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PROCEEDINGS

BEEF IMPROVEMENT FEDERATION RESEARCH SYMPOSIUM AND ANNUAL MEETING

BIF 1998

Hosted by:

Canadian Beef Breeds Council
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1998-99 BEEF IMPROVEMENT FEDERATION BOARD OF DIRECTORS

This 30th BIF Proceedings is dedicated to

Robert de Baca

1998 Beef Improvement Federation Conference
Calgary Convention Centre
Calgary, Alberta
June 30 - July 3, 1998

BIF GENERAL PROGRAM

June 30, 1998

7:00 a.m. - 7:00 p.m.	Registration
8:00 a.m. - 5:00 p.m.	Farm & Ranch Tours
2:00 p.m. - 5:00 p.m.	Board of Directors Meeting
6:30 p.m. - 8:30 p.m.	New Technologies Symposium
8:30 p.m. - 10;30 p.m.	Host Committee Reception

July 1, 1998

7:00 a.m. - 5:00 p.m.	Registration
8:00 a.m. - 12:00 noon	General Sessions
12:00 noon - 2:00 p.m.	Luncheon
2:00 p.m. - 5:00 p.m.	Committee Sessions:
	Multiple Trait Section
	Emerging Technologies & Live Animal Evaluation
6:00 p.m. - 11:00 p.m.	BBQ & Fun Night

July 2, 1998

7:00 a.m. - 3:00 p.m.	Registration
8:00 a.m. - 12:00 noon	General Sessions
12:00 noon - 2:00 p.m.	Awards Luncheon
2:00 p.m. - 5:00 p.m.	Committee Sessions:
	Whole Herd Analysis Committee
	Producer Technology Application Committee
9:00 p.m. - 11:00 p.m.	Board of Directors Meeting

July 3, 1998

9:00 a.m. - 12:00 noon	Calgary Stampede Parade
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NEW TECHNOLOGIES SYMPOSIUM

SORTING FEEDER CATTLE WITH A SYSTEM THAT INTEGRATES ULTRASOUND BACKFAT AND MARBLING ESTIMATES WITH A MODEL THAT MAXIMIZES FEEDLOT PROFITABILITY IN VALUE-BASED MARKETING.

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Basarab, J.A., Graham, B., Brethour, J.R. and Milligan, D. 1997.

Sorting feeder cattle with a system that integrates ultrasound backfat and marbling estimates with a model that maximizes feedlot profitability in value-based marketing.

A study was conducted to evaluate a sorting system developed at Kansas State University by John R. Brethour. The system exploits ultrasound estimates of backfat and marbling score to track future carcass merit. It combines this information with economic conditions such as the carcass price matrix and production costs to project the number of additional days on feed that maximizes profitability (Predicted Days on Feed; PDOF). This sorting system was applied three to four months before slaughter for its ability to improve net return of finished cattle at slaughter. Yearling beef steers (n = 1,705) averaging 409.8 kg (SD = 13.0 kg) were delivered to a large commercial feedlot located in southern Alberta. Animals were randomly assigned to two sorting system treatment groups: sorted by weight (control; n = 856) and sorted by predicted days on feed (PDOF; n = 849). Within the weight sorted group, animals were sorted by individual body weight into low (£ 362.8 kg; long days on feed), medium (362.9 to 408.1 kg; medium days on feed) and high (^{3} 408.2 kg; short days on feed) weight pens. Within the PDOF sorted group, initial animal weight, backfat thickness and marbling score were used to sort the animals into long, medium and short days on feed pens. This procedure was repeated for the purpose of pen replication. Pens of steers on the short, medium and long days on feed were marketed on day 92, 109 and 118, respectively. Steers sorted by PDOF gained 0.12 kg d^{-1} or 6.4% faster and had heavier carcasses (368 vs 353 kg; P = 0.049) than steers sorted by weight. Feed intake and death losses were similar between sorting systems. There was a trend (P = 0.133) for feed efficiency to be improved by 5.6% in steers sorted by PDOF. The group of steers sorted by PDOF also had carcasses with more subcutaneous fat over the 12th and 13 rib (P = 0.122) and more marbling fat (P = 0.097) which resulted in a higher proportion of Y2 yield grade (21.7% vs 16.1%; P = 0.008) and AAA quality grade carcasses (31.4% vs 22.3 %; P = 0.001). The group sorted by PDOF had zero B4 grade carcasses as compared to 1.3% (P = 0.005) for the group sorted by weight. These changes resulted in the PDOF sorted steers being more profitable by \$26.55 hd $^{-1}$ as compared to steers sorted by weight. The increased net return was primarily due to improved weight gains and feed efficiency and a more desirable distribution of carcass yield and quality grades.

Key Words: ultrasound, carcass uniformity, steers

Various feeder cattle sorting strategies, conducted three to six months prior to slaughter, have shown potential in improving the carcass uniformity and profit of finished cattle. In a study conducted at the Kansas State University (KSU) Agricultural Research Center - Hays, Brethour (1990; 1991a) used individual animal weight and backfat estimates to sort feeders into days on feed groups and increase net return by \$20 US hd^{-1} slaughtered. Sainz and Oltjen (1994) used a computer model of growth (Oltjen et al. 1986) to integrate initial animal weight, frame size and backfat thickness and initial feeding information to sort feeders into uniform groups four to six months prior to slaughter. In their trial, the variability in carcass backfat thickness of sorted cattle was reduced by 22.6% as compared to unsorted cattle. In a Canadian study, Basarab et al. (1997) also used a computer model (Oltjen et al. 1986) to theoretically sort animals into estimated days on feed groups three to five months before slaughter. This sorting strategy reduced the variability in carcass backfat thickness by 15.5% compared to steers visually sorted at the end of the feeding period. Recently, Brethour (1994a,b) refined the KSU sorting system by incorporating a live animal measurement of marbling score. This system appears to have economic potential and remains untested under Canadian feeding, grading and economic conditions. The objective of this study was to evaluate the KSU sorting system, applied three to four months before slaughter, for its ability to improve the net return of finished cattle at slaughter.

MATERIALS AND METHODS

Animals, Housing and Management

Yearling beef steers (n = 1,705) averaging 409.8 kg (SD = 13) were assembled by order buyers and delivered to a large commercial feedlot located in southern Alberta. They were delivered from June 24 to 27, 1996 and were from various genetic backgrounds and many different sources. Upon arrival, the cattle were subjected to induction procedures, which included the administration of an IBR-PI_3 vaccine, a combined clostridial vaccine, an injectable parasiticide and a growth-promoting implant. Each animal was individually identified with a visual eartag, recorded for predominant breed cross by visual appraisal and weighed. Backfat and marbling estimates were also taken on each animal with proprietary image analysis software (Brethour 1991b, 1992). The entire induction procedure which included ultrasound measurements and a six way sort (short, medium and long days on feed by two sorting methods) was accomplished at a rate of 65-70 hd hr^{-1}.

Animals were randomly assigned to two sorting methods: sorted by weight; sorted by the KSU sorting system (Brethour 1994a). Within the weight sorted group, animals were sorted by individual body weight into low (£ 362.8 kg), medium (362.9 to 408.1 kg) and high (^{3} 408.2 kg) weight pens. These pens corresponded to long, medium and short days on feed. The chute-side information of weight, backfat thickness and marbling score and the local carcass price matrix and production costs were used to sort the animals into long, medium and short days on feed pens using the KSU sorting system. This procedure was repeated for each sorting system for the purpose of pen replication. The KSU sorting system exploits ultrasound estimates of backfat and marbling score to track future carcass merit. It combines this information with economic conditions such as the carcass price matrix and production costs to project the number of additional days on feed that maximizes profitability (Predicted Days on Feed; PDOF).

After the initial sort, cattle within each pen were managed as a unit. Diet composition and days on each diet are given in Table 1. Feed intake, feed cost, yardage cost and veterinary cost were recorded daily for each pen. Delivery, induction and interest costs, income and net return were recorded on each pen. Income was determined on actual selling price and was \$1.9087, \$1.8999 and \$1.9129 kg^{-1} of slaughter weight for short, medium and long days on feed. Net return was the difference between gross income and total costs (delivery, induction, feed, yardage, veterinary and interest). Additional profit or loss from differences in yield and quality grades were determined by using the grade discounts obtained from Keith Robertson, Canfax (215, 6715 - 8th Street, N.E., Calgary, Alberta T2E 7H7; Table 2). A premium of \$0.2646 kg^{-1} carcass weight was given to AAA quality grade carcasses. Management practices for all cattle followed the guidelines of the Canadian Council on Animal Care.

Black Angus, Hereford, Shorthorn and Red Angus, and crosses among these breeds were classified into the British x British breed group (n=235). Crosses between the Continental breeds (Blonde d'Aquitaine, Brown Swiss, Charolais, Gelbvieh, Limousin, Maine Anjou, Pinzgauer, Salers and Simmental) and the British x British breed group were classified as Continental x British (n=879). Crosses among the Continental breeds were classified as Continental x Continental (n=591).

Each pen of steers was processed at a commercial abattoir. An entire pen was marketed when the majority of steers in the pen approached the carcass weight and grade characteristics required for optimal return under the Canadian Beef Grading System. This was determined by the feedlot manager using visual appraisal. Pens of steers for short, medium and long days on feed were marketed on September 25-26, October 15 and October 23, respectively. Individual animal carcass measurements were obtained the morning following slaughter and included warm carcass weight, backfat thickness, marbling score, lean meat yield, yield grade and quality grade. Backfat thickness and marbling score were obtained using a grader certified under the Canadian Beef Grading Agency. Marbling score was recorded on an inverse descriptive scale, where 1.0 is extreme marbling and 9.0 is devoid of marbling. More specifically, a marbling score of 1.0 to 4.9 equals abundant marbling (AAAA quality grade, USDA prime), 5.0 to 7.9 equals small marbling (AAA quality grade, USDA Choice), 8.0 to 8.9 equals slight marbling (AA quality grade, USDA Select) and 9.0 to 9.9 equals trace marbling or less (A quality grade, USDA Standard). An imprint of the l. dorsi area was obtained using filter paper (Grade 601; 46 cm x 57 cm; Life Science Products, Inc., 10650 Irma Drive, Unit 26, P.O. Box 33090, Denver, Colorado 80233). This 100% cotton fibre paper was approved by both FDA and Agriculture and Agri-Food Canada as "generally regarded as safe" for food contact. The l. dorsi on each imprint was subsequently traced with a black felt pen. The area of the resulting polygon was then determined using image analysis system (Kontron Bildanalyse Image Analysis System, release 1.3, Breslauer Strasse 2, 8057 Eching, West Germany).

Statistical Analysis

All data were analysed using the General Linear Model Procedure (SAS 1992). Differences in variability between sort systems (sorted by weight; sorted by PDOF) for initial weight, backfat thickness and marbling score were tested for significance by subtracting the median for a trait from each animal's value (Lorenzen and Anderson 1993) and then subjecting the absolute deviations from the median to an analysis of variance. Sorting system was the only source of variation in the fixed effect model. The median for a trait was determined using the PROC UNIVARIATE procedure of SAS (1992).

A weighted average for each variable was determined for each replication (n = 2) within sorting system. A replicate consisted of three pens (one pen of short, one pen of medium and one pen of long days on feed) for each sorting system. Sorting system was the only source of variation in the fixed effect model. All performance data, all carcass data with the exception of yield and quality grade distributions and all economic data were analysed using this model. Yield and quality grade distribution data were subjected to Chi square analysis (SAS, 1992).

RESULTS AND DISCUSSION

Initially, steers allocated to the two sorting systems (weight vs PDOF) were similar in body weight (408 vs 410 kg; P > 0.10), backfat thickness (2.51 vs 2.51 mm; P > 0.10) and marbling score (3.75 vs 3.74; P > 0.10). They were also similar in terms of variability for body weight (SD = 45.6 vs 44.8 kg; P > 0.10), backfat thickness (SD = 1.15 vs 1.10 mm; P > 0.10) and marbling score (SD = 0.42 vs 0.41; P > 0.10). However, each sorting system assigned steers quite differently to the short, medium and long days on feed groupings (Table 3). This difference is reflected by the standard deviation which is a measure of the variation within a group. The higher the number is, the lower the uniformity of the group. Thus, steers sorted by weight were 22.4% more uniform in body weight (P = 0.0001), 24.5% less uniform in backfat thickness (P = 0.0025) and equally uniform in marbling score as compared to steers sorted by PDOF.

The average number of days on feed was similar between the sorting systems. This was expected since short, medium and long days on feed groups, regardless of sorting system, were marketed on the same date. Steers sorted by PDOF gained 0.12 kg d^{-1} or 6.4% more than the steers sorted by weight (Table 4). The KSU sorting system is designed to improve ADG and feed efficiency. This is done by estimating the number of days before an animal repartitions feed energy from lean growth to fat deposition. Performance is expected to decline at this time. Estimation of days to feed enables the marketing of early fattening animals sooner to avoid wasting feed merely to produce over-fat animals (Brethour, 1991b). Feed intake and death losses were similar between the two groups. There was a trend for feed efficiency to be improved by 5.0% in steers sorted by PDOF. These results are similar to those reported by Brethour (1991a). In his study, ADG and feed efficiency showed small increases of 2.7% and 2.0%, respectively, for steers sorted by PDOF. Sainz and Oltjen (1994), using a slightly different method for predicting days on feed to grade choice, found no difference in ADG, feed intake and feed efficiency in steers sorted by weight or sorted by PDOF.

Differences were observed in carcass characteristics between sorting systems (Table 4). For example, the average carcass weight for steers sorted by PDOF was 15.1 kg heavier ($P = 0.049$) than that for steers sorted by weight. In addition, carcasses from PDOF sorted steers tended to have more subcutaneous fat over the 12th and 13 rib ($P = 0.122$) and more marbling fat ($P = 0.097$) than carcasses from weight sorted steers. No differences were observed in l. dorsi area or lean yield percentage between sorting systems.

Sorting steers by PDOF resulted in a more desirable distribution of yield and quality grades as compared to steers sorted by weight. For example, the group of steers sorted by PDOF had a higher proportion of Y2 yield grade carcasses and zero B4 grade carcasses. This sorting system also gave a 40.8% increase in AAA quality grade carcasses which was achieved with no significant increase in Y3 carcasses. This reflects the strategy inherent in the KSU sorting system which attempts to project carcasses into the high-value cells of the carcass price matrix without causing them to be over-weight or too fat. For example, since the premium for AAA carcasses exceeded the discount for Y2 carcasses, the model improved profitability by identifying those cattle that could be fed longer to attain AAA quality grade without becoming Y3 nor over-weight. The absence of B4 carcasses (dark cutting) in the PDOF sorted group was unexpected and may reflect a more favourable muscle energy status. A higher level of intramuscular fat has been reported to result in a lower incidence of dark cutting carcasses (Al Schaefer, Pers. Comm. 1997, Lacombe Research Station, Lacombe, Alberta).

The KSU sorting system, applied three to four months prior to slaughter, was more profitable by \$26.55 hd^{-1} compared to sorting by weight (Table 5). The increased net return was primarily due to improved ADG and feed efficiency which resulted in heavier slaughter weights and a more desirable distribution of carcass yield and quality grades. Total costs, which included animal delivery, induction, feed, yardage, interest and veterinary costs, were similar between the two sorting systems. Continued work is warranted to refine the KSU sorting system for incoming feeder cattle under Canadian feeding and grading conditions.

ACKNOWLEDGMENTS
Funding for this project was received from the Animal Industry Division, Alberta Agriculture, Food and Rural Development. Special thanks is extended to Lakeside Feeders Ltd. and Lakeside Packers for the use of their staff, cattle, weigh scales and facilities. Acknowledgments are also extended to Phyllis Day of Alberta Agriculture, Food and Rural Development, Rod Wendorff of Windy Ridge Livestock and Howard

Kirbyson of the Canadian Beef Grading Agency for assistance in data collection and processing.

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Table 1. Diet composition and days on each diet.

	Diet number				
	1	2	3	4	5
Days on each diet	3-5	4-6	3-7	5-7	72-102
Diet Ingredient, % as fed					
Barley silage	91.32	79.60	65.20	46.31	19.58
Barley grain	6.50	17.83	32.58	50.27	75.18
Water	0.17	0.41	0.69	1.07	1.61
Molasses	0.13	0.30	0.52	0.79	1.55
Grease	0.00	0.02	0.06	0.09	0.30
Feedlot supplement	1.88	1.83	0.95	1.47	1.79
Cost, $ te^{-1}	47.28	64.95	85.45	114.25	145.85
Diet composition, DM basis					
Dry matter, %	37.67	43.78	67.93	87.84	74.58
NEm, MJ kg^{-1}	6.00	6.69	7.40	7.93	8.46
NEg, MJ kg^{-1}	3.57	4.18	4.79	5.26	5.72
Crude protein, %	12.32	12.30	12.31	12.26	12.31
Calcium, %	0.76	0.69	0.47	0.52	0.52
Phosphorus, %	0.36	0.35	0.33	0.34	0.34
Potassium, %	1.71	1.42	1.17	0.93	0.72
Sulphur, %	0.22	0.21	0.19	0.18	0.18
Magnesium, %	0.21	0.20	0.19	0.19	0.17
Sodium, %	0.42	0.32	0.15	0.13	0.10
Chlorine, %	0.59	0.48	0.34	0.29	0.22
Salt, %	0.25	0.20	0.08	0.11	0.11
Manganese, mg kg^{-1}	78.2	65.9	40.8	41.1	38.1
Zinc, mg kg^{-1}	177.0	152.0	81.4	97.2	97.6
Copper, mg kg^{-1}	28.6	24.4	13.3	15.3	15.0
Iron, mg kg^{-1}	287.1	243.4	175.9	160.6	140.2
Iodine, mg kg^{-1}	0.88	0.72	0.30	0.39	0.39
Cobalt, mg kg^{-1}	0.71	0.62	0.47	0.45	0.42
Selenium, mg kg^{-1}	0.27	0.23	0.10	0.12	0.12
Vitamin A, KIU kg^{-1}	11.00	9.10	3.83	4.95	4.95
Vitamin D3, KIU kg^{-1}	1.10	0.91	0.38	0.50	0.50
Vitamin E, IU kg^{-1}	1.10	0.91	0.38	0.50	0.50
Crude fat, %	3.77	3.38	3.02	2.70	2.34
Acid detergent fibre, %	28.61	23.22	18.35	13.79	9.58
Ethoxyquin, mg kg^{-1}	0.18	0.15	0.06	0.08	0.08
Antibiotic, mg kg^{-1}	11.00	11.26	8.54	11.04	11.04
Ionophore, mg kg^{-1}	13.00	12.60	8.54	11.04	15.37

Table 2. Carcass grade and weight discounts for finished steers (Canfax, 1996).

Grade discounts			Weight discounts		
Grade	$ lb^{-1}	$ kg^{-1}	Weight category	$ lb^{-1}	$ kg^{-1}
Y1	0.000	0.0000	≤ 464 lb	-0.050	-0.1102
Y2	-0.030	-0.0661	465 - 549 lb	-0.040	-0.0882
Y3	-0.100	-0.2205	550 - 750 lb	0.000	0.0000
B1	-0.100	-0.2205	750 - 820 lb	-0.050	-0.1102
B2	-0.250	-0.5512	821 - 920 lb	-0.100	-0.2205
B3	-0.350	-0.7716	≥ 921 lb	-0.250	-0.5512
B4	-0.350	-0.7716			
D1, 2, 3	-0.650	-1.4330			
D4	-0.800	-1.7637			

Table 3. Initial characteristics of steers sorted by weight or sorted by predicted days on feed (PDOF).

Initial trait	Days on feed	Sorted by weight N	Mean	SD	Sorted by PDOF N	Mean	SD	Prob.[z]
Live body weight, kg	short	408	445.7	31.1	246	456.9	35.6	.0214
	medium	307	386.3	12.9	256	414.8	19.0	.0001
	long	141	344.4	17.6	347	372.5	27.6	.0001
	overall[y]	856	407.7	22.3	849	409.7	27.3	.0001
Backfat thickness, mm	short	408	2.82	1.17	246	3.39	1.39	.0001
	medium	307	2.37	1.16	256	2.53	0.70	.0021
	long	141	1.93	0.76	347	1.88	0.52	.0031
	overall[y]	856	2.51	1.10	849	2.51	0.83	.0025
Marbling score	short	408	3.80	0.41	246	3.88	0.47	.0145
	medium	307	3.71	0.42	256	3.75	0.39	.4453
	long	141	3.70	0.45	347	3.63	0.35	.1412
	overall[y]	856	3.75	0.42	849	3.74	0.40	.9896

[z] Probability that treatment variances are different.
[y] The overall standard deviation (SD) is the weighted average of the SD for short, medium and long days on feed within trait.

Table 4. Performance, feed efficiency and carcass characteristics of steers sorted by initial live weight or sorted by predicted days on feed (PDOF).

		Sorted by weight	Sorted by PDOF	SEM	Prob.[z]
Number of steers		856	849		
Performance					
Days on feed		102	108	2.2	0.212
Average daily gain, kg d^{-1}		1.87	1.99	0.02	0.043
Daily DM intake, kg d^{-1}		12.03	12.22	0.15	0.454
Feed:gain ratio, kg kg^{-1}		6.46	6.15	0.10	0.133
Death loss, %		0.29	0.60	0.23	0.440
Carcass characteristics					
Warm carcass weight, kg		353.0	368.1	2.6	0.049
Backfat thickness, mm		6.3	7.0	0.2	0.122
L. dorsi area, cm^2		86.8	86.7	0.2	0.758
Marbling score[y]		8.34	8.19	0.04	0.097
Lean yield, %		61.2	61.0	0.07	0.184
Yield grade	- Y1, %	80.4	75.4		0.026
	- Y2, %	16.1	21.7		0.008
	- Y3, %	1.3	2.3		0.144
	- B1, %	0.9	0.5		0.381
	- B4, %	1.3	0.0		0.005
Quality grade	- A, %	19.1	13.3		0.004
	- AA, %	58.6	55.3		0.220
	- AAA, %	22.3	31.4		0.001

[z] Probability that means or percentages are different.

[y] Marbling score is a measure of the intramuscular fat: Trace marbling or less = 9.0 to 10.0 (A quality grade, USDA Standard); Slight marbling = 8.0 to 8.9 (AA quality grade, USDA Select); Small marbling = 5.0 to 7.9 (AAA quality grade, USDA Choice); Abundant marbling = 1.0 to 4.9 (AAAA quality grade, USDA prime).

Table 5. Economic performance of steers sorted by initial live weight or sorted by predicted days on feed (PDOF).

	Sorted by weight	Sorted by PDOF	SEM	Prob.[z]
Cost, \$ hd^{-1}				
Delivery	719.17	720.17	16.42	0.970
Feed	216.74	230.95	5.82	0.227
Yardage	22.33	23.51	0.54	0.259
Interest	15.06	16.03	0.21	0.086
Induction	6.77	6.86	0.63	0.925
Veterinary	0.48	0.33	0.20	0.651
Total	980.55	997.85	11.38	0.395
Income, \$ hd^{-1}	1121.12	1158.19	8.77	0.096
Profit, \$ hd^{-1}	140.58	160.34	3.22	0.049
Difference, \$ hd^{-1}		<u>19.76</u>		
Discounts and premiums(base price = \$3.09 kg^{-1})				
Yield grade - Y1 (\$0.0000 kg^{-1})			0.0000	0.0000
- Y2 (\$-0.0661 kg^{-1})			-0.0106	-0.0143
- Y3 (\$-0.2205 kg^{-1})			-0.0029	-0.0051
- B1 (\$-0.2205 kg^{-1})			-0.0020	-0.0011
- B4 (\$-0.7716 kg^{-1})			-0.0100	0.0000
-A (\$-0.0000 kg^{-1})			0.0000	0.0000
-AA (\$-0.0000 kg^{-1})			0.0000	0.0000
-AAA (\$+0.2646 kg^{-1})			0.0590	0.0831
Price, \$ kg^{-1}			3.1235	3.1526
Carcass weight, kg			353.4	353.4
Income, \$ hd^{-1}			1103.84	1114.13
Difference, \$ hd^{-1}				<u>**10.29**</u>
Cost of ultrasound, \$ hd^{-1}				3.50
Total difference, \$ hd^{-1}				<u>**26.55**</u>

[z] Probability that means or percentages are different.

GENERAL SESSION # 1
DEFINING IS THE MARK

CONSUMER & CONSUMPTION TRENDS IN THE UNITED STATES

by Mary M. Adolf, Vice President U.S. Consumer Marketing
National Cattlemen's Beef Association

Consumer confidence has been on the upswing lately. But consumer attitudes can be fickle, as research shows. Nonetheless, these attitudes -- and the purchasing decisions they affect -- are crucial to the beef industry.

First, it's important to understand the lives and priorities of today's consumer. Some significant trends include:

- Baby boomers will enter a new life stage of Empty Nesters with large disposable incomes in the next 10 years;
- The trend of immigrants introducing food flavors and preferences will continue;
- The increase in single person households will mean the need for smaller packages and greater eating pattern variety;
- Consumer attitudes toward nutrition/diet appear to be moderating; there is a shift from an avoidance mindset to one that believes health can be optimized with supplements.
- A reassessment of values/goals will mean more emphasis on family and quality of life;
- The need for simplicity and convenience will continue to be fueled by our time famine.

Changes in Age, Ethnicity and Household Size

People tend to eat less meat as they grow older, and this is of serious concern to the beef industry, as America has an aging population. The shift toward an increasingly older society is being driven by three factors; baby boomers are getting older, Americans are living longer and the U.S. birth rate has hit an all-time low over the past decade. (*Age Wave* by K. Dychtwald, Ph.D.)

For example, 15 years ago the peak population group was graduating from college. Today they are thirty-something. The median age in the U.S. is expected to hit 36 by the year 2000. As recently as 1980 the median age was 30. At the same time, the 65^+ age group has grown tremendously, and will continue to grow. That age group now surpasses the teenagers group, according to the U.S. Census Bureau.

Baby boomers will soon have their children leave home and enter a new lifestage as Empty Nesters. This change, which will tremendously influence the number of 45 -65 year olds, will probably dominate national trends during the next 10 years (Third Wave Research Group for the NPD Group/NET).

In addition, America is now becoming more ethnically diverse, which will drive the kinds of foods we eat, and how we eat them. The percentage of Caucasians in this country was 90 percent in 1950; in the year 2000 it's estimated that it will be 79 percent. By the year 2050, non-Hispanic Whites may make up only a little over half of the population. And by 2015, the Hispanic population is expected to double its 1990 size.

The average household decreased in size from 3.5 in 1960 to 2.6 in 1993 (U.S. Dept. of Commerce). This means more single persons, a decline in couples with more than two children, greater eating pattern variety -- and smaller packages for meat and other foods.

The composition of the U.S. family is also changing. Traditional households are out; they've fallen from a 40.3 percent share to a 25.8 percent share of total households between 1970 and 1994. In fact, there are now more married couples without children than with children. Single parent households have increased from 3.8 million 1970 to 11.4 million in 1994.

Smaller and non-family households are becoming more common. One in every nine adults now lives alone. Since 1970 the number of unmarried couple households has grown from 523,000 to about 3.7 million.

Changing Attitudes about Nutrition and Values

Consumer attitudes toward nutrition/diet appear to be moderating, shifting from an avoidance mindset to one that believes health can be optimized with supplements. According to NPD Net, concerns about cholesterol, caffeine, additives, salt and preservatives have declined since the late 80's and early 90's. They're still interested in health and the foods they eat (not abandoning low-fat, healthy food), but they're rewarding themselves more frequently with small indulgences. In fact, for the first time in 15 years, losing weight/stopping smoking are not the number 1 New Year's resolution -- spending more time with the family was.

More than two thirds of Americans are considered overweight; that number has been consistent since 1993 (Source: Rodale Press Prevention Index, 1995). And attitudes are changing as a result. In 1985, 55 percent of homemakers surveyed completely agreed that "people who are not overweight look a lot more attractive." In 1996 that percentage had dropped to 28 percent.

Values for Americans are being redefined. The three most important priorities today are family life, spiritual life and health.

The scarcest resource, reflected in many consumer attitudes and behaviors, is time. Reasons for this time drain include an increase in women in the work force, increase in single parent households and more work hours. Fifty-one percent of adults surveyed in 1995 said they would rather have more free time even if it meant less money. Only 35 percent said they would rather earn more money even if it required more time. Nearly half (48 percent) of adults report they have taken steps to simplify their lives (Source: U.S. News & World Report, December 1995).

As a result, males are helping out more with chores, such as preparing meals. That's evident in the increased popularity of grilling -- and that's good for beef, as beef is one of the most popular grill meals (Source: NPD Group NET). Females, however, are still the primary meal preparers.

Consumers' Scarcest Resource is Time

More women are now working outside the home. This trend underscores the importance of simplicity and convenience for the primary meal preparer. In 1960, 28 percent of women were in the workforce; in 1995 that had increased to 70 percent.

Customers in supermarkets are streamlining meal preparation, cutting back on meal pre-planning. Only 29 percent of meal preparers check recipes for ingredients before a shopping trip; approximately 2/3 of dinner decisions are made the same day. Forty percent don't know at 4:00 p.m. what they're going to have for dinner that night, and 33 percent of households wait until right before dinner to decide what to eat, based on "what's in the house" (54 percent) and "how much time do I have" (49 percent) (Source: NCBA/Leo Burnett Co., Category Management Qualitative, 1996).

Therefore, convenience remains paramount. There has been an increase in the percentage of households taking less than 15 minutes to prepare a meal. Yet while less time is spent on preparation, more time is spent on mealtime, which is being reclaimed as a way for families to spend time together. Nearly 70 percent of households with children eat five or more dinners together during a typical week.

Despite a surge in away-from-home eating occasions, nearly three out of four main meals are still prepared at home. Working women and two income households are more likely to buy take-out or prepared food for their main meal (Source: Shopping for Health, FMI, 1996).

Recipe usage, still an important factor in meal preparation, is most prevalent in traditional families and older meal preparers. More than one third of all households use recipes on a weekly basis; two thirds use them on a monthly basis.

While they come from a variety of sources, most recipes must be"tried and true" to be accepted by consumers. Recipes from cookbooks account for two in every five recipes used. Family, friends and recipes in/on packages account for another quarter of recipes (Source: NPD Pantry Check, 1996).

Working Women

These trends and other research suggest that, in the future, meals made at home will be:

- ***Easy.*** Americans are using fewer ingredients and there are fewer dishes being made from scratch (Source: NPD/NET). Homemade items are decreasing at every meal.

- ***In larger quantities.*** When prepared, meals are prepared in large quantities. Leftovers are a convenient solution for an additional meal later in the week.

- ***Most likely a one-dish meal.*** According to NPD/NET 1996, the average number of dishes served at a meal went from 3.47 in 1987 to 3.19 in 1996. The only stable part of a meal today seems to be the presence of an entrée.

- ***Prepared by someone else.*** More households are relying on "take-out" or "carry-in" meal solutions. In 1995, 30 percent of meals were take-out from restaurants -- nearly double the 16 percent take-out figure in 1984 (NPD/NET 1996).

The most common reason people eat out more often, in fact, is that they have no time to prepare at home. Others just prefer the atmosphere away from home, or don't want to cook themselves (Source: FoodTrends '95 Survey).

Though they're eating out more often, consumers are increasing their dependence on take-out food. In 1996 take-out food surpassed on-premise dining in terms of the number of commercial restaurant meals eaten per person.

The increase in take-out meals is especially evident at the lunch and supper meal occasions. These meals are often "take-home" meals, as people are purchasing the food at the restaurant and taking it home to eat.

Consumer Attitudes Toward Beef

At $50.3 billion, 1996 beef sales accounted for nearly 1 percent of the total U.S. Gross Domestic Product. Nearly nine out of ten households will serve some form of beef over a two-week period. That's 87 million households, or about 234 million consumers (Source: USDA and Cattle-Fax, NPD/NCBA Meat Purchase Diary).

Beef scores well among consumers in several attributes. In a 1996 Gallup survey, 82 percent of respondents ranked beef high in taste, ease of preparation and appropriateness for various occasions. On the other hand, it did not rank well in how well it can fit into a fat reduced diet or its suitability for light meals.

Taste is one of beef's strengths and consumers think that the flavor and tenderness of beef steaks and roasts is improving. According to the 1997 Hart Research, 21 percent of adults feel that the flavor and tenderness is getting better, versus only 14 percent who think it is getting worse.

Beef Consumption Trends (Meat Purchase Diary)

Fresh beef is still popular, served by 81 percent of households in a two-week period. Those serving fresh beef use it 3.8 times, or about two times a week (Source: NPD/NCBA Meat Purchase Diary). At 81 percent penetration, beef is still ahead of other proteins.

Total dollars spent in supermarkets on fresh meat remained constant from 1996 to 1997. Fewer pounds per household were purchased at a slightly higher price per pound (Source: NPD/NCBA Meat Purchase Diary).

Supermarket expenditures on beef, which account for almost fifty cents of every dollar spent on fresh meat, remained relatively constant with 1996 levels. Chicken which boosted expenditures with price increases, offset losses by pork and turkey. Beef tonnage decreased slightly. Non premium steaks volume grew in 1997 despite higher prices.

As noted in the Foodservice section, away-from-home steaks are just as popular, as steak eatings at casual restaurants rose 34.6 percent since 1993.

Nearly 3/4 of the time, beef is consumed at the evening meal. And, fresh beef is the most popular source of protein at dinner, represented at 22 percent of all meals in this daypart.

Beef is eaten most often "as is" in a base dish, but is also popular as an ingredient and in sandwiches. Versatility is important, as the percentage of dinners that include a center-of-the-plate protein is decreasing.

The most popular ways of serving beef are as a steak, a hamburger or in a ground beef dish. Steak is consumed as a base dish ("as is") 83 percent of the time, while the most popular use of ground beef is in hamburger and cheeseburgers (Source: NPD/Net 1996).

The most popular lunch/dinner entrée-oriented dish (both at home and in restaurants) is the hamburger, followed by pizza and ham sandwiches. Steak ranks seventh in the top ten.

Consumers Attitudes About Safety

In 1996, consumers perceived beef products to be slightly ahead of poultry, pork and seafood in terms of food safety. In 1997, consumers' level of confidence in the safety of beef has fallen considerably since last year according to the 1997 Hart Research study. The concern over safety is related to E.coli and BSE, as well as the use of chemicals and additives in beef.

In 1996, consumers were more confident of the safety of steaks and roasts versus other meats and poultry. Ground beef (hamburger), however, rated below other meats and poultry, with the exception of ground pork, in terms of consumer confidence in microbiological safety.

In 1996, 71 percent of consumers perceived that the beef industry had dealt "very well" or "fairly well" with BSE and E.coli issues. This rating slipped to 65 percent in 1997 for BSE concerns.

Conclusion

Many factors influence consumer attitudes and purchasing decisions. Among the most important factors are:

- An aging population, with smaller households and larger disposable incomes;
- An increasingly ethnic society that introduces new flavors and food preferences to the American scene;
- A moderating attitude toward nutrition and health;
- Reassessment of values and goals that are important, with increased focus on the family and quality of life; and
- Increasing demands for convenience and simplicity, with consumers continuing to feel the time crunch in their lives.

The beef industry will need to react to the changing consumer base by:

- Reinforcing consumers' existing desire for beef;
- Adding consumer value to our product;
- Stressing that beef is a good part of a balanced diet; and
- Insuring safety at all levels of the industry.

Through its advertising, promotion, information and research programs, the beef industry is capitalizing on beef's strengths as it addresses the needs and desires of consumers. Maintaining a clear understanding of the factors involved with consumer demand will help the industry better market its products in the future.

