Breeding for Carcass Improvement

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Changing Industry

- Value Based Marketing
  - Grid Marketing
  - Branded Product
- Genetic Technology
- Consolidation/Coordination

Topics of Discussion

- Economic Aspects of Carcass Traits
- Genetic Tools for Carcass Improvement
- Relationship of Carcass Traits to Maternal Performance

Grid Marketing

- **Individually price carcasses based on:**
  - USDA Quality Grade
  - USDA Yield Grade
  - Compliance Factors
    - Carcass weight
    - Maturity
    - Dark cutters
    - Stags
  - Management Factors

Premiums & Discounts ($/cwt)

- **Quality Grade**

Prime	6.41
High Choice	2.17
Choice	0.00
Select	-13.24
Standard	-22.10

Premiums & Discounts ($/cwt)

- **Yield Grade**

1.0 - 2.0	3.63
2.0 – 2.5	2.00
2.5 – 3.0	1.44
3.0 – 3.5	0.00
3.5 – 4.0	-0.22
4.0 – 4.5	-15.29
5.0 and up	-19.38

Discounts ($/cwt)

- **Non-compliance factors**

Hard Bone	-28.50
Dark Cutter	-31.25
400 –500 lb	-24.00
500 –550 lb	-19.86
950 – 1000 lb	- 7.25
over 1000 lb	-19.75

	YG1	YG2	YG3	YG4	YG5
PR	+10.04	+7.85	+6.19	-8.88	-12.97
CH+	+5.8	+3.61	+1.95	-13.12	-17.21
CH	+3.63	+1.44	-.00	-15.29	-19.38
SEL	-9.61	-11.8	-13.24	-15.29	-19.38
STD	-22.10	-22.10	-22.10	-22.10	-22.10

Grid Comparison

- **Steer 1**
  - **850 car wt**
  - **CH+**
  - **YG3**
- **Steer 2**
  - **775 car wt**
  - **SEL**
  - **YG2**
- **Prem-Disc**
  - **+1.95/cwt**
  - **+16.75/hd**
- **Prem-Disc**
  - **-11.8/cwt**
  - **-91.45/hd**

NW Task Force Steer Feed Out
2000-2001 Decatur County Feeders

Profit by Quality Grade

QG		$/lb	Return
PR		1.31	$13
CAB		1.32	$17
CH		1.26	$24
SEL		1.19	$-31

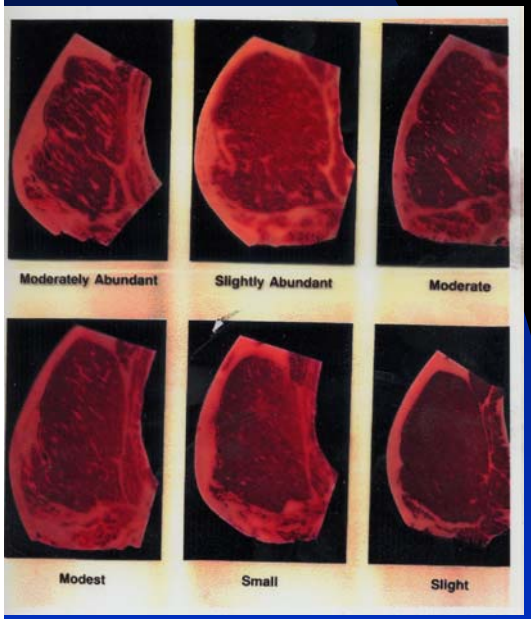
Niche Markets

- **Natural**
  - Hormone free
  - Antibiotic free
- **Feeding Management**
  - Vitamin E
  - DOF
  - By-product Free
- **Other Specifics**
  - Tenderness
  - Leanness

Tenderness

- Important to Palatability
- Difficult to Measure
- Future Incentives Likely
- Management
  - Aging
  - Blade tenderizing
  - Electrostimulation
  - Ca injections
  - Hydrodyne

