COW–CALF
Management School

BREEDING AND GENETICS

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Genetic Strategies

- Bulls (Selection)
  - Effectiveness a function of variation, heritability, and accuracy
  - Choice of breeds and individuals to increase the frequency of desired genes

- Crossbreeding (hybridization)
  - Added vigor over expected from additive genetics
  - A function of mating diversity and heritability

Sire Selection

- Choice of breed and individual breeding bulls
- Greatest opportunity for genetic improvement, produce many progeny
- Low intensity and accuracy of selection with replacement heifers and cull cows
- In herds retaining heifers, 87.5% of genetic makeup due last three sires

Selection Basics

- P variation = $ variation
- P = G + E %G = heritability
- G = ½ Gsire + ½ Gdam
- GBVsire = 8, GBVdam = 6, Avg Prog = 7

Breed-Cross Means for Marbling, Growth Rate & Mature Size, & Milk Production

Breed Group	Marbling*	Growth Rate & Mature Size**	Milk Production**
Jersey X	13.2	X	XXXXX
Her/Ang X	11.3	XXX	XX
Charolais X	10.3	XXXXX	X
Maine Anjou X	10.1	XXXX	XXX
Simmental X	9.9	XXXXX	XXXX
Gelbvieh X	9.6	XXXX	XXXX
Limousin X	9.0	XXX	X
Chianina X	8.3	XXXXX	X

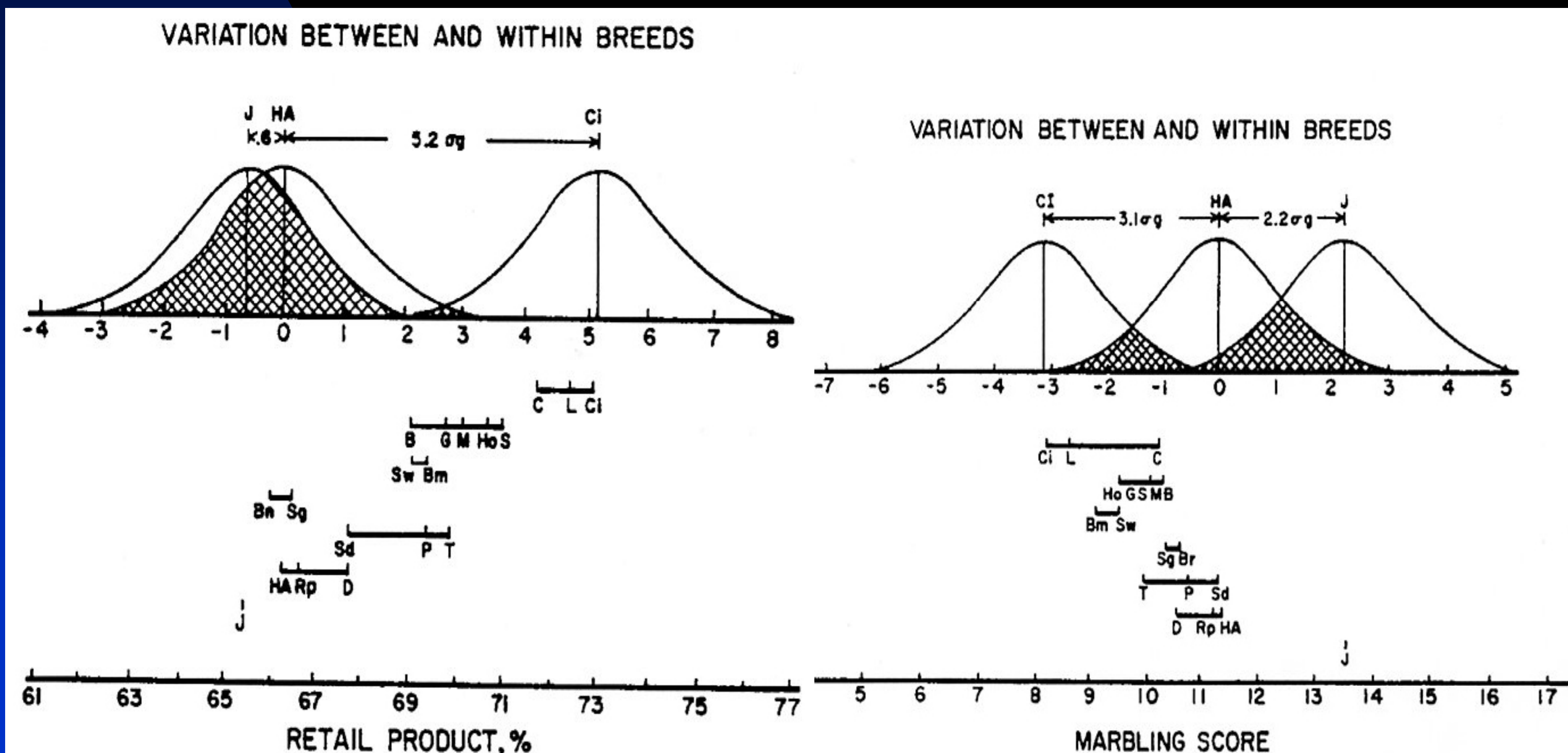
*Marbling: 8 = Slight, 11= Small, 14 = Modest

** Number of X’s represent the magnitude of trait expression

Cundiff et at. MARC, 1998

Variation Between and Within Breeds

breed populations differ widely in traits of economic importance



Recent MARC Breed Data

breed differences for growth are narrowing

Breed	BW	WW	Car Wt	% CH	YG
RAng	85	526	839	96	3.8
Ang	84	533	846	93	3.3
Sim	92	553	854	61	2.9
Char	94	540	843	75	2.8
Lim	89	519	815	44	2.6
Her	90	524	832	79	3.4
Gelb	89	534	826	63	2.9

Estimates of Heritability

• Calving interval	.08
• Fertility	.10
• Birth weight	.45
• Weaning weight	.24
• Feedlot gain	.34
• Slaughter weight	.46
• Feed efficiency	.45
• Weaning height	.82
• Quality grade	.50
• Yield grade	.60
• Fat thickness	.45

Table 1. Heritability estimates for type traits in Simmental cattle (Kirschten, 2002b).

Trait	Heritability	Trait	Heritability
Stature (height)	0.60	Rear legs (hock set)	0.12
Body length	0.39	Foot/pastern angle	0.13
Muscling	0.42	Udder attachment	0.23
Capacity	0.44	Udder depth	0.35
Femininity	0.32	Teat size	0.39

Trait Correlations (0=no relationship)

• Calving Ease – Birth Weight	-0.74
• Birth Weight – Weaning Weight	+0.50
• Weaning Weight – Yearling Weight	+0.81
• Yearling Weight – Mature Weight	+0.59
• Carcass Weight – Yearling Weight	+0.91
• Cutability – Yearling Weight	+0.87
• Ribeye Area - Cutability	+0.45
• Ribeye Area - Marbling	-0.21
• Marbling – Shear Force	-0.31
• Puberty Age – Retail Product	+0.30
• Services/Conception – Retail Product	+0.28

Antagonistic Situations

- Small easy calving cows with low feed needs vs
- Heavy calves from high growth and milk