CONSUMER AND CONSUMPTION TRENDS IN CANADA

By Glenn Brand, Beef Information Centre

SOCIOECONOMIC TRENDS

- Aging Population
- Changing Ethnic Mix
- Smaller Households
- More Working Women

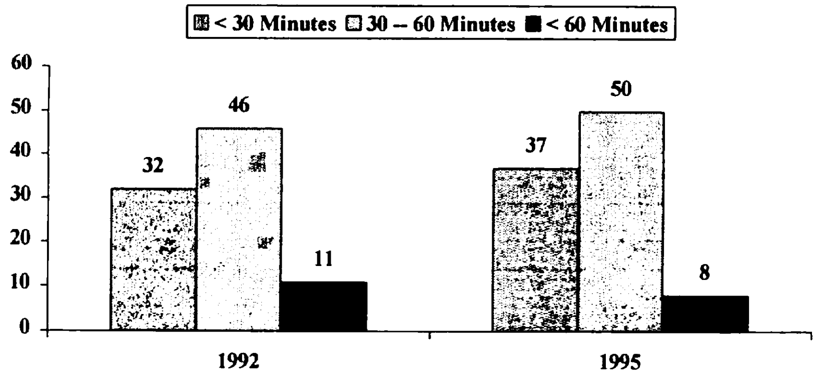
MEAL PLANNING

- During the day - 41%
- On the way home or just before the meal - 23%

TOTAL 64%

Source: BIC Tracking Study - 1997

FOOD PREPARATION
(Weekday Meals)



Source: Kraft Pantry Studies

MEAL PREPARATION
(Evening Meal)

Prepared at home from scratch or with
<u>one or more convenience products</u> -- **79%**

Fully prepared frozen
(cook & serve) -- **8%**

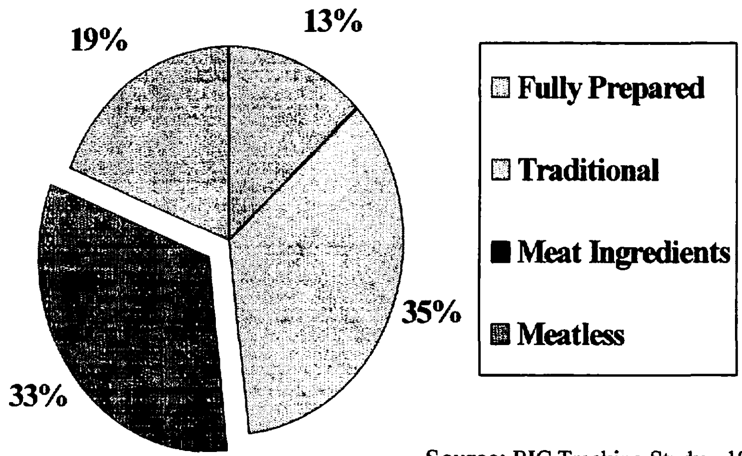
Bought ready-to-eat
(supermarket/foodservice) -- **12%**

Source: BIC Tracking Study - 1997

CHANGING VALUE EQUATION

1950's	P = Q	P=Price
		Q=Quality
1960's - 1970's	V = Q/P	T=Time
		S=Stress
1980's	V = Q/P X T	
1990's	$V = Q/P \times T^2 \times S$	

CONSUMER EATING HABITS ARE CHANGING



Source: BIC Tracking Study - 1995

CONVENIENCE ATTITUDES

The biggest problem with serving beef for a weekday meal...

■ Speed	31%
■ Ease of Use	12%
■ Price	13%
■ Health	11%

Ease of Use + Price = 43%

Source: BIC Segmentation Study

THE BEEF CUSTOMER

What's Important?

■ 65% say tenderness most important

■ consistency -- 51% say buying beef is a game of chance

Source: BIC Consumer Segmentation Study / BIC Quality Study

CUSTOMER COMPLAINTS

Research Shows …

- 96% of unhappy consumers do not complain to the provider of that product or service

- less than 1/10th of 1% of tough steaks are returned to the store

Source: U.S. National Beef Tenderness Study

BEEF QUALITY

- Agriculture Canada, Lacombe Research Station 1996 Retail Audit found…
  - 31% of steaks and
  - 36% of roasts WERE TOUGH

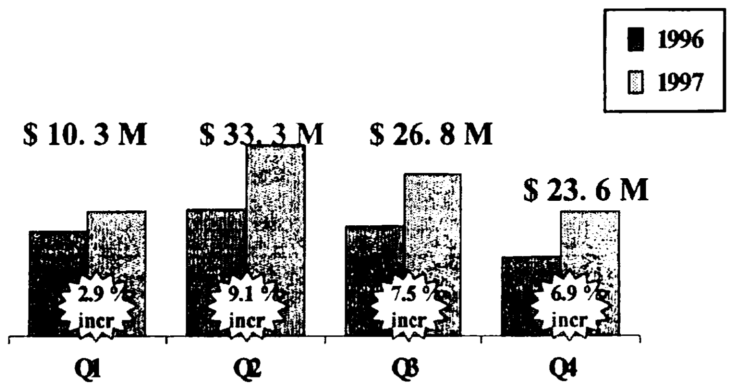
- BIC Marbling Study found ...
  - 33% of "A" grade unacceptable
  - 24% of "AA" grade unacceptable
  - 15% of "AAA" grade unacceptable

BEEF QUALITY

- 1994 U.S. Beef Quality Audit found…
  - 20% of loin & rib steaks
  - 40% of chuck steaks/roasts
  - 50% of hip steaks/roasts WERE TOUGH
  - Overall 1 in 4 were tough

There is room for improvement !

RETAIL BEEF VOLUME -- $'S

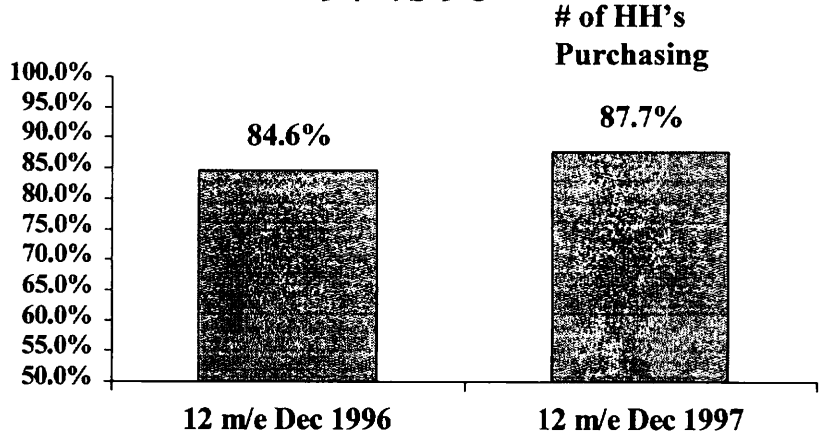


Total ⇧ for '97 = $ 94 Million

Source: NPD Group Canada Inc.

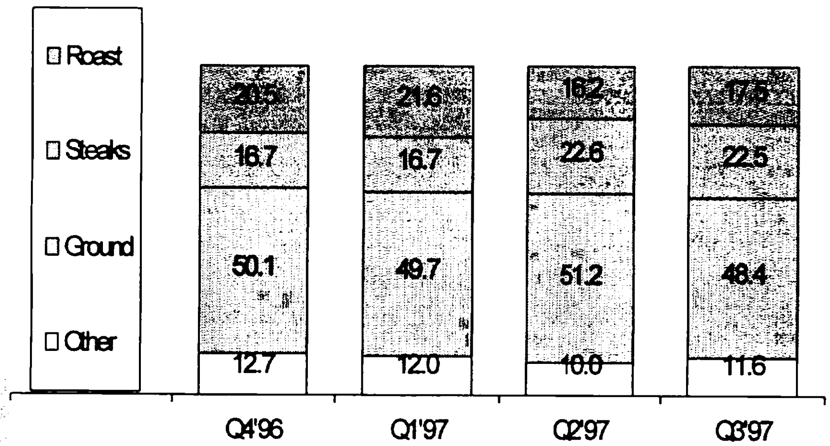
HOUSEHOLD PENETRATION

97 vs 96



Source: NPD Group Canada Inc.

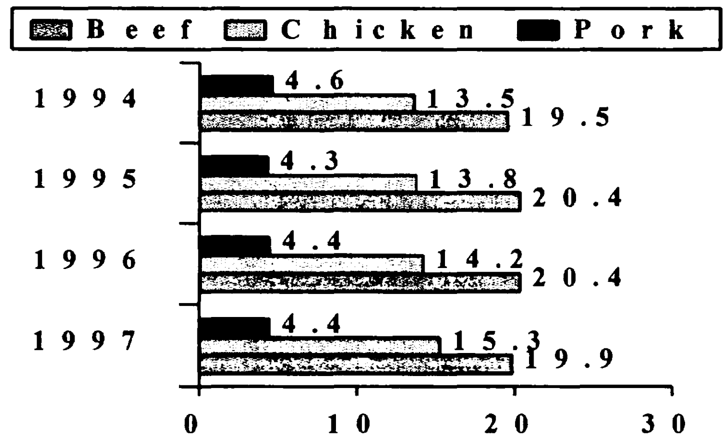
BEEF KILOGRAM SHARE BY TYPE



Source: NPD Group Canada Inc.

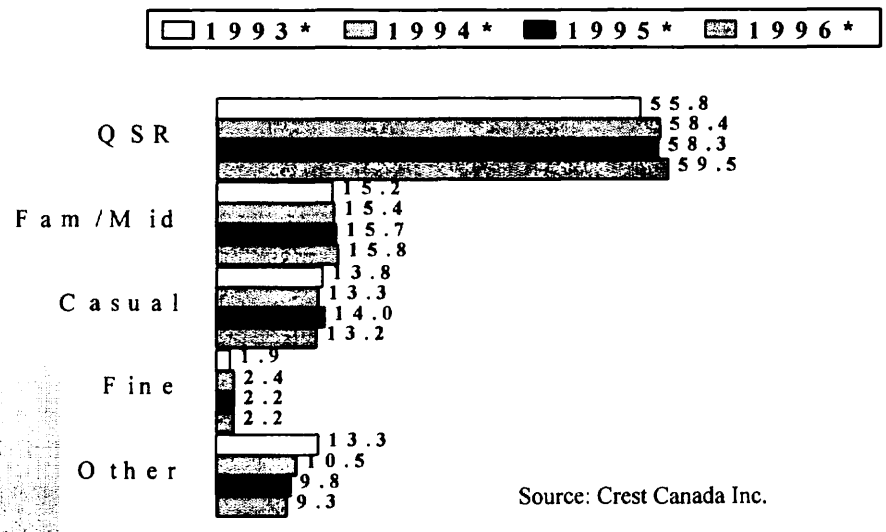
FOODSERVICE

% OF TOTAL EATER OCCASIONS



Source: Crest Canada Inc.

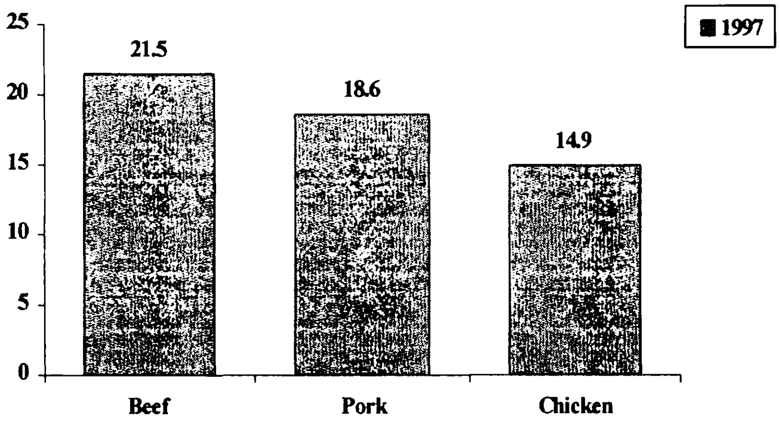
% SHARE EATER OCCASIONS BY OPERATOR



Source: Crest Canada Inc.

PER CAPITA CONSUMPTION

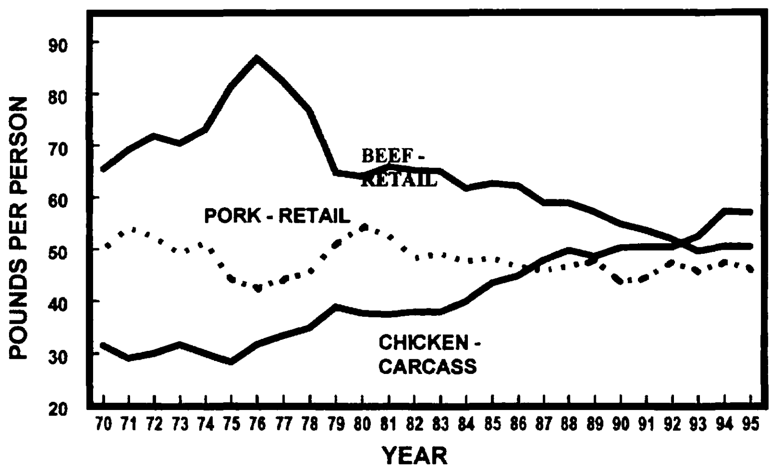
Kg's -- Boneless Basis



Source: Canfax/Statistics Canada

CDN PER CAPITA MEAT CONSUMPTION

POUNDS PER PERSON - 1970 - 1995



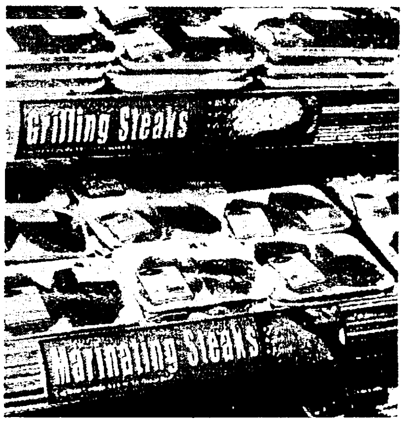
Source: Statistics Canada

PREFERRED NOMENCLATURE SYSTEM

Use of both the anatomical and cooking method systems was preferred by the vast majority (73%)

Strip Loin Grilling Steak
Inside Round Marinating Steak
Blade Simmering Steak
Inside Round Oven Roast
Cross Rib Pot Roast

COUNTER LAYOUT



- 75% preferred counter laid out by cooking method
- more informative and makes shopping easier

NEW RETAIL NOMENCLATURE for the BEEF COUNTER

THE SITUATION

Customer wants a steak to BBQ for dinner.

- **Select on basis of:**
  - **leanness**
  - **bright red color**
  - **price**

- **Chooses an Eye of Round Steak**

- **Grills steak and very dissatisfied -- Steak is tough!**

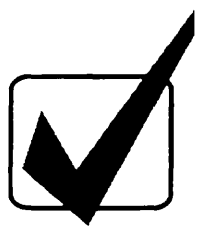
THE CHALLENGE

How do we ensure that our customers get the eating satisfaction they desire from every cut of beef they purchase?

QUALITATIVE RESEARCH

12 Consumer focus groups -- tested 5 different nomenclature systems

- Anatomical
- Occasion
- Time
- Quality
- **Cooking Method -- Preferred System**



USEFULNESS OF CURRENT ANATOMICAL SYSTEM

- Anatomical cuts are poorly understood
- Consumers don't relate cuts to tenderness
- Have very limited cut repertoires
- Shoppers are confused, intimidated and restrict their purchases to a very few cuts

CURRENT ANATOMICAL SYSTEM

- Only 1 in 4 shoppers considers name when buying beef

- Most shoppers buy only 1 cut of steak -- usually a loin/rib steak
- Awareness of roast cuts even lower than for steaks

COOKING KNOWLEDGE

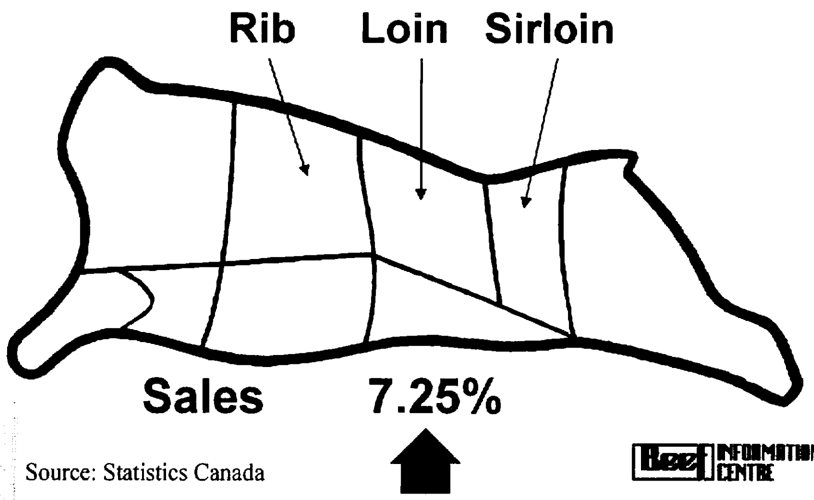
- 1 in 3 shoppers admit their lack of cooking knowledge prevents them from buying certain cuts
- In the 26-35 age group this is increased to almost 50% for roasts

IMPLICATIONS

- Anatomical system limits customers' purchases
- Cuts best known are from rib and loin -- resulting in poor demand for hip and chuck cuts
- If familiar cuts aren't available, too expensive or not visually attractive, customer doesn't buy beef
- Roast sales are being lost within family formation segment (age 26-35)

Beef INFORMATION CENTRE

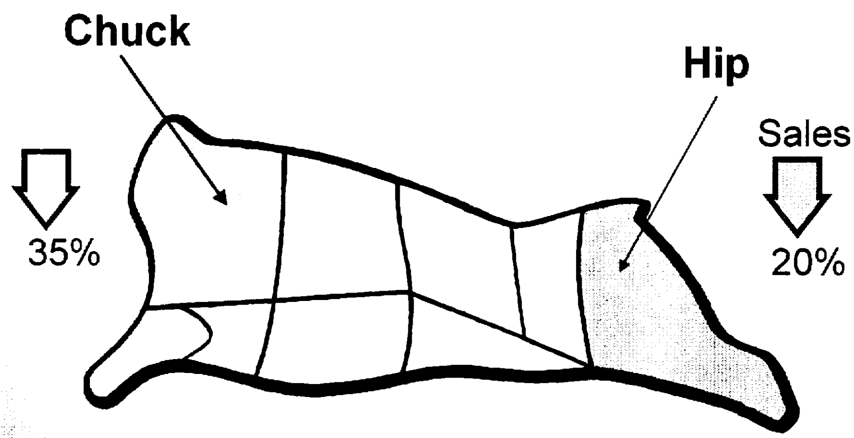
MIDDLE MEATS ARE 28% OF CARCASS



Source: Statistics Canada

Beef INFORMATION CENTRE

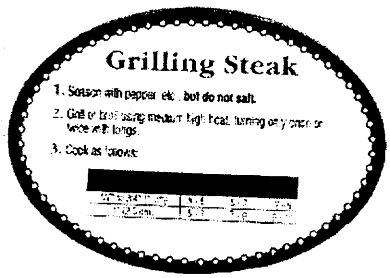
HIP AND CHUCK CUTS ARE 53% OF THE CARCASS



Source: AAFC - National Beef Cut Out

Beef INFORMATION CENTRE

COOKING INSTRUCTIONS



- 83% would use cooking instructions
- 66% want them on the package
- 78% felt cooking instructions would encourage people to buy more beef.

SOLUTION

Three Pronged Approach:

- Revised nomenclature incorporating both the anatomical and cooking method terminology
- Counter layouts based on cooking method with appropriate section identification
- Cooking instructions on all packages

NOMENCLATURE
TEST MARKET RESULTS

- Improvements in customer eating satisfaction
- Expanded cut repertories
- Increase in sales of hip and chuck cuts
- Overall sales increase

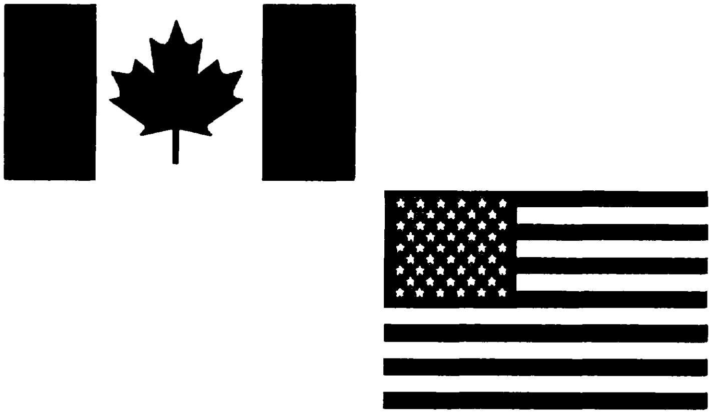
HOME MEAL REPLACEMENT

<u>Three Basic Categories</u>

- Fully Prepared
- Heat 'n Eat
- Value-Added Meal Components

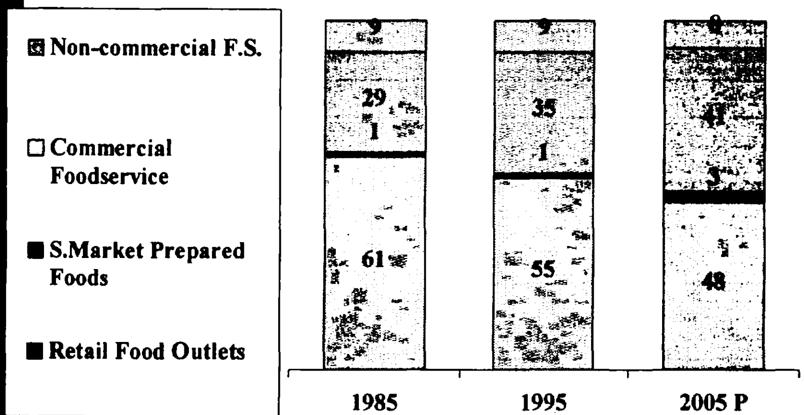
CANADA VS THE U.S.

ARE THE OPPORTUNTIES DIFFERENT ?



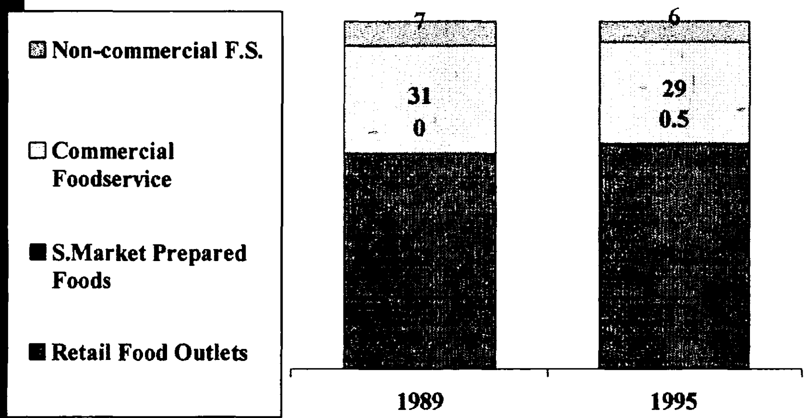
U.S. GROWTH

FOODSERVICE AND SUPERMARKET PREPARED FOODS

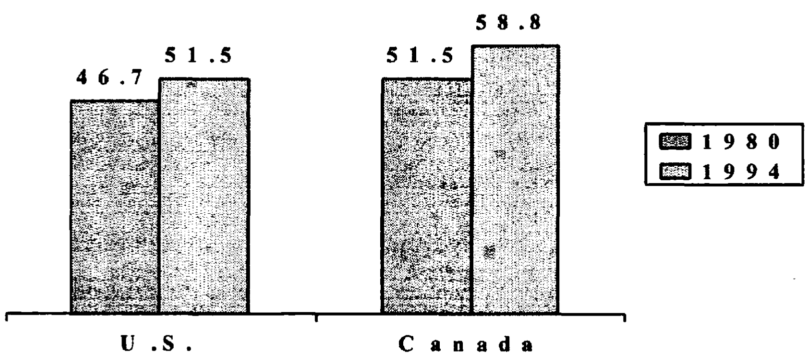


CANADIAN GROCERY STORES GAINED SHARE

AT THE EXPENSE OF FOODSERVICE



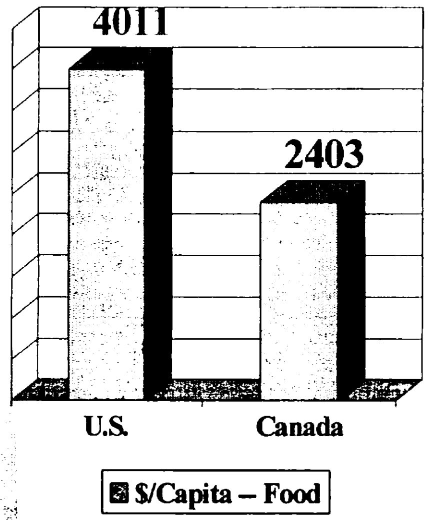
CANADIAN AND U.S. FAMILIES IN TIME CRUNCH



% working women

Source: McKinsey & Company

BUT ...



- Canadian families have less disposable income
- And therefore spend less per capita on food

40% less than U.S.

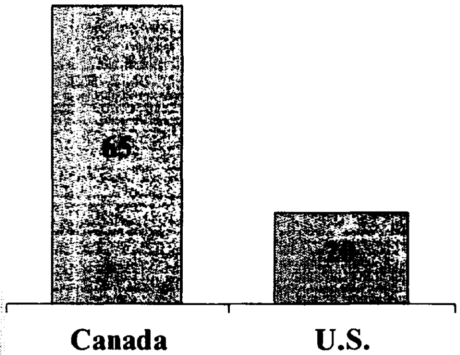
Source: McKinsey & Company

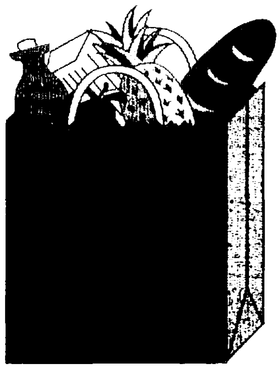
Cooking Still Important

- Most women cook a meal "from scratch" 5 nights a week.
- 64% of households regularly cook from "scratch".

Source: Canadian Living Magazine, Family Health Survey 96
1996 Kraft Pantry Study

CANADIANS HAVE MORE PANTRY ITEMS

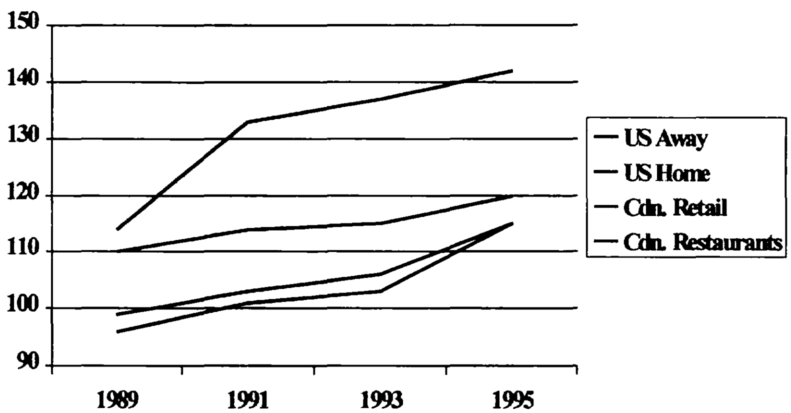




Source: McKinsey & Company

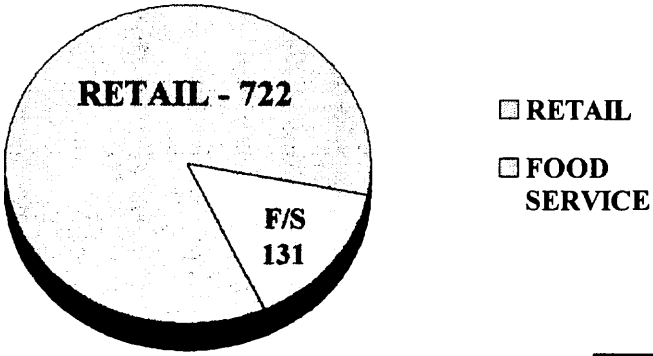
RESTAURANT vs RETAIL

Price gap has widened dramatically in Canada



Source: McKinsey & Company

CONSUMER PURCHASE BEHAVIOR -MEAL P.O.P



Source: Yankelovich and Associates - 1996

DEMAND FOR VALUE ADDED BEEF PRODUCTS

- A recent study conducted by Actionable Market Research showed extremely high "propensity to purchase" scores
- 86% to 96% of those surveyed said they would probably or definitely purchase a line of pre-marinated beef strips, kebobs and steaks in variety of flavors.

Source: Actionable Market Research - 1997

PREMIUM PRICING

- "The vast majority indicated they would be willing to a premium of 10 % or more for marinated products (i.e. "over the equivalent product that had not been marinated")

Source: Actionable Market Research - 1997

Understanding the Consumer is Key to Increased Sales and Profits

GENERAL SESSION # 2
WHAT IS THE MARK

FINK BEEF GENETICS

Galen Fink, Manhattan, KS

Started in 1977 as a purebred Angus program based totally upon artificial insemination (A.I.), Fink Beef Genetics has been dedicated to breeding predictable performance for beef producers. It is a family-owned business that I operate with my wife Lori and our daughter Megan.

Recognizing the Angus breed for its maternal strength, we built our program by stacking generations of proven sires and great Angus cow families. The direct influence of landmark sires such as AAR New Trend and Emulation N Bar 5522 headline their foundation. The most important tool used in building our herd has been high accuracy EPDs of sires, backed by cow family production records, longevity and udder soundness.

The cowherd is the strength of our program. The product of at least six generations of objective performance and a "cowman's eye", the females have built the Fink Angus name. Their matrons are real beef cows with that "mother cow" look. They are practical, functional, productive and structurally sound. They are well-balanced with the inherent and proven ability to breed, milk and produce pounds of beef.

Fink Angus is a nationally recognized source of predictable problem-free Angus genetics in volume with sales to cattle producers in nearly every state. Proven sires dominate with 80 to 90% of the calf crop sired by Sire Evaluation leaders with 100 or more daughters on record. This takes the guesswork out of genetics. Our bulls sire appropriate levels of milk, are moderate frame, "good-doing" stock offering optimum performance balance.

High accuracy sires enable us to provide meaningful marbling and ribeye information backed by generations of carcass data. Fink-sired cattle have proven themselves through customers' feedlot ownership, to combine superior gainability with a typical 95+ percent choice quality grade within industry standard yield grades of 1, 2 and 3

Our production unit is comprised of 150 registered Angus cows critically selected for many generations. They are complemented by one of the largest, most practical cost-efficient embryo transfer (ET) programs in the country. This allows rapid production of superior generations. One of the first to pioneer ET cooperator herds, Fink Genetics now transplants 800 – 1000 embryos annually. This supports mass production of full brothers, increasing predictability and uniformity in the herds of our commercial bull customers.

The discussion to this point has basically described our "roots" in the business. I would now like to briefly discuss some of the additional programs we are involved with in order to enhance our customer services and expand our role in the beef industry.

Term-A Bulls

Fink F_1 "Term-A-Bulls" are bred and promoted for use in terminal-cross programs. Established in 1991, the objectives of the "Term-A-Bull" program are to:

1. take advantage of heterosis or hybrid vigor in order to enhance growth and reproductive performance and.
2. Use Continental-breed genetics to improve yield grade and produce less carcass fat.

"Term-A-Bulls" is a totally separate program from Fink Purebred Angus. Based totally on embryo transfer and upon our most-proven angus cows, this is a co-op herd project with Bill Brooks of Olsburg, Kansas.

There are four "Term-A-Bull" lines. A straight Angus line is available that has been bred for growth and carcass strength. Three F_1 lines include Angus x Black Simmental, Angus x Tarentaise (the modern Continental breed) and Angus x Charolais. These three lines emphasize carcass, maternal or pounds of performance, depending on the cross. There are also options of half and three-quarter blood Angus.

Fink "Term-A-Bulls" are the product of planned crossbreeding based upon proven, high accuracy genetics. They have been developed to produce an end product without changing the working female factory's role as an efficient range-country survivor.

Integrated Genetic Management, Inc.

Integrated Genetic Management, Inc. (IGM) is based in Canyon, Texas and provides superior genetics and genetic management services to commercial and purebred cattlemen. Co-founded by Finks and three other breeders, IGM, Inc., features competitive prices and unique customer services.

IGM, Inc. is built upon sales of semen from leased sires. A full line of A.I. supplies is also available. Company services include custom A.I. breeding, customer feeder cattle and replacement heifer marketing, consignment to a value-added branded beef program and new total herd genetic planning services.

IGM, Inc. is now an exclusive feeder and finished cattle buyer for Premium Gold Angus, Inc., an Austin, Texas based company that markets high quality beef to progressive grocery chains and upscale restaurants. This is the first time ever for a full-service genetics firm and branded beef company to join forces in a total marketing effort.

Genetics Plus, Inc.

Genetics Plus, Inc. specializes in marketing genetically superior, professionally developed replacement heifers. Co-founded by us, it serves as a replacement heifer source for terminal crossbreeding herds and as a marketing option for maternal breeding programs that produce replacement quality females.

Genetics Plus is designed to provide exactly what commercial or purebred cattlemen need for replacement females. Customers place their order with exact specifications for number of head, breed or breed crosses, mature weight, service sire of choice and calving date and interval. Genetics Plus locates a supply of those heifers, sorts, rigidly culls for quality and ships them to the Genetics Plus co-op facility for processing and development. The heifers are then synchronized, AI bred and through ultrasound technology, even the sex of fetus is guaranteed.

Terminal herd producers who purchase Genetics Plus replacements are investing in identified maternal genetics and making efficient use of ranch and labor resources. They eliminate the need for low birth weight "heifer bulls", can use their grass to run more mature cows and will experience a shorter calving season and quicker re-breeding due to synchronization. In addition, they can potentially market the resulting heifer calves through Genetics Plus.

Suppliers of Genetics Plus heifers are paid an appropriate premium for quality replacements and identifiable superior maternal genetics. Bonuses are paid for superior reproductive performance. In addition, a program is available for Genetics Plus to manage development and breeding of a supplier's own replacements.

Genetics Plus programs have proven to work for both buyer and suppliers. Joe Rickabaugh manages Genetics Plus, Inc. and is based in Topeka, Kansas.

Fink Marketing Service

We want to be known as a full-service breeder. Therefore, we have established a marketing service for bull customers' feeder cattle. Programs include rancher-feeder retained ownership alliances, private treaty feeder cattle sales and special feeder calf auctions.

"new to the industry" Fink-Influence Feeder Calf Sales, initiated in October of 1995 at Manhattan (Kansas) Commission Co., are scheduled to feature consignments sired by Fink Angus and "Term-A-Bull" genetics.

Buyers have bid competitively at previous sales selecting from this large source of cattle with identifiable genetics and known health management backgrounds. Many consignments were backed by previous herd feedlot data. Through these sales, commercial ranchers have been able to sell on a market that has paid added value for their genetics and management. Also buyers bid more competitively on smaller consignments of "similar cattle" that could be pooled to build "load lots".

Special marketing seminars have been organized for cattlemen desiring to sell "for more value". Their purpose is to provide more information concerning marketing options available and how they might use them. In the past, industry leaders have presented forums on retained ownership, commercial auction market programs, branded beef and selling replacement heifers.

Finks also present customers with the opportunity to sell quality commercial females in their Fink's Genetics Annual Bull Sale. The bred and open heifers have been a popular sale feature.

In 1996, we entered into a working partnership with the Farmland Supreme Beef Alliance. We were offered a "Select Seedstock Supplier" position for Farmland customers. They are the 4th largest packer in the U.S. (National Beef) and have an excellent record of branded products in the pork industry. "Farmland Black Angus Beef" is very well excepted in the market place.

Also, in 1996 we started a working relationship with "Angus America", through Beef America at Omaha, Nebraska. Beef America is the 5th largest packer in the U.S., and also have their own "Meat America" retail stores selling high quality meat. "Angus America" has given our customers a lot of flexibility in marketing their fat cattle.

We are also pleased to be working with Decatur County Beef Alliance, Decatur County Feedyard, At Oberlin, Kansas. This extremely progressive lot is owned by the Warren Wiebert family and utilizes electronic ear tags, ultrasound electronic sorting and uniform marketing of finished cattle. Their electronic tracking system through the rail has proven to be a great marketing tool for their customers.

Fink Genetic Credit was developed to reward Fink bull customers for making an effort to see how their cattle do on the rail. This credit is available on retained ownership cattle, cattle sold at auction or private treaty as long as the cattle are tracked to slaughter and accurate carcass data is provided to Fink Beef Genetics. Our customers earn $ 8.00 per head credit for cattle that are compared to reference sires and whose slaughter data is eligible to be processed by the American Angus Association. They earn $ 4.00 per head for data that has individual sire ID and $2.00 per head for data from full brother, multiple sire ID cattle.

The goal of Fink Marketing Service is to realize to our customers for value for identified genetics, high quality and proven performance.

Little Apple Brewing Co. and Restaurant

A leading Manhattan, Kansas eating establishment, the Little Apple Brewing Co. and Restaurant is co-owned by my wife and I along with a small group of fellow Angus breeders andintegral team members, Russ and Kelly Loub.

"The Little Apple" completes the circle of Fink Beef Genetics' total industry involvement from cow herd to consumer. Featuring Certified Angus Beef, it is "The Steakhouse in Town", building a reputation upon high quality product, superior customer service and good atmosphere. We have found that this experience has proven the value consumers place upon quality and service.

Restaurant ownership and marketing the end product have emphasized the importance of predictability, quality, and efficiency all the way from cowherd genetics to the feedlot, packer and consumer. It has reinforced our commitment to customer service as a vital part of successful marketing.

Summary

This past spring we established a customer newsletter entitled "Fink Beef Genetics News". We also organized and provided a bus for our customers to tour Supreme Feeders Feedlot with its 80,000 head capacity and National Packing Company at Liberal, Kansas, this past June. We've also toured the Beef America Product Development Plant at York, Nebraska. Customer service is an extremely important part of our program. Our product must make money for our customers. We want therefore to make our customers aware of such things as some of the available alliances and the exciting opportunities that they have created. As far as Fink Beef Genetics is concerned, we believe "The Best Surprise is No Surprise!" We have never waited for things to happen. If we see a need, we do it. Fads and trends will never dictate the way we breed cattle.