Quality Grade

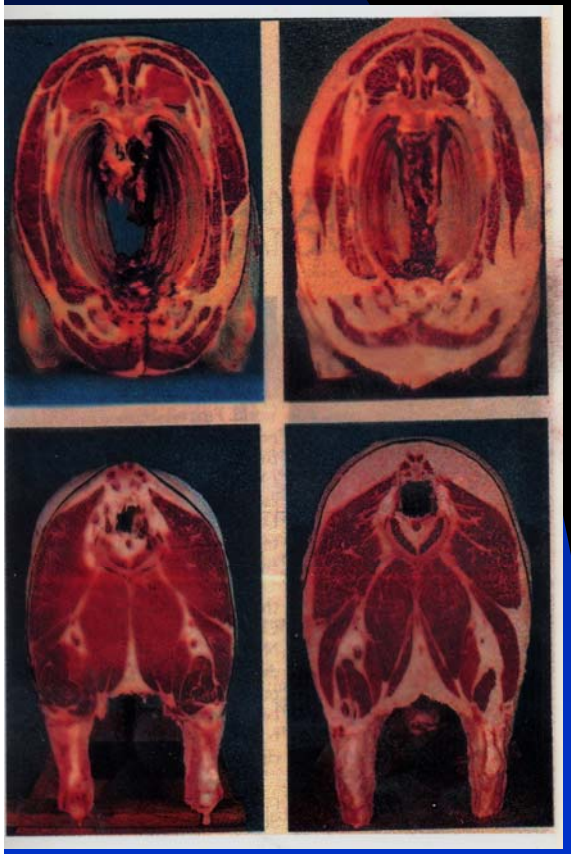


- Ranking of the eating characteristics (flavor, tenderness, juiciness)
- Determined by maturity and degree of marbling
- Non genetic factors:
  - DOF, age, implant, etc
- Genetic factors:
  - **Marbling** at constant fat thickness is highly heritable (.60)

Conversions to Quality Grade

QG	Marbling Score	% IM Fat
PR	8+	9.9+
CH+	7.0 –7.9	7.7 –9.7
CH	6.0 –6.9	5.8 –7.6
CH-	5.0 – 5.9	4.0 – 5.7
SEL+	4.5 –4.9	3.1 – 3.9
SEL-	4.0 –4.4	2.3 – 3.0

Yield Grade



- Ranking for the yield (%) of trimmed retail cuts
- Estimated from fat thickness, ribeye area, KPH fat and carcass weight
  YG=2.5+(2.5*FT)+(.0038*CW)-(.32*RE)
- Non genetic Factors:
  - DOF, age, implant, etc
- Genetic Factors:
  - **REA** is highly heritable (.50)
  - **Fat Thickness** heritability is high
  - **Carcass Weight** is moderately heritable
  - **Cutability** is moderately heritable

Preliminary Yield Grade

YG	RP %	Rib Fat (in)
2.5	51	.2
3.0	50	.4
3.5	48	.6
4.0	46	.8

Identifying the Target

- Where are you at?
  - Data feedback on feeders sold
  - Retained ownership to slaughter
- Mainstream Markets
  - YG2,Low CH, 600-850lbs
  - Realistic 70-70-0
- Specification Programs
  - High Quality (50% >CH, 50% YG2)
  - Lean and Natural (90% SEL, 90% YG 1&2)
- Consider your Management limitations