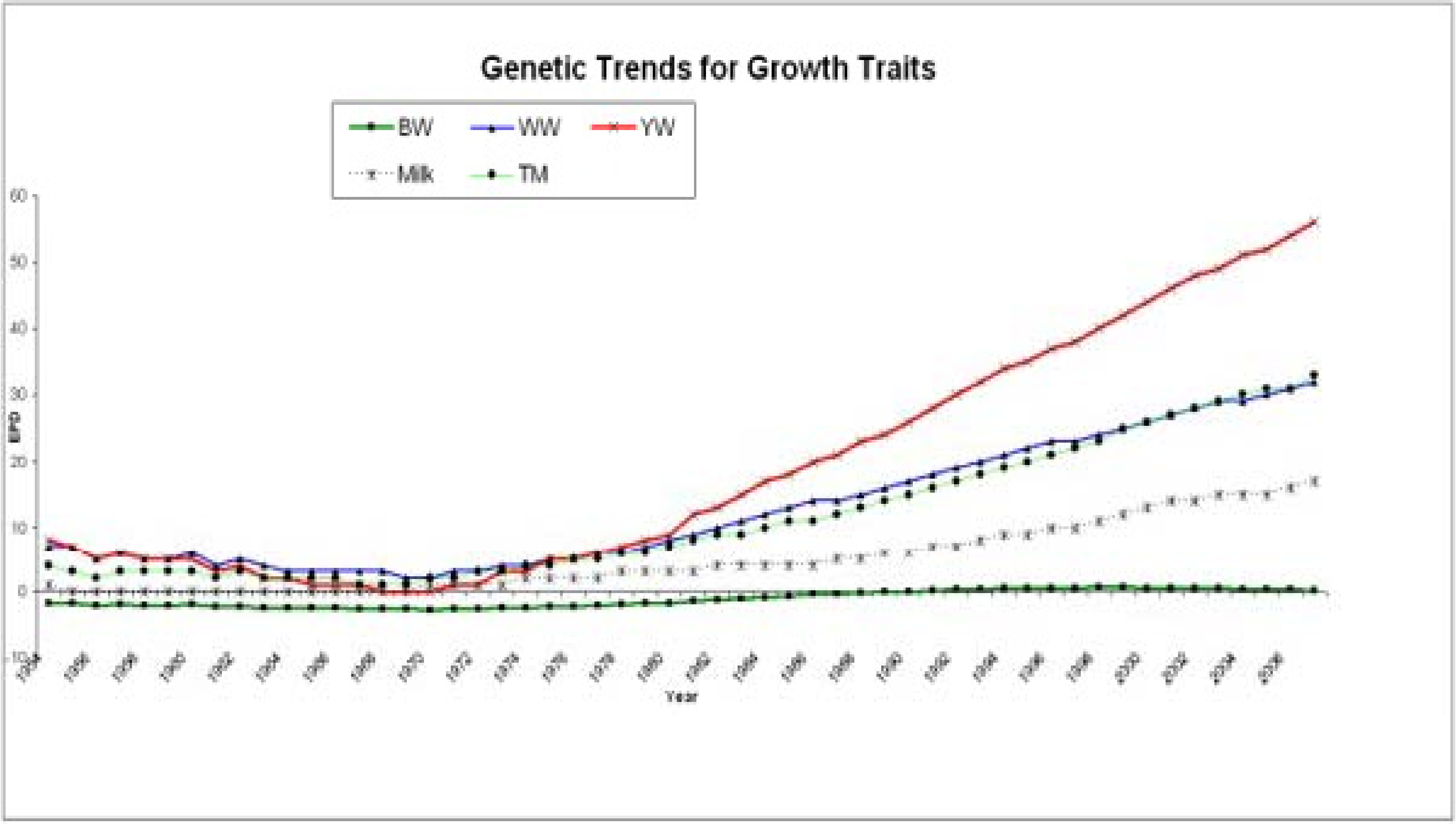
- Early puberty, good fleshing ability, and ability to store fat vs
- Carcass leanness and efficient feedlot growth

- Carcass grading high percent choice vs
- Carcass cutability and retail product yield

Dealing with Antagonisms

- “middle of the road”
  - Best multi trait compromise
- “curve benders”
  - Unique proven individuals
- “specialization”
  - Maternal and terminal differences
  - Breed combinations
- “offset by inputs or markets”
  - Cheap feed/labor, premium niche market

Selection is highly effective for many traits



Setting Breeding Objectives

- Economic Traits
  - Pregnancy rate
  - Calving ease
  - Weaning weight
  - Longevity
  - Cow feed requirement
  - Feed efficiency
  - Feedlot gain/ days to finish
  - Carcass weight
  - Carcass grade
  - Temperament/tenderness

- Situation
  - Breeding cows or heifers
  - Retaining replacements
  - Market (wean,background,finish)
  - Labor, facility, feed resources

- Herd Benchmarks
  - Pregnancy rate/calving distribution
  - % assisted calving/death loss
  - Culling rate
  - Calf sale weight
  - Cow weight/feed cost
  - Biological type of older cows
  - Previous EPD relationships
  - Relative sale price of calves
  - Feedlot gain/COG
  - Carcass weight/grade

- Establish Priorities
  - Evaluate strengths/weakness
  - Define genetic targets

Body Size

- Larger animals need and eat more
  - Stocking rate changes
- Weights are correlated at all stages
  - Larger animals tend to gain faster
- Differences in efficiency are small
  - If fed to same grade and fatness
  - If adequate feed for reproduction
- Packers prefer carcasses 650 to 950 lbs
  - Frame score 4 to 7

Milk Level

- Higher milk requires more nutrients

  High milk increases weaning weight

  High productivity means higher maintenance

- High milking cows need better feed
  - 1200 lb low milk cow
    26 lbs 54 TDN 9 CP
  - 1200 lb high milk cow
    29 lbs 60 TDN 11 CP

- With high quality abundant feed high milk is efficient

Cow Size:
weight and milk to stocking rate

Cow Weight – Peak Milk		AU	Herd Size	Calf Wt
1100		1.07	100	
1200		1.14	94	
1300		1.21	88	
1400		1.29	82	
1170 – 18			96	540
1170 – 24			87	595
1320 – 18			86	605
1320 – 24			79	655

We have increasingly better and more powerful selection tools

- Visual assessment
- Performance data
- EPDs
- DNA profiles
- Multi trait $Indexes
- Decision Support Models

Select a bull to improve weaning weights

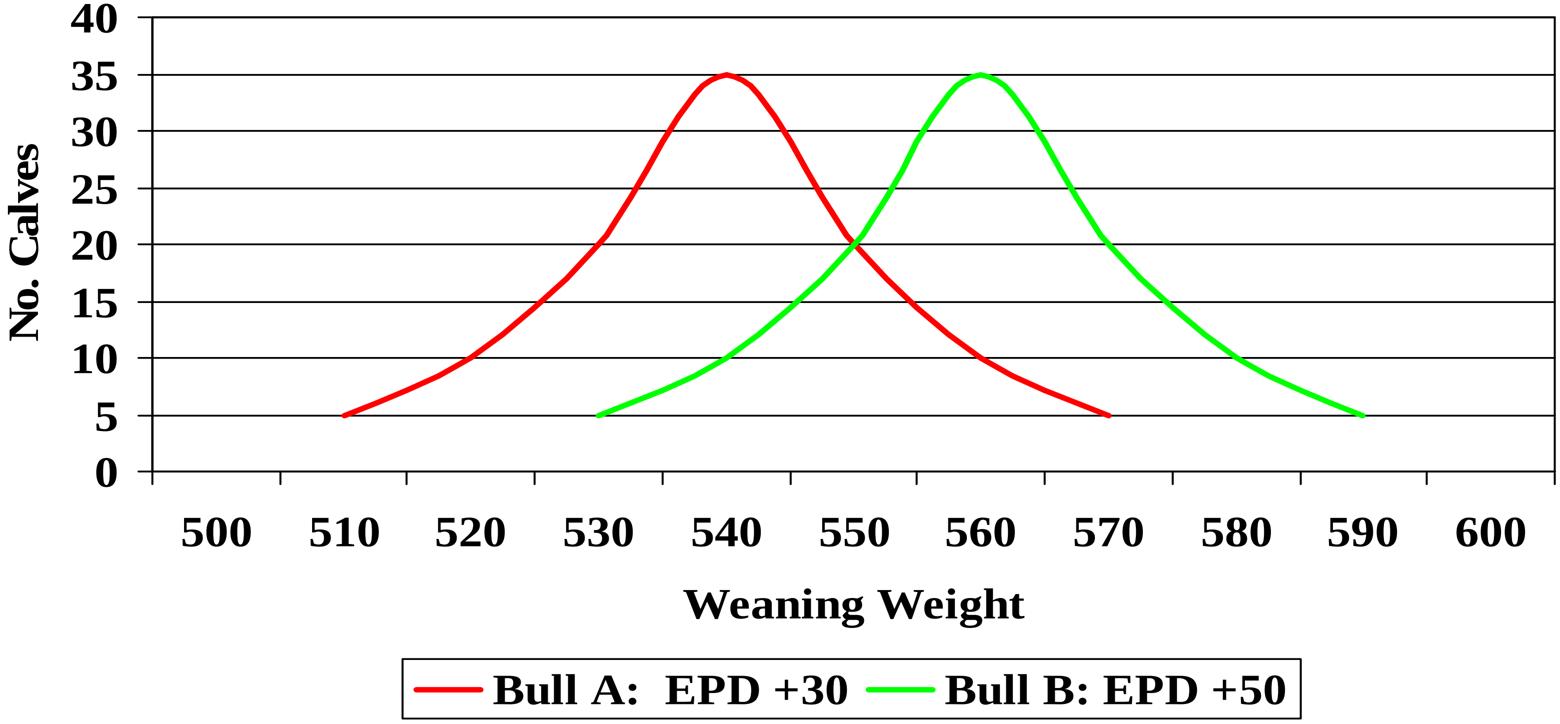
- Birth date – 2/10/01
- 9/25/01 wt - 745
- 205 adj wt – 684
- In herd ratio – 117
- WW EPD - +43

- Birth date – 2/17/99
- 10/01/99 wt - 880
- 205 adj wt – 822
- In herd ratio – 113
- WW EPD - +40

EPD – Expected Progeny Difference

An expression of genetic merit of an animal in a numerical term used to estimate difference in average progeny performance when compared to others

Do not predict actual performance or consistency but average difference



Features and Characteristics

- Calculated by breed associations annually, twice a year, or more frequently using pedigree and performance data bases
- Interim procedures used to estimate EPDs on individuals added to data base between analysis
- Incorporate information on the individual and relatives including ancestors, siblings, and progeny on trait and correlated traits
- Account for contemporary group through linkages in the data allowing for direct comparison across herds and years within breed