WESTERN FEEDLOTS LTD.

by Dave Plett

Presentation not available

BEEF AMERICA

by Bob Norton

Presentation not available

NET FEED EFFICIENCY IN BEEF CATTLE

by Geoff Maynard
Maynard Cattle Co., "Mt. Eugene", Queensland, Australia

The Maynard family runs 4,000 Belmont Red cattle on 45,000 acres in properties in North Eastern Australia. Approximately 700 breeds are performance recorded using Breedplan technology (EBV's), the Belmont Red breed is a tropically adapted Bos Taurus composite derived from the Africander Sanga breed originating in South Africa (50%), and the Hereford (25%) and the Shorthorn (25%).

Selection pressure traditionally has been on traits, such as Fertility, Growth and Adaptation. Heat Tolerance has been a major issue, as the environment in Northern Australia is very hot for extended periods (over 40 degrees Fahrenheit or 110 degrees Centigrade) are not uncommon.

The Parasite resistance has been another selection focus with measurements conducted over 20 years on Tick and Worm loads.

The Mt. Eugene herd has been a participant in the Co-Operative Research Centre for Meat Quality. This is a major co-operating program between 4 research and educational bodies, the Queensland Department of Primary Industries, The New South Wales Department of Agriculture, The Commonwealth Scientific Industrial Research Organizations and the University of New England. The Mt. Eugene herd has generated over 1,000 progeny into the Meat Quality Program over the last 6 years and now has incorporated in it's selection criteria, carcass traits such as Marbling, Yield and Tenderness. Data collected from the C.R.C. program includes Feed Conversion and Net Feed Efficiency information.

Why select for Net Feed Efficiency?

The cost of feed is the single largest cost in most animal production systems. The cost of feed for beef production does not only include direct feed costs, but also includes all costs associated with pasture and fodder production as well as the interest and opportunity cost of land used to produce pasture and fodder crops. Research conducted at Trangie in the early 90's examined the efficiency of the cow/calf unit, and identified variation in efficiency of feed use, with one cow weaning more than twice as much weight of calf per kg feed consumed than another.

In the past, breeding programs have concentrated on increasing production with little effort directed towards lowering costs of production. For a lot feeder and grass finisher, the major determinant of profitability is the difference between purchase and sale price closely followed by the cost of feed and feed conversion efficiency. For some cattle breeders, the cost of feed is the greatest expense and the utilization of that feed is of major concern.

The aim of the current project at Trangie research station is to determine the extent of genetic differences between cattle in the efficiency with which they utilize feed, and how these genetic differences might be used by the industry to produce more efficient cattle.

Measures of efficiency

Feed conversion ratio is a commonly used measure of efficiency, and is simply the ratio of feed intake to weight gain. Research conducted has shown that feed conversion ratio is highly related to growth rate, and so selecting for feed conversion ratio is likely to have similar results to simply selecting for growth rate. While selection for feed conversion ratio will be beneficial for the cattle finisher, an increase in the size of the breeding female will mean that the benefit to the finisher is cost borne by the breeder, as larger cows require more feed.

An alternative way of measuring efficiency is to use Net Feed Efficiency (NFE). NFE refers to the variation in feed consumption between animals beyond that related to differences in growth rate and body weight. In contrast to feed conversion ratio, NFE is independent of body weight and growth rate. The theory suggests selection for improved NFE is likely to reduce feed intake with little change to body weight or growth performance, and therefore, both the breeding and the finishing sectors will benefit.

How is NFE measured?

NFE is measured as the difference between animals actual feed intake during a 120 day test and its expected feed intake, based on its body weight and growth rate. Because NFE is the feed intake of the animal net of its requirements for production, it is sometimes called net feed intake. High NFE animals will eat less than expected (i.e. have negative net feed intake) while low NFE animals will eat more than expected (i.e. have positive net feed intake).

At Trangie, bulls and heifers are tested for net feed intake shortly after weaning in an Efficiency Testing Unit (ETU) over a 120 day period following a 3-week adjustment period. The ETU is an automated system which delivers a high roughage pelleted ration to the animals. Animals are electronically identified and the actual feed consumption of individual animals is recorded. Animals are weighed weekly to monitor growth performance during the test.

Are there genetic differences in feed efficiency?

A total of 1345 weaners have been tested for net feed intake at Trangie to date. These include progeny from the Angus herd at Trangie sired by industry AI sires and heifers purchased from industry herds in southern Australia, including Angus, Hereford, Poll Hereford and Shorthorn breeds. The range in performance traits recorded during the 120 day NFE test are shown in Table 1.

The results indicate that there is wide variation in the performance of animals during the test within each of the breeds tested. Net feed intake has ranged from -287 kg to +265 kg. This means that the difference in feed consumed between the most efficient and least efficient animals was more than 550 kg over 120 days, for the same level of performance. Given the high cost of feed, this variation in feed consumed is of considerable economic importance. More importantly, the results have shown that there is genetic variation in net feed intake with a heritability estimate of approximately 0.4 (similar to growth rate). This suggests that selection for net feed intake should result in genetic improvement of the trait.

Selection for NFE works in practice

Table 1. Range of traits measured during the 120-day NFE Test

Trait	Range for Bulls	Range for Heifers
365 day liveweight (kg)	291 to 597	266 to 524
Average daily gain (kg)	0.8 to 2.0	0.7 to 1.7
Actual feed intake (kg)	931 to 1881	740 to 1667
Net feed intake (kg)	-205 to +243	-287 to +265
Feed conversion ratio	5.7 to 13.7	5.9 to 14.2
Fat depth (mm)	2 to 18	3 TO 18

As part of the design of the research project, the high NFE bulls are mated to the high NFE heifers, while the low NFE bulls are mated to the low NFE heifers, so progeny from these joinings are the result of one generation of selection for high or low NFE. Results obtained so far indicate that the progeny of high NFE parents had lower net feed intake (i.e. were more efficient) than the progeny of low NFE parents (Table 2)

Table 2. Performance of progeny of High NFE and Low NFE bulls and heifers

Trait	High NFE progeny	Low NFE progeny	Difference is significant*
365 day liveweight (kg)	405	398	No
Average daily gain (kg)	1.25	1.22	No
Actual feed intake (kg)	1243	1299	Yes
Net feed intake (kg)	-20	59	Yes
Feed conversion ratio	8.4	9.2	Yes
Fat depth (mm)	7.5	8.3	Yes

- "No" means that there is no statistically significant difference between the high efficiency and low efficiency groups. "Yes" means the difference between the high efficiency and low efficiency groups is statistically significant

Progeny of high NFE animals also had lower feed intake, feed conversion ratio and fat depth compared to progeny of low NFE animals, but there was no difference between the groups in average daily gain and 365-day weight. This means that while selection for net feed intake changed feed intake and efficiency of the animals, there was no observable change in growth and body weight. The difference in fat depth between the high and low line warrants more investigation and any effect on other traits such as marbling will need to be evaluated.

Preliminary results from 2 calvings indicate that selection for NFE has no adverse effect on reproductive performance and cow productivity (weight of calf weaned per cow joined). Early results also indicate that there is a likelihood of savings to be made in mature cow feed costs by selecting for NFE (Table 3).

Table 3. Preliminary results on mature cow feed requirements (1st group of industry cows)

Trait	High NFE Herd	Low NFE Herd	Difference is significant*
Start weight (kg)	542	544	No
Start fat (mm)	5.3	5.5	No
ADG (kg/d)	1.3	1.4	No
End fat (mm)	13.6	14.5	No
Feed Intake (kg)*	1153	1233	Yes
Net feed intake (kg)*	-36	+32	Yes

- "No" means that there is no statistically significant difference between the high efficiency and low efficiency groups
- "Yes" means the difference between the high efficiency and low efficiency groups is statistically significant

Why do we need to generate EBV's for NFE?

The ultimate aim of the research is to deliver a product to the industry in the form of a Breedplan EBV for NFE, to enable seedstock and commercial beef producers to identify bulls which will improve efficiency in their herds. The Trangie research will provide much of the information required to calculate these EBV's. However, to calculate EBVs on industry cattle it is necessary to measure feed intake and growth, and from those calculate the efficiency of these animals.

How can breeders measure feed intake and efficiency of their cattle?

Feed intake is a difficult and expensive trait to measure, but with developments in electronics and automated recording technology, the cost of measuring intake may reduce in the near future.

There are two options for measuring feed intake on industry cattle. The first option is to set up central bull test stations with automated equipment to measure feed intake, similar to the facility at Trangie. Bulls could be sent to these stations as weaners and efficiency measured. Central bull test stations would allow close control of testing procedures and environment by people with technical expertise, and would ensure the data collected is accurate and usable. However centralized testing is expensive, and the limited number of facilities would restrict the number of animals that can be tested. Moreover, comparisons for the purpose of creating EBVs would be restricted to those between animals which are from the same contemporary group (i.e. property of origin, plus other management factors in common).

The Co-operative Research Centre for Meat Quality at Armidale has developed facilities for automated measurement of feed intake in their research feedlot "Tullimba" and is prepared to test industry cattle at times when the feeders are not being used for research cattle.

Establishment of an on-farm testing facility is expensive initially. However, on-farm testing may provide longer term savings and would enable more animals to be tested in larger contemporary groups, thus providing data which is better for calculation of NFE EBVs.

Coordinated guidelines for Testing

Nationally accepted guidelines for testing procedures are necessary to ensure that standardized and acceptable data are generated for development of EBVs. These guidelines apply to manual or fully automated feed intake measuring systems, and to on-farm or central test facilities. These guidelines will include:

Format of tests. Testing could be carried out on an individual animal basis, or as a sire progeny test. Either test is acceptable for the generation of EBVs, and sire progeny testing can increase the accuracy of a sires EBV. Based on current estimates of heritability for NFE, approximately seven progeny would need to be tested to provide the same accuracy as testing the sire. Progeny testing would be useful to test the efficiency of AI sires currently in use, where those sires, if they are still alive, would be too old to meet current test criteria.

Length of test. The test for NFE currently used at Trangie consists of a three week pre-test period followed by a 120 day test. Results from Trangie indicate that a 70 day test period is sufficient to provide an accurate measure of NFE. The length of pre-test period is currently under review at Trangie, but three weeks is accepted as the minimum for weaner cattle.

Age. Current tests at Trangie are conducted immediately post-weaning to coincide with optimum growth patterns, and so the most information exists for post-weaning NFE. However at this stage the range of ages at which testing can take place has been left open, to maximize flexibility and to allow breeders to feed bulls at a time which fits in with management (e.g. breeders may opt to feed bulls prior to sale).

Type of ration. It is not known whether relative rankings for NFE on roughage based diets or high energy feedlot rations are the same. For this reason, all testing should be carried out using similar rations, standardized to available nutrient, i.e. metabolisable energy, crude protein and digestibility. This wold be critical where a common equation is used to calculate NFE across tests or testing facilities.

Current testing at Trangie is carried out using a pelleted roughage based ration, containing 10 to 1.5 MJ/kg and 15 to 18% crude protein. The ration is pelleted for ease of use in an automated facility and to minimize ingredient selection. The automated feeders at the Cooperative Research Centre for Meat Quality at Armidale can utilize a standard feedlot mix. Decisions on the type of ration would be based on the facilities available and cost.

Contemporary groups/provision of genetic links. Animals must be tested in contemporary groups to enable fair comparisons to be made, both for NFE and for other existing Breedplan traits such as 400-day weight, fat depth, etc. which may need to be measured during the efficiency test. The guidelines currently recommend a minimum contemporary group size of four animals, representing two sires with two progeny each. However, more value will be obtained from the data if much larger contemporary groups are tested.

Genetic links are required to enable comparisons to be made across contemporary groups within central tests and between tests, in the same way that Group Breedplan requires links between herds. Traits currently measured in Group Breedplan are relatively inexpensive and are thus measured on most animals in the herd, and so genetic links are relatively easily achieved. As NFE is more expensive to measure, fewer animals from each herd are likely to be measured and so greater consideration will need to be given by breeders to ensuring appropriate links are obtained.

When can we expect NFE EBVs?

In addition to setting up structures for measuring NFE on industry cattle, calculation of EBVs also requires structures to be set up to accept and process data received. Staff from NSW Agriculture at Trangie and the Animal Genetics and Breeding Unit and Agricultural Business Research Institute at Armidale will be involved in this process when requested by a breed society. However the timetable for producing EBVs is dependent upon the quantity and quality of NFE data on industry animals.

Application for Northern Australia.

Currently the majority of producers in Northern Australia are fattening their cattle on pasture: Traditional targeting the grassfed Japanese and Korean markets as well as supplying the manufacturing beef markets in the USA. The most important economic trait for these production systems, still remains to be fertility, growth and adaptation. Predictions have been made to a resurgence of the live export trade in South East Asia over the next 2 years, this also is an important market for these northern grassfed operations. The requirements for the live export trade is for lighter weight feeder steers (300 - 400kg).

With an absence of any carcass specification, this in turn reinforces the importance of growth, fertility in these operations. It is still uncertain, whether feed efficiency in the feedlot does correlate with feed efficiency on pasture. Also the effect of very low nutrient pasture, high parasite challenge and extreme climate temperatures on NFE has not been tested.

However a larger number of Northern Australian operations are targeting the domestic market. This market is currently experiencing a revamp with the introduction of a National Grading System.

The Meat Standards of Australia program is designed to identify different pathways to supplying consistent quality beef and to differentiate that product in the market place. Currently over 30,000 taste tests (both consumer and trained panel) have been conducted, assessing the effects of genetics, nutrition, pre-slaughter handling, processing and preparation of the product.

Many of the pathways involve grain feedings, whether it be short or long term regimes. It is more likely that these producers would have application for NFE genetics in their herds. The problem still remains, that a limited number of animals have been tested, and it will be some time before accurate EBVs are available, especially for Tropical Breeds.

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GENERAL SESSION # 3
HITTING THE MARK

INFORMATION TECHNOLOGY IN THE NEW MILLENNIUM -- APPLYING IT TO THE BEEF INDUSTRY --

by Lee Curkendall

The year is 2050 and the manager of Earth's premier beef alliance begins her workday. She is in charge of monitoring product shipments for the alliance, and this alliance of cattle producers, feeders and packers has a reputation for producing some of the best beef in the galaxy. This morning, she is checking on shipments to make sure her customers are satisfied. But she doesn't go anywhere or call anyone; she simply puts on what look like a pair of sunglasses. The "sunglasses" are actually a pair of bifocal video screens, with sound and microphone built into the frames, complete with a wireless hookup to the alliance's data center. The data center is housed on Earth's moon (the programmers have fewer distractions up there) so information is relayed from all of their customers – from space stations to distant planets – through the moon center.

She speaks to her sunglasses and asks for any exceptions that have occurred in shipping obligations and sees one delay that has already been rectified. She "walks" through a pen of cattle, using her bifocals, to see if they're ready to go to the packer (there still is nothing like a good human judge of cattle to know when they are ready). Most of the cattle are ready for the packer at nine months of age, but she sees one group that is ready at seven months. She okays their "shipment" to the packer. The packer is actually next door to the cattle pens and is physically a very small operation, nothing like the assembly-line systems of the 1900s. Precise laser cutting devices fabricate each carcass individually. After the alliance's patented meat-shrinking system reduces the cuts to one tenth their original size and weight, they are automatically labeled and packed for shipment.

The manager is a bit worried this morning. She has heard that a company in a neighboring galaxy has perfected a way to take hydrogen, nitrogen, and carbon and build a molecular structure that produces a beefsteak out of thin air. How could their alliance ever compete with a system where the inputs are free? In the past, no one has been able to create an artificial steak with the flavor of the real thing. She is hopeful that this attempt is no different...

Actually, we have never been very good at predicting the future – back in the 1930's, the U.S. government gathered together some of the most renowned scientists of the time for the purpose of predicting the future (it was a make-work program for unemployed intellectuals of the time). If you look back on the predictions tallied by the scholars of the day, the results are miserable. They missed all of the major events of the future including the invention of the atom bomb, the computer, and even that humans would some day set foot on the moon. The Buck Rogers comic strip of the day came much closer to predicting the future than did the acclaimed scientists.

It's hard to predict the future because it not only takes a major shift in thinking, it requires thinking about things that don't yet exist. The scientists of the 1930s had no way of predicting the invention of the transistor or the splitting of the atom, let alone what the ramifications of these discoveries could create. As a substitute for trying to predict the future, we can discuss important trends in information technology that should continue, as well as how we should use the technology to our benefit.

Trends in Information Technology

On thing *is* for certain: the information-gathering and knowledge-disseminating part of our economy is the fastest growing and is generating more new jobs than any other sector. It is actually difficult to determine by job label where the growth is generated, but the information systems are everywhere. Someone labeled as an agricultural worker may be spending much of their time using computers to calculate rations, monitor crop yields, and review financial models. The FedEx driver may be labeled as a delivery person, but spends much of the day transmitting the status of the shipments and receiving instructions via information systems.

Much like the industrial technologies in the 1800s began to free many people from subsistence farming and manual labor, information technology is now shifting and redefining our roles in the work world. The process of turning data into information and turning that information into wisdom – wisdom that is used on a daily basis to run entire companies – *is* our next economy.

Ubiquitous Technology

Computers and the microprocessors that run them are ubiquitous – whether they're controlling the processes in your automobile or you wrist watch, determining the amount money available to dispense at the ATM, when your bread is toast, or singing to you from a greeting card – they are literally everywhere. The stereotype of a person sitting at a computer keyboard and monitor is only a small part of reality – the trend is to have a computer in the background, running a process, collecting data and communicating information to the user and to other computers, largely unbeknownst to the people involved.

Interactive Workers

When done correctly, the processor in the background can be very unobtrusive, much like the one in your watch or your automobile. It acts as a workhorse that quietly runs a process and only alerts you when necessary. But just because it's unobtrusive doesn't mean you never interact with it. One example is the FedEx driver mentioned earlier. His main job may be the delivery of packages, but the wireless data processor at his side helps keeps track of each task throughout the day.

A good example of the evolution of data collection is evident in the warehousing and distribution industries. When hand-held data collectors were first introduced to the warehouse, they did just what they were supposed to do -- collect data. A warehouse worker used a hand-held device to scan a bar code of a product as it was received, put away, moved, inventoried, picked, packed and shipped and the information was stored in a central computer in order to keep accurate records on the products on hand.

As the technology evolved, the hand-held collection devices progressed to where they communicated with the central computer in "real time" so that inventories were truly kept current. But this real-time communication with the main system also made the user smarter. When a new product arrived, it could be checked against orders in the system. When it was time to put it away, the main computer could check for available space and suggest the correct location for the new product. When a product was sold, the system could tell the operator closest to that product where to go to get it and how and to whom it was to be shipped. So, instead of passively collecting data all day and posting it to the computer at day's end, there was a real-time interaction between the operator and the computer that occurred without a lot of thinking – the operator completed a task and the device directed him to the next task at hand.

We should be able to learn from this process and emulate it in the beef industry. As cow/calf producers and feedyard operators gather or "work" their animals, the system that collects the data should run in the background. The operator should be able to scan electronic tags on the animals using either stationary or hand-held readers much as is done at the checkout counter at a grocery store. When an operator scans the animal being worked, a wealth of information can be stored, automatically, on each animal. Events or actions that happen to every animal worked can be pre-stored in the computer for posting to each animal's record as it's worked, along with the exact date and time of the action. Events that aren't known on individual animals until they are worked, such as sex, breed, pregnancy results, etc., can be easily scanned into the system as well, without ever having to use a computer keyboard. Body weights, temperatures, back fat estimates, etc. can all be sent to the computer as the animals are worked. The entire process is more dynamic (and more important) than in a warehouse since these animals are individuals, all with the ability to perform differently.

But, as in the warehouse industry, the process doesn't stop with the efficient collection of the data. Another piece of this "front-end" process is to interact with the operator. A computer (in the background) can process data collected at the squeeze chute in real time and direct the operator as to the next steps in the process. The system may tell the operator the location to send an animal based on size, weight, condition, breed, sex, health, or a combination of these and other characteristics. The system might also prescribe a specific treatment regimen based on data collected at chute-side. The decision to adjust and administer are still up to the operator, but he would be directed toward the best treatment known, based on the data received on that animal. As information on numerous animals is collected and results of treatments tallied, future recommendations can become even more effective.

The Power of Knowledge

As Francis Bacon said, knowledge is power. Whether it's the knowledge that your enemy lies over the next sand dune or that consumers tend to buy products that they know are safe, collecting the data and presenting the information are only the first steps. When the data are used to create knowledge, the true power that results from the process can be priceless.

A Solution for Grocers

In the 1960's, a group of grocery manufacturers began meeting with technology companies to discuss possible solutions to common supermarket problems. They were looking for ways to speed up their checkout lines, manage their inventories and reduce errors in accounting. Surely there was a way that technology could be used to solve their problems. By 1973 the group had agreed on a standard code for identifying products in their industry. The resulting Universal Product Code (UPC) is the bar code that is now on almost every retail product sold around the globe.

The bar code, however, had an impact that went far beyond speeding up checkout lines and reducing accounting errors. It made the grocers much smarter about their products. On a second-by-second basis, they now know how fast products are moving off their shelves. They can analyze how changes in prices and product placement influence sales as often as they care to check the data. And if you have signed up for your own "preferred shopper" card, they even know your buying habits. When you sign up for your grocery card, and supply your address, age, etc., the grocers can become quite smart about your purchasing routines. They can target advertising to certain parts of the community and even decide where they should build the next new store – all from information that derives from that little catalyst, the bar code.

In the absence of bar-coded products and the information systems to track them, the stores could never afford to hand-tally information on each product sold – to propose doing it would be ridiculous. But with bar codes on the products, a computer in the background can do the tallying automatically.

A Manufacturing Example

In 1984, AT&T's Denver Works plant had a problem: they needed to fit $280 million in inventory into a warehouse that could only store $65 million. They had products stacked in the aisles, on pallets in the yard and on truck trailers parked all over the property. The goal was to get the entire inventory under one roof – one roof that looked ridiculously small.

The first step they took was to analyze what was causing the problem – why did they need so many parts in their inventory? The problem that they found was grossly inaccurate data. Upon inspection, data accuracy that was reported to be 100%, were closer to 40%!

The potential solution to the inventory problem was to collect accurate data. They installed electronic weigh scales in order to eliminate hand counting of the products received and shipped. They applied bar codes to their product and to the warehouse locations so that they knew exactly which product was on hand and where it could be found. They installed radio frequency data collection (RFDC) devices to provide real-time correction.

Within 18 months, they had reduced their inventory on hand to $40 million – a reduction of $240 million! With an inventory carrying cost of 30%, that represented $72 million/year in real savings – all from gaining knowledge about the state of their products.

There were other unexpected benefits as well. Once they began accurately counting the products coming in, they were able to report the results and "rate" vendors on their shipment accuracy. The result was a $300,000 annual savings on products purchased form the vendors. They also realized a two-fold improvement in worker productivity. Where it had taken four people to receive product, it now only took two. And the quality of work life improved as well – it was less stressful and more rewarding to have a real-time system for counting, receiving, etc. than chasing the paper of the past and putting out inventory inaccuracy fires.

Linking the Systems Together

In addition to becoming more efficient and knowledgeable within the confines of our own businesses, putting the pieces of previously unlinked systems together can provide the biggest benefits. In most businesses, the linkages should be designed so that we can become more knowledgeable about the products that will show up at our facility, learn more about what our customers require, and educate our customers about the products we are delivering. In the AT&T example, they should require their vendors to let them know, electronically, exactly what to expect in each shipment prior to its arrival. They should also require their customers to send electronic purchase orders so they can match the orders to their inventory. Lastly, they should provide their own customers with electronic notices of the products that they have shipped.

Just-In-Time

Again, we can use the manufacturing sector as an example of efficient production. A model called "just-in-time" (JIT) delivery of components is now in widespread use in that sector. In the old system, suppliers would make long runs of parts and deliver the large batches to manufacturers infrequently. The JIT model demands frequent delivery of small quantities of each part, just in time for assembly. Some manufactures have reported that JIT has cut their lead times and inventory requirements by 75%. Ideally, the manufacturers wait until they get an order before building a product.

It's understood that cattle cannot be "built" and delivered in a classical JIT model – they require approximately two years to plan from conception to packer. But, arguably, the lead-time on a Boeing 747 is quite long as well. The long lead time is no excuse for beef producers not to know their input needs as precisely as possible, negotiate forward contracts, and use the commodity market to hedge both the supply of inputs and the demand of for the final product. Packers who know their markets will be able to go to savvy producers and contract for specific types of animals for specific dates. Producers and networks of producers with the best information on what they have available, as well as what is in the queue, will get those contracts.

Electronic Data Interchange

Another powerful system used by many businesses is "electronic data interchange" or EDI. In its most basic form, EDI is a way for businesses to exchange purchase orders, invoices, inventory data, shipping notices, specifications, etc. within agreed upon standards, electronically instead of with paper. EDI not only reduces paperwork and product inventory, but it provides quicker and more flexible response to customer's needs.

The benefits that accrue from installing an EDI system include much more than just a simple increase in the efficiency of data sharing. EDI facilitates virtual partnerships between companies, allowing them to operate as integrated units rather than as a group of small, detached entities. Intimacies that could only be attained with large integrated companies in the past can be obtained (and surpassed) with an assemblage of smaller companies linked together via EDI.

In the future, EDI will become even easier and less expensive to implement. In the past, companies needed to set up dedicated, usually expensive, communication networks in order to facilitate EDI. With today's Internet available to any business with a phone line and a modem, the new EDI becomes cheap and easy to accomplish.

In the beef industry, EDI can be used by all of the participants in the supply chain, from the cow/calf producer to the packer. When a feedyard or grower is in the market for a number of animals of a certain specification for a given date, they can review cattle inventories held by members of their EDI network. They might transmit an electronic purchase order to get the order filled, and receive an advance ship notice (ASN) from their supplier before the cattle are shipped. When the cattle are received, they can be "scanned in" (using their electronic ear tags) against the ASN.

The ASN in the beef supply chain accomplishes a couple of things. When the cattle arrive at their destination they can be received against the list that has already been sent to the buyer's local computer. If the cattle have electronic ID, this "shipped versus received" function happens by simply scanning the cattle on arrival. Any discrepancies are reported automatically after the shipment is received. Additionally, when the incoming cattle are scanned, their records will already be in the local computer, so any background information that is important to the receiving party can be noted – a feedlot might want to know what vaccines have already been given to incoming animals, or a packer may be interested in segregating animals that have received growth promotants. It's all possible with the electronic sharing of data between the parties involved.

Transferring the Data

Databases

Databases don't provide for very lively subject matter, but they are an essential component of all of the systems described to this point. Whether it's a "local" database on a laptop or PC in the warehouse or at the squeeze chute, or a central database repository in a mysterious building, far, far away, some structure on the computer needs to be in place to store and receive the data that's generated. And there can be many links in the chain between the local and final repositories.

What's important is that any entity in a supply chain, whether it's a beef alliance or a manufacturing group, shares data in a database that is common to the group. The common database that receives, stores and updates data amongst the group's entities is an essential component used to simplify the transfer of data – everything simply flows into and out of one group database.

Using the Internet

With the proliferation of the Internet, and with no slow-down in sight, we have a built-in system for fast, inexpensive data transmission. Without any increase in the current transmission speeds of the Internet, the medium can already act as a conduit for sending and receiving data without building anything.

And the communication doesn't require long connect times while sorting through distant databases. With the computing power of today's laptops and PCs at our fingertips, all we have to do is make a quick call over the Internet to send updates to the next database in our chain and receive data that's waiting for us. After that one to two minute connection, the call is finished and the information can be reviewed at leisure on the local computer.

Tying it all Together

From Beginning to End

In the beef industry, as in others outlined here, the goal should be to get as much pertinent data entered along the way as possible without intruding on those doing the work. If done correctly, the collection should occur in the background. Once collected, the data should flow to where it's needed to make all of the players smarter about the products with which they're involved. The downstream players – growers, feeders, and packers – learn about what animals are available and know their histories when they arrive. Producers learn about the results of their breeding and management practices by receiving the carcass details from the packer. Even the retailer and consumer can learn about how to receive the products they enjoy the most, and about the steps that go into producing a safe product.

Borrowing Successes

As we've seen, many of the trends of the future for information systems in the beef industry can be borrowed from the successful implementation of technology in other business sectors, from warehouses, to toy stores, to supermarkets. Like the man in the old television commercial for Purdue chicken said, "parts is parts". To a computer information system, parts truly are parts. A feedlot is just a warehouse where the boxes are replaced with animals and the forklift operators with cowboys. A packing plant is similar to many manufacturing plants that receive raw materials and turn them into finished goods – sometimes goods that need to be traceable and remain in a database for years.

The changes in other industries didn't happen overnight, but the results were dramatic, yielding benefits beyond the efficiencies that were sought. When a little company named Verifone went to the major banks in the early 1980s to present their idea for transacting credit card purchases electronically, the bankers didn't fall over themselves to try the new technology. It took a couple of forward-thinking bankers that believed in what an electronic data transfer system could achieve to get the process started. Today, with Verifone and other devices installed in every corner of the globe, we take for granted the speed and security of the electronic transfer that occurs when we hand our card to a clerk or swipe it at the gas pump, and we wouldn't tolerate anything less.

A sign posted for would-be sellers entering the main Toys-R-Us buyer's office is a graphic example of how important bar code identification has become to the retail industry. The sign reads, "If you don't have Universal Product Codes on your goods, don't sit down, because we're not going to write the order." A technology that didn't even exist thirty years ago is now a prerequisite for doing business.

INDUSTRY CONCERNS REGARDING DATA OWNERSHIP, TRANSFER AND STORAGE

presented by Dr. Kee Jim, Feedlot Health Management Service, Okotoks, AB

Introduction

- In order to increase or stabilize beef demand, the industry must produce carcasses that meet the expectations of consumers
- Cow/calf operators must receive feedback regarding the carcass traits of the animals that they produce

Historical barriers to a "feedback loop"

- Segmented industry (cow/calf, backgrounder, feedlot, packing plant)
- Change of ownership
- Transfer of risk
- Information has value
- Taking advantage of information asymmetry
- Industry goals versus competitiveness of individual firms

Who owns the carcass information?

- Packing plant
- Producer who sold the animals to the plant
- Both
- Depends on the terms of the sale (Live versus Rail)
- Defined by a contractual arrangement/alliance

Who owns the feedlot performance information?

- Feedlot
- Owner of the cattle in a custom feeding arrangement

Why is data ownership a controversial issue?

- databases capture information
- proper analysis of information creates knowledge

- knowledge results in competitive advantage
- competitive advantage in production or acquisition strategies improve profitability

Solutions to the data ownership issue

- retained ownership
- market risk of cattle ownership is significantly greater than carcass risk!
- cow/calf producers must own the animals from birth to slaughter to access the performance data
- producers must sell animals by a method that gives access to carcass data (rail, formula, grid, etc.)

Transfer and storage of information

- technical issue
- money and time
- the difficult issue is achieving "match-up" in the plant
- incorrect data is worse than no data
- how motivated are the plants to achieve "link-up"?

BACK TO THE BASICS
A REAL-WORLD STRATEGY FOR IMPROVING THE QUALITY AND CONSISTENCY OF BEEF

by Don Schiefelbein, American Gelbvieh Association

We are living in the midst of the "information age." Scientists have estimated that information is accumulating at such a staggering pace that every 6 to 8 months the world's body of information effectively doubles. This information explosion combined with huge advancements in media communications and computing power has had an overwhelming effect on nearly all of us. Just as we got comfortable with Windows 3.1, Microsoft released Windows 95. Just when we were getting the hang of sending information over the modem, the internet became the medium of choice. Cattlemen just got a handle on growth EPDs and how to use those EPDs in their respective environments as breeds released a barrage of new EPDs including: Carcass, Stayability, Docility, Scrotal, Mature Height, Mature Weight, Calving Ease. And the list goes on.

First Things First

With this onslaught of information, the temptation often exists to try and expose persons to as much data as possible with little regard for their current level of understanding or their ability to use the information. Would a 3rd grade teacher ever seriously consider beginning a math course with the latest developments on using matrix notation to solve simultaneous equations? NO! School teachers have long recognized the importance of relating to their intended audience. Teachers know that for kids to truly understand mathematics, they must first learn basic math (e.g., 1+1=2).

Yet, our beef industry seems determined to throw volume of the latest information at cattlemen with no consideration as to how it can directly or even indirectly benefit their operations. Over the past couple of years an enormous amount of time and effort was made by researchers and writers to explain the impact that several potential "silver bullets" (calpastatin, Vitamin E, Vitamin D, DNA Tenderness markers, Electronic I.D.) might have on improving the quality and consistency of beef. Like discussing the importance of matrix notation with 3rd graders, it can be questioned as to whether this truly is the most effective method of information sharing.

Take a quick glance at the wide variation of cattle in the pens of any feedyard and you will wonder why we are concentrating so much of our time trying to "fine-tune" our end product when reality shows we don't have the basics in order. The current reality of the beef business is that almost no one knows what they are producing and whether it fits consumer needs. Can we truly expect to improve the quality and consistency of beef when the persons producing "good" beef and "bad" beef don't know who they are? Imagine the success rate of any industry in which the persons producing a product never received any feed back as to how their product performed. That is why value-based marketing is the single most important undertaking the beef industry must implement to make improvements in the quality and consistency of beef.

A Basic Approach for Regaining Market Share

1st Step: Understanding the "Target"

Under current value-based systems, cattle create value in four key areas: 1. dressing percentage (pounds), 2. quality grade (marbling), 3. yield grade (muscling and leanness), and 4. conformance (fitting the packer's box). All four of these areas can significantly contribute to or reduce the value of cattle. Most grids assess relative value as Figure 1 shows. Notice that premiums are paid for increasing levels of marbling and improving red meat yields provided the carcass fits the packer's box. Maximum premiums are paid when cattle combine exceptional marbling with exceptional leanness and muscling.

Figure 1. A Typical Value-Based Grid

Quality (marbling) — Yield (muscling & leanness)

	Prime	CAB	Choice	Select	Standard	Other
YG 1	$$$$$	$$$$	$$$	$$	-$$$$$	-$$$$$$
YG 2	$$$$	$$$	$$	$	-$$$$$	-$$$$$$
YG 3	$	$	-$	-$$	-$$$$$	-$$$$$$
YG 4	-$$$$$	-$$$$$	-$$$$$	-$$$$$	-$$$$$	-$$$$$$
YG 5	-$$$$$$	-$$$$$$	-$$$$$$	-$$$$$$	-$$$$$$	-$$$$$$

Conformance (fitting the box) - the 3rd dimension

Heavies (>950 lbs.)	-$20.00/cwt
Lites (<535 lbs.)	-$20.00/cwt
Dark Cutters	-$20.00/cwt

It is equally important to understand what diminishes value. Most value-based grids severely discount cattle that are unacceptably low in marbling (Standard), unacceptably poor in yield grade (too fat), too heavy (>950 lbs.), too light (<535 lbs.) or are dark cutters. Discounts for these carcass defects typically cost the producer around $200 per head!

To avoid these large discounts, it is important that cattle are balanced in yield grade, quality grade, and carcass weight. The accompanying table shows the characteristics of the top 25% of all pens marketed through the Gelbvieh Alliance. Keep in mind, these are entire pens of cattle. The top 25% of pens were extremely balanced in yield grade and quality grade. The cattle graded 68.2% Choice and better , 69.8% graded yield grade 1 & 2s, dressed at 64.3% and had only 3.1% problem cattle.

What Creates Value on a Grid
Top 25% of Pens processed through the Gelbvieh Alliance

Summary:	
Number of Pens	421
Number of Head	22,220
Live Weight	1153 lbs.
Carcass Weight	742 lbs.
Dressing Percent	64.3%
Choice and Prime	68.2%
Yield Grade 1s and 2s	69.8%
Total Out Cattle	3.1%

Value Summary:		
DP Value (Muscle)	$	13.25
QG Value (Marbling)	$	7.41
YG Value (Leanness)	$	6.68
Fitting the Box	$	3.36
Total Premium Per Head	$	30.69

Equally impressive are the premium dollars earned by these balanced cattle. Almost 45% of the premiums earned were the result of additional carcass pounds from higher dressing percentages. Quality grade and yield grade each returned around 20-25% of the total premiums while fitting the box generated the remaining 10%.

A realistic, attainable target for all commercial producers should be an end product that approaches 70% Choice and better, 70% Yield Grades 1 & 2s and 0% problem cattle, with ample carcass weight.

2nd Step: Defining the Strengths and Weaknesses of Your Cattle

Now that the target is clearly defined, the next step is to determine the strengths and weaknesses of each producer's cattle. There are numerous alliances available which can provide producer's with a wide range of information on their cattle.