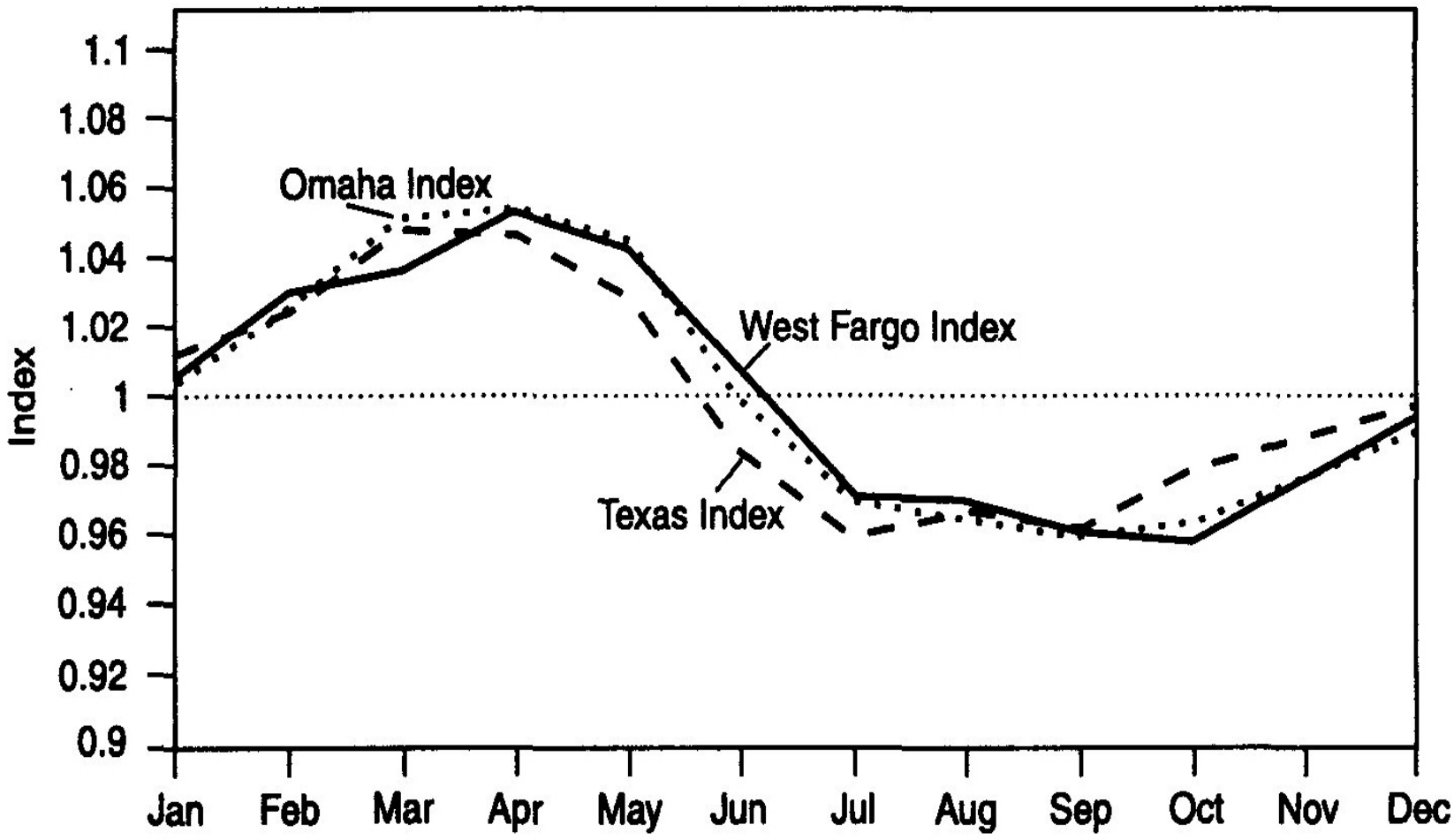
“ The cattle that invariably make the most money in our feed yard are those that stay healthy and gain the most weight in the shortest period of time, on the least feed.”

Dallas Horton

Improvement In Feed Efficiency			
Feed Cost	**10%**	**15%**	**20%**
$120/T	**$27**	**$40**	**$54**

Market Seasonality and CH-SEL Spreads are Significant Factors

Month	#	% CH	$/lb	Return
April	33	46	1.28	$13
May	24	75	1.22	$-15
June	18	33	1.15	$-19


1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
Index
Omaha Index
West Fargo Index
Texas Index
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Performance still Matters