EPD implies a comparison

single EPD values have little meaning

- Individual to individual
  - Bull A WW EPD +36   Bull B WW EPD +43
    - Expected difference in WW of progeny 7lbs

- Individual to Breed Average
  - Avg WW EPD of sires +37
    - Bull A progeny expected to be –1lbs WW than Avg Sire

- Individual to Breed Distribution
  - 25 percentile for WW +43
    - Bull B ranks in the 25% of breed for WW EPD

Fall 2005 — Percentile Breakdowns

Current Sires | Current Dams | Non-Parent Bulls | Non-Parent Cows

Percentile Breakdown Current Sires*

	Production						Maternal					Carcass					Ultrasound		
Top Pct	CED	BW	WW	YW	YH	SC	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	%RP	IMF	RE	Fat
1%	+13	-2.4	+60	+107	+1.3	+1.62	+13	+32	+112	+2.0	+28.15	+35	+.68	+.64	-.056	+1.01	+.47	+.72	-.033
2%	+12	-1.7	+57	+102	+1.2	+1.43	+12	+30	+99	+1.7	+24.71	+30	+.58	+.58	-.049	+.91	+.41	+.63	-.029
3%	+11	-1.3	+56	+99	+1.1	+1.30	+11	+29	+92	+1.6	+22.85	+26	+.54	+.53	-.045	+.82	+.37	+.58	-.026
4%	+11	-1.0	+54	+97	+1.0	+1.24	+11	+29	+88	+1.4	+21.62	+24	+.50	+.49	-.040	+.78	+.34	+.55	-.024
5%	+11	-.8	+53	+95	+1.0	+1.17	+11	+28	+84	+1.4	+20.52	+23	+.48	+.45	-.038	+.72	+.32	+.52	-.022
10%	+9	-.1	+49	+89	+.8	+.97	+10	+26	+68	+1.1	+17.37	+18	+.40	+.38	-.029	+.55	+.24	+.42	-.017
15%	+8	+.5	+47	+85	+.7	+.84	+9	+25	+61	+1.0	+15.43	+15	+.33	+.33	-.022	+.46	+.20	+.36	-.013
20%	+8	+.8	+45	+82	+.7	+.74	+9	+24	+54	+.9	+14.00	+13	+.30	+.29	-.018	+.38	+.17	+.31	-.010
25%	+7	+1.1	+43	+80	+.6	+.65	+8	+23	+50	+.8	+12.84	+11	+.25	+.25	-.014	+.31	+.14	+.27	-.008
30%	+6	+1.4	+42	+77	+.6	+.57	+8	+22	+45	+.7	+11.89	+10	+.22	+.22	-.011	+.26	+.12	+.24	-.006
35%	+6	+1.7	+41	+75	+.5	+.50	+7	+21	+42	+.7	+10.96	+8	+.19	+.19	-.008	+.22	+.10	+.20	-.004
40%	+5	+1.9	+40	+73	+.5	+.44	+7	+20	+38	+.6	+10.08	+7	+.16	+.17	-.005	+.18	+.08	+.17	-.002
45%	+5	+2.2	+38	+72	+.4	+.37	+7	+19	+34	+.5	+9.25	+6	+.14	+.14	-.003	+.14	+.06	+.14	+0
50%	+4	+2.4	+37	+70	+.4	+.31	+6	+19	+31	+.5	+8.47	+4	+.12	+.13	+0	+.09	+.04	+.11	+.002
55%	+4	+2.6	+36	+68	+.4	+.25	+6	+18	+28	+.4	+7.63	+3	+.09	+.10	+.001	+.05	+.02	+.08	+.004
60%	+3	+2.9	+35	+66	+.3	+.19	+5	+17	+24	+.4	+6.75	+2	+.07	+.08	+.004	+0	+0	+.06	+.006
65%	+2	+3.1	+34	+64	+.3	+.13	+5	+16	+20	+.3	+5.96	+1	+.05	+.06	+.007	-.04	-.02	+.03	+.008
70%	+2	+3.4	+33	+62	+.2	+.06	+4	+15	+16	+.2	+5.10	+0	+.03	+.03	+.010	-.09	-.04	+0	+.010
75%	+1	+3.6	+31	+60	+.2	-.01	+4	+14	+12	+.2	+4.15	-1	+0	+0	+.014	-.14	-.06	-.04	+.012
80%	+0	+3.9	+30	+57	+.1	-.09	+3	+13	+7	+.1	+3.06	-3	-.03	-.02	+.018	-.20	-.08	-.07	+.015
85%	-1	+4.3	+28	+54	+.1	-.18	+2	+12	+2	+0	+1.86	-4	-.06	-.06	+.023	-.26	-.11	-.11	+.018
90%	-2	+4.8	+25	+49	+0	-.29	+1	+10	-5	-.1	+.31	-7	-.11	-.10	+.027	-.37	-.14	-.16	+.022
95%	-4	+5.5	+21	+42	-.1	-.47	+0	+8	-14	-.3	-1.91	-12	-.18	-.19	+.037	-.52	-.19	-.25	+.028
100%	-28	+16.3	-26	-42	-1.1	-1.58	-19	-17	-73	-1.2	-20.86	-36	-.65	-.61	+.086	-1.20	-.69	-.80	+.075
Total Animals	**21,770**	**21,784**	**21,981**	**21,981**	**7,806**	**10,913**	**21,770**	**21,981**	**2,208**	**2,208**	**21,992**	**1,622**	**1,622**	**1,622**	**1,622**	**1,622**	**13,943**	**13,943**	**13,943**
Avg	**+4**	**+2.4**	**+37**	**+69**	**+.4**	**+.33**	**+6**	**+18**	**+32**	**+.5**	**+8.74**	**+5**	**+.13**	**+.13**	**+.000**	**+.09**	**+.05**	**+.12**	**+.002**

National Beef Cattle Evaluation Consortium (NBCEC) is currently working on a multibreed analysis

- Analyses will produce EPDs for all breeds that are comparable on the same base
- 14 breed associations are participating
- EPDs will be produced for mixed breed composites
- Complex still in accounting for and adjusting for heterosis

ADJUSTMENT FACTORS TO ADD TO EPDs OF SIXTEEN DIFFERENT BREEDS TO ESTIMATE ACROSS BREED EPDs

Breed	Birth Wt.	Weaning Wt.	Yearling Wt.	Maternal Milk
Angus	0.0	0.0	0.0	0.0
Hereford	2.7	-3.1	-12.7	-15.7
Red Angus	2.5	-4.7	-0.7	-5.1
Shorthorn	7.0	32.5	46.1	16.6
South Devon	5.8	23.1	41.7	8.0
Braunvieh	6.3	30.3	17.4	24.5
Charolais	9.6	40.9	48.7	3.5
Gelbvieh	4.4	7.0	-21.2	6.2
Limousin	4.0	-1.3	-24.0	-12.6
Maine-Anjou	7.1	-2.9	-31.9	-6.2
Salers	4.2	30.7	43.5	12.8
Simmental	5.7	24.4	17.0	13.7
Tarentaise	3.0	31.9	18.3	20.0
Beefmaster	9.0	42.2	43.7	-4.1
Brahman	12.1	38.5	2.6	26.7
Brangus	5.0	24.3	26.5	-3.1

Across Breed Comparisons

- Angus Bull
- Breed YW EPD +65
- AB YW EPD +65
  - (65+0) = 65

- Simmental Bull
- Breed YW EPD +58
- AB YW EPD +75
  - (58+17) = 75

Accuracy and Change

- Accuracy values are associated to reflect the reliability of an EPD based on the amount of information available for its calculation and reflect the extend of possible change in the future (range of Acc values 0-1)

- Will change with additional information with new analysis
- Will change with an adjustment to scaling or base definition

Young non-parent animals have low EPD accuracies

- <.20 indicates EPD is primarily a pedigree estimate based information on parents
- .20 -.30 indicates EPD also includes the animal's own performance information
- >.30 indicates at least some progeny information, GRP/PRG designates number of progeny and number of herds
- <.40 unreliable but our best guess
- .60 -.80 make comparison with limited confidence
- >.80 compare with confidence