Many alliances have chosen to prove their value by providing participants with page after page of data on a single group of cattle. In one particular case, a group of 120 head of cattle yielded a stack of paper two inches thick. For most, this information is so overwhelming that producers generally take one of two wrong approaches: 1. The information is so extensive he doesn't know how to start evaluating it and ends up doing nothing; or 2. The information is so detailed he can't see the forest for the trees. He ends up acting on small, isolated problems rather than fixing major areas of concern (culling individual cows rather than adjusting the bull battery).

The goal of all alliances must be to provide data in a manner that cattle producers and feeders can quickly and easily identify strengths and weaknesses of each group of cattle. An approach

Value Summary Per Head	
Value of Dressing Percent	$7.03
Value of Quality Grade	$10.08
Value of Yield Grade	($8.79)
Value of Conformity	$3.79
Avg. Value per Head	**$12.12**

used by the Gelbvieh Alliance provides producers with two overall summaries of each group of cattle. The Value Summary Per Head shows how the group performed in each of the major areas for net dollars earned per head. This is done because every cattlemen can relate to dollars and cents. It has often been said, "show a cattleman where a dollar can be found, and he'll get it". In the accompanying example, the group of cattle had an excellent dressing percentage ($7.03 per hd. premium), quality graded extremely well ($10.08 per hd. premium) and 100% of the cattle fit the box ($3.79 per hd. premium). However, the cattle were light muscled and too fat costing the producer $8.79 per head.

The Gelbvieh Alliance also summarizes the same data with a simple pen score card. As in most report cards, A equals excellent, B equals above average, etc. The score card quickly reveals the strengths and weaknesses of each set of cattle. From this simple summary, the producer sees clearly that he needs to add leanness and muscling.

Pen Score Card	
Value of Dressing Percent:	A
Value of Quality Grade:	A
Value of Yield Grade:	Needs Improvement
Fitting the Box	A

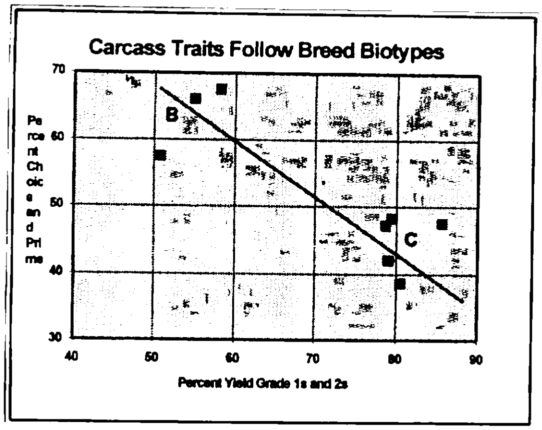
3rd Step: Using the information to improve cattle

The last step is the most crucial, yet the least acted upon. By the time most cattlemen get to step 3, the perceived complexity of their problem or the shear volume of information forces them to inaction.

The correct use of biological types (breeds) is the single most important tool for improving the quality and consistency of beef. Contrary to popular belief, current biological types have very real strengths and weaknesses. Data from the Gelbvieh Alliance clearly shows how different biological types perform very much as expected on the packer's rail. Plainly put, the quickest, most effective way to improve your cattle's quality grade is by increasing the percent Angus or Red Angus genetics in your calf crop. On the other hand, if your cattle need improved muscling and leanness, Continental genetics should be added.

British Breed Biotype:	More Marbling......More Fat Less Muscle
(Angus, Red Angus and Hereford)	
	avg. 64% Choice & Prime avg. 55% Y1s & Y2s

Continental Breed Biotype	Less Marbling......Less Fat More Muscle
(Gelbvieh, Charolais, Simmental, Limousin and Salers)	
	avg. 45% Choice & Prime avg. 81% Y1s & Y2s



An astute cattlemen or beef industry leader might suggest that carcass EPDs be used to make the needed improvements. And, yes, they should be used...But, ONLY after your cattle have proven they can hit the main area of the target... say 60% Choice with 60% Y1 and Y2s. Carcass EPDs are tools that can and should be used by commercial producers to further improve our end product beyond that initial target. Correctly balancing breed biotypes and carcass EPDs will eventually allow our industry to reach and go beyond the 70-70-0 target.

The growing number of seedstock quality hybrid bulls should afford cattlemen the selection availability needed to correctly meet their specific needs. The cattlemen who needs a fairly strong dose of muscling and leanness without shifting the percent blood dramatically in his cow herd could use a hybrid bull consisting of 75% Continental and 25% Angus blood.

Keep It Simple (KIS Principle)

The best solution to any problem is the simplest answer that works. It will be tempting for beef industry to get caught up in the information age and spend inordinate time and effort discussing solutions to the problems of quality and consistency through methods that most cattlemen can neither understand nor implement. Our industry at all levels of production should make a concerted effort to inform cattle producers in simplistic terms about our end product target. The target of 70-70-0 should be on the minds of every producer. At the same time, our industry must continue to encourage the rapid adoption of value-based marketing and encourage all beef processors to provide producers with carcass information. The power of biological types should not be ignored, rather, it should be exploited to the benefit of our end product. Finally, our industry can ill-afford to ignore the forest for the trees. We must recognize our intended audience and their current level of understanding . We must not forget the lesson of the 3rd grade teacher. Let's concentrate on getting the basics right, then we move on to discussions about matrix notation.

GENERAL SESSION # 4 - SHIFTING THE FOCUS

FROM EVALUATION TO IMPROVEMENT

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Background

Modern beef cattle breeding has been continually evolving for at least the last 30 years. The main focus of the change has been from "subjective" evaluation to a combination of "subjective" and "objective" animal evaluation. In fact, the birth of the Beef Improvement Federation was deeply rooted in the development of methods to "objectively evaluate" beef cattle. The term "objective evaluation" has become synonymous with genetic evaluation over the last few decades. The industry has moved from solely visual appraisal methods to a situation today in which expected progeny differences are available on a variety of traits. Clearly the focus of today's beef cattle breeding is genetic evaluation. New statistical methods and models are being developed and implemented like never before. The seedstock industry seems to have an insatiable appetite for more EPD. The historical focus of EPD has been on growth traits and maternally-related aspects of growth. These traits are easy to measure and direct growth rate is certainly one aspect of profitability that any producer can describe in detail. In addition field recording programs are increasing in scope and are moving to a whole-herd base rather than a calf-weaned base. This will further increase the number of potential traits available for genetic evaluation. The recent emphasis on consumer driven products, product quality and consistency has given rise to genetic evaluation of carcass and meat quality traits. The potential to uniquely and electronically identify all beef cattle will create even more data from which even more genetic evaluations can be produced. The recent development of molecular genetic tools has also been focused on evaluating and defining the genetic makeup of an animal. Clearly genetic evaluation is "king" in the beef cattle breeding industry.

However, is evaluation of the genetic potential of our cattle sufficient for our industry to progress? Are genetic evaluation and genetic improvement the same thing? Does the commercial producer really need to know the complete genetic profile of every animal they purchase? Do they have time to understand genetic evaluation at the seedstock level? Clearly something more than just genetic evaluation is needed for our industry to progress.

What is Genetic Improvement?

For the purposes of this paper I will define genetic evaluation as the accurate and precise estimation of an animal's true genetic merit. Genetic improvement will be defined as directed change in the genetic potential of a target population. Two other definitions worth noting are base and target. The base is defined as the seedstock population that undergoes intense selection and the target is defined as the commercial cattle population in which the improved genetics will be expressed in the product. Clearly genetic improvement involves a system or program and is much more than just genetic evaluation. Successful genetic improvement programs include a five step process:

1. Define goals and objectives for improvement.
2. Create genetic change in the base population.
3. Multiply the improved genetics.
4. Transfer the improved genetics to the target population.
5. Monitor change in the base and the target population.

Steps to a Successful Genetic Improvement Program

Step one requires a focus on your customer(s), not on your own herd. Profitability (revenue - costs) and not gross revenue is what will determine the long term success of your customers. Their profitability will define the economically important traits that you must include in the goals and objectives of your genetic improvement program. Economically important traits are your genetic objectives and are not necessarily the criteria that you may actually measure and use to evaluate your cattle. The focus in this step is defining what's important and how much you want to change.

Step two is the one with which we are most familiar and comfortable. It includes genetic evaluation, EPD, herd and performance recording, selection criteria, selection indexes, selection and mating programs, etc. It involves most of the direct cattle work we are involved with in our own herd(s). It is also the main reason most of you are in the business because you can see first hand the fruits of your labours.

Step three involves making sufficient quantities of your genetic product available to meet the demand of your customers. It simply asks the question: "How do I create enough of my improved genetics to satisfy the demand of my customers?" Reproductive technologies are the most common methods used (eg. AI and ET), however other emerging technologies could have a role in the future. Technologies such as sexed semen, *in vitro* fertilization and molecular technologies such as cloning or embryo splitting can all be used to increase the supply of improved genetics. A concept from the poultry, swine and dairy industries is one of nucleus and multiplier herds whereby intense selection is practised in the nucleus and the multiplier herds are used solely for increasing or multiplying the amount of superior genetic material available to the commercial industry.

Step four involves the actual transfer of the genetic material to the target population. Far and away the most common method, next to actual transfer of live animals, is artificial insemination. Other technologies such as embryo transfer can be used.

Step five is the final and perhaps most important step in the whole system because it allows the seedstock producer to collect information on not only their own herd but also evaluate and determine the performance of their genetic products in the target population. This provides the seedstock producer with feedback that can be used to re-evaluate their goals and objectives and the whole system continues. This step is perhaps the one in which technology could have the greatest impact. The concept of a complete industry information system in which each animal is uniquely identified and thereby tied directly to it's herd of origin and it's parents is a very powerful tool. A unique industry wide identification system could be the most powerful tool available to the seedstock producer.

Conclusions

Genetic evaluation has been the focus of the beef seedstock industry for many years. However genetic evaluation has a very narrow focus and in order to meet the needs of your customer a much broader approach is required. Genetic improvement encompasses everything from defining your goals and objectives to monitoring change in your customers' herds and the industry in general. The seedstock producer is in the business of genetic improvement not genetic evaluation. Genetic improvement is becoming more technology based all the time. Seedstock organizations, just like seedstock producers need to provide the services that their customers need to achieve genetic improvement. Seedstock producers and organizations that meet the needs of their customers

ECONOMY OF INPUTS AND OUPUTS

by Mabel Hamilton

Presentation not available

ECOSYSTEMS, SUSTAINABILITY, AND RANGELAND AGRICULTURE

by R. K. Heitschimidt

Note:

I assume that the Beef Improvement Federation's gracious offer to include a presentation by me at this meeting stems in large part from a series of 6 invited presentations I made last winter at various locations across Saskatchewan with Steve Radakovich. The foundation for those presentations was a submitted presentation I made at the VII World Conference on Animal Production held in Edmonton, Alberta in 1993 and a subsequent invited presentation I made at the American Society of Animal Science meeting in Minneapolis, MN in 1994. Because the text of the American Society of Animal Science presentation was eventually published in the Journal of Animal Science, and it is the foundation of this invited presentation, I requested and received permission from the Journal of Animal Science to publish the original paper in this meeting's proceedings. The Journal of Animal Science reference is:

> Heitschmidt, R.K., R. E. Short, and E. E. Grings. 1996. Ecosystems, Sustainability, and Animal Agriculture. J. Anim. Sci. 74:1395-1405.[1,2,3]

[1] Presented at a symposium titled "Toward Sustainability: Animal Agriculture in the Twenty-First Century" at the ASAS 86th Annu. Mtg., Minneapolis, MN.
[2] This research was conducted under a cooperative agreement between USDA-ARS and the Montana Agric. Exp. Sta. and is published as contribution no. J-3009 from the Montana Agric. Exp. Sta. Mention of a proprietary product does not constitute a guarantee or warranty of the product by USDA, Montana Agric. Exp. Sta., or the authors and does not imply its approval to the exclusion of other products that may also be suitable. USDA-Agricultural Research Service, Northern Plains Area, is an equal opportunity/affirmative action employer and all agency services are available without discrimination.
[3] USDA, ARS, Rt. 1 Box 2021, Miles City, MT 59301, Phone: 406-232-4970, Fax: 406-232-8209.

Abstract

The long-term sustainability of animal agriculture is examined in an ecological context. As an aid to defining agriculture, animal agriculture, and sustainable agriculture, a broad overview of the structural and functional aspects of ecosystems is presented. Energy output/cultural energy input ratios were then calculated for 11 beef cattle management systems as relative measures of their long-term sustainabilty. Energy output was estimated by direct conversion of whole body mass of steers to caloric values. Cultural energy inputs were estimated using published forage and cereal grain production budgets in combination with estimated organic matter intakes. Cultural energy inputs included raw materials, manufacturing, distribution, maintenance, and depreciation of all equipment and products used in a 250-animal cow-calf farm/ranch operation.

Management systems evaluated included: 1) spring calving with slaughter beginning at either weaning (age of calf ~ 6 mo) or after 84, 168, or 252 d in post-weaning finishing lot; 2) spring calving with slaughter beginning at about 18 mo of age after either 0, 42, 84, or 126 d in finishing lot; and 3) fall calving with slaughter beginning at about 14 mo of age after either 63, 126, or 189 d in finishing lot. Estimated efficiencies were < 1.0 in all treatments, even when assumed marketed calf crop was 100%. Product energy output/cultural energy input ratios ranged from a high of .40 in the spring calving ➡ stocker ➡ 126 d in finishing lot treatment to a low of .23 in the spring calving ➡ slaughter at weaning treatment. The low levels of efficiency were found to be largely the result of the interaction effects of the high levels of cultural energy required to maintain a productive cow herd and grow and finish calves in the rather harsh environment of the Northern Great Plains. Results pointedly reveal the high level of dependency of the U.S. beef cattle industry on fossil fuels. These findings in turn bring into question the ecological and economic risks associated with the current technology driving North American animal agriculture.

Key Words:

Ecological Efficiency, Sustainable Agriculture, Beef Cattle, Ecosystem, Energy Flow

Introduction

Sustainable agriculture is a subject of great interest and lively debate in many segments of the world. The debates stem largely from differing viewpoints as to what is sustainable agriculture (USDA, 1980; Lowrance et al., 1986; Dover and Talbot, 1987; Keeney, 1989; Science Council of Canada, 1992; Crews et al., 1991; Lehman et al., 1993). The resulting effect is that no concise, universally acceptable definition of sustainable agriculture has yet emerged. This is in part because sustainable agriculture is viewed more often as a management philosophy rather than a method of operation (MacRae et al., 1993), and as such acceptance or rejection of any definition is linked to one's value system (Clark and Weise, 1993). But regardless of its precise definition, most agriculturalists agree that the concept of sustainable agriculture is of paramount importance to the sustainability of our biosphere and its ever increasing human population.

There is a wide array of response variables that can be used to examine the potential long-term sustainability of various agricultural practices with one of the most useful methods being energy output/input ratios. Such analyses are performed to quantify the energy return from products produced relative to the cultural energy invested to produce the product. Energy outputs are estimated by the direct conversion of product yields of mass (e.g., lb or kg) to energy yields (e.g., kcal or MJ). For example, a corn grain yield of 7,000 kg/ha is equivalent to a yield of about 24.5 million kcal/ha because 1 kg of corn grain contains about 3,500 kcal of energy (Pimentel and Burgess, 1980). However, in contrast to estimating outputs, assessing energy inputs is a much more difficult task because: 1) the array of kinds of inputs included in the production of a product is extremely diverse (e.g., human labor, transportation, fertilizer, machinery, fuels, etc.);

and 2) detailed estimates of energy inputs associated with the manufacturing and operation of all the equipment and products used in an agricultural enterprise are highly variable and difficult to quantify. But regardless of these difficulties, energy output/cultural energy input estimates are of considerable value because they provide an estimate of our level of dependence on exogenous energy sources to meet established production goals. Moreover, such estimates provide insight into agriculture's dependence on inexpensive fossil fuels to meet established economic goals. This information is important if it is assumed that adequate supplies of alternative energy sources may not be readily available when the world's finite sources of fossil fuels are exhausted.

The broad objective of this paper is to examine the potential role of animals in sustainable agriculture systems. Because this objective necessitates that we define sustainable agriculture in a clear, unambiguous manner, we will firstly present, as an aid to developing this definition, a fundamental overview of the structural and functional attributes of ecological systems. Next, we will examine agriculture from an ecological perspective with emphasis on sustainability. We will then present a case study to examine the sustainability features of several Northern Great Plains beef cattle management systems. We will then conclude the paper by tying these findings back to our original objective.

The Ecosystem Concept

The ecosystem concept is fundamental to understanding what agriculture generally, and animal agriculture specifically, is all about. An **ecosystem** is simply an assemblage of organisms and their associated chemical and physical environment (Briske and Heitschmidt, 1991). A fishbowl is an ecosystem, as is a vegetable garden, a field of corn, a pasture, an entire ranch or farm, a city, a state, a country, or the entire world. In other words, an ecosystem can be essentially anything we desire providing we can define its boundaries.

The structural organization of all ecosystems can be described as consisting of four components; one non-living and three living. The **abiotic** (i.e., non-living) component defines the chemical and physical environment of the biotic (i.e., living) component. It includes such things as climate, atmosphere, and soils. It is the water in the fishbowl and the soil, air, and sunlight in the garden, cornfield, and pasture.

The three **biotic** components are producers, consumers, and decomposers. **Producers** are organisms that capture solar energy. They are the phytoplankton in the fishbowl, the vegetables in the garden, the corn in the cornfield, and the grasses, forbs, and shrubs growing in the pasture. **Consumers** are organisms that obtain their energy by consuming other organisms. Consumer organisms are animals except in very rare instances (e.g., the Venus fly trap). Consumers that consume plants are called herbivores, those consuming other animals are called carnivores, and those consuming both plants and animals are called omnivores. Cattle are herbivores, coyotes are primarily carnivores, and people are omnivores. **Decomposers** are the final or last consumers of organic matter. They are the microorganisms, primarily bacteria and fungi, that complete the decomposition process.

The integrity of an ecosystem is dependent on the efficient flow of energy through the system and the efficient cycling of the raw materials required to capture and process solar energy. **Food chains** are energy processing pathways that determine the pattern of energy flow through an ecosystem (Figure 1). There are two types of food chains; **detrital** and **grazing**. In both chains, the first **trophic level** consists of the primary producers or green plants. The difference between the chains come at the second trophic level in that if the primary consumers are decomposers, then the food chain is a detrital food chain (e.g., chain #1, Figure 1), otherwise that defined food chain is called a grazing food chain (e.g., chains #2, 3, and 4, Figure 1).

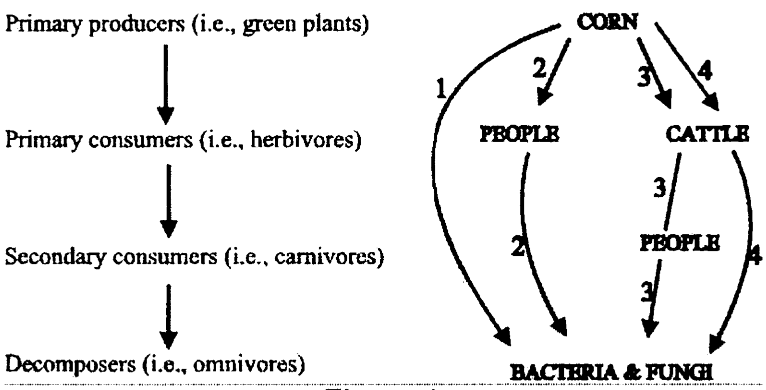

Figure 1.

Regulation of energy flow through an ecosystem via various food chains is governed by the first two laws of thermodynamics. In their simplest form, these laws state that although energy can be transformed from one form to another, it can never be created nor destroyed nor can any transformation be 100% efficient. The impact of these laws on energy flow through an ecosystem is that they dictate that the amount of energy that will flow through an ecosystem is set by the primary producers, and that a portion of this energy, usually greater than 90%, will be lost each time the energy is transferred from one trophic level to another. These concepts are depicted in Figure 2 wherein the largest energy store is the primary producers and the amounts of energy stored in each successive trophic level becomes smaller at every step.

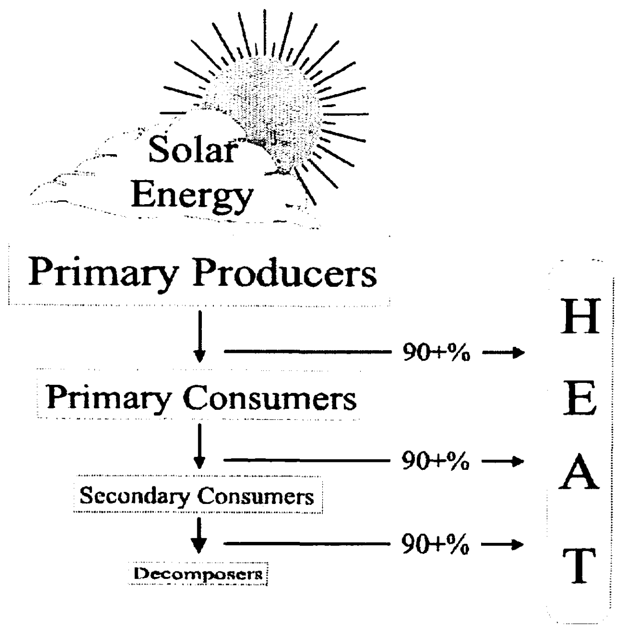

Figure 2.

The second indispensable function performed by ecosystems is the cycling of nutrients. Nutrients are the abiotic raw materials required by organisms to capture and process solar energy. Carbon, nitrogen, oxygen, and water are examples of nutrients that are continually cycled by ecosystems (Figure 3). The cycle revolves around the assimilation of nutrients by the primary producers followed by the sequential reduction of complex organic compounds by consumers to simpler, less complex forms.

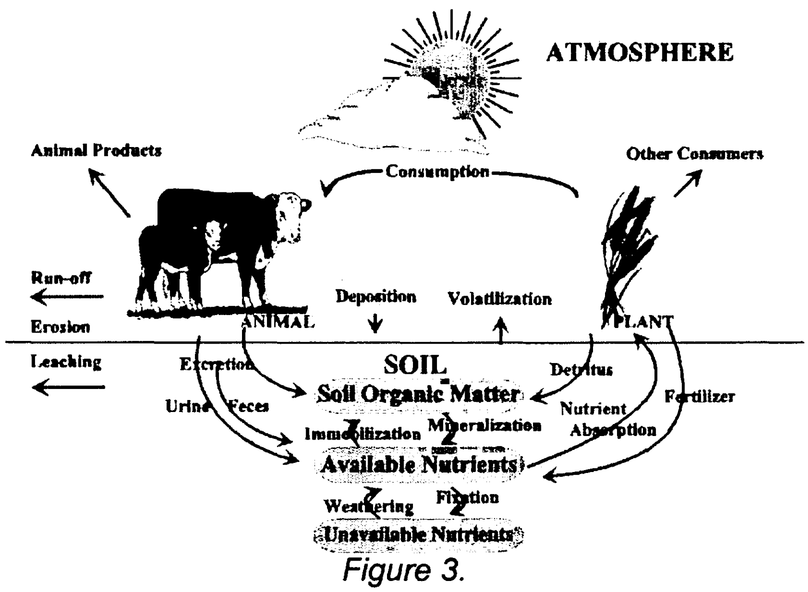

Figure 3.

The Ecosystem Concept and Agriculture

Agriculture is traditionally defined as the business of producing food and fiber. But a basic understanding of the structure and function of ecosystems reveals that

agriculture can be defined also as the business of managing resources to capture solar energy and transfer it to people for their use. It can be reasoned then that success in agriculture is closely linked to the employment of management tactics that either: 1) enhance the efficiency that solar energy is captured; and(or) 2) the efficiency that captured solar energy is harvested; and(or) 3) the efficiency that harvested solar energy is assimilated.

Examples of management practices attempting to improve the efficiency that solar energy is captured, harvested, and assimilated are numerous. For example, irrigation, fertilization, and the planting of hybrid seeds are common tactics utilized to enhance efficiency of solar energy capture. Two examples of tactics used to improve the efficiency whereby captured solar energy is harvested are the use of insecticides and livestock grazing of post-harvest residue. In these instances, the insecticides are employed to shift the flow of captured solar energy from food chains that do not include people (e.g., rangeland forage ➡ grasshoppers ➡ decomposer) to those that do include people (e.g., rangeland forage ➡ livestock ➡ people ➡ decomposer). This shift is achieved by simply eliminating the competing consumer. Likewise, livestock grazing of post-harvest residue works in a similar fashion in that it shifts the flow of energy from a detrital food chain (e.g., corn stalks ➡ decomposers) to a grazing food chain that includes people (e.g., corn stalks ➡ livestock ➡ people ➡ decomposers).

Similarly, many different types of tactics are employed to improve the efficiency whereby harvested solar energy is assimilated. Two examples of tactics commonly used to directly enhance assimilation efficiency are the feeding of mineral supplements and doctoring sick animals. Often feeding just a small amount of a deficient nutrient or vaccinating to eliminate disease will dramatically improve an animal's performance. But the most common factor affecting assimilation efficiencies is quality of foodstuff. In fact, **food quality** can be defined relative to its effect on assimilation efficiencies in that high and low quality foods are those that result in high and low net energy gains to consuming organisms. For example, rangeland forages are deemed low quality human foodstuff but high quality ruminant livestock foodstuff. The reason for this disparity is that ruminant digestive systems are such that they can process range forages in a manner whereby they can derive most of their life giving nutrients from the forage. This is in contrast to human digestive systems which are incapable of effectively digesting these same forages. Thus, the assimilation efficiency of range forages is low for humans and high for ruminants.

Even the efficient production of fiber (e.g., cotton, timber, and wool) is dependent on the efficient capture of solar energy and its subsequent harvest. That is why cotton, for example, is often irrigated and fertilized (i.e., increase efficiency of solar energy capture). But in contrast to food production practices, post-harvest processing of fibers is designed primarily to interrupt food chains and prevent consumption of the fiber (e.g., termites consuming wood).

Sustainable Agriculture

A fundamental problem with the questions associated with sustainability stems in part from our inability to define what sustainability is or what it is not. An understanding of how ecosystems function provides an additional means of defining sustainable agriculture. As such, **sustainable agriculture** may be broadly defined as ecologically sound agriculture and narrowly defined as eternal agriculture, that is, agriculture that can be practiced continually for eternity. It is those forms of agriculture that do not necessarily require exogenous energy subsidies to function. For example, grazing of indigenous grasslands is one of the most sustainable forms of agriculture known. This is because no other form of agriculture is less dependent on external finite resources, such as fossil fuels, and(or) external, potentially environmentally sensitive resources such as fertilizers, pesticides, etc., than grazing of native grasslands.

But the issue of sustainable agriculture goes beyond the idea that it is eternal agriculture because without the use of fossil fuels, it is not possible for agriculturalists to feed and clothe the world's human population. Fossil fuel technology is a major reason that agriculturalists can produce an abundance of food and fiber. This is reflected in **Table 1** which shows that as use of fertilizers, etc. (i.e., fossil fuels) are increased, yields increase also. Unfortunately, these data also reveal that the efficiency of production, as measured by energy output/input ratios, decreases as yields increase; and therein lies the dilemma. So what is the issue of sustainable agriculture all about? It is about the issue of how we can maintain high yields of agricultural products while maintaining high levels of ecological efficiencies. The challenge to agricultural scientists is to develop the technology that will allow us to maintain and(or) increase product yields while increasing ecological efficiencies.

Materials and Methods

Study Area

Research was conducted from 1990 to 1993 at the 22,250 ha Fort Keogh Livestock and Range Research Laboratory near Miles City, Montana. The regional natural vegetation is a mixed grass dominance of grama-needlegrass-wheatgrass (*Bouteloua-Stipa-Agropyron*) (Kuchler, 1964). Annual precipitation averages 338 mm with about 60% received during the 150 d, mid-April to mid-September growing season. Average daily temperatures range from a low of -10 C in January to a high of 24 C in July.

Treatments

Spring calving finishing lot. Crossbred cows were bred by A.I. to high index Charolais or average index Hereford sires to calve in April. Cow-calf (steers only) pairs grazed perennial planted pastures, primarily crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.] and Russian wildrye [*Psathyrostachys juncea* (Fisch.) Nevski], during May and June and native rangeland thereafter. Calves were weaned in early October and either slaughtered immediately or fed a corn silage (64%) and barley grain (30%) finishing ration for 84, 168, or 252 d before slaughter. Cows remained on rangeland until early February when they were placed on a full feed ration of alfalfa hay (23%), grass hay

(72%), and barley grain (5%) until calving and returning to tame pasture. Cows were fed a soybean meal based 32% CP supplement every 3 d at a rate of .9 kg/d from mid-December to early February.

Spring calving ➡ stocker ➡ finishing lot. Cows were bred and managed same as spring calving ➡ finishing lot treatment. However, following weaning in early October, calves grazed wheatgrass-ryegrass dominated tame pastures for about 75 d before entering drylot. Calves were fed a silage (78%) - grass hay (20%) based growing ration thereafter until returning to the tame pasture - native rangeland grazing treatment with the cow herd in early May. These stocker cattle were then either slaughtered off grass in early October or placed in finishing lots for 42, 84, or 126 d before slaughter. Ration fed in feedlot was a corn silage (39%) and barley (56%) based mix.

Fall calving ➡ stocker ➡ finishing lot. Cows were bred and managed same as spring calving cows except they were bred to calve in early October. They calved on native rangeland and were placed on full feed from mid-November until calves were weaned in mid-April. The full feed ration was the same as that fed spring calving cows during late winter and early spring. After weaning, the cows were moved to tame pasture. Management thereafter was the same as the spring calving cows. Calves were creep fed a grain based pellet throughout winter. After weaning, the calves were managed the same as the cow herd, grazing tame pasture during May and June and native rangeland thereafter. All calves entered the finishing lot in early October for 63, 126, or 189 d before slaughter. Ration fed was same as that fed to finish the spring calving ➡ stocker ➡ finishing lot treatment cattle.

Data Set

Organic matter intakes (OMI) of all animals (**Table 2**) were estimated using either unpublished study data or literature values. Key intake estimates (forage + supplemental feeds) derived from concurrent unpublished grazing studies were: 1) cows = 1.9% BW/d; 2) spring born suckling calves = 1% BW/d; 3) spring born stocker steers = 1.65 to 1.75% BW; and 4) fall born stocker steers = 2.0% BW. Estimates of OMI of cows on full feed were developed from standard ration procedures whereas estimates for weaned calves were the average for the Charolais and Hereford crosses as measured using individual feeding pens. Estimated OMI of calf creep feed was 0.5% BW/d.

Energy budgets for cultural energy inputs (Table 3) were derived from Cook et al. (1980) with some modifications. These budgets included all energy inputs associated with the operation, manufacturing, distribution, maintenance, and depreciation of equipment (e.g., farm machinery, vehicles, etc.) and products (e.g., fertilizer, herbicides, etc.) used in the farm/ranch operation. These budgets were based on inputs required to attain predicted yields (**Table 3**). Energy inputs/ha were then divided by yields/ha to attain energy inputs/yield estimates (**Table 4**). These estimates were then multiplied by OMI estimates (Table 2) to attain cultural energy input/animal estimates (**Table 5**). Body composition of marketed calves (Table 6) was based on whole body grinding following the procedures outlined by Short et al. (1993). Energy output/input ratios were derived by dividing yields (Table 5) by energy inputs (Table 4).

Results

Study results pointedly revealed the heavy reliance of these 12 beef cattle management systems on energy subsidies. Specifically, results (**Table 6**) showed energy output/cultural energy input ratios: 1) averaged .31 and .28 when marketed calf crops were assumed to be 100% and 80%, respectively; 2) varied little among management systems ranging from a low of .18 for the 80% calf crop, spring calving 0 d in finishing lot system to .40 for the 100% calf crop, spring calving stocker 126 d in finishing lot system; and 3) increased within a management system as days in finishing lot increased.

The underlying reason for these results is related largely to the interaction effects of low product output (i.e., small body mass) and the high cultural energy inputs required to maintain a productive cow and a growing or finishing calf in the rather harsh environment of the Northern Great Plains. For example, when minimal cultural energy was expended to grow and finish a weaned calf (Table 4), as was the case for the spring calving 0 d in finishing lot system (8 Mcal), energy outputs (Table 5) were too low (280 Mcal) to offset the energy inputs (Table 4) required to maintain the cow-calf pair up to time of slaughter (1237 Mcal). On the other hand, when product outputs were increased, the energy required to grow or finish the calves offset gains in size. For example, in the spring calving stocker 0 d in finishing lot treatment, an additional 894 Mcal were invested (902 - 8 = 894; Table 5) to increase product output from 280 Mcal to 523 Mcal (Table 6) with a resulting increase in efficiency of .02 (.23 vs .25) with a 100% calf crop and .03 (.18 vs .21) with an 80% calf crop. Likewise, by investing an additional 1,355 Mcal in the finishing lot (2,257 - 902 = 1,355; Table 5) to increase product output from 523 Mcal to 1,390 Mcal (Table 6), we were able to increase efficiency from .25 to .40 for a 100% calf crop, and from .21 to .37 for an 80% calf crop. Although these increases were relatively large (60%), the absolute increase was very small (.16).

A point of initial concern in the analyses was the magnitude of the textbook (Cook et al., 1980) cultural energy inputs estimate for general operations (Table 3). This estimate (567,642 $kcal \cdot cow^{-1} \cdot yr^{-1}$) seemed excessive because at an assumed low rate of stocking of 20 $ha \cdot cow^{-1} \cdot yr^{-1}$, cultural energy inputs/ha for native rangeland would be only slightly less than that for irrigated corn (7,096 vs 7,862 kcal). Granted, a portion of these general operations energy inputs could be allocated to the various cropping enterprises (e.g., pickup and fencing), but even so these estimates seemed extremely high. However, a reduction in these estimated inputs did not change the efficiency estimates as greatly as originally expected. For example, when the general operations cultural energy input estimate was reduced 50%, from 568 to 284 Mcal cow year, estimated efficiencies for the spring calving finishing lot treatment increased a maximum of only .07 with a 100% calf crop. This was because the general operations inputs were < 50% of the total annual inputs/cow thereby emphasizing again that the fundamental reason for the low efficiencies is simply that considerable cultural energy inputs are required in this region to maintain a biologically efficient "factory" (i.e., cow).

Discussion

The results of this study bring to question the long-term sustainability issue as it relates to currently accepted beef cattle production systems. The beef cattle industry's heavy reliance on fossil fuels to maintain a productive cow herd in regions where nutrient shortfalls are common and to market a consumer acceptable product carries with it some ecological and economic risks. These risks arise from the historical perspective that agriculture's continued success (i.e., sustainability) is tied to developing the technology needed to "control" nature as opposed to "living with" nature. Because the integrity of natural ecosystems is dependent on the efficient capture and processing of solar energy, ecosystem control strategies that alter natural flows of energy often require large inputs of exogenous energy. Risks accompany these control strategies because of future uncertainties about: 1) the availability of cheap sources of exogenous energy (e.g., fossil fuels); and 2) the potential disruption of critical life supporting ecological systems due to the continued generation of control strategy by-products (i.e., pollutants).

Central to the sustainability debate are the omnipotent technology and ecological constraint hypotheses. The omnipotent technology hypothesis embraces the fundamental concept that resource depletion (e.g., fossil fuels) automatically sets into motion a series of economic forces that alleviate the effects of depletion on society as a whole (Cleveland, 1987). On the other hand, the omnipotent ecological constraint hypothesis (Heitschmidt, 1991) is the underlying hypothesis supporting biophysical economic theory. Biophysical economics differ from standard economics in that they attempt to more fully factor the role of natural resources into the economic process (Pearce 1987). The focus is on merging ecology and economics so as to ensure that what is economically sound on the short-term is ecologically sound on the long-term. In this sense, it is important we recognize that economics is simply a measure of the intensity of society's beliefs rather than a measure of the merits of those beliefs (Sagoff, 1981). As such, some argue that "Economics can no longer afford to ignore, downplay or misrepresent the role of natural resources in the economic process. In the final analysis, natural resource quality sets broad but distinct limits on what is and what is not economically possible. Ignoring such limits leads to the euphoric delusion that the only limits to economic expansion exists in our own minds" (Cleveland, 1987).

These economic-ecological debates are central to the development of agricultural management strategies that are both ecologically and economically sustainable. Surely the results of our study provide some motivating interest to closely examine the general direction of agriculture research and specifically animal agriculture research. Our industry's heavy reliance on cheap fossil fuels is obvious and currently quite profitable. But is it the way of the future, and if not, what technology are we developing to meet this challenge? If we accept the premise that sustainable agriculture is eternal agriculture, i.e., agriculture that can be practiced forever, then what forms of animal agriculture might we consider sustainable?

