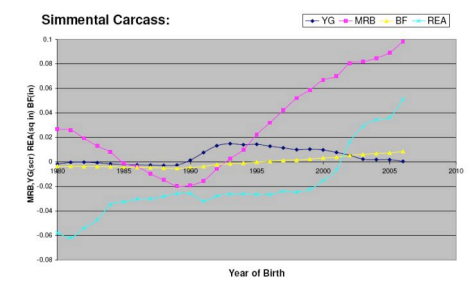


Source: USDA

USDA Choice and Yield Grade



Genetic Trends for Carcass Traits--Simmental



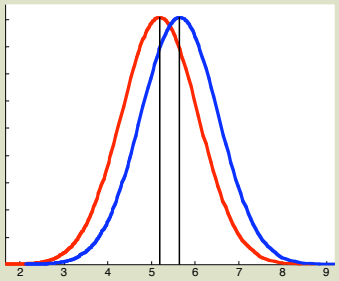
Marbling Required to Achieve % USDA Choice and Higher

% Choice and Higher	Pen Average Marb Score	Needed Increase in Genetic Merit	Genetic Std Dev Required to Achieve Increase	Incremental Genetic Std Dev	Incremental Genetic Merit
50	5.00	--	--	--	
60	5.20	0.20	0.38	0.38	0.20
70	5.41	0.41	0.78	0.40	0.21
80	5.65	0.65	1.25	0.47	0.25
90	5.99	0.99	1.91	0.66	0.34

5.00 = Small 00; 6.00 = Modest 00

σ_P = 0.88; σ_A = 0.52; h^2 = 0.35

Increase USDA Choice and Higher from 60-80%



- 60% Choice and Higher: Average Marbling Score Small 19
- 80% Choice and Higher: Average Marbling Score Small 65

Question 2

Are there large antagonisms between carcass traits and other economically important production traits (e.g. reproduction and growth)?

YES

NO

Genetic Correlations EPDs

	STAY	BWT	CE(d)	CE(m)	WW(d)	WW(m)	YW	YG	MRB
STAY	1.00	-0.10	0.20	0.40	0.00	-0.10	0.00	-0.10	-0.20
BWT		1.00	-0.41	0.14	0.50	-0.15	0.47	-0.05	0.00
CE(d)			1.00	0.35	-0.15	-0.15	-0.10	-0.05	0.05
CE(m)				1.00	0.25	-0.05	0.30	-0.05	-0.05
WW(d)					1.00	-0.32	0.89	-0.20	-0.15
WW(m)						1.00	-0.21	0.00	0.10
YW							1.00	-0.25	-0.20
YG								1.00	0.20
MRB									1.00

Genetic Correlations Selection Criteria & Breeding Obj.

	MWT	MLK	FERT	SURV	WWd	ADG	FI	DP	YG	MRB
STAY	-0.25	-0.10	1.00	0.50	0.00	0.00	0.00	0.00	-0.10	-0.20
BWT	0.61	-0.15	-0.10	-0.50	0.49	0.32	0.65	-0.15	-0.05	0.00
CE(d)	-0.20	-0.15	0.20	0.75	-0.15	-0.20	-0.10	0.00	-0.05	0.05
CE(m)	0.20	-0.05	0.40	0.65	0.25	0.20	0.10	0.00	-0.05	-0.05
WW(d)	0.65	-0.32	0.00	0.00	1.00	0.51	0.67	0.22	-0.20	-0.15
WW(m)	-0.10	1.00	-0.10	0.00	-0.30	-0.02	0.10	0.00	0.00	0.10
YW	0.65	-0.21	0.00	0.00	0.90	0.84	0.78	0.18	-0.25	-0.20
YG	-0.25	0.00	-0.15	0.00	-0.20	-0.10	-0.25	0.10	1.00	0.20
MRB	-0.25	0.10	-0.20	0.00	-0.15	0.10	0.10	0.16	0.20	1.00

Question 3:

Improving average marbling score via selection from 60 % to 80 % Choice and Higher results in how much change in net merit value ($) due to correlated changes in other traits and marbling?

A. Zero change
B. Increases net merit Zero to $20
C. Increases net merit $50-75
D. Increases net merit > $100

Predicted Response via Multiple Genetic Regression

Predicted response in traits in BO given selection for increased marbling in SC via genetic regression

MWT	WW(m)	FERT	SURV	WW(d)	ADG	FI	DP	YG	MRB	% Choice
-54.02	0.99	1.34	2.01	1.00	0.15	0.38	0.70	1.00	1.00	50
-55.40	0.99	1.35	2.03	1.00	0.15	0.40	0.72	1.00	1.04	60
-56.88	0.99	1.36	2.06	1.00	0.16	0.41	0.73	1.00	1.08	70
-58.60	0.99	1.37	2.09	1.00	0.16	0.43	0.75	1.00	1.13	80
-61.00	0.99	1.38	2.13	1.00	0.17	0.46	0.78	1.00	1.20	90

Predicted response in traits in SC given selection for increased marbling in SC via genetic regression

STAY	BWT	CE(d)	CE(m)	WW(d)	WW(m)	YW	YG	MRB	% Choice
-7.77	0.23	0.66	-2.36	-24.92	5.47	-51.97	1.15	1.00	50
-7.99	0.23	0.71	-2.42	-25.29	5.65	-52.75	1.16	1.04	60
-8.22	0.23	0.78	-2.49	-25.69	5.84	-53.58	1.16	1.08	70
-8.48	0.23	0.85	-2.56	-26.15	6.07	-54.56	1.17	1.13	80
-8.85	0.23	0.95	-2.66	-26.79	6.38	-55.92	1.18	1.20	90

Changes in Net Merit ($)

% Choice and Higher	Increase in Marbling Level	Change in Net Merit API 2006	Change in Net Merit API 2007
50	0.000	$0.00	$0.00
60	0.196	$0.98	$8.63
70	0.406	$1.05	$9.25
80	0.652	$1.23	$10.81
90	0.992	$1.71	$15.01
50-90	***0.992***	***$4.98***	***$43.70***

Assumptions

- Not traditional correlated response to selection
- Results not scaled by:
  - Accuracy of prediction
  - Selection intensity
  - Generation interval
- Genetic responses are fully expressed in phenotypes

The $64K Question?

- Do the benefits of selection for carcass traits within breed (straight-breeding) outweigh the heterosis improvements of lowly heritable traits (especially maternal) via crossbreeding?
- Give away $100 to make $50?
- Selection should be for **BOTH** additive and non-additive genetic merit.

The Dollars of Heterosis

100 cows, 80% Weaning Rate, 575 avg. weaning weight, 10 year horizon

Calf Survival to Weaning (6%) = 60 hd.
Weaning wt. (4%) = +19,780 lb.

Weaning wt. per cow exposed (23%)=**+105,800 lb.**
~ 18 calves/year
~ heterosis is worth $100/cow/year

How much heterosis is lost?

Generation	Breed A Fraction	Breed B Fraction	Individual Heterosis
1	1/2	1/2	100%
2	3/4	1/4	50%
3	7/8	1/8	25%
4	15/16	1/16	12.5%
5	31/32	1/32	6.25%

What I've not told you so far….

- Concentration of selection pressure on a few traits results in correlated responses in measured and un-measured traits
  - *Average response*
- Correlated responses can be countered by including traits in selection criteria or breeding objective.

Acknowledgements

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