	Production						Maternal				Carcass					Ultrasound			
Accuracy	CED	BW	WW	YW	YH	SC	CEM	Milk	MW	MH	CW	Marb	RE	Fat	% RP	IMF	RE	Fat	% RP
.05	7.8	2.49	11.01	16.17	.41	.70	9.3	9.21	38	.62	15.42	.25	.27	.034	.53	.17	.31	.022	.37
.10	7.2	2.36	10.43	15.32	.39	.66	8.8	8.73	36	.58	14.61	.23	.26	.032	.51	.16	.30	.021	.35
.15	6.7	2.23	9.85	14.47	.37	.62	8.3	8.24	34	.55	13.80	.22	.25	.030	.48	.15	.28	.019	.33
.20	6.2	2.10	9.27	13.62	.35	.59	7.8	7.76	32	.52	12.99	.21	.23	.028	.45	.14	.26	.018	.31
.25	5.8	1.97	8.69	12.77	.32	.55	7.3	7.27	30	.49	12.17	.19	.22	.027	.42	.13	.25	.017	.29
.30	5.4	1.84	8.12	11.92	.30	.51	6.8	6.79	28	.45	11.36	.18	.20	.025	.39	.12	.23	.016	.27
.35	5.1	1.71	7.54	11.06	.28	.48	6.3	6.30	26	.42	10.55	.17	.19	.023	.36	.12	.21	.015	.25
.40	4.7	1.58	6.96	10.21	.26	.44	5.8	5.82	24	.39	9.74	.16	.17	.021	.34	.11	.20	.014	.23
.45	4.3	1.44	6.38	9.36	.24	.40	5.4	5.33	22	.36	8.93	.14	.16	.020	.31	.10	.18	.013	.21
.50	3.9	1.31	5.80	8.51	.22	.37	4.9	4.85	20	.32	8.12	.13	.14	.018	.28	.09	.17	.011	.20
.55	3.5	1.18	5.22	7.66	.19	.33	4.4	4.36	18	.29	7.30	.12	.13	.016	.25	.08	.15	.010	.18
.60	3.2	1.05	4.64	6.81	.17	.29	3.9	3.88	16	.26	6.49	.10	.12	.014	.22	.07	.13	.009	.16
.65	2.7	.92	4.06	5.96	.15	.26	3.4	3.39	14	.23	5.68	.09	.10	.012	.20	.06	.12	.008	.14
.70	2.4	.79	3.48	5.11	.13	.22	2.9	2.91	12	.19	4.87	.08	.09	.011	.17	.05	.10	.007	.12
.75	2.0	.66	2.90	4.26	.11	.18	2.4	2.42	10	.16	4.06	.06	.07	.009	.14	.04	.08	.006	.10
.80	1.6	.53	2.32	3.40	.09	.15	2.0	1.94	8	.13	3.25	.05	.06	.007	.11	.04	.07	.005	.08
.85	1.2	.39	1.74	2.55	.06	.11	1.5	1.45	6	.10	2.43	.04	.04	.005	.08	.03	.05	.003	.06
.90	.8	.26	1.16	1.70	.04	.07	1.0	.97	4	.06	1.62	.03	.03	.004	.06	.02	.03	.002	.04
.95	.4	.13	.58	.85	.02	.04	.5	.48	2	.03	.81	.01	.01	.002	.03	.01	.02	.001	.02

Website: http://www.angus.org/sireeval/accuracy.htm

Some New Traits

- Calving Ease
  - Difference in percentage of unassisted births
  - Higher number greater ease in first-calf heifers
- Heifer Pregnancy
  - Difference in the percentage of sire’s daughters to become pregnant during a normal breeding season
- Mature Cow Maintenance Energy
  - Mcal/month based on mature weight and milk production (hay =.86 Mcal)
- Stayability
  - Difference in the percentage of a sir’s daughter staying in the herd until six years of age
- Docility
  - A percentage difference in offspring to have the most docile rating
- Marbling
  - Difference in USDA marbling score of sire’s progeny

	Grade	Mb Sc	% IMF
	Prime -	8.0-8.9	9.9-12.1
	Choice +	7.0-7.9	7.7-9.8
	Choice	6.0-6.9	7.6-5.8
	Choice -	5.0-5.9	5.7-4.0
	Select +	4.5-4.9	3.1-3.9
	Select -	4.0-4.4	2.3-3.0
	Standard	2.0-3.9	

Corona

Some breeds now publish over 20 EPDs on individual animals

Are we are overwhelmed with data and lacking information

AMERICAN ANGUS SIRE SUMMARY FALL 2005

TRAIT	CED	BW	WW	YW	YH	SC	CEM	MILK	Hd/Dts	MW	MH	$EN
EPD	+7	+2.2	+49	+94	+0.7	+.59	+8	+28	0	+62	+0.8	-5.01
ACC	.39	.60	.58	.56	.40	.38	.19	.26	0	.05	.05	

TRAIT	CW	MARB	REA	FAT	%RP	Grp/Pg
EPD	+4	+.37	+.21	-.004	+.22	0
ACC	.05	.05	.05	.05	.05	0

TRAIT	IMF	uRE	uFAT	u%RP	Grp/Pg
EPD	+.71	+.78	-.001	+.73	5
ACC	.56	.57	.57	.57	25

	$W	$F	$G	$B
INDEXES	+25.28	+34.22	+32.81	+58.81

Individual Performance		
BW	72	
205	661	100 ratio
365	1,242	105 ratio
SC	40.71	12 Mo.
YFS/FS	6.2	
Weight	N/A	
Height	51.5	12 Mo
Born: 1/4/02		

Multi-trait selection when many traits contribute to profit

- Independent Culling Levels
  - Sire sort
- Economic Selection Index
  - Generalized Indexes
  - Customized Indexes

Selection Trait Asc Desc	Valid Range	Minimum	Maximum	Mininum Accuracy .00 to .99
Production				
Calving Ease Direct	-33 to 17			
Birth Weight	-5.6 to 16.3			
Weaning Direct	-20 to 83			
Yearling Weight	-19 to 136			
Yearling Height	-1.1 to 2.0			
Scrotal Circum.	-1.58 to 2.52			
Maternal				
Calving Ease Maternal	19 to 17			
Milk	-16 to 44			
Mature Weight	-56 to 137			
Mature Height	-1.0 to 2.6			
Cow Energy ($EN)	-20.86 to 42.21			
Carcass				
Carcass Weight	-31 to 53			
Marbling	-.65 to .88			

Website: http://www.angus.org/sireeval/se_epd_search.cfm

Some AAA Index Examples

- Weaned Calf Value ($W)
  - Expressed in $ per head in future progeny preweaning performance
  - Assumptions $105 calf price, $.055 feed cost, 1300 lb cow, 80/20 cow and heifer mix and incorporates revenue and cost associated with BW, WW, MM,and MW
- Cow Energy Value ($E)
  - Expressed in $ savings per cow per year of sires daughters due to lower energy lactation and mature size requirements
- Feedlot Value ($F)
  - Expressed in $ per head relating to differences in returns of progeny in feedlot incorporating feedlot gain, feed costs, and cattle prices
  - Assumptions 160 days on feed, $150/t feed, $78 per cwt.
- Grid Value ($G)
  - Expressed in $ per head relating to differences in carcass value attributable to grade and yield premiums and discounts
  - Three year industry average grid values assumed
- Beef Value ($B)
  - Expressed as $ per head due to combination of feedlot performance and carcass value

Formulating and Using EPDs to Improve Feed Efficiency

- Feed requirements are a major component of stocking rate and finishing cost
- Common measure is feed per unit of gain
- Observed feed intake measures are difficult to obtain
- Calan gate and GrowSafe technologies limit number of animals

- Feed requirements can be predicted on basis of maintenance, growth rate, composition of gain, pregnancy, and lactation

- Residual Feed Intake (RFI) – moderate heritability measures difference between expected and known feed intake. RFI is not correlated with ADG, REA,or MA

Growsafe Feed Intake Measurement

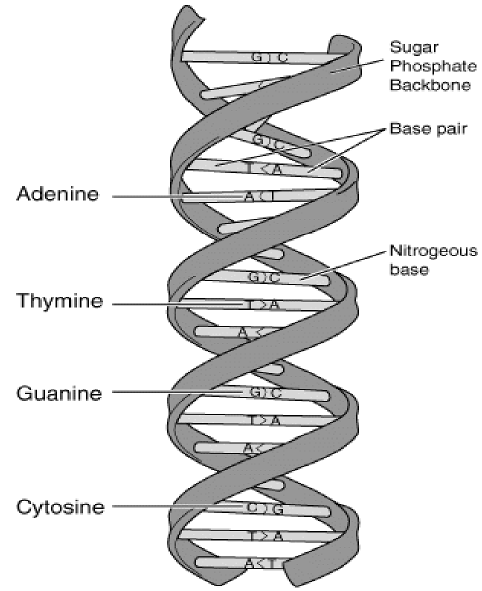
- Bunk scales
- RFID animal ID
- Ultrasound
- Computerized
- RFI Range
  - -2 to +2 lb
  - $10 to $40

Marker Assisted Selection

- DNA Markers are commercialized for several carcass traits
  - Marbling
  - Tenderness
  - Fat deposition
  - REA
  - Yield grade
- Information is not being kept at most breed associations
- Inclusion of genetic marker data in multi-trait analysis including pedigree, individual, and progeny ultrasound and carcass information would provide best estimates of genetic merit
- Single genes seldom account for anymore than 10% of variation

DNA Technology

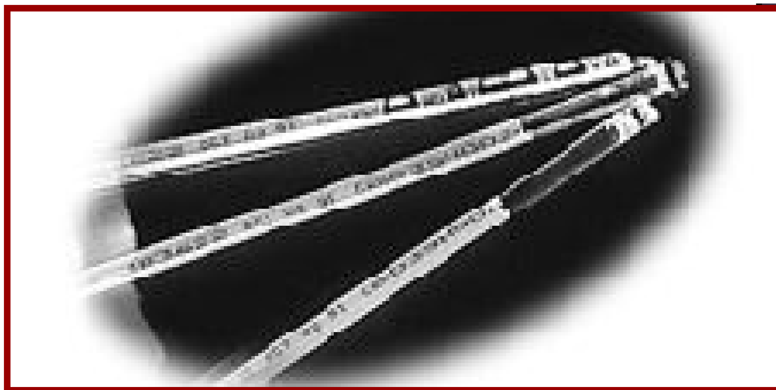
- Test animals of any age
- Not influenced by environment or management
- For expensive or hard to measure traits
- Supplemental to EPD
  - High acc EPD more accurate than DNA profile
- How to test
- companies



Results are presented to show whether the animal was 2-STAR (homozygote), 1-STAR (heterozygote) or 0-STAR with respect to the favourable form of the gene.