NW Task Force – Profit by ADG

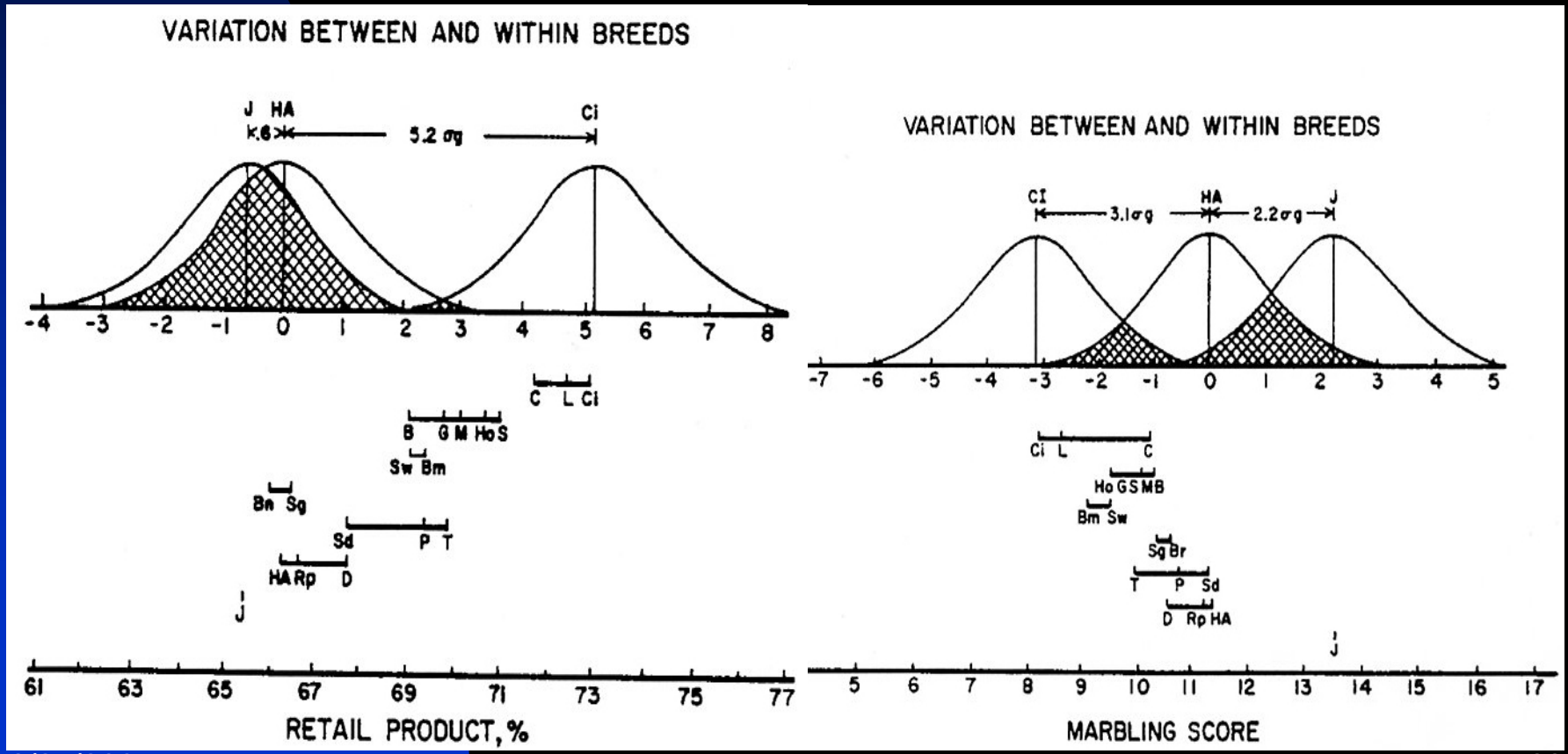
ADG	#	Return
< 3.25	24	$ -16.13
3.25 –3.50	17	$ +.30
3.50 –3.75	22	$ -.40
3.75 –4.00	7	$ +16.01
> 4.00	5	$ +7.16

Genetic Tools

- Breed Resources
- Mating Systems
  - Heterosis
  - Breed complimentarity
- Sire Selection
  - phenotype
  - ultrasound
  - EPD
  - DNA markers