The fundamental characteristic of sustainable animal agriculture systems must be that animals act as "energy brokers," that is they convert low quality human feedstuff (e.g., corn stalks, spoiled grains, waste products, etc.) into high quality human feedstuff for their consumption (e.g., meat, milk, eggs, etc.) (e.g., see Oltjen and Beckett, 1995). For example, livestock grazing of indigenous grasslands is fully sustainable in many regions of the world where level of cultural energy inputs required to maintain a productive herd of animals is low. Rangeland agriculture is grazing, and when properly managed, rangeland agriculture is fully sustainable having gone on long before the discovery of fossil fuels and will, without doubt, go on long after the depletion of fossil fuels.

Any discussion concerning the longterm sustainability of animal agriculture would be shallow and incomplete without some consideration given to the ecological relationship between human population food demands and livestock production systems. From an ecological perspective, humans are consumers that most often either solely occupy the second (herbivorous) or third (carnivorous) trophic level of food chains or concurrently occupy both the second and third trophic levels (omnivorous). Occupation of trophic levels greater than the second is in many instances a luxury afforded to only a privileged few, that being those living in an environment where human food demand is well below supply. However, when human food demand begins to exceed supply, the laws of thermodynamics dictate that humans occupy the second trophic level to the maximum extent possible, and as such, the role of animal agriculture is relegated to that of an "energy broker" (i.e., converting low quality foodstuff, such as rangeland forages, into high quality meat). Thus, the challenge to animal agriculturalists in a world of an ever increasing human population is to develop technology that will enhance animal conversion efficiencies of both high (e.g., cereal grains) and low (e.g., rangeland forages) quality foodstuff into high quality products that meet human expectations (e.g., tender, flavorable, etc.). Historically, North American animal agriculturalists have done a commendable job developing technology and associated seedstock that perform well in converting feed grains into consumer acceptable meat products. But because most selection criterion have focused largely on off-spring's performance in feedlot environments, it is not surprising that these same seedstocks do not generally do an acceptable job of converting grazable forages and other low quality roughages (e.g., straw) into highly desirable meat products. The fact of the matter is little effort has been expended in North America developing this ruminant animal production technology; and yet, it is this technology that will insure that North American animal agriculture will continue to play a critical and important role in sustaining the ever bulging human population inhabiting our biosphere.

Finally, we hope the contents of this article provide readers with insight as to why we believe the long-term health of modern day animal agriculture is highly dependent on the long-term health of this biosphere's human population and its associated ecological life support systems. Contrary to popular belief, the ecological ills of this biosphere are largely the result of human rather than livestock production activities. Thus, the longterm health of animal agriculture is as dependent on focused, problem solving social science research activities as it is on traditional animal science research activities. Together we can overcome; apart we limit our options.

Implications

Results show that accepted Northern Great Plains beef cattle management systems rely heavily on exogenous sources of cultural energy primarily in the form of fossil fuels. Thus, the long-term survival of this industry appears to be largely dependent upon either: 1) the continued availability of cheap, traditional and(or) new sources of energy; and(or) 2) increased revenue to offset increased energy costs; and(or) the development of new animal production technology to increase the ecological efficiency of production. The analyses also reveal that a major factor threatening the long-term sustainability of modern day U.S. animal agriculture systems is human population growth.

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***Table 1**. Energy output/cultural energy input ratios for corn production systems in Mexico (manpower only) and the United States (conventional)*[a]

	Management system	
Item	Mexico	United States
	---------- kcal/ha ----------	
A. Cultural energy inputs	553,678	8,390,750
B. Grain yield	---------- kg/ha ----------	
1. Weight	1,944	7,000
	---------- kcal/ha ----------	
2. Energy	6,901,200	24,500,000
C. Energy output/input ratio	12.5	2.9

[a] Pimentel, 1984.

***Table 2**. Estimated organic matter intakes for cows and steer calves*

	Treatment													
	Spring calving → finishing lot					Spring calving → stocker → finishing lot					Fall calving → stocker → finishing lot			
		Calf					Calf					Calf		
Feedstuff	Cow	0[a]	84[a]	168[a]	252[a]	Cow	0[a]	42[a]	84[a]	126[a]	Cow	63[a]	126[a]	189[a]
	kg/yr	------ kg/lifetime ------				kg/yr	--------kg/lifetime---------				kg/yr	------ kg/lifetime ------		
A. Grazable forages														
1. Native rangeland	2,093	147	147	147	147	2,093	740	740	740	740	1,773	507	507	507
2. Tame pasture	585	30	30	30	30	585	706	706	706	706	444	287	287	287
B. Hay														
1. Alfalfa	283	-	-	-	-	283	-	-	-	-	474	-	-	-
2. Tame pasture	739	-	-	-	-	739	252	252	252	252	1,243	-	-	-
C. Corn silage	-	-	349	765	1,287	-	983	1,224	1,391	1,542	-	377	568	795
D. Barley grain	60	-	164	359	603	60	-	346	579	802	199	541	716	1,141
E. Supplements														
1. Calf creep	-	-	-	-	-	-	-	-	-	-	-	118	118	118
2. Protein	89	-	-	-	-	89	-	-	-	-	89	-	-	-
3. Finishing	-	-	33	62	102	-	25	56	77	97	-	48	73	102
Total	3,849	177	723	1,363	2,169	3,849	2,706	3,324	3,745	4,139	4,222	1,878	2,269	2,950

[a] Days in finishing lot.

Table 3. *Energy budgets used to estimate cultural energy inputs (after Cook et al., 1980), yields, and output/input ratios for various feedstuffs*

Item	Treatment: General operations		Alfalfa hay (irrigated)		Corn silage (irrigated)		Barley grain (dryland)		Perennial pasture (dryland)	
	Quantity	Mcal/yr	Quantity	Mcal/ha	Quantity	Mcal/ha	Quantity	Mcal/ha	Quantity	Mcal/ha
A. Inputs										
Labor (hr)	3,170	7,925	11.4	29	112.6	281	5.1	129	1.9	5
Machinery (hr)	-	-	3.8	1,092	3.6	1,301	2.5	918	0.2	78
Pickup (km)	20,000	83,660	-	-	-	-	-	-	-	-
Transportation (km*kg)	573	1,662	238	690	317	920	1.5	4	-	-
Fertilizer (kg)	-	-	123	332	262	2,623	-	-	-	-
Pesticides (kg)	-	-	0.6	8	2.2	54	-	-	0.5	12
Seed (kg)	-	-	1.1	68	25	625	67	201	0.8	3
Irrigation (cm)	-	-	25	1,262	50	2,058	-	-		
Fence (km)	80	34,856	-	-	-	-	-	-	-	-
Water (AUM)	3,000	13,815	-	-	-	-	-	-	-	-
Total		141,918		3,481		7,862		1,252		98
			---- kg output/ha ----							
B. Yields	250 hd cow herd		9,945		12,750		1,427		350	
	------kcal/cow------		---- kcal input/kg output ----							
	567,672		350		617		877		280	
			---- kcal/kcal[a] ----							
C. Output/input ratio			11.4		6.4		4.6		14.3	

[a] @ 4,000 kcal/kg

***Table 4**. Cultural energy inputs/product output*

I. Feedstuff	----kcal input/kg output -----
A. Grazable forages	
1. Native rangeland	0[a]
2. Tame pasture	280[b]
B. Hay	
1. Alfalfa	350[b]
2. Tame pasture	280[c]
C. Corn silage	617[b]
D. Barley grain	877[b]
E. Supplements	
1. Calf creep	885[c,d]
2. Protein	1,546[c,e]
3. Finishing	1,023[f]
II. General operations	--- kcal input$\cdot$cow$^{-1}\cdot$yr^{-1} [b,g] ---
1. Ranch-farm	567,642
	--- kcal input$\cdot$animal$^{-1}\cdot$d^{-1} [c,h] ---
2. Feedlot	1,862

[a] Energy inputs are embedded in II.1.
[b] See Table 3.
[c] After Cook et al. (1980)
[d] 877 kcal for barley grain base + 84 kcal for pelleting
[e] 1,462 kcal for soybeans + 84 kcal for pelleting
[f] Ration = 63% barley, 20% soybean meal, 6% urea, and 11% minerals and vitamins
[g] Based upon 250 hd cow herd
[h] Based upon 1,000 hd feedlot

Table 5. *Cultural energy inputs/animal (from Tables 1 & 3)*

	Treatment													
	Spring calving ➔ finishing lot					Spring calving ➔ stocker ➔ finishing lot					Fall calving ➔ stocker ➔ finishing			
		Steer					Steer					Steer		
Item	Cow	0[a]	84[a]	168[a]	252[a]	Cow	0[a]	42[a]	84[a]	126[a]	Cow	63[a]	126[a]	18
	--- Mcal/yr ---	Mcal/lifetime				--- Mcal/yr ---	Mcal/lifetime				--- Mcal/yr ---	Mcal/lifetime		
A. Grazable forages														
1. Native rangeland[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Tame pasture	164	8	8	8	8	164	198	198	198	198	124	80	80	8
B. Hay														
1. Alfalfa	99	-	-	-	-	99	-	-	-	-	166	-	-	-
2. Tame pasture	207	-	-	-	-	207	71	71	71	71	348	-	-	-
C. Corn silage	-	-	215	472	794	-	607	755	858	951	-	233	350	49
D. Barley grain	53	-	144	315	529	53	-	303	508	703	175	474	628	10
E. Supplements														
1. Calf creep	-	-	-	-	-	-	-	-	-	-	-	104	104	10
2. Protein	138	-	-	-	-	138	-	-	-	-	138	-	-	-
3. Finishing	-	-	34	63	104	-	26	57	79	99	-	49	75	10
F. General operations														
1. Ranch-farm[c]	568	-	-	-	-	568	-	-	-	-	568	-	-	-
2. Feedlot[d]	-	-	156	313	469	-	-	78	156	235	-	117	235	35
Total	1,229	8	557	1,171	1,904	1,229	902	1,462	1,870	2,257	1,519	1,057	1,472	2,1

[a] Days in finishing lot.
[b] Cultural energy inputs are embedded in F. 1.
[c] Includes energy inputs required to maintain and manage 250 hd cow herd.
[d] Based on number of days in 1,000 hd feedlot.

***Table 6**. Whole body weight and composition, energy yield animal and energy output/cultural energy input ratios*

	Treatment										
	Spring calving → finishing lot				Spring calving → stocker → finishing lot				Fall calving → stocker → finishing lot		
Item	0[a]	84[a]	168[a]	252[a]	0[a]	42[a]	84[a]	126[a]	63[a]	126[a]	189[a]
A. Composition	---- kg ----										
1. Protein	23.0	29.5	38.0	46.0	41.0	51.0	54.0	60.5	38.5	44.5	50.0
2. Fat	16.0	35.0	62.5	91.5	31.0	60.0	89.0	111.5	39.5	76.0	105.0
Total	39.0	64.5	100.5	137.5	72.0	111.0	143.0	172.0	78.0	120.5	155.0
B. Energy yield	---- Mcal ----										
1. Protein[b]	130	167	215	260	232	288	305	342	218	251	283
2. Fat[c]	150	329	587	860	291	564	837	1048	371	714	987
Total	280	496	802	1,120	523	852	1,142	1,390	589	965	1,270
C. Output/input ratios											
1. 100% calf crop	.23	.28	.33	.36	.25	.32	.37	.40	.23	.32	.35
2. 80% calf crop[d]	.18	.24	.30	.33	.21	.28	.34	.37	.20	.29	.32

[a] Days in finishing lot.
[b] @ 5.65 Mcal/kg
[c] @ 9.40 Mcal/kg
[d] $\frac{\text{80\% calf output}}{\text{100\% cow input + 80\% calf input}}$

COMMITTEE SESSION: MULTIPLE TRAIT SELECTION COMMITTEE

MINUTES - BIF MULTIPLE TRAIT SELECTION COMMITTEE MEETING WEDNESDAY, JULY 1, 1998, 2:00 TO 5:15 P.M.

The second meeting of the Multiple Trait Selection Committee was held in Calgary, Alberta, Canada on Wednesday, July 1, 1998 from 2:00 until 5:15 p.m. The general theme of the meeting was "Delivering Multiple Trait Selection Objectives." The following presentations were made and are included elsewhere in these proceedings:

Delivering Multiple Trait Selection Objectives...

...to producers using the "Decision Evaluator for the Cattle Industry (DECI)" Model - a progress report

Dr. Rick Bourdon
Colorado State University

...through the use of feedyard closeout and carcass information - using data to buy better bulls

Mr. Don Schiefelbein
Mr. Tom Brink
American Gelbvieh Association

Multiple trait selection considering an optimal product

Dr. Steve Miller
University of Guelph

Optimizing performance through the use of straightbred vs. hybrid seedstock - a team debate/panel question and answer session

Straightbred -	Dr. Don Boggs South Dakota State University	Mr. Mark Gardiner Gardiner Angus Ranch
Hybrid -	Dr. Jim Gosey University of Nebraska	Mr. Lee Leachman Leachman Cattle Company

Following opening comments by participants in the debate, a lively question and answer session was held relative to the advantages and disadvantages of using straightbred and hybrid bulls to optimize performance across many traits and as a result maximize profit. This format provided an informative and entertaining method in which to present the pros and cons of a potentially controversial issue.

There being no motions, resolutions or further business the meeting adjourned.

Respectfully submitted,
Kent Andersen, Chairman

DETERMINING SELECTION OBJECTIVES USING THE DECI MODEL A PROGRESS REPORT

Rick Bourdon
Colorado State University

What Is DECI?

DECI stands for Decision Evaluator for the Cattle Industry. In technical terms, it is a firm-level, life-cycle, bioeconomic computer simulation model of beef production. "Firm-level" simply means that the model simulates a single operation, in DECI's case, a single commercial cow-calf operation. "Life-cycle" indicates that cows are simulated from conception to sale. "Bioeconomic" denotes the biological nature of the simulation; the model simulates underlying biological mechanisms. And bioeconomic indicates that the results of the simulation are translated into measures of profit or parallel economic terms.

DECI is a compendium of equations that animal scientists have developed over the years to describe biological relationships. These equations govern such things as feed intake, diet selection, growth rate (weight loss), body composition, milk production, fertility, and death loss. In addition, DECI simulates a number of management options. These include timing of breeding, weaning, and sale, mating and crossbreeding systems, supplemental feeding, grazing systems, sire selection, culling, and replacement.

History of DECI

DECI is just the most recent development in the evolution of beef models. It traces back to the Texas A&M Beef Production Model developed by Jim Sanders and Tom Cartwright in the 1970's and later versions built in Nebraska and Colorado. DECI includes recent contributions from federal researchers Tom Jenkins and Charles Williams at the US Meat Animal Research Center in Nebraska. We anticipate scientists at a number of institutions will work on DECI in the near future.

Who Will Use DECI and Who Will Run It?

DECI is designed primarily for commercial producers. Seedstock producers may also use the model to better understand the operations of their commercial customers. These are not necessarily the people who will actually sit down in front of the computer and run the model, however. DECI is complex, and to use it intelligently takes knowledge and experience. We expect to see growth in a new class of agricultural advisors, both in the public and private sectors, for whom DECI will be an important analytical tool.

Purposes of DECI

DECI is designed as a management decision support tool for commercial producers. It can be used to predict outcomes of many management decisions. For example, it could help determine the effect on production and profit of late spring calving, early weaning, terminal crossbreeding, or combinations of these. Eventually DECI should have the ability to evaluate sire selection decisions, i.e., it should be able to determine optimal EPD combinations for sires from various breeds. At that point DECI will have become a *bona fide*, customized, multiple-trait selection technology.

DECI and Multiple-Trait Selection

Sire selection has always been something of an art. That is because in order to do a good job of sire selection, we must determine how the use of different sires (different sets of EPDs) affects costs, returns, and economic risk for a particular commercial operation. A complicated problem. To solve the problem, we must be able to predict the phenotypes (actual performance) of offspring. Differences in sire EPDs are supposed to reflect phenotypic differences in offspring, and, in many cases, they do, especially in purebreds under "average" environmental conditions. EPDs don't predict actual weights, however, and differences in EPDs among sires may not accurately represent offspring differences in the presence of genotype by environment ($G\times E$), genotype by genotype ($G\times G$), and genotype by genotype by environment ($G\times G\times E$) interactions.

For example, consider two sires, one with high genetic potential for yearling weight and one with low genetic potential for the trait (Figure 1). If the progeny of these two sires are fed high energy rations, we expect large differences in the weights of the two groups at a year of age. But if they are fed low energy rations, we expect smaller differences. This is an example of a $G\times E$ interaction. The effect of differences in genetic potential (in this case, genetic potential for yearling weight) depends on the environment (in this instance, energy level of the diet).

A similar interaction can be expected with genetic potential for fertility (Figure 2.) In high stress environments, differences in mean observed fertility between daughters of high and low fertility sires will be clear. In low stress environments, however, such differences may not be detectable. The effect of differences in genetic potential (in this case, genetic potential for fertility) depends on the environment (in this instance, the level of environmental stress).

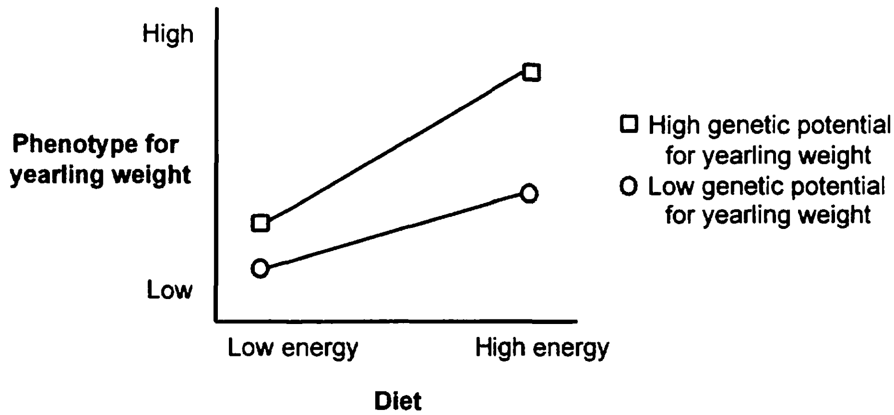

Figure 1. *G*×*E* interaction (yearling weight by diet energy).

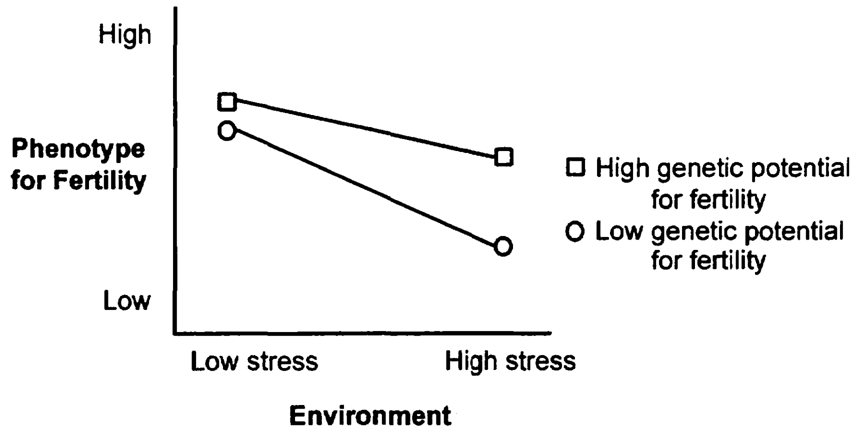

Figure 2. *G*×*E* interaction (fertility by stress).

We can have *G*×*G* interactions too. Figure 3 illustrates how the effect on observed fertility of differences in genetic potential for fertility depends on genetic potential for milk production. Genetic differences in fertility are easily observed when milk levels are high, but not so easy to see when milk levels are low. And if the strength of this interaction depends on the level of stress in the environment, then we have a 3-way *G*×*G*×*E* interaction (Figure 4).

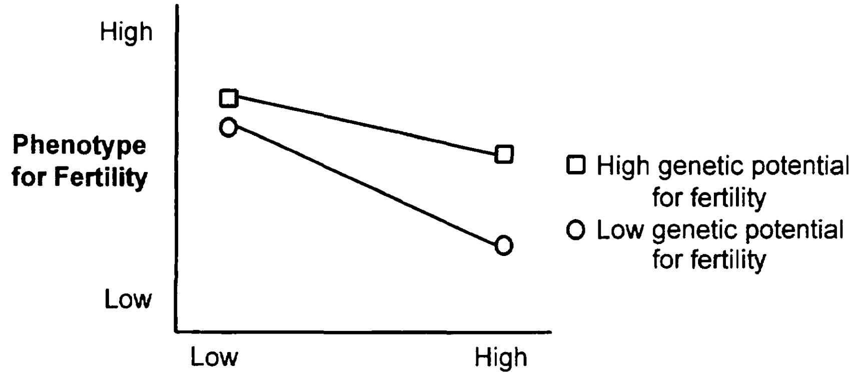

Figure 3. *G*×*G* interaction (fertility by milk production).

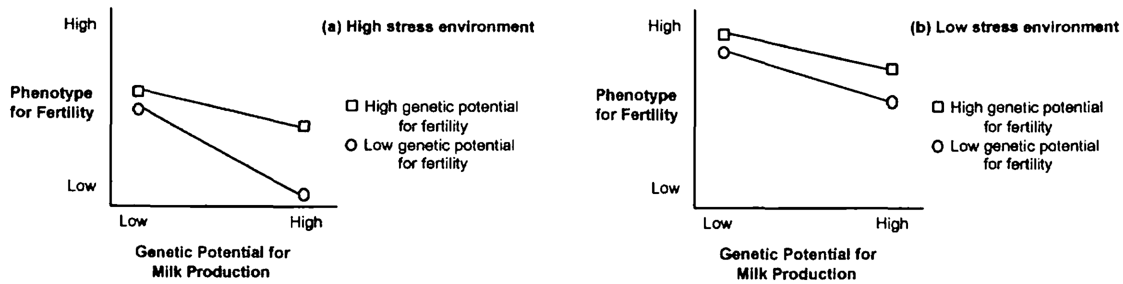

Figure 4. *G*×*G*×*E* interaction (fertility by milk production by stress).

Phenotypic prediction is further complicated by changing relationships between traits. Consider, for example, the relationship between scrotal circumference of sires and heifer pregnancy rate of their daughters (Figure 5). Scrotal circumference is a reliable indicator of age at puberty. So if heifers are developed slowly, in other words, if only a portion of them have reached puberty by the beginning of the breeding season, age at puberty is an important determinant of pregnancy rate, and there will be a fairly strong relationship between sire scrotal circumference and heifer pregnancy rate of daughters (Figure 5a). But if heifers are developed rapidly, if virtually all heifers are cycling before the breeding season, age at puberty is no longer a factor, and the relationship between scrotal circumference and heifer pregnancy rate is weak (Figure 5b).

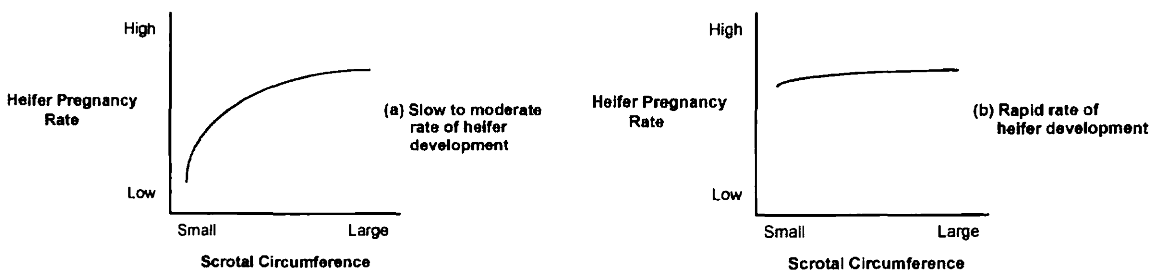

Figure 5. Scrotal circumference and heifer pregnancy rate.

The particular value of biological simulation is that it uses a *mechanistic* approach, an approach which recognizes underlying biological mechanisms instead of relying on statistical relationships. Biological simulation is able to account for interactions (like the interaction between genetic potential for fertility and milk production) and changing relationships (like the changing relationship between scrotal circumference and heifer pregnancy rate) by *recreating* them. The entire multiple-trait selection/bioeconomic simulation process is shown in Figure 6.

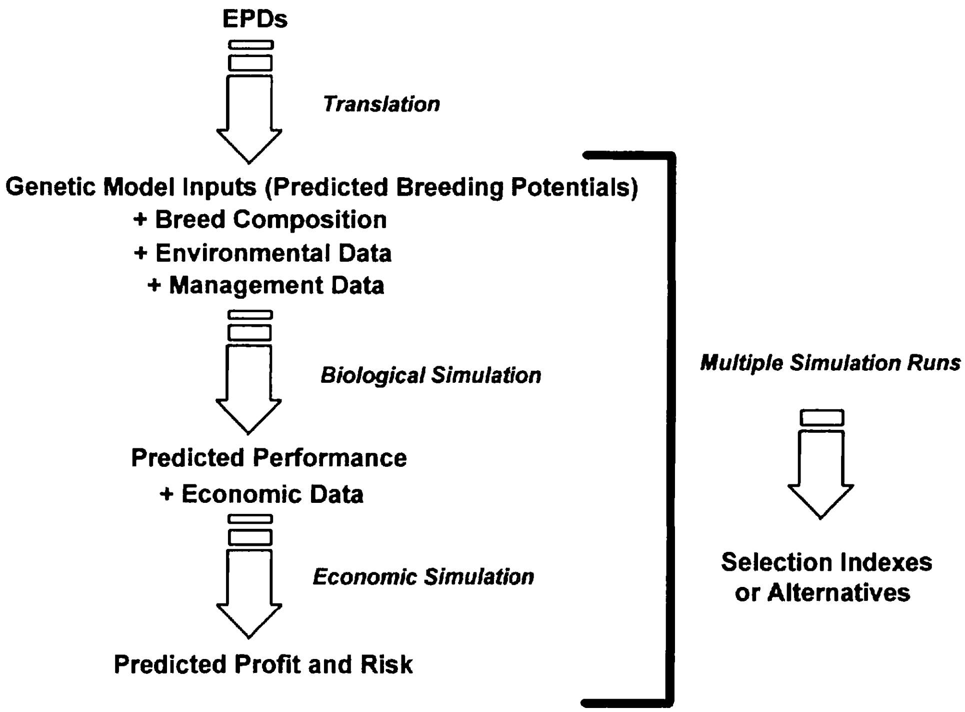

Figure 6. The multiple-trait selection/bioeconomic simulation process.

First EPDs from within-breed evaluations are translated into genetic inputs required by the simulation model. These inputs are then combined with data on environment and management specific to a commercial operation. The simulation uses all these data to produce predictions of animal performance which, when combined with economic information, predict profit. If we make many simulation runs, each time changing the kinds of sires used, we can produce selection indexes or alternatives that are customized for the commercial operation we are simulating. And if we change not only the sires but management practices as well, we can identify optimal combinations of sires and management practices. In other words, we can *co-optimize* sire selection and management.

New Concepts

If DECI is to be used to determine selection objectives, breeders will be confronted by a whole new set of concepts (just when you were getting comfortable with EPDs!). One is the concept of *breeding potential (BP)* and *predicted breeding potential (PBP)*. These are the genetic inputs to DECI and are defined very differently from EPDs. An animal's breeding potential for a trait is the transmittable portion of genetic *potential*—performance potential under the most favorable environmental conditions. For example, a cow's genetic potential for milk production represents her maximum production given optimal nutrition, body condition, age of cow, and demand of calf (i.e., a high growth calf). Unlike conventional breeding values and progeny differences, breeding potentials are not expressed as deviations from a mean. They look like typical phenotypic measures. And in contrast to breeding values and progeny differences, breeding potentials are not population dependent. They are directly comparable across breeds.

Getting from EPDs to PBPs is no small trick. We are just beginning the research required to translate one measure to the other. Someday, however, we should have EPD/PBP "maps" like that shown in Figure 7. Such maps will make it possible to accurately simulate the use of any bull from any breed (assuming the bull has been well evaluated within breed).

Another new concept is the idea of *biologically relevant traits*. Currently we speak of measured traits, traits with EPDs, and, as breeders move toward more sophisticated methods of multiple-trait selection like index selection, economically relevant traits. For example, we measure weaning weight. From this one measurement we produce EPDs for three components of weaning weight: weaning weight direct (growth), weaning weight maternal (milk), and total maternal weaning weight (milk and growth). Neither weaning weight nor any of its component traits is necessarily economically relevant, however. To be relevant in an economic sense, a trait must have a clear and direct influence on profit. Weaning weight is economically relevant only if calves are sold at weaning. Now, as biological simulation enters the picture, we are faced with a new set of traits—traits that make sense from a simulation standpoint. I call these biologically relevant traits, and weaning weight is not one of them. The biologically relevant traits required to simulate weaning weight are potential for growth rate (likely represented by potentials for weight at various ages) and peak milk production potential (measured in lb of *milk*).

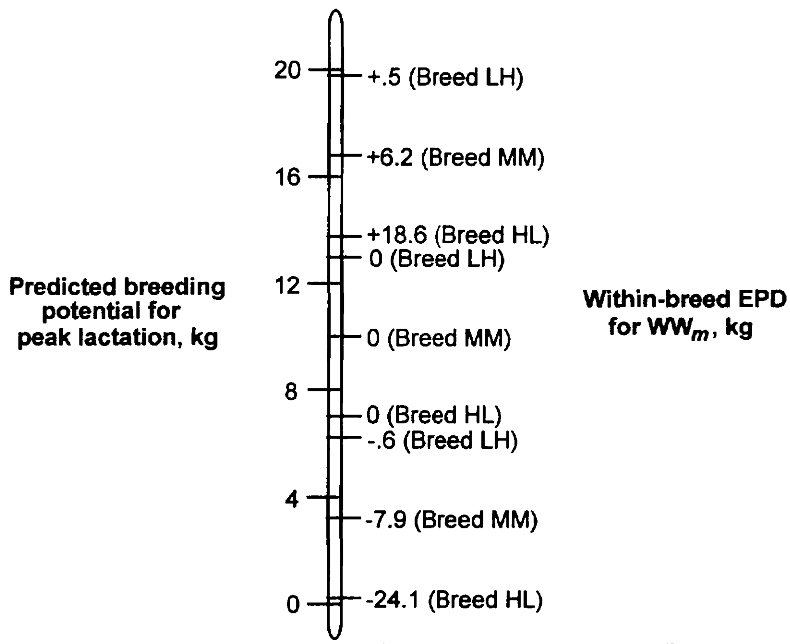

Figure 7. Hypothetical EPD/PBP "Map."

A third concept associated with multiple-trait selection via computer simulation is "sire selection by simulation." Sire selection by simulation is both a multiple-trait selection technology and a way of presenting sire selection information. It is an alternative to selection indexes. In a nutshell, sire selection by simulation uses many simulation runs to derive optimal sequences of sires to be used in a specific commercial operation. A hypothetical example of such a sequence is shown in Table 1. This particular sequence suggests using bulls with gradually increasing growth, mature size, and milk production potential over a 20-year period.

Table 1. Optimal sire sequence for four traits in a hypothetical commercial beef herd[a]

	Sire biotype (Breeding Potential)			
Years	AAP	YW	MW	MP
1 to 5	350	604	1078	17.6
6 to 10	350	626	1100	17.6
11 to 15	350	648	1122	19.8
16 to 20	350	670	1144	22.0

[a]AAP = age at puberty, d; YW = yearling weight, lb; MW = mature weight, lb; MP = peak milk production, lb/d.

DECI's Current Status

The current version of DECI contains a visually oriented "front end" making it relatively easy to use. But relatively few management options are available. The model is limited to the preweaning phase of production. It is likewise limited in the kinds of mating/crossbreeding systems that can be simulated and in the kinds of culling and replacement strategies that can be implemented. The economic part of the model is quite naïve as well. Currently, forage information must be entered by the user; the model does not simulate forage production.

Plans for DECI

All this will change, however, in the near future. An immediate priority is to restructure/reprogram DECI so that it is easier for researchers to understand and improve. The next version, due in October, 1998, will include a postweaning phase. Later versions will include a forage module. Biological submodels—for example, the fertility submodel—are scheduled for overhaul, and a more sophisticated economic module is in the offing. Longer-term plans include the construction of databases for climate, soils, and forage inputs; continued improvement of biological components; translation of EPDs to model inputs; optimization of code for producing customized selection indexes and(or) sire sequences; and world-wide-web compatibility.

PAY YOUR COWHERD A MAJOR COMPLEMENT

by J. Tom Brink, Executive Director, American Gelbvieh Association

Introduction

Don't you wish your cattle would consistently gain 4 pounds a day in the feedlot, convert feed to gain at 4:1, then hang up carcasses that were 80% Choice and 80% Yield Grade 1s and 2s? Well...most of us aren't there yet. So we need to focus on making progress from where we are. We need to keep our breeding programs moving in a positive direction, which means selecting bulls that complement the cows we have in our pastures.

To do that, each producer must know the strengths and weaknesses of their own cattle. Producers need to know where they are with respect to important factors like feedlot performance and carcass traits. A roadmap is useful if you know where you are and have a destination in mind. If you don't know where you are, a map isn't much help.

There's a point of action here that is quite simple: If you don't have feedlot and carcass data on your cattle...GET IT! There are many programs available to help you obtain this information. Take advantage of them. Whether it's five head a year or 500, every serious producer (both seedstock and commercial) needs to repeatedly sample his genetics, so he knows what he's producing.

Producers that have fed some of their own genetics and followed them into the packer's cooler have a good idea how their genetics stack up. For most, this valuable exercise revealed some positives, along with several areas that could use improvement. I've yet to meet a producer who retained ownership for the first time, and discovered his cattle excel in all the economically important traits.

Feedlot and Carcass Performance

There's been a lot of emphasis on carcass traits in recent years, which is good. Improving carcass characteristics is very important to the long-term health of the beef industry. At the same time, however, we must not forget about feedlot performance. If our cattle bring a large premium on a grid, but don't perform well in the feedlot, we have not been as successful as we might think. Study the table at the right as a case in point.

Eagle Pass Ranch Retained-Ownership Cattle

	Group 1	Group 2
Number of Head	80	79
Feedlot In Weight	559 lbs.	570 lbs.
Feedlot Out Weight	1254 lbs.	1164 lbs.
Days on Feed	217	208
Average Daily Gain	3.17 lbs.	2.72 lbs.
Pounds of Dry Feed/Gain	5.84:1	6.68:1
Cost of Gain (per cwt.)	$46	$53
Grid Premium (per head)	$7	$32
Total Profit (per head)	**$60**	**$36**

In 1997, Eagle Pass Ranch of Highmore, South Dakota, fed two groups of steers they had raised on the ranch. The steers represent separate genetic pools, which explains the different results. Group 1 performed well in the feedlot, but earned a smaller grid premium. Group 2 earned a large premium on the grid, but did not perform as well in the feedlot. Comparing the two groups demonstrates that large grid premiums and large profits don't always go hand in hand. Feedlot performance is at least equal in importance to carcass traits, and producers need to be cognizant of this.

Processing more than 100,000 cattle (all breeds and crosses) through the Gelbvieh Alliance during the past three years has taught us a simple axiom: **Premiums should not be pursued to the point of sacrificing feedlot performance. Nor should feedlot performance be pursued without regard to grid premiums.** Balance is best, less risky, and should be the goal of most breeding programs. We need to produce cattle that excel both in the feedlot and on the rail.

Utilizing Breed Differences

As we begin a discussion on balanced-trait cattle, the subject of breeds and biological types must be addressed. For a long time, the phrase **"there's more variation within breeds than between breeds"** has been used to downplay breed differences. This statement is basically true, but it misses the point. Breed populations are very different in many important traits. Instead of avoiding the issue, we should seek to better understand these differences and benefit from them.

Let's first take a look at carcass traits. We'll come back to feedlot performance later. The table on this page summarizes key carcass characteristics for Continental and Angus biotypes. It is appropriate to use the term "biotype" in this discussion, because the Continental breeds do represent a different biological type compared to British breeds.

Straightforward evaluation of the table reveals that each biotype has strengths and weaknesses. These two biological types also complement each other very well. The British (Angus) biotype has a clear advantage in marbling, while the Continental biotype excels in leanness, muscle and pounds of salable beef.

On the Rail, Continental and Angus Carcasses have

Differing Strengths

	High-Percentage Continental	High-Percentage Angus
Number of Head	16,183	17,647
Number of Pens	298	276
Average Age (months)	16.8	17.4
Live Weight	1193 lbs.	1179 lbs.
Carcass Weight	759 lbs.	745 lbs.
Dressing Percent	63.6%	68.2%
Choice and Prime	44.2%	68.9%
Yield Grade 1s and 2s	79.8%	57.5%
Net Carcass Value (per cwt.)	$105.61	$106.60
Total Value Per Head	$801.60	$794.20
Strength(s):	Leanness Muscle More Pounds	Marbling
Weakness(es):	Less Marbling	More Waste Fat Less Red Meat Fewer Pounds

Source: Gelbvieh Alliance Database (data current as of 5/28/98)

Don Schiefelbein, who manages the Gelbvieh Alliance for the American Gelbvieh Association, has described the relationship between these two biotypes as being like "boots and spurs." They work very well together. Thus, it is not surprising that Continental x Angus crosses have been some of the most valuable cattle marketed on the Gelbvieh/Monfort grid. Blending marbling from the Angus (or Red Angus) influence with muscle and leanness from the Continental breeds is a simple approach to creating valuable carcasses. And it works, because balanced trait cattle tend perform well on the rail, as well as in other important segments of the industry.