Table 1. Frequency of STARS amongst Yearling and Calf-Fed groups

Group		GeneSTAR® Marbling Result			
		0	★	★★	Total
Yearling-Fed	# of animals	243	198	34	475
	%	51	42	7	100
Calf-Fed	# of animals	386	169	36	591
	%	65	29	6	100




IGENITY™
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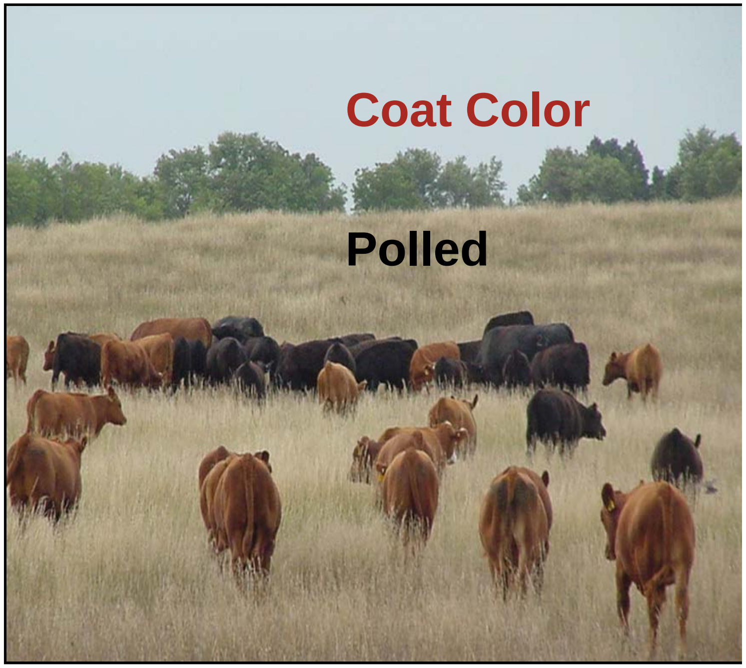
igenity

Parent MATCH Test Report

4701 Innovation Drive, Suite 101, Lincoln, NE 68521
Phone: 877-443-6489 Fax: 402-477-3946 Email: igenity.labusa@merial.com



Dr. Milt Thomas
Animal and Range Sciences
2980 South Espina Street
NMSU
Las Cruces, NM 88003

Date: 9-06-06
Updated 9-07-06

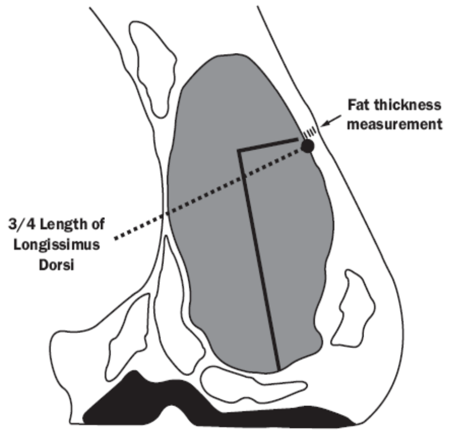
	Animal ID No.	Sample Collector Number	Sex M/F	Breed	Sire Group	Most Likely Sire	Probability %	Number of Exclusions	Most Likely Sire Qualifies?	Other sires with zero exclusions Sire 2	Sire 3	Comments
1	2006041	158994	M	Brangus	NA	MC DURABULL	99	0	Yes			
2	2006042	158993	F	Brangus	NA	MC DURABULL	99	0	Yes			
3	2006043	158997	M	Brangus	NA	MC DURABULL	99	1	Yes			
4	2006044	158969	F	Brangus	NA	889N14	99	0	Yes			
5	2006045	158996	M	Brahman	NA	805/5	99	0	Yes			
6	2006046	158972	F	Brangus	NA	MC New Direction 000M24	99	0	Yes			
7	2006047	158987	M	Brangus	NA	NMSU 4087	99	0	Yes			
8	2006049	158973	M	Brangus	NA	222K14	99	0	Yes			

Scores do not define what's best

Tenderness	1	5	10	**More Tender**
Fat Thickness	1	5	10	**More Fat**
Yield Grade	1	5	10	**Higher YG**
Ribeye Area	1	5	10	**Larger Ribeye**
Carcass Weight	1	5	10	**Higher CW @ CH**
Percent Choice	1	5	10	**Higher % CH**
Marbling	1	5	10	**Higher Marb. Score**

IGENITY Result	Yield Grade	% Choice Based on Quality Grade	Ribeye Area in Square Inches	Hot Carcass Weight lbs.	Back Fat Thickness in Inches	USDA Marbling Score	Tenderness in lbs. of WBSF
10	1.17	53.7	2.12	44.6	0.231	96.0	-2.27
9	1.02	47.1	1.86	40.0	0.202	84.7	-1.95
8	0.90	41.2	1.63	34.8	0.177	74.0	-1.85
7	0.77	35.5	1.40	29.7	0.152	63.6	-1.54
6	0.65	29.7	1.17	24.9	0.128	53.2	-1.22
5	0.52	23.9	0.94	19.7	0.103	42.9	-1.13
4	0.40	18.1	0.71	15.0	0.079	32.5	-0.79
3	0.27	12.4	0.49	9.8	0.054	22.0	-0.42
2	0.15	6.6	0.26	4.7	0.029	11.3	-0.21
1	0	0	0	0	0	0	0

Fat Thickness



Score	Fat Thickness
10	0.23
9	0.20
8	0.18
7	0.15
6	0.13
5	0.10
4	0.08
3	0.05
2	0.03
1	0.00

.23 inch

Producers who continue to embrace and utilize EPDs and the latest technologies will continue to shape the future of the industry and keep it competitive

… the future promises to allow us to more accurately gauge differences between breeds and incorporate marker–assisted selection into EPDs for improved accuracy, and a myriad of new selection indexes will allow us to make better decisions in the context of our own production systems

…which means EPDs' value will only grow as the industry completes the continuum of any new technology

Troy Marshall

Questions?

Crossbreeding

- Improvement of fertility, survival, and longevity
- optimize breed strengths and weakness
- Up to 20% greater calf weight weaned per cow exposed
- Specialized crossbreeding schemes best opportunity to manage trait antagonisms

Crossbreeding the Forgotten Tool

- Crossbreeding can potentially result in a 25% advantage in lifetime productivity yet many producers have opted to move closer to pure breeding to simplify breeding programs, try produce more uniformity and consistency, use hide color for market advantage, …