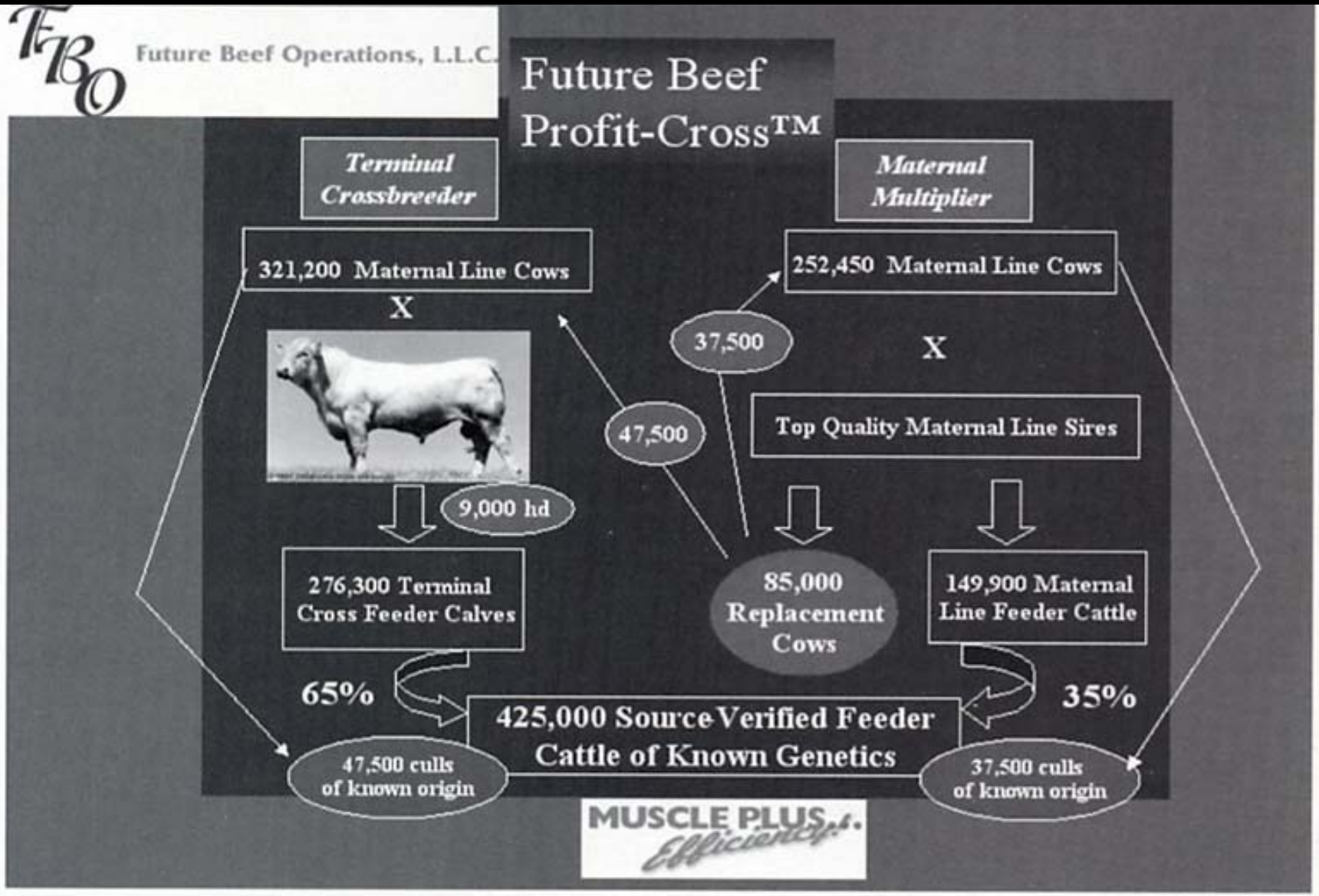
Variation Between and Within Breeds

breed populations differ widely in traits of economic importance



Crossbreeding

- Combine breeds that compliment each other
- Maternal heterosis increases profit
- Use a system that fits management
  - Terminal – maximize heterosis and consistency
    out source replacements
  - Rotational – need breed similarity for consistency
    greater record keeping
  - Composite - practical compromise for simplicity
    limited by evaluated seedstock