As we better understand breed differences, we can begin to use them to complement our individual cow herds. For example, if the carcass data you've collected suggests your cattle need more marbling, the best place to look is probably within a biotype that excels in marbling (Angus or Red Angus). If you need more pounds and better red-meat yields, you should add genetics from the biotype that does those things well (Continental breeds).

If your cows already have a balanced mix of Continental and British breeding, properly selected, genetically-documented hybrid bulls are a viable way to maintain desired breed percentages. Hybrids have been increasingly used for this purpose during recent years, and such use is likely to continue.

On the issue of complementarity, someone might say that it is possible to find "outlier" cattle which excel in traits their particular breed is not known for. Some British cattle are lean and muscular, and some Continental cattle marble very well. However, if you decide to use these outliers to complement the weak spots in your cow herd, you'll face at least two challenges. The first challenge is finding these cattle, because there aren't many around. The second challenge is affording them.

Feedlot Performance Follows Breed Biotype

It's time to wrap up this discussion with a look at feedlot performance. As would be expected, feedlot performance is also related to biological type. Feedlot close-out data collected via the Gelbvieh Alliance has shown that the Continental breeds typically have an advantage in the feedlot, especially in feed conversion. See the table below, which uses Gelbvieh as a representative Continental breed and Angus as the British breed.

Feedlot Performance of
Gelbvieh and Angus-Sired Cattle

	Gelbvieh-sired	Angus-sired
Number of Head	3,048	5,953
Number of Pens	53	103
Average Daily Gain	3.24 lbs.	3.19 lbs.
Feed Conversion (DM)	6.47 : 1	7.15 : 1
Cost of Gain (per cwt.)	$56.08	$59.20

Source: Gelbvieh Alliance

This is not surprising, because the conversion of energy to lean tissue is metabolically more efficient than the conversion of energy to fat. Lean and muscular biotypes (Continental breeds) convert a larger percentage of their body weight to lean tissue--as opposed to fat--when fed to normal slaughter endpoints. Thus, these breeds tend to convert feed into gain more cost effectively.

Data collected by Northwest Missouri State University during the last 13 years reveals the same biotype differences. In NMSU's feedlot bull tests, Continental breed bulls (on average) gained faster and more efficiently than Angus.

Northwest Missouri State University Bull Performance Summary (1986-1998)

	Number of Bulls	ADG	Dry Feed/Gain
Angus	489	3.36 lbs.	7.08 to 1
Continental*	521	3.50 lbs.	6.54 to 1

Source: NMSU
*Gelbvieh, Charolais and Simmental

Collectively, the data we've reviewed support the fact that British breeds represent a different biological type which more readily lays on fat (both marbling and external fat). This works against their feed efficiency in the feedlot. However, rapid fat deposition is desirable in the pasture. Cows with easy fleshing characteristics generally have higher breed-back percentages and/or lower cow-carrying costs.

Once again, we see a strengths/weaknesses situation for each biotype. And, we note the complementarity that exists between the Continental and British breeds.

Conclusion

There are many important subjects that have not been addressed in this discussion. Fertility, maternal traits, calving ease, environmental adaptability, docility and mature size (just to name a few) should all be considered as each producer sits down to design a logical breeding plan. Heterosis is a tool that should not go unused by any commercial producer, though it has not been directly mentioned in this paper.

Carcass traits and feedlot performance, which have been reviewed, should be high on every producer's priority list as well.

Honest evaluation typically reveals that every commercial cow herd has both strengths and weaknesses. Each producer should first quantify those strengths and weaknesses, then seek to complement his breeding program by bringing in genetics that can bolster the weak spots.

Breed differences can and should be used to make rapid genetic progress in traits where improvement is needed. Complementarity between biological types must become better understood, so it can be more broadly utilized. The production of "balanced-trait" cattle should be the goal of most commercial cattle operations. And, finally the use of documented hybrid seedstock must be supported by associations and eventually expanded to help maintain a balance of economically important traits in crossbred cowherds.

MULTIPLE TRAIT SELECTION CONSIDERING AN OPTIMAL PRODUCT

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Summary

A method of selecting beef bulls for commercial use considering their genetic evaluation on a number of traits is described. Two markets leading to 2 separate objectives are considered. Price grids for different markets are implemented, resulting in non-linear relationships between trait means and economic value. An example of this non-linearity is presented. The method incorporates selection across breeds and crosses considering the possibility of an optimal product. Additional improvements to selection through improvements in carcass evaluations are discussed.

Introduction

Programs to aid in the selection of beef bulls for commercial use have traditionally focussed on the development of genetic evaluations for traits of importance to breeders. Multiple trait selection has been available for some time as a way to combine these traits to optimize profit potential but until recently has received little attention in beef cattle breeding. However, there is now considerable international interest in multiple trait selection for beef cattle. An example of a long term selection program utilising multiple trait selection has been previously presented by Ens and Bourden (1997). A commercial software package is available to Australian breeders implementing a customizable selection index as described by Barwick et al. (1994).

Objectives are to describe a multiple trait selection procedure for beef bulls across breeds using an example of market and production situations in Ontario, and the information generated in herd performance tests and central evaluation stations and to describe procedures to incorporate optimal carcass weights and characteristics along with differences in retail markets.

Materials and Methods

Traits measured via multiple trait evaluation can be combined into a net economic value (NEV) by summing the products of the multiple trait EPD's multiplied by their respective economic weights. The multiple trait BLUP equations account for the genetic covariances between the traits evaluated and lead to evaluations equivalent to traditional selection index equations (Smith 1993). This approach is easily applied to a multiple breed populations where multiple breed evaluations allow breeders to compare animals for additive genetic merit despite breed or cross (Miller et al. 1994; Wilton and Miller, 1994).

Central evaluation stations in Ontario facilitate across breed evaluations on bulls for a number of economically important traits. Before the 112 day test period begins, bulls will have genetic evaluations for Birth Weight (BW), Weaning Gain (WG) and Maternal Weaning Gain (WG-M) from measurements through the herd performance test. The following traits are measured during the central post-weaning performance test, Post Weaning Gain (PWG), Feed Intake (FI), Scrotal Circumference (SC), Back-Fat thickness (BF), Rib-Eye Area (REA) and Intra-Muscular Fat (IMF) with the later three traits measured via ultrasound.

A bio-economic model was developed for a typical production program in southern Ontario. Progeny biological performance was predicted by combining the Across Breed Comparison's (ABC's, across breed EPD's) for the various traits with the appropriate trait means. These biological performance predictions were then substituted into the model for each animal individually to determine the differences in profit potential between bulls. Returns were based on market carcasses and cull cows sold and costs included feed, labour and other variable costs.

Production aspects influenced by measured and evaluated traits included calving difficulty, feed costs of the cow and the calf both pre and post-weaning, replacement costs, fertility in females, milk yield of the cow, increased birth weights, carcass weights, carcass grade as well as days on feed.

Some traits in the bio-economic model were not measured on the bulls directly. However, these could be predicted from the traits available on the bulls. For example, differences in heifer and cow fertility were predicted from a bull's genetic evaluation for SC and differences in calving difficulty were predicted through BW. Carcass weight, days from weaning to slaughter and feed intake from weaning to slaughter were predicted based on predicted performance for progeny end-of-test measurements of weight, BF and FI using equations of McWhir and Wilton (1986). A constant finish (back-fat thickness) endpoint, which is common in Ontario, was assumed. Intra-muscular fat at end of test was transformed to a finish constant prediction using an age adjustment and the predicted difference in days from weaning to slaughter. Equations of Jones et al. (1989) were used to predict retail yield based on predicted rib-eye area and carcass weight.

Traits were predicted on a bull progeny basis and transformed to a steer equivalent through a linear adjustment assuming a genetic correlation of unity. Predicted carcass weights were adjusted to a common management program in Ontario by deviating predicted differences in carcass weight from an Ontario average carcass weight. Differences in mature cow weight were predicted through differences in predicted steer weights at a constant finish.

Two production systems or potential lines of cattle were modeled independently. Both production systems assumed a bull would service 30 cows per year for two years. Beef Builder (BB) modeled popular commercial production practices where producers retain their own replacement heifers and market their steers on the current grid of predicted prices per unit of carcass. Prime Plus (PP) was intended to develop specialized replacement females with the steer progeny generated, along with cull heifers, satisfying a specific market. The market for PP animals was speculated such that there would be demand for a smaller carcass with an optimum weight as it relates to portion size and a high degree of marbling. The different markets for each of the lines BB and PP were incorporated into the respective NEV calculations through the bio-economic model by substituting the appropriate price grid which relates price per unit of product to carcass weight and percent intra-muscular fat. Average progeny price was then determined by predicting the proportion of progeny expected in each grid cell. Grid cells for PP, for example are a combination of marbling and weight.

Depending on the assumed price grid, a non-linear relationship between traits such as carcass weight and revenue, as a major component of NEV, developed. This was the case for the price grid assumed for both lines BB and PP. The relative trait emphasis is then different for every animal. The relative trait emphases were determined for a prospective genotype by increasing each of the traits evaluated independently by one tenth of the respective genetic standard deviation.

Results and Discussion

Table 1 illustrates the change in trait emphasis with changing genotypes. Generally, due to the non-linearity imposed by the price grids in both lines, as predicted carcass weight increases through a combination of increasing growth and decreasing relative finishing ability (BF) the emphasis on BF was increased and growth was decreased. The price grid for BB essentially decreased the value per unit of product as carcasses got heavier. The price grid for PP on the other hand favoured an optimal carcass weight with higher marbling. As a result, premiums were paid for heavier marbling for carcasses at the desired weights. As a result, bulls with predicted progeny carcass weights closer to the desired weight had greater emphasis on increased marbling. This is illustrated by comparing bulls 1 and 2 for their emphasis on marbling for line PP. Progeny of bull 2 were close to the optimum weight where bull 1's progeny were over weight. There was little advantage to increasing growth further on bull 1 as his progeny were already over weight, likewise there was an advantage to increasing back fat thickness (BF) on this bull where increasing BF on bull 2 was undesirable as it related to under weight carcasses.

The accuracy of selection relies on the estimation of breeding values (EPD's or ABC's) and their application in predicted performance. Traits such as carcass traits can be problematic as breeding values are often static. For example fat or rib-eye area are often expressed at a year of age. However, animals are not slaughtered at exactly a year of age. Application of these breeding values then requires adjustment to a more applicable endpoint such as weight or finish. These adjustments can be difficult as each animal will require a different adjustment to reflect their individual development patterns. However, with repeated measures, individual patterns in development can be modelled and evaluated using random regression / covariance function methodology (Jamrozik et al., 1997; Meyer and Hill 1997). Application of random regression methodology to repeated measures data on growth, carcass and feed intake traits provides advantages of flexible endpoints and appropriate within animal adjustments (Miller and Goddard, 1998).

Improvements in carcass evaluations are currently being investigated. Random regression methodology has the potential to increase the accuracy of evaluations through incorporation of repeated measures. A bull's accuracy will then increase as additional data is available on his progeny through BIO's birth to beef electronic tracking system, BIO-LINK (Robinson et al., 1998). A bull's progeny could contribute to his sires proof through a combination of RTU measures as well as actual carcass data from the abattoir. Random regression methodolgy can then be employed to utilize the progeny carcass data with appopriate endpoint adjustments. Carcass evaluations can then be easily implemented into phenotype modelling programs for selection purposes. With random regression, solution differences in progeny performance can be predicted at any endpoint desired. Such an approach is more directly applicable to phenotype modelling in concert with management information.

Continued improvements in genetic evaluations will result in continued improvements in selection tools. Results presented here illustrate the use of multiple trait selection using mutliple trait genetic evaluations with the incorporation of grid pricing to enable the selection for an optimal product.

Table 1. Net Economic Value and trait emphasis for two sample bulls in two lines

Item	Bull	NEV[A]		Traits[B]		
		Line A	Line B	PWG	BF	IMF
ABC[C]	1	3642	693	79	0.4	0.1
	2	1429	4327	13	1.0	0.7
E[D] Prme Plus	1			101	23	
	2			117	-10	
E[D] Beef Builder	1			-28	323	34
	2			185	-106	154

[A] Net Economic Value
[B] Central evaluation Post Weaning Gain (lb), Back Fat thickness (mm), Intra-Muscular Fat percent
[C] Across Breed Comparison (multi-breed EPD)
[D] Emphasis, change in NEV with 1/10 genetic standard deviation increase in trait

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COMMITTEE SESSION
LIVE ANIMAL EVALUATION
&
EMERGING TECHNOLOGIES

MINUTES - JOINT MEETING OF EMERGING TECHNOLOGIES AND LIVE ANIMAL AND CARCASS EVALUATION COMMITTEES

July 1, 1998
Calgary, Alberta

Chairs:
Ronnie D. Green, Emerging Technology
John Crouch, Live Animal and Carcass Evaluation

The Emerging Technology and Live Animal and Carcass Evaluation Commitees met jointly at this year's annual meeting due to the coverage of topic areas of common interest to the two groups. Ronnie Green convened the meeting at 2:30 pm on July 1, 1998 to a full audience of approximately 150 attendees.

The committee session was opened with a presentation by Ronnie Green, Colorado State University, which provided the background behind and experimental plans and protocol of the recently approved national beef tenderness genetic evaluation project in the United States. The project was approved for funding by the Beef Program Operating Committee of the checkoff program in late May. A total of 16 breed associations have indicated intitial commitment to the effort which will evaluate 11,000 cattle for tenderness and other measures of carcass merit over the next 42 month period. A summary of the protocol of the project appears elsewhere in the proceedings. Lengthy discussion followed Dr. Green's presentation regarding specific requirements for breed associations in the project, ownership and distribution of data and results, and other issues.

The committee agenda then moved to a focus on review of individual animal identification programs in the U.S. and Canada and evaluation of technologies either currently available or developing in the marketplace for individual animal ID. Dr. Jim Gibb from the National Cattlemens Beef Association reviewed the mission, objectives and current activities of the NCBA's Individual Animal Identification Task Force. Julie Stitt from the Canadian Cattle Identification Agency then reviewed the efforts of her group in Canada. Glenn Fischer, Vice President of Allflex USA then provided an overview of electronic ID technology currently available on the market and how it is being used. The final presentation was given by Dr. Thomas Unger from Miragen, Inc. regarding the use of immunoassays for animal identification.

The committee session concluded with a question and answer session for the speakers and was adjourned at 5:15 pm. The two committees expressed their appreciation to all of the speakers for their efforts and timely information.

CARCASS MERIT TRAITS: DEVELOPMENT OF EPD'S AND GENETIC MARKER VALIDATION (NATIONAL TENDERNESS EPD PROJECT)

Principal Investigators:
Michael E. Dikeman, Kansas State University
John Pollak, Cornell University
Ronnie D. Green, Colorado State University
Steve J. Koontz, Colorado State University
Jeremy F. Taylor, Texas A&M University
Scott K. Davis, Texas A&M University

Collaborators:
Ted Montgomery, West Texas A&M University
Tom Holm, Perkin Elmer AgGen, Salt Lake City, UT

Project Manager:
James O. Reagan, National Cattlemens Beef Association

The purpose of this presentation is to provide an overview of a new national tenderness genetic evaluation project recently approved by the beef checkoff for funding beginning on June 15, 1998. This is a 42-month effort which addresses the development of genetic evaluation technology to allow genetic improvement in beef tenderness. The project is multi-faceted and involves a multi-institutional and multi-breed association team effort. Over the past several months, breed associations have been contacted and briefed on the project. Breeds have been asked to commit to the project no later than July 8, 1998. Committing to the project involves the minimum of providing progeny groups of 50 or more head for each of ten reference sires in a respective breed. Testing of additional sires will be available on a proxy basis and will be dependent on the total number of breeds which commit to the study. A total of 11,000 progeny are covered in the project protocol. Initial commitment to the project has been made by Angus, Brangus, Charolais, Gelbvieh, Hereford, Limousin, Maine-Anjou, Red Angus, Salers, Shorthorn, Simmental, and South Devon associations with interest also expressed by Chianina, Beefmaster, and Brahman breed societies.

The protocol for the project, as it was approved for funding by the Beef Checkoff Operating Committee, is presented here for a broader picture of the project. The project will also be discussed further at the Mid-Year Meeting of the National Cattlemens Beef Association in Denver July 15-18, 1998.

Objectives:

1. Develop methodology and procedures for collection of information necessary for further development of EPD for carcass merit traits.
2. Collect carcass data and measure tenderness of the *Longissimus thoracis* by Warner-Bratzler shear force of contemporary groups of progeny of multiple sires within each breed.
3. Measure striploin sensory attributes on a sample of contemporary groups included in DNA marker validation.
4. Validate DNA markers to be used in industry-wide marker-assisted selection programs for improvement of carcass merit traits.
5. Determine DNA genotypes of these progeny for previously identified carcass merit markers.
6. Compare several selection indexes for potential responses to selection.
7. Measure direct costs of implementing EPD for carcass merit traits for the alternative genetic selection programs and combinations of management x genetic improvement of carcass merit traits.
8. Measure opportunity costs and returns of implementing EPD for carcass merit traits for the alternative genetic selection programs and combination of management x genetic improvement of carcass merit traits.

Experimental Procedure:

I. **CATTLE FOR THE PROJECT:** Commercial cows will be inseminated to several of the most widely used AI sires of each of the breed associations cooperating and supporting the research project. It will be the responsibility of each breed association to provide the leadership and all costs associated with nominating cattle for the study, estrous synchronization, semen, AI, ear tags and application of tags, collecting feedlot performance data, blood sampling/collection, carcass data collection, shipping of blood samples and the development of EPD for their respective breeds. Dr. Ronnie Green will act as the facilitator and liaison to the breed associations. One or more references sires of each breed would need to be used in a test herd in which that breed is being tested. Breed identity will be coded to prevent breed associations and/or breeders from comparing breeds. Sires will only be compared within breed and NOT across breeds. BIF guidelines for sire evaluation will be followed **(Appendix 1).**

Progeny would be fed at several locations and ultimately slaughtered at several cooperating packers. Age at which cattle are started on feed and other appropriate information will collected by each participating breed association in collaboration with the NCBA coordinator. It is strongly encouraged that each breed association try to keep as few contemporary groups as possible and that the cattle be slaughtered in as close a time frame as possible. Comparisons between progeny will be within breeds.

Breed associations will also be encouraged to employ any new technologies available that objectively capture additional carcass data or information on the live animal.

It is estimated that 11,000 animals will be involved in the 42-month study. This number could fluctuate depending on the number of breed associations participating and the number of progeny generated. The budget approved for this project reflects 11,000 animals.

II. REQUIREMENTS FOR DNA MARKER VALIDATION:

An ideal number of bulls for each breed is 9-10 with 50 progeny for each sire. The required number of progeny can be accumulated over the 42-month period as long as reference sires are repeated. Also, depending on the relatedness of sires within each breed, some progeny data may be pooled. DNA will be collected at an appropriate time, such as entering the feedlot. This blood would be collected by the breed associations with 20 ml sent to Perkin-Elmer and 20 ml sent to Texas A&M. Collection of additional blood at this time for future use by the breed associations is being strongly encouraged. Only 50-55% of the total animals in this study will be used for the DNA marker validation portion (estimated at 6,000 and reflected as such in the budget). Screening of sires for inclusion in the validation portion of the project will be done as the project progresses. This can be achieved by analyzing semen samples that are provided by the breed associations.

Carcass merit markers will be co-validated by Colorado State University and Texas A&M.

III. **CARCASS DATA COLLECTION:** Carcass data collection, sensory and Warner-Bratzler steak collection and tissue sampling will be done by the NCBA Carcass Data Service performed by West Texas A&M. This group will also develop a nomenclature and identification system and provide eartags to the breed associations for the progeny entering the study. Detailed carcass data will be obtained at the time of carcass grading. Breed associations need to be present at the time of slaughter in order to maintain animal identification and assist in data collection. A strip steak (1 for EPD-only cattle and 1 additional for cattle used for EPD information and DNA marker validation) will be collected 48-72 hours postmortem and shipped overnight to Kansas State University for Warner-Bratzler shear (using the National Beef Tenderness Survey protocol) and sensory analyses (AMSA guidelines). A small portion of tissue (preferably muscle) will be collected at the time of slaughter and shipped to Texas A&M as a backup sample for DNA verification and quality control.

IV. **DATABASE INFORMATION:** The database containing all of the relevant data for the project will be maintained by Cornell University. This data will be secure and updated with the cooperation of all parties, including the NCBA coordinator. A description of the database is in **Appendix 2.**

V. OWNERSHIP OF DATA: NCBA and breed associations will own all carcass, shear force and sensory panel data. The development of carcass merit EPD will be the sole responsibility of the breed associations. The marker identities and protocols remain the property of Texas A&M and NCBA. The genotypes produced by scoring these markers will be owned by NCBA & Texas A&M; however, this information must be provided to the breed associations as anonymous markers (e.g. Tenderness 1, etc.) for their use in computing EPD's. All DNA samples collected in this project will be property of NCBA.

VI. ECONOMIC ANALYSIS: The first phase of the economics portion will measure direct costs of developing carcass merit based EPD's and implementing management systems necessary to use this information. Phase 2 will involve balancing the direct cost side. To accomplish this, information is needed on the expected returns for implementation of a carcass merit based production system. The third phase addresses the marketing system.

VII. PROTOCOL VALIDATION: Quality control of this project is critical. The NCBA coordinator will be responsible for implementation and oversight of the validation of all laboratory procedures. These include but are not limited to Warner-Bratzler shear force determination, sensory analyses and DNA marker validation. The NCBA coordinator has the responsibility to ensure quality control and data verification for the project and communication between all parties involved. This person, along with the breed association liaison, will cooperatively handle resolution of problems and should be viewed as the contacts for such matters. A producer steering committee will also be appointed by NCBA to give oversight as needed for the duration of the project and to provide insight on future use of the DNA information and blood samples.

VIII. BUDGET: The budget for this project is a total of $4.2 M. Of this total, $930,000 is being supported by beef checkoff funds, and $217,000 by Perkin Elmer AgGen. The remainder is being supported by the individual breed associations and breeders. Approval granted May 25, 1998 provides the first $162,000 of checkoff funds to start the project.

APPENDIX 1

BIF Guidelines:

The BIF guidelines appropriate to the design program for testing bulls for tenderness and other carcass qualities are those outlined on pages 63 through 73, "Guidelines for Seedstock Performance Programs." The highlights from this section that need to be emphasized are for contemporary grouping of animals.

- The guidelines state that care be taken to ensure that animals are compared fairly and to ensure that the difference between animal performance computed for use in genetic assessment reflects differences in genetic potential, not differences in environmental contributions. To this end, contemporary groups are defined as animals which have been managed together and treated alike. With reference to carcass traits and tenderness (sensory) scores this refers to animals that were together in contemporary groups from birth. Also all calves in a contemporary group should be measured so that bias does not occur by selectively recording animals.

- A second important component of the guidelines refers to sires of animals in the project. Each contemporary group should have more than one sire. Also each contemporary group should have at least one sire that is used in other contemporary groups (commonly referred to as a reference sire) to ensure the data in that contemporary group is connected to the other data.

The BIF guidelines appropriate to computing EPD's for bulls for tenderness and other carcass qualities are those outlined on page 44 through 62, "National Cattle Evaluation."

The important components from this section relate to the method of analysis and information produced.

- The methodology is mixed model methodology for BLUP. The analysis could be with a sire model or animal model but should probably follow the guidelines for multiple trait evaluation. Data checks and edits for forming contemporary groups and eliminating data are described, but our hope here is that we will have greater control on the design so the editing is minimal.

- Contemporary groups for the carcass traits will be defined such that an animal must have been in the same contemporary group for weaning and yearling measures. A contemporary group for carcass traits should not be formed by merging animals from different contemporary groups for growth.

APPENDIX 2 -- Database Management

This budget consists solely of purchasing the time of two staff members who are expert in IBM DB/2 and programming the interface of this database system and the Internet (web based access). The responsibilities of these two will be to:

1. Create the database for the project and provide mechanisms for entry of data. We estimate we will be getting data sent in from over 20 different sources, 12 breed associations and a number of universities including those that might be added for the censure project.
2. Develop a security system for the database that will allow for different user levels of entry and access. As examples, a researcher on this project might be given access to all data while a breed association is allowed access only to their own breed information.

3. Program access to the database through a secure site on the web. This access will be somewhat interactive allowing interrogation of the database. For example, if Ted Montgomery wanted a printout of the birth dates and ages of all animals in the pipeline for scheduling sites for slaughter or trips for data collection, he would be able to do so via the web from any remote site.
4. Create a database in which the data are encrypted. For verified users of the database this will be transparent, i.e., when they access the data it will be decoded. For anyone else they would not know breed, sire, or any other information making the data useful. Our system is protected for access but no system is foolproof.
5. Backup the data once a week and/or after every major data entry.
6. Rebuild the database table structure as necessary to ensure flexibility of interrogation based on unforeseen uses of the database.
7. Maintain the database so that in the future, if you there are other projects that utilize the blood and data to create new information, the database will be expandable.
8. Create a screen to alert us if faulty data has been submitted, i.e. automatic verification of data for efficacy.
9. Help users understand how to access the data and how to make corrections and changes to the data.

Hardware and software needs to establish and maintain the database will be the responsibility of Cornell University. Cornell owns a large high-speed database server in the animal-breeding group and is licensed for many programs.

The highest needs of the project are in the first year when the database tables and programs (database and web based) need to be written. In subsequent years the responsibilities will be to maintain existing data, enter new data and create need programs for interrogation or access as need arises.

NCBA ANIMAL ID TASK FORCE
MISSION STATEMENT AND RECOMMENDED ID SYSTEM REQUIREMENTS

As reported to the NCBA Live Cattle Marketing Committee, February 6, 1998.
presented by Jim Gibb, National Cattlemen's Beef Association

Background
In June 1997, the NCBA Animal Identification Task Force was appointed by Paul Hitch, Chairman of the Live Cattle Marketing Committee.

Task Force Members

Paul Hitch, Chairman, *Guymon, Oklahoma*
Ann Anderson, *Austin, Texas*
Kent Anderson, *Englewood, Colorado*
Rob Brown, *Throckmorton, Texas*
Ken Bull, *Witchita, Kansas*
Bill Miller, *Council Grove, Kansas*
Kevin Munn, *Dakota City, Nebraska*
Bill O'Brien, *Amarillo, Texas*
Tim Schiefelbein, *Greeley, Colorado*
David True, *Casper, Wyoming*

Mission Statement for National Cattle Identification (NCID)

To develop and implement a voluntary National Cattle Identification (NCID) System that will be shared and used mutually by all segments (producers, feeders and processors). The primary focus of the NCID System is information sharing with source verification a secondary benefit.

Recommended Key Requirements of the NCID System
1. System shall provide bi-directional flow of information between participants and be accessible by NCID partners involved in the production process of that specific animal. Only an owner of the animal during its lifetime or an authorized agent for the owner (i.e. custom feeder, extension agent, auction market, etc.) will have access to the data.

➢ *If the cattle ID process begins with the feedyard, the information accessibility initiates at that point. Past that point, all data are available to all participating production partners. Only those that submit data will have accessibility to the data. Identification of sites may be buried, though the data will remain accessible. For example, a listing of birth weight or calf pharmaceuticals may be available, but the ranch ID on which they were collected or administered will be confidential. Ownership identification is blind.*

2. System needs to provide electronic access (modem and Internet) to existing data or data collection systems (interfaces) so that manual data entry is minimized. Data entry shall be as simple and cost effective as possible.

3. System needs to be usable by all segments regardless of size. System needs to accommodate the producer who has no or limited computer access as well as producers who possess on-line capability.

4. It is anticipated that the system will be based on radio frequency identification (RFID) ear tags. As alternative technologies surface, they will be evaluated for their merit and potential inclusion in the National Cattle Identification System (NCID). All technologies must meet certain criteria (*ISO - International Organization of Standardization, see notes below - 11785 compliant*) for technology, readability and reliability compliance. Electronic readers must be capable of reading all approved ear tags. System to provide for unique animal identity through use of a computer generated ID number.

5. System needs to handle groups as well as individual animal identification and be capable of creating one from the other.

6. Security and reliability provisions shall be incorporated to protect the integrity of the data and its users. Electronic system may carry only user ID's with name and address stored off premises.

7. Data will be provided to the government only under specific circumstances such as a disease outbreak. Under no circumstances will the government have direct access to the database but rather will obtain necessary information through the governing board.

8. System to be administered by a governing board of industry representatives appointed by the NCBA.

Notes:
The International Organization of Standardization (ISO), a non-governmental organization, is a worldwide federation of national standard bodies from 100 countries. The mission of ISO is to promote the development of standardization and related activities in the world in order to facilitate the international exchange of goods and services, and to develop cooperation in the areas of intellectual, scientific, technological and economic activity.

RE-IDENTIFYING OUR CANADIAN CATTLE HERD

Julie Stitt, Canadian Cattle Identification Agency

An individual animal identification traceback system is imperative for human health, food safety and consumer confidence. We are all food producers, and are committed to assuring consumer confidence. The provision of safe and wholesome product to domestic and foreign consumers is vital for maintaining market access and increasing the competitiveness of the Canadian industry. In addition, Canada has an excellent health status. To safeguard this status, we need to develop an integrated way to prevent, control and eradicate disease. The cattle industry together with public officials have ample evidence of the costly consequences of complacency and the need to trace disease, residues and physical contaminants from the point of detection to the source of the problem.

Rationale

The Canadian beef and cattle industry has become over 50% dependent on export markets and access requirements are becoming more restrictive. In the event that our borders were ever closed to beef and cattle exports due to a health scare such as the BSE situation in the United Kingdom, it would mean an immediate loss of over $2 billion in annual sales. It is also estimated that every dollar in beef and cattle sales generates four spin off dollars in related industries, so a closure of our borders to beef and cattle exports could potentially cost the Canadian economy $8 billion. Depending on the situation we would also expect a dramatic loss in domestic consumer confidence, resulting in a corresponding decline in domestic sales as well.

A Lesson from Recent History

A National Traceback System is not new to the Canadian beef industry. Rather it's the reintroduction of a more streamlined system that has already proven its value to the Canadian cattle industry. The major difference is that this time we are proactively initiating a traceback system prior to a problem being identified. This hypothetical scenario is not without historical precedence. In 1952, the Health of Animals program which was initiated in the 1940's to rid the national herd of Bovine Tuberculosis, was instrumental in the industry's quick containment of an unexpected and potentially devastating outbreak of Foot and Mouth disease. An immigrant European farm worker had inadvertently introduced Foot and Mouth disease in Saskatchewan. With the ear tagging program already in place for Bovine Tuberculosis, the Foot and Mouth outbreak was quickly contained. This successful effort predated a similar and equally successful initiative in the 1960's through the early 1980's to eradicate Brucellosis from the national herd. The ultimate eradication of Brucellosis was difficult and was achieved only after the establishment of an Industry Consultative Committee on Animal Health, which continues today and has become a model of Government/Industry cooperation. Following the eradication of Brucellosis in 1985 individual animal identification within a federal program fell into disuse. Concern began to escalate within the Federal Health of Animals Directorate, (now the Canadian Food Inspection Agency) and within the dairy and beef sectors, that we were losing an important tool in disease control. Today, within the beef industry, we only have a 10% level of identification for traceback, compared to a 95% level in the 1950s. If a disease outbreak similar to that of 1952 were to take place today, we would have great deal more difficulty bringing the situation under control.

We are Responding

The Canadian Beef Industry is responding. On March 9, 1998 the Canadian Cattle Identification Agency (CCIA) was incorporated with the mandate to develop a credible and reliable individual identification traceback system for beef cattle in Canada that may be activated in the event of an animal health or product safety concern.

The Agency was formed under the direction of the Canadian Cattlemen's Association Animal Health and Meat Inspection Committee, based on consultation throughout the past year with the various industry sectors. The Agency is a non profit entity, accountable to a Board of Directors representing the purebred and commercial cattle industry, the feedlot industry, the packing industry, auction markets, veterinarians and the dairy industry. We are also working closely with our counterparts, including Quebec, dairy and the United States, to ensure that our approach meets international standards and is compatible with other systems being developed.

Principles and Commitments

The role of the CCIA is to develop standards and protocol for an individual animal traceback system. The proposed National Identification System is designed to be affordable, simple and reliable. The information is secure and will only be accessed by the Canadian Food Inspection Agency in the event of a Health or Safety concern. A system will be in place to allow information transfer from service centres and distributors to the CCIA on an ongoing basis. The CCIA will run simulated traceback tests with the Canadian Food Inspection Agency (CFIA) to ensure the system is effective and can be activated in the event of a health or safety crisis.

The basic identification system will be market neutral and will not circumvent particular sectors. However, it is easy to imagine other benefits that will be derived from an individual animal birth to beef identification system. This system is the "missing link" and will facilitate vertical integration of information and will provide the infrastructure for more "value-based" programs within private industry. Additional benefits, such as tracking parentage, herd performance and genetic improvement information, health status, feedlot performance and carcass information will be available to interested participants and will allow us to advance our genetic and production systems and become more competitive.

Identifying the System

To achieve a successful traceback system an animal must be individually identified prior to leaving the farm or ranch of origin with a unique identification number that will remain with it through to slaughter. This number will then be transferred to the carcass and maintained through to the point of meat inspection. In an effort to identify ear tag/identification technology to meet our basic requirements manufacturers were invited to submit samples of tags that would meet CCIA criteria; namely minimal size, low cost, high retention, a visible unique ID number assigned by the CCIA and a bar code. The system is being designed to allow for expansion and adaptation, as new technology becomes available.

In the first phase of the field trials approximately 28,000 ear tags consisting of over 20 different types are being tested in about 80 herds across Canada. They range from the most basic plastic tag to tags with electronic identification encoded within. All tags are being tested in reference to a Health of Animals type benchmark tag. The most important criteria for evaluating the tags will include cost, retention, and readability. Preliminary recommendations based on initial results at weaning, producer comments and results of additional trials within the industry will be available by the end of the year.

In consultation with the packing plants the second phase of the trials are now being initiated. Individual ear tags/identification will be administered near the end of the feedlot phase and individual animal identification will be followed from live animal entry into the packing plant to the point of meat inspection. The greatest technological challenge facing the traceback system is the transfer of individual live animal identification to the carcass in a fast-moving packing plant situation.

During these trials we will be working with potential service centres and distributors to identify and assess information systems which will address such items as data integrity, data collection, data storage, information flow, information access, security and traceback simulation.

Based on the acceptance of the recommendations forthcoming from the trials, a voluntary system will be gradually offered to the industry in 1999. Once the effectiveness of the system has been demonstrated and accepted, a mandatory approach to ensure sufficient participation for traceback may be considered.

Communications

Important to the success of this project will be the development of an effective communications strategy in partnership with all sectors of the industry to obtain broad industry support. The CCIA and its industry representatives are convinced that a national system of identification and a method of traceback are essential to the secure future of the Canadian cattle industry; we must communicate our conviction and provide a means of information exchange with all players in the industry.

Food safety is recognized as the most important issue facing the beef cattle industry globally. We must never forget that we are producers of food, not cattle. The CCIA system of national identification and traceback will go a long way towards increasing our competitiveness both domestically and internationally and assuring consumers of the quality of our product.

RADIO FREQUENCY IDENTIFICATION TECHNOLOGIES

Glenn Fischer, Allflex, USA

Presentation not available

MIRAGEN ANTIBODY FINGERPRINTING TECHNOLOGY

Thomas Unger, Miragen Inc.

Presentation not available

COMMITTEE SESSION: WHOLE HERD ANALYSIS

MINUTES
BIF WHOLE HERD ANALYSIS COMMITTEE
Thursday July 2, 1998, 2:00 to 4:30 p.m.
Calgary, Alberta, Canada

The meeting was called to order by Chairman John Hough of the American Hereford Association at 2:00 p.m. A brief introduction was made as to the history and focus of the committee. The following presentations were then made. Written papers follow in these proceedings.

1998 BIF Whole Herd Analysis Committee Agenda

- ❑ **New Developments in Production Efficiency.** — Larry Corah, National Cattlemen's Beef Association and the American Angus Association.
- ❑ **The Economic Factors in Beef Cattle Breeding.** — Brian Freeze, Lethbridge Research Centre.
- ❑ **Standardization of Disposal Codes.** — Bruce Cunningham, American Simmental Association.
- ❑ **Review of Breed Association Whole Herd Reporting.** — Bruce Cunningham, American Simmental Association.
- ❑ **Genetic Evaluation Possibilities with Whole-Herd Reporting.** — Warren Snelling, BeefBooster Management LTD.
- ❑ **Discussion of Future Committee Directions.**

Following each presentation, further discussion pursued. After considerable interaction, the committee adjourned at 4:30 p.m.