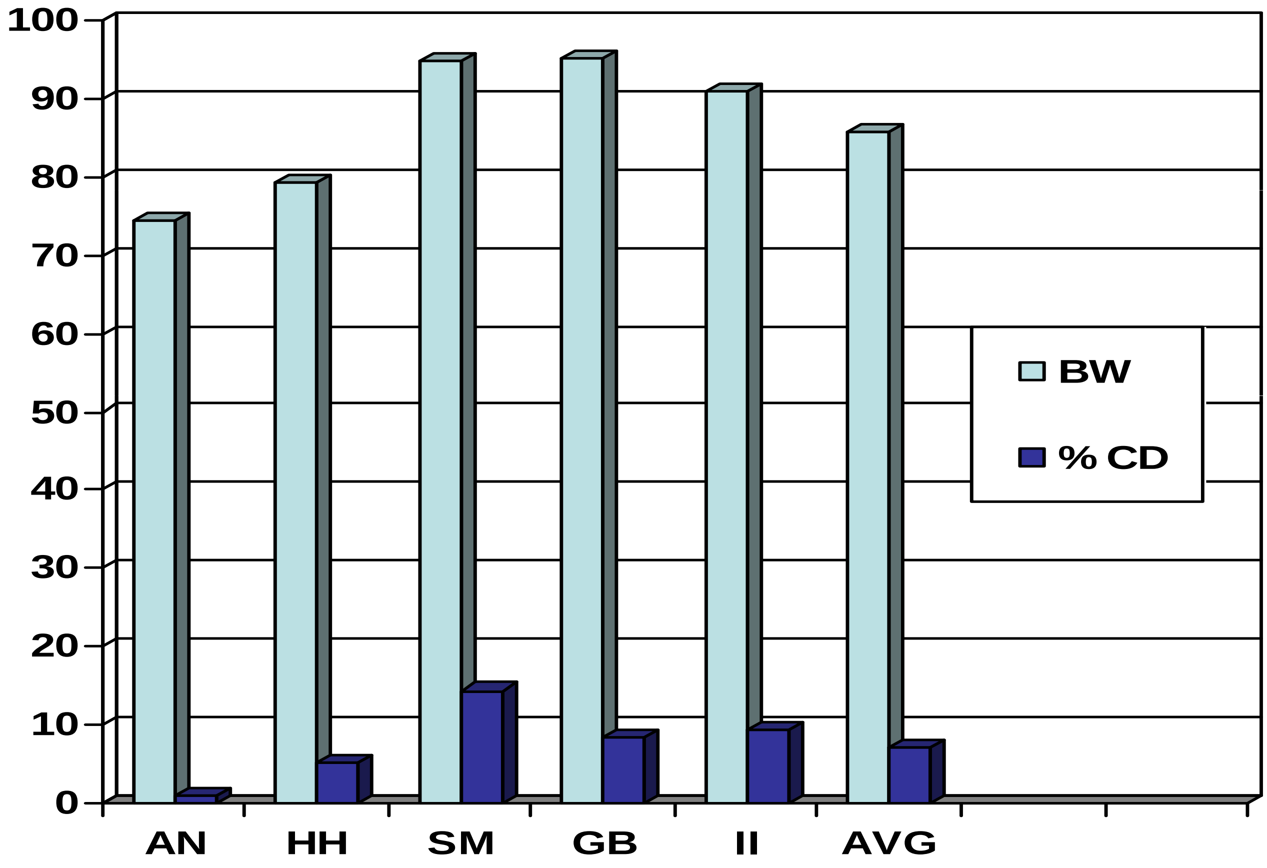
  » Jim Gosey   University of Nebraska

While Within-Breed Selection is a Useful Tool…

- Maximum genetic benefit is typically obtained via the exploitation of breed differences and the creation of heterosis as a result of planned crossbreeding systems.

Heterosis Defined

-Superiority of crossbred animal relative to average of its straightbred parents

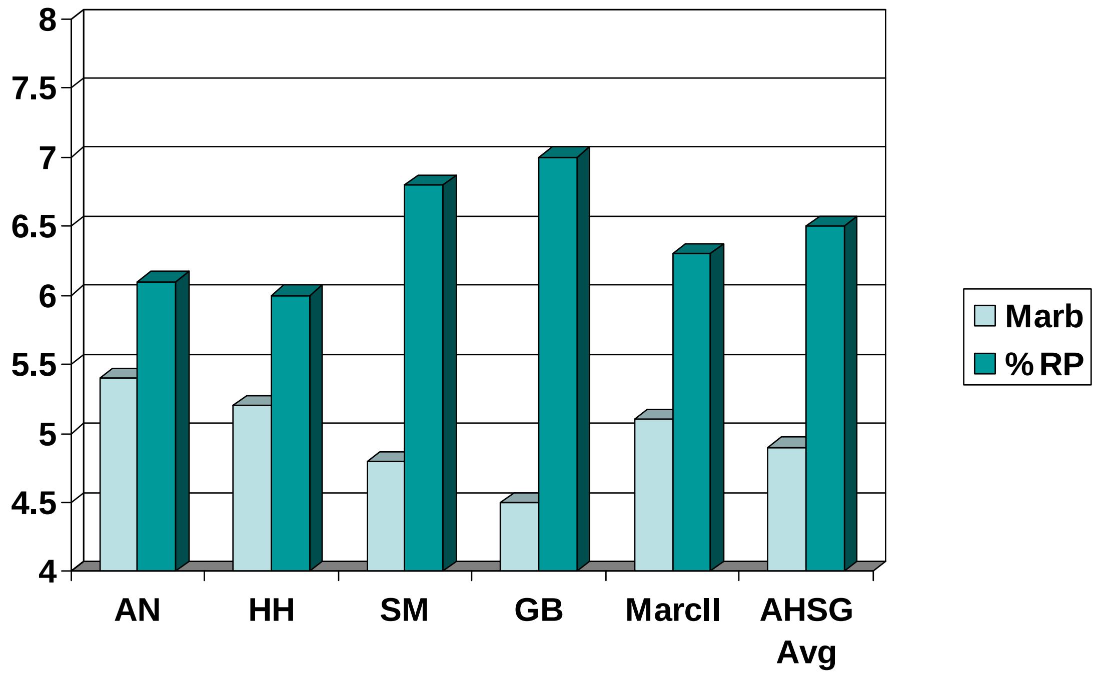


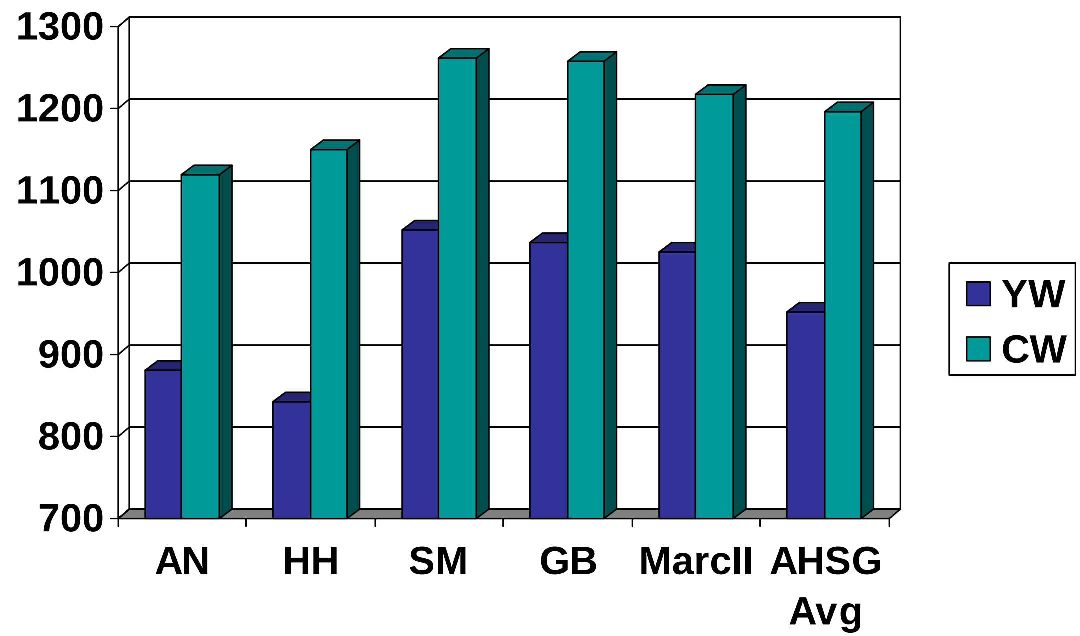
Some heterosis for Birth weight and Calving difficulty

Table 2. Individual units and percentage of heterosis by trait.

Trait	Heterosis Units	Percentage (%)
Calving rate, %	3.2	4.4
Survival to weaning, %	1.4	1.9
Birth weight, lb	1.7	2.4
Weaning weight, lb	16.3	3.9
Yearling weight, lb	29.1	3.8
Average daily gain, lb/d	0.08	2.6