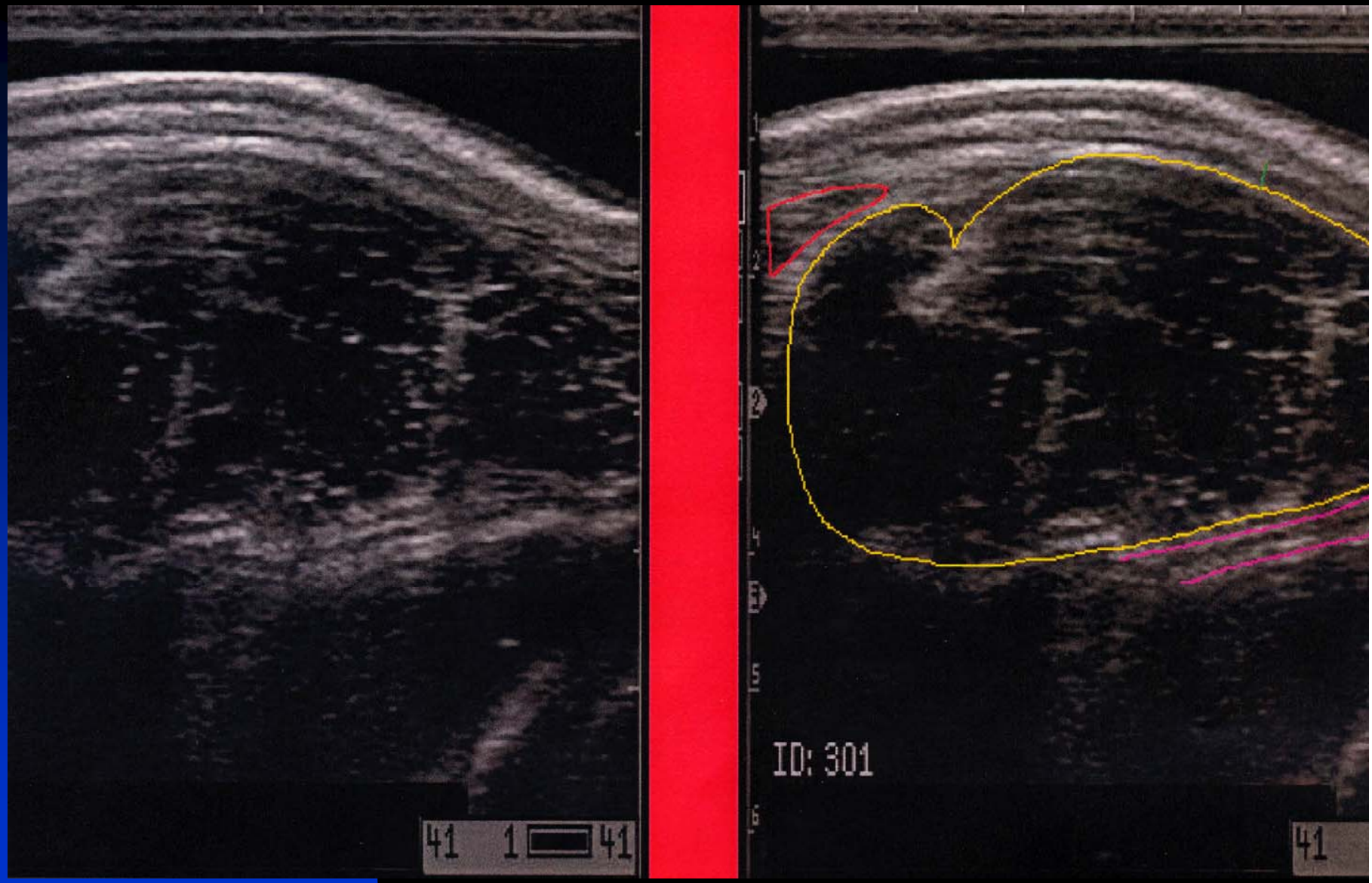

Future Beef Operations, L.L.C.
Future Beef Profit-Cross™
Terminal Crossbreeder
Maternal Multiplier
321,200 Maternal Line Cows
X
252,450 Maternal Line Cows
X
37,500
47,500
Top Quality Maternal Line Sires
9,000 hd
276,300 Terminal Cross Feeder Calves
85,000 Replacement Cows
149,900 Maternal Line Feeder Cattle
65%
35%
425,000 Source Verified Feeder Cattle of Known Genetics
47,500 culls of known origin
37,500 culls of known origin
MUSCLE PLUS Efficient