Respectfully submitted,

John Hough, Chairman

NEW DEVELOPMENTS IN PRODUCTION EFFICIENCY

Larry Corah, Associate Executive Director
Certified Angus Beef

As the cattle industry continues to compete for its fair share of the consumer dollar, numerous challenges face our industry. Food safety issues, product quality and consistency, and cost of production concern producers and industry leaders.

What are the critical challenges facing the beef industry?

Industry loss of market share. **Beef's loss of market share means less profit opportunity for producers.** Only through increased consumer expenditures will the flow of dollars increase in the beef system and enhance producer profit opportunities. The 11.9 percent loss of market share since 1980 resulted in a $12.84 billion cost to the industry in 1996 alone. Recovery of half of that market share would have meant an increase of $9/cwt in the price of a fed steer (Source: Cattle-Fax).

Table 1. Per Capita Beef Consumption (% Market Share--by Retail Wt.)

	1970	1980	1997	2003 (projected)
Beef	44%	39%	32%	29%
Pork	29%	29%	23%	25%
Poultry	25%	30%	44%	45%

Source: USDA & NCBA

The loss of market share can also be evaluated from a per capita consumption standpoint. In 1985, the per capita consumption of beef was 78.8 pounds (Source: USDA), while in 1998, the projected consumption is 66.2 pounds or 16.4 percent. In contrast, total poultry meat consumption for the same period has increased from 65.6 pounds in 1985, to 95.2 pounds (projected for 1998) or a 45.1 percent increase.

Product variability and lack of convenience products. **Lack of product quality and consistency greatly hinders growth potential for our industry**. There is no question that three of the major criticisms of beef is 1) the tremendous product variability; 2) the tremendous lack of consistency, and 3) the lack of convenience products. The recent U.S. palatability study (Source: Smith, CSU) implies that one in four steaks produced does not meet consumer acceptability. Other studies have indicated that figure may be one in five, or even one in six, but all studies imply that high percentage of product produced by the beef industry does not meet consumer acceptability.

Nationally and globally there is extremely strong market demand for Choice and high Choice grading product; yet, the percent of cattle grading Choice has dropped from 76 percent in 1975 to current levels of 48 to 49 percent. Equally, food safety issues have plagued the beef industry in recent years even though the U.S. beef supply is the safest supply in the world.

Unprofitable nature of the cattle industry plagues beef operations. The inability of the beef industry to substantially reduce production costs and capture added value on products sold has greatly impacted the profit potential of operations. Whether it was the poor calf prices during 1995-1997 or poor fed cattle prices in early 1998, the fact that various segments of the beef industry are continually plagued by substantial economic losses certainly will have a structural impact on the composition of the beef industry in the future. It is absolutely imperative that the beef industry finds ways of either cutting costs through enhanced production efficiency or find ways of adding value to the product produced as that product moves through the production chain. If this economic stability is not achieved, we will continue to see a decline in the number of producers, the size of the industry, and the economic opportunities for people in the future.

Marketing inefficiencies. **The beef industry's commodity approach to marketing has created barriers between key industry segments.** In a commodity-oriented marketing program, products are sold to a buyer in quantity generally with little or no value added. Beef today is primarily produced in this manner.

Because the beef industry is commodity-oriented, it must rely on various segments within the supply and distribution channel to bring its products to market. To enable satisfactory profits for all segments of the industry, it is necessary for each of these segments to work together efficiently.

What are the opportunities for enhancing production efficiency?

In assessing change in production efficiency over the next 5-10 years, it is logical to immediately look at potential technological advancements that could enhance efficiency within the beef industry. Will there be new feed additives, implants, repartitioning agents, or microbial enhancers that could or will be released during this period of time? Although it is difficult to speculate exactly when new products will be released, it is very unlikely that at least within the next five years any major technological breakthrough will occur in the beef cattle industry. Then are there not opportunities to enhance production efficiency? Quite to the contrary, the beef cattle industry has numerous opportunities to enhance the production efficiency. Let's examine just a few of these.

Enhance cost control for cow-calf producers. The stocker and feedlot industry has relatively narrow spread between the high cost and low cost producers, but on the cow-calf side there is an absolute immense variation in the annual cost of maintaining a cow herd and the cost of producing a pound of calf. Individual state data, like North Dakota, Iowa, Idaho, etc., as well as the National SPA Economic Database, all shows that there is $100-200 difference in the annual cost of maintaining a cow herd between the most profitable producers and the least profitable producers. This translates into a cost of producing a pound of calf for the low cost producers of 50-60¢/lb, making these extremely economically viable units while, in contrast, high cost producers will often exceed $1/lb, making these economically inviable operations.

Identifying the critical control points for profitability within a cow-calf operation is a current focus of NCBA National IRM effort. The results point out that in any region of the North American continent there are opportunities to greatly enhance economic efficiency on most cow-calf units.

Enhance use of superior genetics. It's extremely disappointing that numerous surveys have shown that only 25-40 percent of sires are selected utilizing existing genetic information. In spite of the tremendous progress that has been made in the quality of genetic information available to cow-calf producers, many herd sires are selected without the use of valuable information. Most cow-calf operations fail to have any type of a genetic plan with targeted goals. The recent 1998 National Animal Health Monitoring System (NAHMS) beef survey showed that 65 percent of the producers in the last five years have placed no genetic emphasis on carcass traits, and yet we see major advances in enhanced economic value of calves and fed cattle when superior genetics exist for carcass endpoints.

Reduction in morbidity and mortality at weaning time. One of the major production inefficiencies in the beef industry is the absolute lack of cooperation between the various sectors of the production chain. James Herring, CEO of Friona Industries and current NCBA Brand-like Commission Chairman, stated recently that the "lack of functional partnerships in the production process has been the cattle industry's achilles heel." This has created an inefficient, duplicative and misdirected production system that leads to high cost and inconsistent end product.

The classic response of beef producers is traditionally "I won't be paid for it, so why bother doing it." In spite of volumes of research data that has shown how the use of programs such as preconditioning at weaning time, can reduce one of the major production inefficiencies of the beef industry--morbidity and mortality at weaning time. The 1998 NAHMS survey shows that 64.3 percent of the calves did not receive vaccinations prior to sale and 42.4 percent of the calves were sold directly at the time of weaning. Further, 20.1 percent of the calves are not castrated prior to sale. This still commonly occurs in spite of the fact that the 1998 CSU Beef Report study shows that premiums of properly preconditioned calves bring $1.61-3.89/cwt over non-preconditioned calves, and programs such as the *Producers Edge* in Texas offer premiums of $8/cwt for properly preconditioned calves. Why then does our industry continue to tolerate these economic losses?

The failure to improve the quality and consistency of the beef product. This previously alluded to in the discussion regarding the decline of market share that must be stopped for the beef industry to continue to have a bright economic future. A 1991 National Beef Quality Audit sponsored by NCBA found that the beef industry lost a potential $280 for every fed animal marketed because of carcass defects such as excessive external fat, lack of marbling, and carcass defects. Utilizing these same criteria, a study conducted in 1995 showed that virtually no progress had been made and that the quality defects cost the industry an average of $276.59 per head.

In spite of grid pricing premiums for Choice and high Choice grading cattle, the industry has seen a decline of from nearly 76 percent of the cattle grading Choice in 1975 to under 50 percent of the cattle grading Choice in 1998. Survey data showed that little progress has been made in terms of the muscling of the cattle and the magnitude of external fat carried by cattle sold at the time of final marketing.

When the industry reaches a point that cattle are truly priced on their carcass merit will we reach a point that the industry focuses on the genetic and production opportunities that exist to improve the quality of the end product produced for the consuming public.

Summary

A functionally integrated beef industry offers tremendous opportunity for enhancement of production and economic efficiency by the elimination or reduction of production phase inefficiencies that currently exist in a segmented industry. Not to be overlooked is the fact that a functionally integrated industry also offers greater opportunity for producers to enhance product value by specification beef production.

ECONOMIC FACTORS IN BEEF CATTLE BREEDING

B. Freeze, Ph.D, P.Ag.
Bio-Economist, Agriculture and Agri-Food Canada, Lethbridge Research Center

Introduction

In March 1998 the Canadian Charolais Association announced plans to introduce a "carcass quality alliance program" that will provide carcass grade, yield and quality reports to cow-calf producers on any animal registered in the program (Hart 1998). Packers are starting to offer premium prices for high-yielding carcasses that grade well. XL Foods of Calgary, Alberta, for example, under their "Original Alberta Beef" program offer a 10% price premium (over the Canfax weekly average price) for such cattle (Hart 1998). Programs like the "carcass quality assurance program" are directed at providing the information for producers to be able to adjust their breeding programs to consistently produce animals that have good rates of gain and superior carcass merit. Is the attention to carcass and meat quality traits economically justified?

Much of the focus on carcass and meat quality has arisen from the perception that beef is losing market share to poultry and pork products because of a lack of product consistency. Evidence cited includes the U.S. National Beef Quality Audits (1992, Boleman et al 1995) sponsored by the National Cattlemen's Association which, respectively, estimated a $279.82 loss from quality "defects" for every steer and heifer slaughter in the U.S, and further reduction in marbling and increased incidence of brands and bruising. Recent demand studies show a continued leftward shift in demand for beef versus a rightward shift in demand for chicken and are also cited as proof of declining beef quality (Winslow 1998). The August 1998 Canadian Cattlemen's Association National Convention in Edmonton is to have an expert panel discussion to address the question, "Why has beef continued to drop in market share and what can we do to improve the marketability of beef?"

To give perspective to the importance of carcass and meat quality traits, this paper examines the literature on the relative economic value of various cattle selection traits . To some extent it reiterates the message of others (Melton 1994b) that beef producers (and researchers) may be unduly changing breeding priorities away from equally economic or more important traits in attempt to remedy quality defects. It also examines the economic cost of alternative methods of remedying beef meat quality problems and the question of market share.

Caveats re: Breeding Objectives and Economic Weights

So what traits are important economically? To a great extent it depends on the economic or breeding objective, and the perspective; e.g. the nation, a region, the beef industry, seedstock producers, the feedlot and packing industry, the cow-calf producer and lastly, consumers. Therefore, some caveats are in order regarding the determination and interpretation of what traits are economically important.

Harris and Newman (1994) defined the desired end of genetic improvement in livestock as "an improved economy of producing consumable livestock products for the benefit of all consumers". This macroeconomic view provides at least a directional guide for the setting of breeding objectives, but those making selection decisions, i.e. seedstock producers, and commercial beef producers, usually take a microeconomic perspective, that is, "how do I increase my profits?". They tend to ignore industry impacts of their decisions and the share of benefits accruing to consumers in the form of increased supply and lower prices. For a region like Canada that sells into a much larger North American market, the change in output resulting from a genetic improvement would have minimal effect on the North American beef price and much of the economic benefit would be captured by producers (Amer and Fox 1992). Genetic improvement over the entire North American market would result in beef price declines and almost all the benefit would accrue to consumers. Thus, a breeding objective, i.e., the relative economic value of various selection traits, may differ considerably for an individual producer versus that guiding some national genetic research and development effort.

Even at the microeconomic level "profitability" has been interpreted several ways. For example: profit per unit of product, profit per breeding female, profit per animal, profit per unit of land area, and profit over some long run time horizon. Amer and Fox (1992) provide a conceptual framework based on neoclassical economics that involves simultaneous determination of input use, herd size and output level that will maximize profits before and after incorporation of a genetic improvement technology. They show that economic weights calculated for different profit definitions can be equalized by the automatic output adjustments that arise under the neoclassical economics format. Division of the economic weights by the number of breeding females or units of output will yield proportionately equivalent economic weights. To date much of the literature on economic weights has been based on more restrictive assumptions regarding the nature of the production relationships. Output effects of genetic change are not accounted for and the economic weights may not be comparable over different profit definitions.

Also ignored in many analyses determining economic weights are time and risk effects. Breeding decisions are implemented and have effect over long periods of time. For example, if a producer is selecting replacement heifers for increased weaning weight in their progeny, the effects of the selection decision will not be realized for approximately two years until their first calves are weaned (Melton 1995). Appropriately, these returns need to be discounted to reflect the time transpiring between the selection decision and the genetic improvement. Risk attitudes of producers may also affect economic weights of various traits as the variance of genetic and performance characteristics differ, for example, by breed. Selection decision makers may ascribe higher or lower values to economic weights depending on whether they are, respectively, risk loving or risk averse.

These caveats aside, the current literature provides some guidance to producers and the industry as to what traits are important.

Economic Factors

The performance traits of greatest economic importance in beef production have long been recognized as: reproductive performance, cow productivity, post-weaning performance and carcass merit (Fredeen 1968). Reproductive performance is a complex trait combining calving interval, conception rate, calf survival and other factors influencing the number of calves weaned. Environment greatly affects these factors and the role of heredity is small, thus, success of a selection program for reproductive performance may be limited. However, reproductive performance shows considerable heterosis and effects are maximized in crossbreeding systems with crossbred cows and calves. Cow productivity is also a complex trait combining milk yield, pre-weaning growth, feed efficiency and longevity. It is moderately heritable and heterosis is moderate to high (Fredeen 1968). Hamilton (1987) documented heterosis effects for these traits against referenced purebreds as per Table 1.

Table 1. Heterosis % for Economic Traits

Trait	Due to Crossbred Cow	Due to Crossbred Calf
Conception Rate	10	-
Calf Livability	5-10	5
Calving Ease	10	-
Milk Yield	5-10	-
Preweaning growth	-	5
Postweaning growth	-	3
CUMULATIVE EFFECT	15 % increase in lbs weaned per cow exposed	10% more lbs weaned per calf born

Postweaning performance involves ability of the animal to grow. Postweaning growth is highly heritable and highly correlated with feed efficiency so selection would be expected to improve economy of gain.

Optimal Crossbreeding and Selection

Selection and crossbreeding programs should be designed to optimize the expression of the above economic factors in parent females and their offspring. At the centre of this "breeding objective" is production of the economically "optimum" cow. Economic efficiency, defined as the ratio of dollar value of output per $100 of total input costs, differs depending on the cow environment and implies that the relative economic value of various beef traits will vary by region. Ritchie (1997) cites compelling evidence that the crossbred cow offers so much maternal heterosis that "she becomes a needed ingredient for maximizing profit in a commercial cow/calf herd". In part this is because reproductive traits, which are mostly influenced by heterosis, have a general relative value of approximately 50% over growth and product traits. The challenge becomes the choice of breeds that go into the makeup of the crossbred cow, i.e. the matching of cow genotype to the production environment. Rotational crossbreeding systems which produce replacement females as well as market cattle, must select sires with maternal traits in mind as well as growth and carcass traits and strike a balance between reproductive merit and growth (Hamilton and Wilton 1987). Terminal crossbreeding systems which purchase female replacements from outside the herd allow for greater selection emphasis on growth and carcass traits.

The choice of breeds then depends on: (1) individual breeding goals; (2) environment; (3) quantity and quality of feeds available; (4) cost and availability of good seedstock; (5) how breeds will complement each other in the crossing program; and (6) market-specific breed combination premiums (Hamilton and Wilton 1987). General guidelines have been developed by the Beef Improvement Federation (BIF) Systems Committee for targeting optimal levels of a number of traits in varying production environments. Examples include: (1) Restricted feed resources, arid climate: British X British, (2) Medium feed resources, semi-arid climate: British X Smaller Continental, (3) Abundant feed resources, adequate precipitation: British X Larger Continental (Ritchie 1997). While these guidelines help beef producers choose a breed or biological type to fit the crossbreeding program, they provide minimal help in selecting specific animals (Basarab 1995). In this regard, De Rose and McMorris (1988) and Notter (1992) review the use and availability of expected progeny differences (EPD) information within-breeds and across breeds. For single trait selection, where other traits are unaffected, the "right" animal of the "right" breed is determined by comparing within-breed EPDs. For example, to improve carcass marbling and grade producers may opt to use sires with high marbling EPD. Vieselmeyer et al (1996) showed that calves from high marbling EPD Angus sires were shown to have an increased ability to grade USDA Choice than calves from low marbling EPD Angus sires without increasing yield grade or decreasing animal growth or feed efficiency. However, the relationship between purebred EPDs and observed performance in other environments can differ and continued work is needed to access genotype-environment interactions. Notter (1992) also discusses the need for comprehensive across-breed EPDs and notes BIF efforts to develop standardized reporting procedures and provide the information needed to evaluate published EPDs in a consistent way. Across-breed EPDs would be useful to commercial producers who need to initiate or re-evaluate crossbreeding programs or who are forced into compromises with regard to breed selection (Notter 1992).

In practice, however, beef producers are concerned with many characteristics in a breeding program and their interactions, and would like to compare potential breeding animals based on a multi-trait selection index that would combine important trait EPDs into a single-valued measure of worth in relation to the breeding objective and particular herd environment (Harris and Newman 1992). Melton (1995) reviews the principles of multi-trait selection and the derivation of economic weights using mathematical programming. Melton (1994b and 1995) provided a specific example for a representative commercial producer in West Texas. Although the results were specific to a West Texas herd, sensitivity analyses were performed in regard to feed supplies and prices, and with respect to marketing objectives, i.e. marketing weaned calves or retain ownership through to slaughter. The results provided robust (same conclusions under low and high cattle price scenarios) insights regarding the relative value of reproductive performance, cow productivity, post-weaning performance, and carcass merit traits.

Generalized Results - Economic Weights

Melton's results (1994b, 1995) classify beef characteristics into three categories: reproduction, production and consumption (Table 2). Reproduction encompasses reproductive performance and cow productivity traits discussed above, while production encompasses growth performance traits. Consumption relates to carcass traits and meat quality factors.

Table 2. Selected Beef Characteristics by Category

Characteristic	Mean	Reproduction	Production	Consumption
Gestation Length (days)	286.9	X		
Weaning Rate (percent)	83	X		
Birth Weight (kg)	40	X		
Lactation Ability (milk)	3.55	X		
Rate of Maturity (growth)	1.73	X		
Weaning Weight (kg)	190.37	X	X	
Feed Conversion	0.12	X	X	
Mature Cow Weight (kg)	518.35	X		X
Post-Weaning Rate of Gain	1.05		X	
Slaughter Weight (kg)	517.14		X	X
Carcass Weight (kg)	294.57		X	X
Retail Product (%)	0.70		X	X
Marbling Score	9.80		X	X
Tenderness Score (0-100)	45.23			X
Flavor Score (0-100)	47.75			X
Juiciness Score (0-100)	44.56			X

After adjusting the determined discounted economic weights by trait heritabilities, their genetic and phenotypic covariances, and their variances, Melton (1995) determined the relative selection emphasis that should be devoted to each stage of the production system for two different market objectives: marketing carcasses versus marketing weaned calves (Table 3). Elements on the main diagonal of each panel reflect the selection emphasis that should be applied to all traits that solely impact on that phase. Off-diagonal values represent the relative selection emphasis for traits that have joint effects in more than one phase of production. Adjusting for these overlapping effects results in the last column, which shows that for a vertically integrated firm, selection emphasis on reproductive, production and consumption traits is nearly equal (30.9% for reproduction, 29.2% for production traits and 39.9% for consumption traits). Most beef producers do not retain ownership of their cattle through to slaughter, and the majority market their output as calves. The results indicate a greater selection value to cow-calf producers for maternal (growth, lactation ability, weaning weight, etc.) and reproductive traits (weaning rate, gestation interval, etc.). If weaned calf prices discriminated for expected post-weaning and carcass performance (as might occur under a value-based-trace-back pricing system), relative selection emphasis would shift toward that of the vertically integrated firm. However, the shift is not enough to warrant selection for more "growthy" type cattle that would otherwise be preferred by cattle feeders alone (Melton 1994b). Melton (1994b) also found the relative selection emphasis indicated in Table 3 to be robust over price and climatic conditions. At prices 50% above the 1980-84 base years average, optimal breed choices (as dependent on breed average assumptions) did not change (Melton 1994b). Under drought conditions, the relative emphasis on output characteristics (weight, number of calves, milk production, etc.) fell versus those more reflective of cost efficiency (e.g. feed conversion) (Melton 1994b).

Table 3. Relative Selection Emphasis Standardized Percentages by Industry Phase

Phase	Reproduction	Production	Consumption	Overall	Adj. Overall
Vertically Integrated Firm - Birth to Slaughter					
Reproduction	20.3	6.4	14.7	41.5	**30.9**
Production	6.4	0.4	51.3	58.1	**29.2**
Consumption	14.7	51.3	6.9	72.9	**39.9**
Commercial Cow-Calf Firm					
Reproduction	30.8	16.6	15.1	62.5	**46.6**
Production	16.2	2.4	25.8	44.8	**23.6**
Consumption	15.1	25.8	9.4	50.2	**29.8**

Are Consumption Traits Important to Beef Market Share?

Melton's results place smaller relative selection weights on consumption traits. This may seem contradictory to current industry concerns that improving meat quality (in particular, tenderness) is vital to maintenance of beef's meat market share. Melton (1995) explains the apparent contradiction by noting findings that show that although tenderness, flavor and juiceness account for nearly 85% of the variance in the "eatability" of meat, overall "eatability" explains only 25% of the variance in beef price. Although taste panel studies have indicated consumers can discern between categories of tenderness and would be willing to pay a premium for tenderness (Boleman et al 1997), they have not involved "price bidding" to determine the magnitude of premiums that might be paid. Meat quality factors are important, but the real question is how much are consumers willing to pay for improved quality before they will switch to chicken or pork. In fact, Melton and Huffman (1993) studying over 30 years of price and cost data found that most of the decline in beef's market share can be directly attributed to other factors, most notably the relative price changes between beef and other goods (dairy, pork and poultry). Much of the price differences between beef versus chicken and pork are due to vertical integration and resultant lower costs in the chicken and pork industies (Ward 1998). The lower costs are the result of lower transactions costs (beef has more stages of production e.g. cow-calf, backgrounding, finishing and is more geographically dispersed) and lower costs due to specialization and economies of size. The beef industry will be much slower to integrate (if at all) because of its long biological process, wider and widening genetic base, geographic dispersion, more stages of production, and large capital requirements (Ward 1998). Ward (1998) notes that only with a technological breakthough in beef cattle genetics (such as mapping of the beef genome or finding a "tenderness" gene) or beef processing and product development, will there be a sufficient profit opportunity created to overcome the large capital costs to drive vertical integration in the beef industry.

Lower costs aside, there is still some question as to whether consumers would repeatedly continue to buy "tough" steak even if it was priced lower or competitively with chicken and pork. Recent demand studies of beef, pork and chicken in Canada in the 1980s versus the 1990s show a leftward shifts in demand for beef and pork (less quantity purchased at lower prices) and a rightward shift in demand for chicken (more quantity purchased at higher prices). Lower relative quality and/or consistency of beef quality is implied as the reason for the shift (Winslow 1998) but a more likely reason is the increased use of chicken in processed foods. Before beef quality (tenderness) is deemed the culprit, further studies need to be done. Some of Melton's work (1995) gives some perspective of how importance tenderness is and is discussed below.

Fixing the Tenderness Problem in Beef

In the late 1960's the advent of boxed beef shortened the aging time and effectiveness of beef processing. Beef previously sold as hanging carcasses, is now vacuum packed in plastic and shipped shortly after to slaughter to retail outlets. Aging time and tenderness of the carcass is reduced significantly but saves the packer dollars in terms of the moisture shrink that accompanies a hanging carcass (Melton 1995). Any strategy or technology that might fix the tenderness problem must cost less than the shrink benefit accruing to the packer.

Several technologies to fix the tenderness problem were recently reviewed at a national workshop held May 4, 1998 at the Lacombe Meats Research Centre There is a lot of effort in this area, encompassing genetics and feeding strategies and research, pre-slaughter stress minimization and post-slaughter physiology. Interesting genetics research included: development of genetic markers to predict early in an animal's life its propensity to marble (University of Lethbridge), investigation of Waygu cross cattle and marbling-glucose-insulin physiology (Lethbridge Research Centre), and sire/progency evaluations to determine the genetic basis of meat tenderness (University of Guelph, Lethbridge Research Centre). Novel nutritional and management research included: use of Vitamin E to prolong shelf life at cost of $4 per head (Lacombe Research Centre), use of musculo-skeletal imaging to sort cattle into outcome groups to improve carcass uniformity (University of Alberta and AAFRD), effect of Vitamin D to reduce or eliminate tough steaks (University of Saskatchewan), and the use of electrolytes and hydration to reduce transport and handling pre-slaughter stress and meat toughness (Lacombe Research Centre). An overriding message, however, was that complex interactions post-mortem can override the pre-slaughter genetics and feeding strategies designed to improve meat quality and tenderness.

To determine an upper limit ($ per head) that could be spent pre or post slaughter to correct the tenderness problem, Melton (1995) investigated the cost of several post-slaughter technologies that would do just that. The technologies included: aging an additional 14 days over the current 3-5 days, and aging 9 days with calcium chloride injections. The total cost of remedying tenderness by these methods were calculated at $9 and $6 per head respectively if all the animals were treated or $1.35 to $0.90 per head, respectively, if only 15% problem carcasses were treated (Melton 1995). Since the packing industry has not employed these technologies, it may be assumed that the "tenderness" premium on a per head basis is not larger than $ 0.90 per head. Melton (1995), in fact, estimates the average value of tenderness score to be $ 0.43 per head.

Conclusions

Beef cattle breeding and selection criteria, whether for a region, the industry or for an individual beef operation, must focus on increasing profitability. Although breeding objectives for individual beef operations will be specific to their environment (climate, feed supply, current cattle types), regional and industry objectives may be guided by the average relative economic value of various traits. The beef industry has long recognized the economic importance of reproductive, production efficiency and consumption traits. Reproductive traits are most influenced by heterosis and the design of crossbreeding systems, while production efficiency and consumption traits are more influenced by sire and replacement selection. Generalized results presented here are fairly robust and show an economic bias towards reproductive traits for cow-calf producers (47% emphasis on reproductive traits, versus 24% for production traits and 30% for consumption traits, or 2:1:1). A totally vertically integrated industry would weight the three categories almost equally. This is a significant shift from traditional theory that suggests a relative selection emphasis of 5:2:1 for reproduction : growth : carcass characteristics.

Recent debate regarding beef's meat market share loss to poultry and pork have focused on meat quality and consistency. The perception is that increasing beef quality (tenderness, flavor, juiceness, etc.) and consistency will increase consumer demand for beef. The perception is subject to question and creates a large perceived economic benefit re: consumption traits that may be incorrectly influencing breeding and selection decisions away from equally or more important reproductive and production traits. Evidence in fact suggests that price and processing effects are more important in understanding market share changes. Lower relative prices and costs of production in the poultry and pork industries and greater use of chicken in processed foods are driving the loss of beef's meat market share. The lower relative prices and processing effects are the result of economies of size and lower transactions costs created by vertical integration. The beef industry is hampered in its ability to vertically integrate because of biology (long generation interval, one calf per cow offspring), decentralization (large number of small producers widely dispersed regionally) and production structure (3 phases of production). It may be several decades (if at all) before new technologies (mapping of the beef genome, development of separate male and female genetic lines coupled with embryo transplant, new processing methods) create enough profit incentive and capital to drive vertical integration in the beef industry. Until that time the beef industry should focus appropriate selection emphasis on reproductive and production efficiency traits. Even when "cafeteria" genetics becomes available we will need to continue to recognize the greater relative importance of reproductive and production traits, especially in the cow-calf sector.

The Future

Just a note about the future of genetic selection and design of crossbreeding systems. Although there has been a lot of progress in generating EPD information for various traits within breeds, there needs to be much more done to make them easily comparable across breeds. More research is needed to develop multi-trait selection indices applicable both within and across breeds and that can be customized to fit individual farm operations and environments. The future will see development of easy-to-use Internet-based simulation software for evaluating farm-level selection and cross-breeding strategies (Amer et al 1994a, Amer et al 1994b, Lamb et al 1993, Melton et al 1994a, McNeil et al 1994a, McNeil and Newman 1994b, Naazie et al 1997, Snelling 1998), and more market-based approaches for determining the economic value of various traits (Amer et al 1992, Kerr 1984, Richards and Jeffery 1996, Walburger 1994).

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STANDARDIZATION OF COW DISPOSAL CODES

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As part of an integrated management program for commercial cow-calf or seedstock producers, it is very important to know the reproductive status of each cow in the herd. Also, the knowledge regarding why cows leave the herd can provide information so the producer can take steps to correct problems in the herd.

Since 1995, breed associations in the US and Canada have become interested in inventory recording programs which emphasize recording information on the breeding herd rather than recording information on calves. In an inventory recording program, the breeder reports the performance data on each cow's calf or reports the reason(s) why a calf was not produced for that year along with the cow's current status in the herd. The codes for reproductive status/disposal provide the information about the cow's current status in the breeding herd.

A simple set of codes for recording cows' reproductive or disposal history was printed in the last revision of the BIF Guidelines (BIF, 1996). These nine codes are listed below:

Score 1	Cow open, sold
Score 2	Cow open, kept alive
Score 3	Cow open, died
Score 4	Pregnancy unknown, sold
Score 5	Pregnancy unknown, died
Score 6	Pregnant, sold before calving
Score 7	Pregnant, died before calving
Score 8	Pregnant, aborted
Score 9	Cow calved

These codes provide a simple way for recording a cow's reproductive history in a commercial cow herd each year. These codes are probably not detailed enough for use total herd inventory programs or for the producer who wishes to record more information regarding reproductive history in the herd.

Several breed associations were contacted to see if they were using or adopting inventory reporting programs and if a set of reproductive history/disposal codes were developed for use by association members. The contacted associations do not represent every beef breed association in North America however, the information regarding disposal codes gives a good review of what's being used in the industry.

The reproductive history/disposal codes are listed in tables 1 through 4 for seven associations. Each of the associations provide codes to detail reasons for dying, culling, selling. Several associations provide codes to note if cows are being used in embryo transfer programs, either as recipients or donors. The codes used to describe why a cow was culled or died provide useful information to determine why cows leave the herd. Over a period of years, the associations using inventory based recording programs should be able to describe why cows leave the herd with some detail.

In table 5, the different disposal codes are compared to a proposed set of codes for the American Simmental Association. The ASA is in the process of developing a inventory recording program so a set of disposal codes needed to be developed and presented to the membership. The codes used by the associations listed in table 5 can be grouped into categories and translated between association data bases. Certainly, some associations are interested in more detailed information than other associations. It would appear problematic that an uniform set of disposal codes could be developed for breed association use through BIF. Many of the associations have codes in place that their members have experience using while processing herd records.

In summary, BIF may wish to develop a set of standardized codes for use by commercial producers and those breed associations that do not have disposal codes. The codes used in the industry today or currently under development adequately describe the reasons cows leave the herd or their current status in the herd. The codes used by the seven associations in this report can be translated with ease. Breed associations need to be careful that they do not get carried away trying to describe every reason a cow may die or be culled from the herd.

Table 1. Reproductive History and Disposal Codes

American-International Charolais Association		North American Limousin Foundation	
Code	Reason	Code	Reason
10	Did not wean a calf, still in herd	A	cow used as embryo donor or recipient
20	Died - Old Age	B	cow or heifer didn't conceive or aborted, but has been retained for breeding
21	Died - Disease	D	cow had calf that died at birth or within 72 hours following birth due to calving difficulty, but was retained for breeding
22	Died - Calving Difficulty	F	cow had calf that died at or following birth for reasons other than calving difficulty, but was retained for re-breeding
23	Died - Other	C	cow or heifer did not conceive or aborted, was culled and should be removed from the herd inventory
30	Culled - Infertility	E	cow had calf that died at birth or within 72 hours following birth due to calving difficulty, was culled and should be removed from the herd inventory
31	Culled - Calf Performance/Productivity	G	cow had calf that died at birth or following birth for reasons other than calving difficulty, was culled and should be removed from the herd inventory
32	Culled - Temperament	H	cow was culled because of unacceptable disposition, remove from the herd inventory
33	Culled - Udder Problems	I	cow was culled due to teat and/or udder problems, remove from the herd inventory
34	Culled - Structural Unsoundness	J	cow was culled due to old age, including no teeth, remove from the herd inventory
35	Culled - Illness	K	cow was culled due to unsoundness of feet and legs, remove from the herd inventory
36	Culled - Reasons Related to Calving	L	cow was culled because of inferior calf weaning weight, remove from the herd inventory
37	Culled - Age	N	cow was sold without papers and should be removed from herd inventory
38	Culled - Other	O	cow died or was sold to slaughter for reasons other than listed above; use this code to remove cows from the inventory that were culled for unknown reasons
40	Sold	M	cow was sold with papers, submitting transfer to NALF
50	In Embryo Program - No Natural Calf		

Table 2. Reproductive History and Disposal Codes, continued

International Brangus Breeders Association		American Angus Association	
Code	Reason	Code	Reason
0	Still in herd	1	Open
1	Sold as breeding animal with papers	2	Poor maternal milk
2	Sold as commercial breeding animal	3	Poor growth EPDs
3	Died, sickness or disease	4	Mastitis/milk problems
4	Died, injury	5	Feet/leg soundness
5	Died, calving difficulty	6	Body condition
6	Died, old age	7	Temperament
7	Died, act of God	8	Udder problems
8	Culled, produces unacceptable underline	9	Genetic defects
9	Culled, produces color problems	10	Health problems
10	Culled, produces poor quality	11	Reproductive disease
11	Culled, lacks milking ability	12	Died natural death (old age)
12	Culled, hard keeper/lacks fleshing ability	13	Sold as purebred
13	Culled, poor calving interval	14	Sold as commercial
14	Culled, open	15	Struck by lightning
15	Culled, illness	16	Died at calving
16	Culled, injury	17	Accidental Death
17	Culled, poor temperament	18	Died, respiratory disease
18	Culled, produced calf with genetic defect	19	Died, digestive disease
19	Culled, bad feet	20	Died, poisonous plants
20	Culled, structurally unsound on front end	21	Died, other health problems
21	Culled, structurally unsound hocks	22	Died, other
22	Culled, structurally unsound hind leg set		
23	Culled, poor udder		
24	Culled, prolapsed		
25	Culled, old age		
26	Culled, calving difficulty		
27	Culled, bad mouth		
28	Culled, small testicles		
29	Culled, failed breeding soundness exam		
30	Heifer, not exposed to a bull		
31	Open, missed calving opportunity		
32	Open, moved to next calving season		
33	Open, bull went bad		
34	ET program, donor cow		
35	ET program, recipient cow		
36	Aborted/premature		

Table 3. Reproductive History and Disposal Codes, continued

American Gelbvieh Association		American Hereford Association	
Code	Reason	Code	Reason
	No code for animals still in herd	1	Still in herd or sold with papers
1	Sold as a breeding animal - certificate transferred	2	Sold as a breeding animal without papers
2	Sold as a breeding animal - not transferred	3	Died, illness
3	Sold as a feeder calf	4	Died, injury
4	Died, illness	5	Died, calving difficulty
5	Died, injury	6	Died, old age
6	Died, calving difficulty	7	Died, other
7	Died, old age	8	Culled, inferior production
8	Died, other	9	Culled, infertile
9	Culled, inferior production	10	Culled illness
10	Culled, infertile	11	Culled, injury
11	Culled, illness	12	Culled poor temperament
12	Culled, injury	13	Culled or died, genetic defect
13	Culled, poor temperament	14	Culled, bad feet
14	Culled or died, genetic defect	15	Culled, poor udder
15	Culled, bad feet	16	Culled, Prolapse
16	Culled, poor udder/teats	17	Culled, cancer eye
17	Culled, Prolapse	18	Culled structurally unsound
18	Culled, calving difficulty	19	Culled, old age
19	Culled, structurally unsound	20	Culled, other
20	Culled, old age		
21	Culled, other		

Table 4. Reproductive History and Disposal Codes, continued

Red Angus Association of America	
Code	Reason
1	Open, missed calving opportunity
2	ET program/donor dam
3	Moved to next calving season
4	ET program/recipient cow
5	Aborted/premature
7	Died after weaning - disease
8	Died after weaning - other
9	Died - age
10	Culled - physical defect
11	Culled - fertility
12	Culled - performance/productivity
13	Culled - temperament
14	Culled - age
15	Culled - other (including sold but not transferred)

Table 5

	Breed Association						
Disposal/Reproductive Status	**RAAA1**	**AHA**	**AAA**	**NALF**	**AGA**	**AICA**	**IBBA**
Active	Blank	Blank	Blank	Blank	Blank	Blank	0
Cow used as Donor	2			A		50	34
Cow used as Recipient	4			A			35
Open, retained for breeding	1			B		10	31
Open, moved to next breeding season	3						32
Aborted/Premature	5						36
Retained, Calf died due dystocia				D			
Retained Calf died for other reasons				F			
Sold, Certificate Transferred			13	M	1	40	1
Sold, Certificate not transferred	15	2	14	N	2	40	2
Died, sickness or disease	7	3	18,19		4	21	3
Died, Injury		4			5		4
Died, Calving Difficulty		5			6	22	5
Died, Old Age	9	6	12		7	20	6
Died, Other (Act of God)	8	7		O	8	23	7
Culled, Calf performance / Productivity	12	8	2,3,4	L	9	31	10,11
Culled, Calving Difficulty				E	18	36	26
Culled, Feet and Legs	10	14,18	5	K	15,19	34	19,20,21,22
Culled, Disposition	13	12	7	H	13	32	17
Culled, Teat and Udder		15	8	I	16	33	23
Culled, Age	14	19		J	20	37	25
Culled, Open or Aborted Calf	11	9	1	C	10	30	14
Culled, Injury		11			12		16
Culled, Sickness or Disease		10			11	35	15
Culled, Prolapse		16			17		24
Culled, lost calf for reasons other than dystocia				G			
Culled, Other	15	20		O	21	38	

1 Red Angus Association of America (RAAA), American Hereford Association (AHA), American Angus Association (AAA), North American Limousin Foundation (NALF), American Gelbvieh Association (AGA), American-International Charolais Association (AICA), International Brangus Breeders Association

GENETIC EVALUATION POSSIBILITIES WITH WHOLE-HERD REPORTING

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Introduction

Guidelines for Uniform Beef Improvement Programs (BIF, 1996) lists over twenty reproductive, growth, carcass and cost traits that might be considered in national cattle evaluations (Table 1). All traits on this list may be related to profitability in some situations, although no single trait, or category of traits, has an overwhelming influence on profitability in any situation. To fully evaluate overall genetic merit, assuming that overall genetic merit is related to profitability, evaluations need to include traits from all categories affecting income and expense.