Feedlot and Carcass





Maternal Heterosis
Advantage of the Crossbred Cow

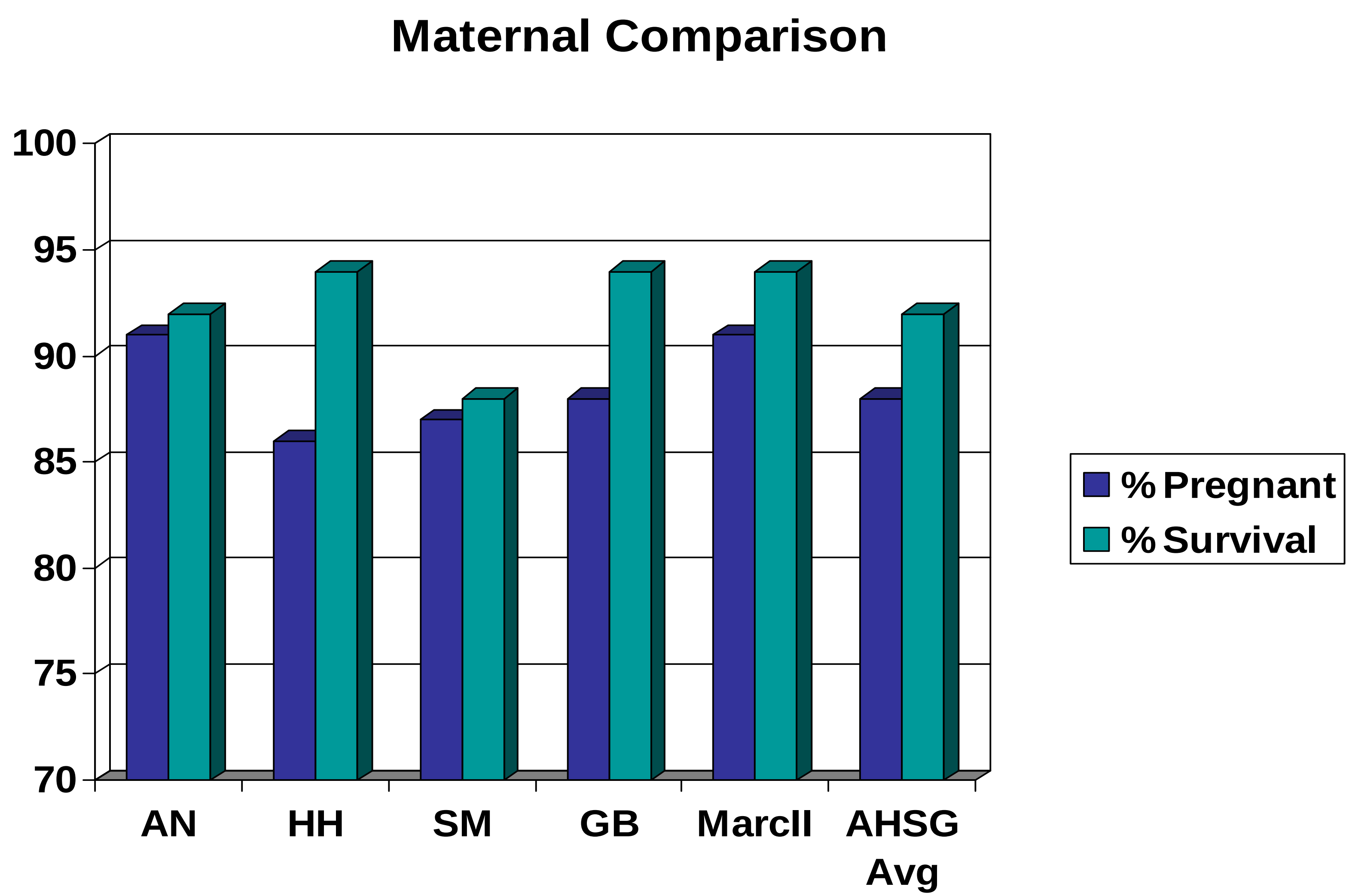
- Advantage of crossbred cow vs. straightbred
  - Reproductive efficiency
  - Maternal ability
  - Longevity
- Increased lifetime productivity
- Maternal heterosis accounts for largest portion of total heterosis advantage (60%)

Table 3. Maternal units and percentage of heterosis by trait.

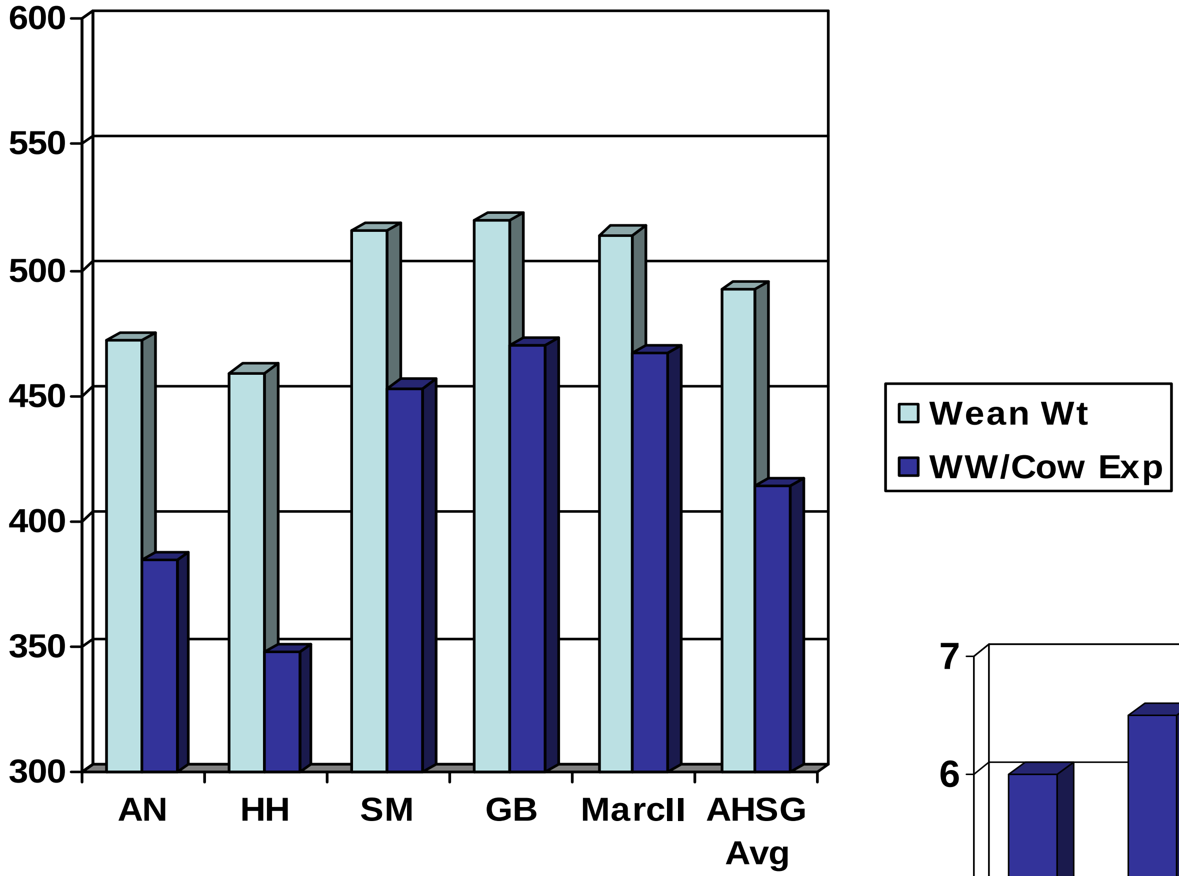
Trait	Heterosis Units	Percentage (%)
Calving rate, %	3.5	3.7
Survival to weaning, %	0.8	1.5
Birth weight, lb	1.6	1.8
Weaning weight, lb	18.0	3.9
Longevity, years	1.36	16.2
Lifetime Productivity		
Number of calves	0.97	17.0
Cumulative weaning wt., lb	600	25.3

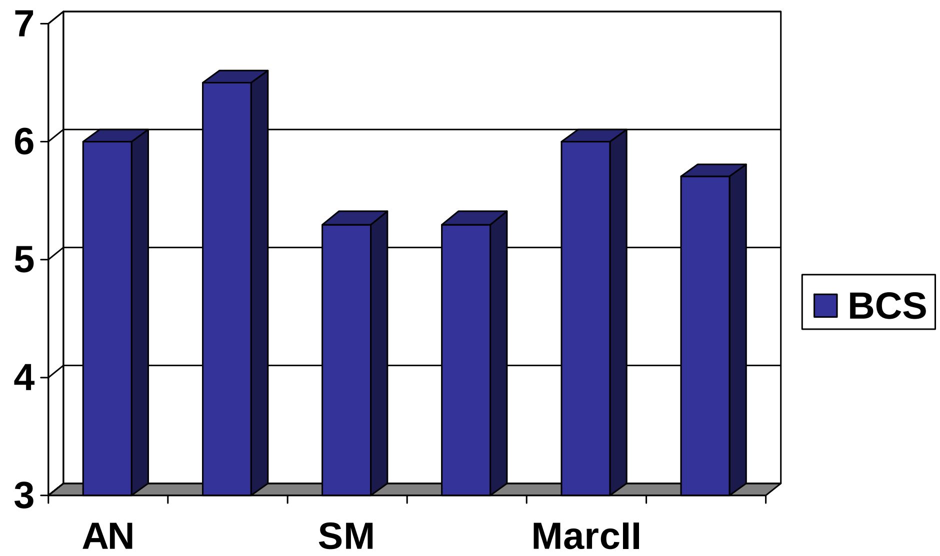
Heterosis Defined

-Superiority of crossbred animal relative to average of its straightbred parents



More Lbs per cow
From
higher fertility
greater survival
and weaning weight





Breed complementarity for trait antagonisms

Conformance of Breed Types to Carcass Targets

Trait	British	Cont	25:75	50:50	75:25
– YG 1&2	38	89	83	56	53
--%CH	70	30	43	55	66

Crossbreeding offers opportunity to counter antagonism between Quality and Yield grades

It is difficult to maintain calf crops of 75% British and 25% Continental breeds without composite breeding

Figure 1. Two-breed rotation.