Ultrasound Measurements

- Measure composition traits on live animal
- Produce a video image by ultrasonic sound waves
- Images are captured and used to make measurements of carcass traits
- Not the same but highly correlated to carcass measurements
- Measurements are a phenotypic description of animal

Ultrasound Measurements

- Collected on yearling heifers and bulls (320 –410 days of age)
  - REA
  - Inter Muscular Fat
  - Fat Thickness
  - Rump Fat Thickness
- For genetic prediction measure contemporary groups and adjust for age and weight
- Technician testing and certification for greater accuracy
- ISU provides central processing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Carcass EPDs

- Calculated on carcass data collected on progeny and progeny of relatives slaughtered and ultrasound data of breeding animals
- Carcass data collection has been difficult and expensive
- Electronic ID and alliance programs increasing information
- Valid genetic comparisons across herds
- Traits: **Marbling, Fat Thickness, REA, Car Wt, Percent Retail Product**

EXPECTED PROGENY DIFFERENCES

PRODUCTION									CARCASS						ULTRASOUND BODY COMPOSITION					
BW AC	WW AC	Milk AC	HRDS DTRS	YW AC	YH AC	MW AC	MH AC	SC AC	CW AC	Marb AC	RE AC	Fat AC	%RP AC	GRP Pg	%IMF AC	RE AC	Fat AC	Rump Fat AC	%RP AC	GRP Pg
-1.3 .96	+4 .91	+16 .89	6 33	+16 .90	-.1 .92	I-18 .08	I+.1 .12	-.17 .69	-26 .59	+.20 .63	-.21 .56	+.013 .53	-.1 .53	8 19	+.04 .09	-.04 .09	+.010 .10	+.010 .12	-.01 .09	1 2
+6.9 .98	+48 .98	-2 .93	23 104	+78 .94	+.9 .73	I+23 .18	I+1.1 .21	+1.62 .51	+7 .52	-.22 .56	+.11 .50	-.005 .48	+.1 .47	3 12	-.37 .55	-.03 .55	-.004 .56	-.005 .60	+.06 .55	10 38
+.6 .97	+34 .94	+25 .86	18 56	+73 .93	+.5 .82	I+6 .11	I+.4 .14	-.32 .58	+8 .56	+.10 .60	+.13 .53	+.029 .51	-.2 .50	6 13	+.03 .13	+.02 .13	+.013 .13	+.003 .16	-.08 .13	3 3

Active Purebred Simmental Sires
Fall 2001 Genetic Evaluation

Percentile Level	Calving Ease	Birth Weight	Weaning Weight	Yearling Weight	Maternal Calv Ease	Maternal Milk	Maternal Wean Wt	Carcass WT	Percent Carcass Retail C	Marbling
1	13.8	-1.7	61.8	99.7	11.0	21.2	42.7	23.6	0.63	0.30
2	12.8	-1.1	58.6	94.1	9.7	19.2	40.8			
3	11.9	-0.6	56.2	91.2	8.9	18.3	39.6			
4	11.5	-0.3	54.9	88.7	8.4	17.6	38.7			
5	11.1	-0.1	53.6	86.7	8.1	17.0	37.9	15.8	0.39	0.17
10	9.9	0.8	49.5	80.2	6.8	15.1	35.3	11.7	0.27	0.12
15	9.0	1.3	46.6	75.9	5.7	13.8	33.7	9.5	0.20	0.09
20	8.2	1.7	44.4	72.7	4.9	12.8	32.4	7.2	0.16	0.07
25	7.5	2.0	42.7	69.9	4.3	11.9	31.2	5.8	0.12	0.06
30	6.9	2.3	41.2	67.3	3.7	11.1	30.1	4.5	0.09	0.04
35	6.2	2.6	39.8	65.2	3.2	10.4	29.2	3.5	0.06	0.03
40	5.6	2.9	38.5	63.2	2.8	9.6	28.1	2.4	0.04	0.03
45	4.9	3.1	37.3	61.3	2.3	8.9	27.1	1.4	0.01	0.01
50	4.2	3.4	36.1	59.5	1.9	8.2	26.2	0.4	-0.01	0.00
55	3.5	3.7	35.0	57.5	1.5	7.5	25.3	-0.7	-0.03	-0.01
60	2.7	3.9	33.8	55.7	1.0	6.8	24.4	-1.8	-0.05	-0.02
65	1.8	4.2	32.7	53.9	0.5	5.9	23.4	-3.0	-0.07	-0.03
70	0.8	4.5	31.5	51.9	-0.1	5.1	22.4	-4.2	-0.09	-0.04
75	-0.2	4.8	30.2	49.7	-0.8	4.2	21.3	-5.3	-0.12	-0.05
80	-1.4	5.2	28.7	47.4	-1.6	3.2	20.1	-6.7	-0.15	-0.07
85	-3.1	5.7	26.9	44.7	-2.7	2.0	18.8	-8.9	-0.20	-0.09
90	-5.2	6.3	24.7	40.5	-4.2	0.5	17.2	-11.4	-0.26	-0.13
95	-8.0	7.3	20.8	34.6	-6.9	-1.7	14.9	-15.3	-0.37	-0.19
Average	3.2	3.5	36.6	60.0	1.5	8.0	26.3	0.1	0.00	0.00
Low	-25.2	-6.7	-3.6	-4.0	-29.9	-19.1	-0.9	-40.3	-1.24	-0.57
High	19.7	15.1	103.4	151.1	19.4	29.2	51.5	49.5	1.08	0.65