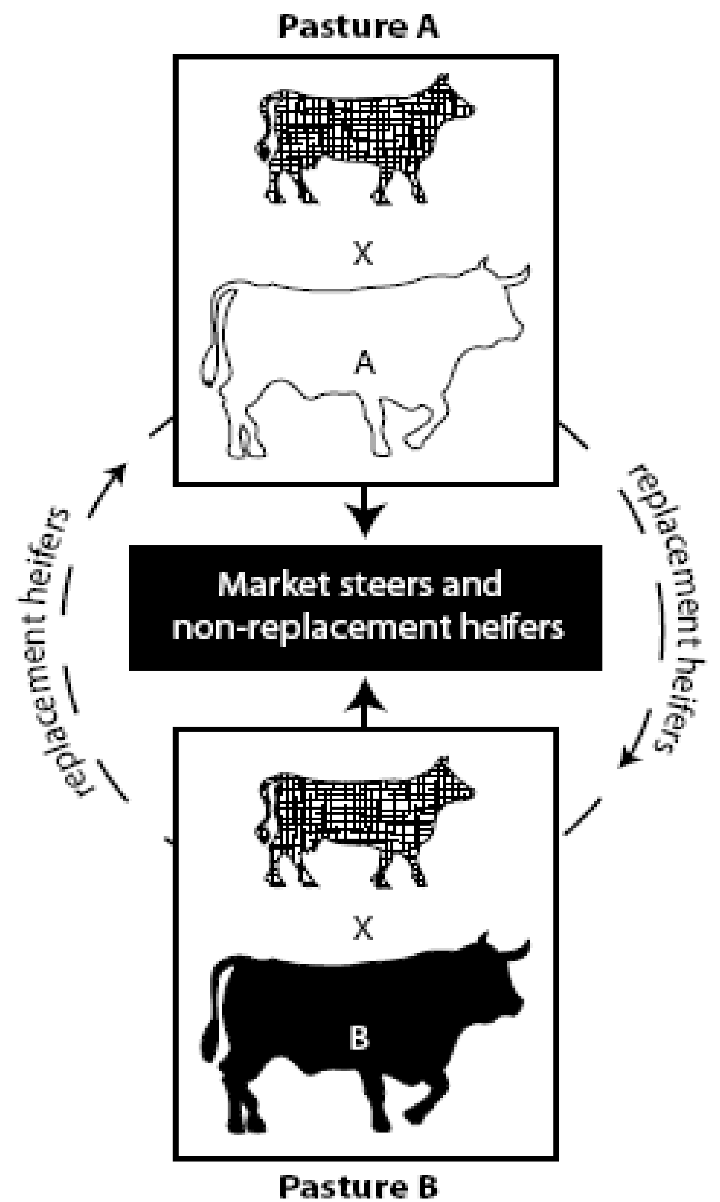
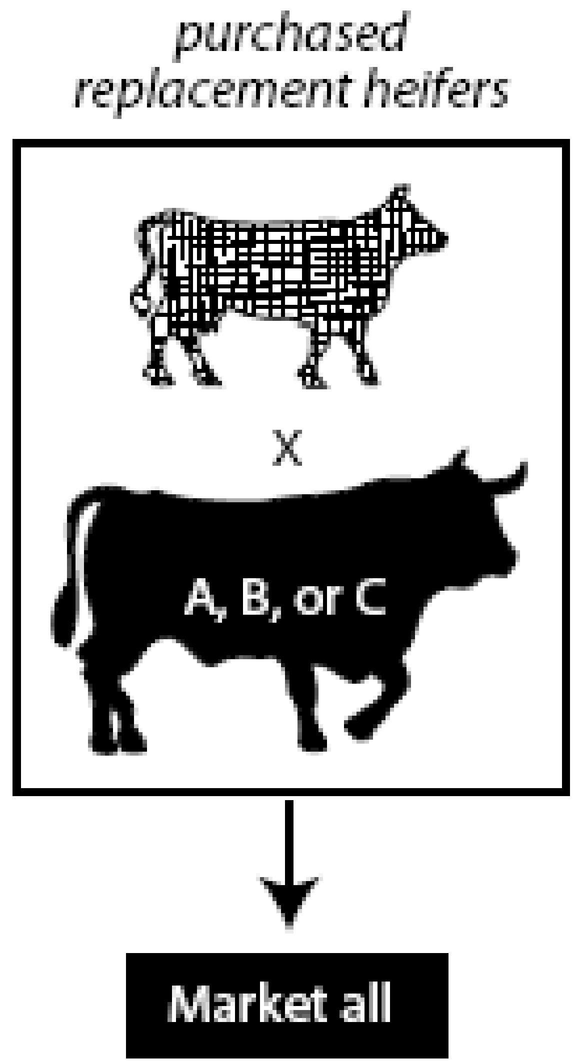


Figure 4. Terminal cross with purchased F_1 females.



Crossbreeding Systems

System	%Heterosis	%Advantage
2 breed rotation	67	16
3 breed rotation	87	20
Rotation terminal	67 + 100	24
AB Composite	50	12
AABC Composite	63	15
ABCD Composite	75	17

Rotational–terminal systems are extremely effective with

rotational breeding of heifers and young cows, terminal mating once 5 or 6 years of age but hard to implement in small herds

Composite breeding does not have as high of level of heterosis but is simpler and allows for more breed complimentarity

Benefits and Drawbacks Associated With Crossing Systems

Mating System	Benefits	Requirements/Drawbacks
2-Breed Rotational	Weaning wt./cow exposed 16%	Minimum of 2 breeding pastures. Herd size of 50 or greater. Replacement heifers identified by sire breed. Generation-to-generation variation may be large. Management intensity—moderate.
Terminal Sire X Purchased F1 Females	Weaning wt./cow exposed 21%. Any herd size. Target marketing	Purchased females. Replacement heifers identified by source. Increased risk of disease. Management intensity—moderate

What is a workable breeding system ?

- Retained heifers vs purchased
- Number of breeding groups
- Straight breeding
- Designed Crossbreeding
  - True rotation
  - Sire rotation
  - Terminal crossing
- Composite breeding

Composite

Composites 101

- Definition
  - Are hybrids of two or more breeds expected to be bred to their own kind
  - When used so are expected to achieve much of the benefit associated with traditional crossbreeding
- Why
  - Simplicity
    - breeding composites is like straight breeding
    - Composites produces their own replacements
  - Hybrid vigor
    - 4 breed composites expected to retain 75% of potential heterosis
    - Future loss would be proportional to inbreeding

Composites - continued

- Why
  - Consistency
    - While greater variation for simple traits as color there is no greater variation for production traits than for purebreds
  - Complimentarity
    - Some opportunity to select breed combinations that minimize weakness

- Why Not
  - Finding the right breed mix
  - Limited sources
  - Questionable merit of foundation animals
  - Complexity and time to create
  - Maintaining hybrid vigor
    - Composite breeding herds should be over 500
    - Reconstitute from time to time

Coefficients of Variation

Trait	Purebreds	Composites
Birth wt	.12	.13
Wean wt	.10	.11
Carc wt	.08	.09
% retail prod	.04	.06
Marbling	.27	.29
Shear Force	.22	.21

Calves sired by Univ. of Neb. Composite bulls

Date	#	Wt.	Fat	REA	YG	%Y1:2	%Ch
6/05	37	836	.54	13.2	3.19	49	97
5/05	45	823	.57	13.8	3.02	49	84
5/05	89	795	.51	13.5	2.83	62	85
3/05	22	802	.41	14.6	2.34	82	91
3/05	24	729	.49	13.0	2.74	75	96
12/4	53	809	.40	14.5	2.35	89	81
AV.	270	802	.49	13.8	2.77	66	87

Crossbreeding Systems Reminders

- No one breed does all things well and no one breed is without weaknesses.
- Match breed choices to your production environment.
- Careful matching of breed strengths and weaknesses can yield optimal trait combinations.
- Hybrid vigor provides a buffer against environmental stress that allows crossbred animals to be more productive in some traits with the greatest advantage in reproductive performance, calf survival, and cow longevity.
- Implementing an effective crossbreeding system requires thoughtful planning and management intensity.
- Crossbreeding is not a silver bullet and a poorly designed program with poorly selected sires will yield less than desirable results.

Questions ?

THE END

Can We Have It All???

- Reproductively efficient cow herd
- Cows that are low-cost, adaptable to feed and environmental resources
- Superior growth/feed efficiency
- End product merit

Many Traditional Crossbreeding Systems Fail “Management Ease” Test

- Too many breeding pastures
- Difficult to source replacements
- Swings in breed composition

Cow-Calf Production Goals

- Cows breed at an early age and regularly thereafter
- Calve unassisted and raise a healthy calf
- Cows live and stay productive for a long time
- Cows efficiently use ranch forage and require minimal supplementation
- Calves gain fast and efficiently
- Calves produce high yielding, high quality carcasses, of desired weight, with high marketability

NBCEC is developing a web-based decision support tool at http://ert.agsci.colostate.edu

- Customized to producers situation, ie. Nutritional and financial implications
- Direct comparison of animals across breeds and accounting for heterosis in breeding systems
- More accurate interpretation of threshold traits as stayability, calving ease, and pregnancy
- Accounts for interactions between traits and risk associated with low accuracy bulls