Genetic Markers

- Identify gene with large effect on important carcass trait
  - Myostatin – muscle hypertrophy
- Develop techniques to identify animals with gene
  - GeneStar - marbling
- Account for part but not all genetic variation for the trait
- Likely to be included in EPD calculations

Creating Consistency

- Genetics
  - Uniform crossbreeding
  - Related Sires
  - Herd culling
- Management
  - Limit calving season
  - Calve heifers early
  - Implant late calves
  - Creep feed calves
  - Herd health program
  - sorting

Genetic Relationships Between Carcass and Maternal Traits

- Will selection and improvement for carcass characteristics negatively affect important maternal traits?
- Will breed substitutions to improve carcass traits negatively impact maternal traits?

Maternal Traits and Performance

The Primary Profit Driver for Cow Calf Producers

- Lbs calf weaned per cow exposed
  - Conception rate, age at puberty
  - Calf survival, calving difficulty
  - Calf weight, milk production
  - longevity
- Cow maintenance requirements
  - Mature weight
  - Milk production
- Cheap Feed is a Mitigating Factor

Marbling vs Maternal

Age at Puberty		**Favorable Relationship Slightly younger**
Calving Rate		**Little Relationship**
Maternal Calving Difficulty		**Little Relationship**
Maintenance Requirements		**?**

Ribeye Area vs Maternal

Age at Puberty		**No Correlation**
Calving Rate		**Favorable Slight effect**
Maternal Calving Difficulty		**Little Relationship**
Maintenance Requirements		**?**

Fat Thickness vs Maternal

Age at Puberty		**Unfavorable Relationship Leaner - Older**
Calving Rate		**Unfavorable Relationship Leaner - lower**
Maternal Calving Difficulty		**Slightly Unfavorable**
Maintenance Requirements		**Little Relationship Leaner tend to be larger**

Retail Yield % vs Maternal

Age at Puberty		**Little Relationship**
Calving Rate		**Unfavorable Higher Yield lower rate**
Maternal Calving Difficulty		**Unfavorable Higher yield more difficulty**
Maintenance Requirements		**Tendency for larger mature**

Summary

- Selecting for marbling would result in little correlated change in maternal traits
- Selection for decreased carcass fat is expected to result in older age at puberty, decreased fertility, and increased calving difficulty
- Selection for increased muscling would have little effect on maternal traits but slightly antagonistic to marbling

Breeding for Today

- **Structured Crossbreeding**
  - **Exploit maternal heterosis**
  - **Combine breed strengths**
- **Multi Trait Selection**
  - **maternal + growth + carcass**
  - **Compromise vs Extremes**
  - **Records, EPDs, indexes**
- **Management Strategies**
  - **Reduce variation and outliers**
  - **Vertical coordination**