Many genetic evaluation programs, however, have focused on birth weight and growth traits, too limited a set of traits to adequately address all aspects of profitability. Recently, some breed associations have expanded their genetic evaluations to include additional traits. Much attention is currently being given to carcass traits, and some evaluations for reproductive traits are conducted. A major obstacle to evaluating more traits and more fully characterizing overall genetic merit is the lack of data available to predict genetic merit for other traits. Whole-herd reporting schemes may be implemented to obtain some of the required data, as well as improve reliability of currently predicted EPD.

Whole-herd reporting can involve simply recording and reporting performance records from every animal born, reasons why each cow did not calve, and reasons for disposal when animals go out of production each and every year (J. Hough, personal communication). To encourage whole-herd reporting, fees may be structured so that a herd submitting records on all cows and calves will pay the same or less that a similar size herd that submits records on a few chosen calves. Taken to an extreme, whole-herd reporting could include lifetime records, from conception to slaughter, for every cow and calf in all seedstock and commercial herds. Sifting through the resulting mountain of data may yield some useful information, but probably not enough to justify the expense of collecting and storing all these records. Without whole-herd reporting, selectively reported data may provide enough information to identify animals superior for specific traits, but not enough to fully evaluate overall genetic merit. To be effective, whole-herd reporting schemes need to collect enough data to fairly evaluate traits influencing income and expense, at a cost less than the potential benefit of more profitable selection decisions.

The traditional traits (birth weight, weaning weight, yearling weight)

Because of direct and indirect relationships with several factors influencing income and expense, as well as the amount of data available on these measurements, birth, weaning and yearling weights can provide the basis for more complete genetic evaluations addressing profitability. Rather than traditional expression as birth weight, weaning weight, milk, total maternal and yearling weight EPDs, these records might be used in conjunction with other data in genetic predictions for traits such as calving assistance, calf survival, weaning and slaughter sale weights, and cow maintenance costs.

Most performance recording programs include birth, weaning and yearling weights, although reporting is usually voluntary. Not requiring complete information, at least for birth and weaning weights, leaves the door open for selective reporting and the possibility of biased evaluations resulting from incomplete data (Mallinckrodt et al., 1995; Gilbert, 1997). To reduce reporting bias, whole-herd recording schemes should encourage complete reporting of these traits; when a measurement is not submitted a reason why that data is unavailable should be recorded.

Complete reporting of birth weight may not be possible, as weighing all calves at birth could be expensive and impractical under extensive management. When calving can be observed closely enough to record birth dates, tag all calves and weigh some, there seems to be little reason not to weigh all calves. Collecting reasons for missing birth weights may help to ensure validity of birth weights that are recorded. Whether or not birth weight is measured, calving difficulty can easily be recorded using either calving ease scores or an indication of which calves were assisted at birth.

Whole-herd performance recording should include a weaning record for every calf born, either a weight or reason why the weight is not available. Because a number of calves may be culled at weaning, due to unacceptable weaning weights, structural and other defects, an expectation of complete postweaning records is unrealistic. Complete preweaning records are useful to predict EPDs for postweaning traits in multiple-trait analyses, but keeping undesirable calves, for the sake of having complete post-weaning data, would require unnecessary expense and have little impact on eventual selection decisions. Keeping track of why the calves were culled, however, may provide data useful in genetic analyses of calf culling.

Carcass traits

Increased emphasis on value-based marketing, with individual carcasses priced according to quality grade, yield grade and other characteristics, has motivated some breeding programs to increase emphasis on carcass traits. Several breed association have implemented, or are planning to implement, carcass EPD programs to provide tools needed to select for improved carcass quality and yield. As with several other traits, a major limitation to computing EPDs for carcass measurements is a lack of data.

The expense and planning necessary to arrange collection of marbling, rib-eye area, and fat thickness measurements precludes inclusion of these traits whole-herd reporting schemes. These underlying components of quality and yield grades are best be obtained from designed progeny tests comparing test and reference sires, although ultrasound and other technologies can provide useful data on indicators of carcass merit from live animals. A whole-herd approach to carcass data collection may be through structuring value-based alliances to encourage enrollment of complete sire-identified calf crops from commercial herds. The quality grade, yield grade and carcass weight records collected should support EPDs predicted from structured data. Additional evaluations might predict EPDs for probabilities of undesirable carcasses - overweight and underweight, insufficient quality, unacceptable yield - providing information to reduce the risk of substantial discounts.

Reproduction and Survival

Basic reproductive data, whether or not a cow was exposed to breeding, conceived, calved and raised that calf to weaning, is perhaps the most easily collected and economically important performance data that could be recorded. Somehow, this information seems to have been overlooked in most performance programs, which have focused on recording and evaluating calf measurements. Shifting the emphasis from calves to cows, with whole-herd reporting based on all females exposed to breeding, will allow genetic evaluations to address female reproduction with no detrimental effects on calf performance analyses. In addition to yearly reproductive status information, collecting reasons for removing females from breeding herds will enhance evaluations for long-term measures of length of productive life and stayability.

A few breed associations have implemented, or are contemplating stayability EPDs to indicate sustained fertility. Using observations of success or failure of dams to have calves reported before and after the age of six, stayability was originally developed as a concession to the lack of complete reporting (Snelling et al., 1994). Stayability observations can be deduced from existing pedigree and birth date records, where females failing to calve every year cannot be identified separately from females who calved every year with some calves unreported. This definition of stayability provides a composite measure of culling, and may be a reasonable measure of long-term fertility as long as reproductive failure is the primary reason for culling young cows. Recording annual reproductive status and culling reasons should enable more reliable genetic evaluations of female fertility, and allow separating reproductive failure from other reasons for culling.

Whole-herd reporting may enable a suite of EPDs for female fertility and culling, Heifer pregnancy EPD could predict genetic potential for fertility of yearling heifers, and two-year-old pregnancy EPD may address rebreeding in first-calf heifers (Golden et al., 1996). Stayability and length of productive life EPD may become more dependable genetic predictions of sustained fertility by accounting for non-reproductive reasons for culling. If culling codes are sufficiently descriptive, these records may be useful in a set of EPDs for specific culling reasons, such as unsound feet and legs, poor teats and udder, and unacceptable temperament. A full set of female fertility and culling EPDs, used individually to address specific problems or combined in a single composite EPD, should provide tools to genetically improve reproduction and ultimately profit.

Cost and Convenience

Many traits in other categories have some influence on costs of production. Birth weight, as an indicator of calving ease and calf survival, along with calving ease and survival records, contributes to costs of labor calf death loss at calving. Birth weight and growth traits can be used to predict mature weight, related to cow maintenance costs, and milk EPD can indicate costs to feed lactating cows. Fertility and culling EPD may be useful to predict costs associated with reproductive failure, including replacement heifer development costs. Perhaps bio-economic simulation could be used to express genetic predictions for fertility and culling in terms of relative impact on costs and income.

Other traits affecting costs, particularly individual intake and feed efficiency in confinement or pasture settings, are too expensive and difficult to measure to expect wide-spread data collection. Costs of measuring growing or mature animal intake may exceed the value of information gained, especially when relatively simple and less expensive measures may provide useful information related to feed costs. Cow weights and condition scores will give some indication of individual requirements, and should be relatively easy to obtain. Producers with facilities to weigh cattle individually may have little trouble collecting weights when cows are pregnancy tested, and submitting cow weights along with pregnancy data.

Exactly accounting for expenses may be difficult, but some of the most costly cattle are those needing extra individual attention for a number of reasons. Sick calves, balloon teats, rank attitudes all cause extra trouble; addressing costs of inconvenience requires some record of which individuals are causing problems. Whole-herd reporting schemes might consider simple indications of health, temperament, structural and other defects which should eventually allow evaluations for convenience traits.

Whole-herd Reporting Requirements

Cow-based recording of seedstock cattle, requiring a record for each breeding female every year, can provide much data needed to expand current genetic evaluations. Most specifically, this cow data will enable computing EPDs for reproduction and survival, and increase reliability of the few reproductive EPDs that are currently computed. To be complete, whole-herd reporting should also include records for each calf from birth until it is marketed or returned to the herd as a breeding animal. Some organizations, however, are adamant that calf performance records be submitted voluntarily; these may consider enacting policies to discourage selective reporting. Fee structures that provide incentive to report performance of all calves, whether or not they are registered, should be implemented. Some consideration might also be given to allowing different levels of participation in whole-herd reporting schemes. Breeders may choose which measurements they are willing to take, and agree to submit all available records along with reasons for missing records. In order for genetic evaluations to reliably address all aspects of profitability, seedstock organizations need to develop policies that encourage complete reporting of cows and calves for a full set of traits affecting income and expense.

While individual animal records are most meaningful to seedstock herds, information from commercial production should not be ignored. In commercial herds, the expense of collecting extensive individual animal records is usually not justified, although measures of overall herd performance, such as those included in the Standardized Performance Analysis (SPA) and simplified in SPA-EZ (Kniffen and Hamilton), may be beneficial. These records, perhaps coupled with incidence of calving difficulty, disease, and other troubles, can identify problem areas for commercial herds. Seedstock organizations may consider processing some commercial herd records as a service to their customers and to obtain information to guide breeding decisions for both seedstock and commercial herds.

Conclusions

Current genetic evaluations are incomplete, and do not provide enough information for breeding decisions to address all areas affecting profitability. Genetic evaluations for many traits affecting income and expense are currently impossible due to a lack of data. Some of the data needed for more complete and reliable genetic evaluations can be obtained from whole-herd reporting schemes. Reproductive status and culling information can be collected with annual records of breeding females, and reliability of EPDs for calf performance will be improved with complete reporting of entire calf crops. Cow weight records and some simple indications of convenience traits may be useful to deal with some costs of production.

Some traits may be too difficult or expensive to measure to expect widespread data collection. Genetic evaluations for these traits may include limited data, augmented by observations of more easily collected and completely reported indicator traits. Effort should be devoted to determining the value of specific measurements, relative to costs of measurement. With more complete information on traits affecting profitability, expressing genetic predictions in terms of relative impact on income and expense, rather than EPDs in units of measure should also be considered. Exactly what might result from whole-herd reporting remains to be seen, but a whole-herd approach to data collection will provide more complete genetic information allowing producers to breed for profitable beef production.

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Table 1. Traits[a] recorded and analyzed by North American breed associations[b].

Trait	Number of Associations Recording Trait		Number of Associations Computing EPD	
	Voluntary	Mandatory	Current	Future
Reproduction - fertility				
Yearling scrotal circumference	10		6	3
Stayability			4	3
Calving date	2	7	1	
Gestation length	6	2	4	2
Reproduction - survivability				
Calving ease (direct)	11		5	4
Calving ease (maternal)			5	4
Birth weight (direct)	12		12	
Birth weight (maternal)			7	
Pelvic area	7			
Growth and milk production				
Weaning weight (direct)	8	4	12	
Milk (maternal weaning weight)			12	
Total maternal weaning weight (maternal + .5 direct)			12	
Yearling weight	10	2	12	
Carcass yield				
Carcass weight	11	1	5	6
Rib-eye area	11	1	6	6
Fat thickness	11	1	5	7
Kidney, pelvic and heart fat	7		2	2
Percent retail cuts	6	1	1	7
Carcass quality				
Marbling score	11	1	7	4
Tenderness (Warner-Bratzler shear force)	6	1		7
Maintenance				
Mature cow weight	7	1	1	4
Mature cow height	4	1		1
Body condition score	7	1	1	1
Yearling hip height	6	1		1
Other traits				
Teat size score	2	1		
Udder suspension score	2	1		
Sheath / navel score	1	1		
Temperament score	3	1	2	

[a] Candidate performance traits for national cattle evaluation (BIF, 1996)
[b] Results of informal survey of twelve U.S. and Canadian beef breed associations.

COMMITTEE SESSION: GENETIC PREDICTION COMMITTEE

GENETIC PREDICTION COMMITTEE MINUTES

July 2, 1998
Calgary, Alberta, Canada

Submitted by: Keith Bertrand, Recording Secretary

Chairman Larry Cundiff called the meeting to order at 2:30 p.m. First order of business was to announce the appointment of Keith Bertrand to the position of Recording Secretary for the Committee. Keith replaces Richard Willham who retired earlier in the year from Iowa State University. Dr. Willham served for many years as Recording Secretary for this Committee, and he will be missed. Chairman Cundiff announced that the current session of the Committee meeting would consist of the presentation of several papers. The presenters and the titles of their presentations during the meeting were:

Roy Wallace - "Real World Indexes for Selection";
Jim Wilton - "Selecting Yearling Bulls Across Breeds for Profit";
Keith Bertrand - "International Genetic Evaluation";
Bob Kemp - "Research Focusing on Carcass and Meat Quality Traits at Lethbridge Research
Centre";
Larry Cundiff - "Updated Across Breed MARC EPD Tables".

Chairman Cundiff adjourned the meeting at 5:00 p.m.

J. Keith Bertrand, Professor
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1996 AVERAGE EPDs FOR EACH BREED

Larry Cundiff

For selection of breeding stock, it is important to know how expected progeny differences (EPDs) for an individual animal compare to the current breed average. Mean non-parent EPDs are useful for making comparisons within breeds. They cannot be used to compare different breeds because EPDs are estimated from separate analyses for each breed. The means are for all calves born in 1996 from the most recent (1998) genetic evaluations. The 1996 birth year was chosen because limited data were available on calves born in 1996 for yearling weight and other traits

1996 ALL ANIMAL NON-PARENT AVERAGE EPDs FROM 1998 OR MOST RECENT GENETIC EVALUATIONS

	Birth wt lb	Wean. wt lb	Yrlg. wt lb	Milk lb	Total mat. lb	Yrlg. ht. in	Scrot. circ. cm	Calv. ease dir. %	Calv. ease mat. %	Gest. length days	Ribeye area sq in	Stay- ability
	+2.7	+27.9	+50.9	+11.9		+.05						
	+.15	+2.4	+4.8	+2.3								
	+1.45	+10.2	+17.2	+5.0								
	+1.3	+14.8	+27.0	+.7	+9.0		+0.2				+0.21	
	+1.8	+12.0	+21.1	+5.6	+11.6							
	-.2	+5.1	+9.6	+1.9	+4.7			101.2	101.8	-.2		
	+3.7	+29.5	+50.5	+9.2	+23.9		+0.3					
	+1.04	+8.1	+15.3	+2.4			+0.11			-.40		+11.5
	-.2	+1.9	+2.7	0.0	+.9							
	-.1	+.6	+.7	-1.0	-.7							
	+.6	+22.8	+37.0	+8.7	+20.1							+5.2
	+.9	+10.1	+16.5	+1.5	+6.6		+0.1					
	+.67	+4.6	+5.6	+1.3	+3.6							
	+1.9	+12.3	+19.2	+2.5	+8.6							
	+3.8	+33.7	+51.6	+9.0	+25.8			+1.3	+1.1			
	+2.4	+11.3	+20.7	+2.0	+7.6			100.3	100.6			

REAL WORLD INDEXES FOR SELECTION

Roy Wallace
Select Sires, Inc.

Recently I have been looking for an index that can be used for 'multiple-trait' selection in Angus bulls. As many of you know, I have used a score called my 'Power Score' for a number of years where I compute an index using birth, weaning, yearling and milk EPD percentiles. All four percentile rankings are added together then divided by four. The bulls that end up with the lowest numbers have the best power score.

$$\text{Growth Power Score:} \quad \frac{BW\% + WW\% + YW\% + Milk\%}{4}$$

Because of increased utilization of carcass traits, having more carcass data available and the interest in improving the carcass genetics of cattle, I developed a new power score for carcass traits. I have used only marbling and % retail product EPDs because fat can be greatly influenced by environment whereas marbling and lean yield are not. The formula adds together the percentile ranking for both marbling and %RP which is then divided by two to come up with a carcass power score.

$$\text{Carcass Power Score:} \quad \frac{Marbling\% + RP\%}{2}$$

I utilized data from Melton's model (ISU, 1994) where he looked at beef production and the percentage of attention that should be given to traits in two beef cow systems.

Melton data (1994)

Cow-Calf Operation (selling calves at weaning)		Integrated Cow-Calf Operation (conception to carcass)	
Reproduction	47%	Reproduction	31%
Production (Growth)	23%	Production (Growth)	29%
Product	30%	Product	40%

In both systems, production and end product are roughly equal in value. I didn't include reproduction in this index because the only trait we can get our hands on is scrotal size and the trait of most importance is the conception rate of the sire.

I then arrived at a combined index we can call the 'Combined Power Score' which uses 50% from the Growth Power Score and 50% from the Carcass Power Score. The final index weights the traits in the following fashion: Birth Weight: 12.5%, Growth: 25%, Milk: 12.5%, Marbling: 25% and %RP: 25%.

Combined Power Score

1/2 from Growth Power Score and 1/2 form Carcass Power Score
(Bulls must have actual carcass data)

$$\frac{\text{Growth + Carcass}}{2} = \text{Total Index (Combined Power Score)}$$

As you look at the bull rankings, they will change if we change the trait balance, but as I look at Melton's model and the traits of the most economic importance, I feel it is a good balance between all traits.

One other area that I have addressed deals with accuracy values on bulls to identify those bulls that will not change much with future sire summary data. With the traits that we currently evaluate, I have established a class of what I call the 'Old Warhorses'--bulls that have survived 'genetic battles', have stood the test of time and are the seasoned veterans of the breed. Bulls with this designation must have less than 5 daughters per herd--most 'Old Warhorses' with lots of daughter data will average about 3.5 daughters per herd, thus they are well sampled. To belong to this group of 'Old Warhorses' a bull must meet or exceed the following accuracy levels on the following traits:

Birth Weight	.90	Carcass Weight	.62
Weaning Weight	.90	Marbling	.70
Yearling Weight	.90	Ribeye	.62
Pure Milk	.85	Fat Thickness	.60
Yearling Frame	.70	% Retail Product	.60
		Scrotal Circ.	.70

The following tables include 10 of the top 30 Angus bulls for registrations in the past fiscal year. The first table includes the EPDs and percentiles used to calculate the Growth Power Score. Table 2 lists the same bulls with their current data and percentile ranks for the Carcass Power Score, while Table 3 lists the bulls with their Growth Power Score, Carcass Power Score and their Combined Power Score, as well as their individual rank within each category.

TABLE 1.

10 Sires out of top 30 Angus for registrations
Growth Power Score

Sire		BW	WW	YW	Milk	Growth PS
A	EPD	2.1	45	83	18	
	% rank	35	5	3	15	14.5
B	EPD	5.4	56	106	1	
	% rank	90	1	1	95	47
C	EPD	1.4	30	53	20	
	% rank	25	45	50	10	32.5
D	EPD	1.6	35	73	29	
	% rank	25	30	15	1	17.8
E	EPD	0.6	27	56	30	
	% rank	15	60	45	1	37.5
F	EPD	1.8	29	70	14	
	% rank	30	50	15	35	32.5
G	EPD	4.5	36	60	9	
	% rank	75	25	35	65	50
H	EPD	2.2	43	79	13	
	% rank	35	10	5	40	22.5
I	EPD	8.7	50	98	40	
	% rank	95	2	1	1	24.8
J	EPD	4.9	39	67	28	
	% rank	85	15	20	1	47.8

TABLE 2.

10 Sires out of top 30 Angus for registrations
Carcass Power Score

Sire		Marbling	%RP	Carcass PS
A	EPD	.10	-0.1	
	% rank	40	75	57.5
B	EPD	.14	0.0	
	% rank	35	70	52.5
C	EPD	.24	0.6	
	% rank	20	10	15
D	EPD	-.24	0.1	
	% rank	70	55	62.5
E	EPD	.68	0.4	
	% rank	1	20	10.5
F	EPD	.33	0.6	
	% rank	10	10	10
G	EPD	.24	-0.4	
	% rank	20	90	55
H	EPD	.16	-0.2	
	% rank	30	85	57.5
I	EPD	-.64	0.0	
	% rank	100	70	85
J	EPD	.10	.30	
	% rank	40	30	35

TABLE 3.

10 Sires out of top 30 Angus for registrations
Combined Power Score

Sire	Growth PS		Carcass PS		Combined PS	
A	14.5	(1)	57.5	(7)	36	(3)
B	47	(7)	52.5	(5)	50	(6)
C	32.5	(5)	15	(3)	24	(2)
D	17.8	(2)	62.5	(8)	40	(4)
E	37.5	(6)	10.5	(2)	24	(2)
F	32.5	(5)	10	(1)	21	(1)
G	50	(9)	55	(6)	52.5	(7)
H	22.5	(3)	57.5	(7)	40	(4)
I	24.8	(4)	85	(9)	55	(8)
J	47.8	(8)	35	(4)	41	(5)

SELECTING BULLS ACROSS BREEDS FOR PROFIT

J.W. Wilton[1], S.P. Miller[1], M.T. Lazenby[1] and J.A.B. Robinson[1,2]

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Summary

Developments leading to expansion of multiple breed, multiple trait evaluations of Beef Improvement Ontario are presented. Developments include the estimation of genetic parameters related to bulls in central evaluation stations including, growth, feed, weight, carcass and scrotal traits. Traits were moderately to highly heritable with most traits having moderate genetic correlations between them. Reducing the length of test period and subsequent number of weight measures reduced accuracy of evaluation. Results from the implementation of economic selection guides for selecting bulls across breeds for predicted profit in each of two management and marketing scenarios are presented.

Introduction

Multiple trait, across breed genetic evaluations have been available to users of Beef Improvement Ontario's (BIO) services since 1994. Methods and results from implementation have been previously described by Wilton and Miller (1994) and Miller et. al. (1994). Results include Across Breed Comaprisons (ABC's) or across breed EPD's, a byproduct of these being a table of breed differences. These ABC's allow breeding decisions to be made comparing animals across breeds for additive genetic merit for birth weight and pre and post weaning growth, both on the farm and in central evaluation stations. Recent developments in across breed evaluations in Ontario have included traits related to feed efficiency, reproduction, and carcass traits through Real Time Ultrasound.

Recently, software has been developed which combines these ABC's into one value summarizing the predicted profit potential or Predicted Dollar Difference (PDD). This new service allows producers to compare bulls across breeds for profit potential and is described by Miller et al., (1998). Objectives of this paper are to describe current developments of across breed evaluations for bulls in central evaluation stations with results from genetic (co)variance component analysis; determine the consequence of a reduction in evaluation period length; and provide examples from the implementation of BIO's Genetic Leader Selection Guides across breeds.

Materials and Methods

The current multiple trait model used in the multi-breed analysis consists of an additive genetic animal model with fixed effects for management group, age of dam and sex of calf. Data is pre-adjusted for multiple births and heterotic effects of the dam as well as the calf . Data consists of over 1 million animals with over fifty percent of these being crossbred. Breed effects are accounted for by tracing all animals back to purebred ancestry. Unknown purebred ancestors are then grouped by breed and year of birth to form phantom groups (Quass et al., 1988). These phantom groups are treated as random. More detailed descriptions along with tables of resulting breed differences have been presented earlier by Wilton and Miller (1994) and Miller et al. (1994).

Recent developments have been to more completely include available Central Evaluation information on bulls in BIO's Bull Evaluation Program (BEP), going beyond weight gain. Performance data in the BEP dates back to 1975 with traditional measures being weight gain determined via individual animal regression utilising 6 weight measures at 28 day intervals. In addition to weight measures, bulls have individual feed intake measured using electronic feeders. At end of test, bulls were also measured for Hip Height (HH, frame score) and Scrotal Circumference (SC). Since 1971 end of test measures have also included Back-Fat Thickness (BF) via ultrasound (Wilton et al., 1973). Recently, additional Real Time Ultrasound (RTU) measures have included Rib-Eye Area (REA) in 1995 and more recently Intramuscular Fat Percentage (IMF), or marbling. In 1995 the test length was reduced from 140d to 112d. Both 112d and 140d data were considered using the later 112d of the 140d period.

(Co)Variance Component Analysis

Genetic Parameters were derived using Variance Component Estimation software, VCE (Groenveld, 1994), which implements a Restricted Maximum Likelihood (REML) algorithm. Data included central evaluation data on bulls from BIO's BEP program. A total of 40,358 data records spanning 1975-1996 were selected including 62,630 animals, with pedigrees dating back to 1955. Purebreds only were considered, including the following breeds which represent the majority of the data, Angus, Red Angus, Blonde D'Aquitaine, Charolais, Hereford, Polled Hereford, Limousin, Maine Anjou, Salers, Simmental, Shorthorn and Shaver Beef Blend.

Model for analysis considered effects of test group, age, breed and the additive genetic effect of the animal. Observations included one of the following 8 traits, average daily gain on 112 day test with the last 112 days considered as a record for animals completing the traditional 140 day test, cumulative feed intake on test, hip height at end of test, back fat thickness at end of test, scrotal circumference at end of test, weight at end of test and rib-eye area at end of test. Table 1 describes the data by breed and trait.

Results and Discussion

Results of the genetic parameter estimation of central performance data of bulls is presented in Table 2. Generally, estimates of heritability were moderate to high. Genetic change can then be made by selection for these measured traits. Many of the traits which are measured at end of test are influenced by size. Weight at end of test, rib-eye area and hip height are examples of traits influenced by size. For this reason the genetic correlation estimates between many of the traits are moderately positive. The correlation of backfat with other traits was generally lower. The correlation between backfat and gain was low (0.05), however correspondingly the correlation of gain with weight at end of test was high. This indicates that, as expected, selection for gain will increase weight at a constant finish endpoint.

The heritability of weight at end of test was high (0.5) compared to average daily gain (0.37). All traits related to size at end of test were essentially estimated with high heritability. This could be a function of the preweaning environment of the calf that was not removed in the pre-adjustment period. Pre-weaning environment effects contributing to size traits at end of test could include herd and maternal effects. Further research is currently under way to investigate the contribution of maternal and herd of origin effects to end of test measures.

Preliminary analysis indicated that the genetic correlation between 112 day and 140 day ADG was essentially unity. Heritability was estimated to be 0.43 for 140d ADG compared to 0.37 for 112d ADG; this indicates that some accuracy has been compromised by reducing test length from 140d to 112d. Recent research by Archer et al., 1997 indicates that test lengths could be reduced to 70d with weights every 14d. More research would be required to verify the results of Archer et al., 1997 using BEP data. Perhaps test length could be further decreased with a corresponding increase in weighing frequency to 14d intervals from 28d intervals to avoid a compromise in accuracy.

Results from the implementation of the genetic leader selection guides for bulls completing the BEP program in 1998 are illustrated in Tables 3 and 4. Bulls were compared across breeds for predicted profit when used on 30 cows for each of two years. As described by Miller et al. (1998), the Beef Builder guide (BB) selects bulls where progeny are sold on the current market with discounts for overweight carcasses but no premium for marbling. Prime Plus was designed to select for a specialised dam line with surplus heifers and steer progeny satisfying a niche market demanding an optimal smaller carcass weight with a higher degree of marbling.

Across Breed Comparisons (ABC's) presented are relative to a rolling base where animals born in the most recent three years would have an average ABC of zero. Generally, a different type of animal is selected for each of the specific markets, with some overlap. Beef Builder stresses efficient beef production with less emphasis on traits expressed in females such as fertility, milk and mature cow size. The economically optimum carcass weight in BB is higher than in PP, as a result less emphasis is placed on finishing ability for most bulls. Generally, contrasting the two guides, bulls at the top of BB could be described as efficient growth with more emphasis on retail yield. Bulls in the top ten represent an array of breeds including British, Continental and composites. The PP guide on the other hand places more emphasis on maternal traits with an optimum carcass weight, in concert with increased marbling and more emphasis on moderating cow weights. Breeds that excel at PP are generally British or composites with British influence.

The importance of the selection guides becomes apparent as one tries to simultaneously consider all of the 9 traits as well as their related traits such as carcass weights, retail yield, mature cow weights etc. The BB list illustrates how different animals are perhaps profitable for different reasons with the importance of considering all measures when selecting animals. For example, some animals, although not as high for growth, have high predicted retail yields through their rib-eye area ABC and predicted carcass weight at a constant finish. Considering only a few traits such as growth and birth weight would miss these potentially profitable sire choices. The importance of the selection guide is even more apparent in the PP line. In the PP line, in addition to the emphasis on maternal traits there is a balance to strike between growth, finishing ability and marbling. The PP line is an example where more is not necessarily better. For a bull to do well he must combine high, efficient growth with the backfat ABC to moderate mature size and keep carcass weights on target for the grid pricing. This efficient production of a carcass of the desired weight must coincide with increased marbling to match price grid specifications. This balance among traits cannot be achieved in the PP line through a simple linear combination of traits and their weightings when comparison across the entire population of animals is desired.

Results presented for the selection guides have considered some standard management practices and herd parameters. The software in development is cutomizable for the individual producers specific production and marketing scenario. Specific items of customization include, definable costs including calving and feed costs for example, herd size, replacement rate, age structure, genetic composition of cow herd, marketing grid, and feeding program. Resulting from this customization would potentially be a separate ranking of bulls for each herd. The software can also be used as a tool for management and decision support.

Table 1. Number of records used by breed and trait

Breed	ADG[b]	SC	FI	HH	BF	WT	REA
AN[a]	2112	2099	157	2113	2070	2316	96
AR	817	796	51	805	805	803	212
BD	1404	1388	232	1397	1395	1397	225
CH	6452	6548	558	6565	6492	7271	540
HE	4863	5049	91	5040	5068	6646	0
HP	3223	3171	185	3186	3144	3000	169
LM	8395	8461	570	8482	8431	8630	721
MA	457	457	32	461	455	469	39
SA	414	407	11	411	410	410	52
SM	6406	6566	534	6538	6482	7151	355
SS	967	957	14	984	1037	1157	30
SV	391	386	0	392	392	392	95
Totals	35901	36285	2435	36374	36181	39642	2534

[a]AN = Angus, AR = Red Angus, BD = Blonde D'Aquitaine, CH = Charolais, HE = Hereford, HP = Polled Hereford, LM = Limousin, MA = Maine Anjou, SA = Salers, SM = Simmental, SS = Shorthorn and SV = Shaver Beef Blend

Table 2. Heritabilities and Genetic Correlations

Traits	ADG[b]	SC	FI	HH	BF	WT	REA
ADG	.37	.23	.42	.38	.05	.63	.25
SC		.58	.24	.26	.13	.42	.02
FI			.53	.28	.29	.55	.23
HH				.66	-.11	.64	.15
BF					.43	.16	.03
WT						.50	.44
REA							.37

[b]ADG = average daily gain on 112d test, SC = scrotal circumference at end of test, FI = cumulative feed intake, HH = hip height at end of test, BF = back fat at end of test, WT = weight at end of test, REA = rib-eye area at end of test

Table 3: Top 10 1998 bulls ranked by Beef Builder value with Across Breed Comparisons for evaluated traits

	Selection Guides[a]		Across Breed Comparisons[b]								
BC[c]	BB	PP	BW	WG	M	PWG	BF	REA	SC	FI	IMF
AR	2467	3055	-2	13	9	55	0.66	-0.26	0.6	10	0.19
CH	2374	-1531	3	21	1	58	-0.47	0.63	1.7	93	-0.03
CH	2299	1585	2	14	5	27	0.34	0.44	0.7	-114	-0.25
CH	2219	357	-3	10	0	33	-0.31	0.51	-0.1	-11	-0.20
LM	2214	637	-3	-2	2	20	-0.47	0.78	-1.5	-132	-0.19
CH	2200	1133	3	26	10	33	0.39	0.41	-0.1	24	-0.13
CX	2122	1518	-1	16	9	50	0.16	0.23	0.6	134	0.51
CH	2104	-1770	3	18	7	33	0.77	0.97	0.2	-8	-0.08
SM	2084	-67	2	32	15	50	0.11	0.17	1.1	137	0.02
BD	2050	1445	-2	11	7	0	-0.18	1.13	-1.0	-13	0.08

[a]Predicted difference in profit ($)
[b]Across Breed EPD's , BW = birth weight (lb), WG = weaning gain (lb), M = maternal weaning gain (lb), PWG = post-weaning gain (lb), BF = backfat thickness (mm), REA = rib-eye area (square inches), FI = feed intake (Mcal ME), IMF = intramuscular fat (%)
[c]BC = Breed Code, CX = composite, see Table 1.

Table 4: Top 10 1998 bulls ranked by Prime Plus value with Across Breed Comparisons for evaluated traits

	Selection Guides[a]		Across Breed Comparisons[b]								
BC[c]	PP	BB	BW	WG	M	PWG	BF	REA	SC	FI	IMF
AR	4619	1134	-3	9	2	38	0.94	-0.30	0.77	260	1.10
AR	4390	1294	-5	17	4	20	0.65	-0.82	1.60	-48	0.64
AN	3925	1130	0	25	8	34	1.20	-0.87	1.24	81	0.57
AN	3735	590	1	9	2	29	1.34	-1.02	1.21	36	0.79
HE	3295	1165	-2	9	12	13	0.49	-0.05	0.47	-5	0.57
AN	3142	568	0	14	2	22	1.14	-0.91	0.99	34	0.57
AR	3055	2467	-2	13	9	55	0.66	-0.26	0.59	10	0.19
AN	2985	1002	-4	8	6	13	1.13	-0.56	1.53	22	0.54
AN	2983	128	-2	9	-2	19	1.26	-0.87	-0.25	217	1.13
AR	2837	1919	-2	14	10	42	0.35	-0.05	0.66	87	0.62

[abc] see Table 3.

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INTERNATIONAL GENETIC EVALUATION

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Currently, several breeds have joint Canadian-U.S beef cattle genetic evaluations. These joint evaluations have occurred because breeders and breed associations in both countries have decided it is in their best interests to combine their evaluations, because there are enough common sires used across the two countries to ensure an acceptable level of connectedness and because the research indicates that genetic and phenotypic parameters are similar across the two countries. There has been an interest among some breed associations and breeders in Canada, the U.S. and other countries to expand the joint Canadian-U.S. evaluations to include other countries so that genetic values can be predicted across countries in different hemispheres. The purpose of this paper is to briefly discuss some of the key issues that will need to be considered before international genetic evaluation becomes a reality. Some of these points were touched upon in a previous BIF proceedings paper (Bertrand et al., 1996). Also, the presentation made at the BIF Conference will include some additional information on the genetic correlation of sire breeding values in different countries; this information was not available at the time of manuscript preparation.

International Evaluation: Problems and Possibilities

Since the data banks in the Canada and the U.S. that will contribute to multi-country evaluation is owned by breeders and breed associations, breeders must be convinced that the use of these data banks for the prediction of across country genetic values will provide them a direct economic benefit. International genetic evaluation should provide increased marketing possibilities for Canadian and U.S. breeders. Due to health concerns at the present time, the U.S. and Canada does not accept germ plasm from many of the countries that are major cattle producers; therefore, Canada and the U.S. have somewhat of a competitive advantage due to the virtually unrestricted flow of germ plasm out of these to countries to anywhere in the world. Also at the present time, the largest performance data bases for many breeds are in North America; therefore, bulls from North America will make up a large proportion of sires being evaluated, which should ensure that Canadian and U.S. bulls will fare well in terms of ranking for many traits of economic importance. Multi-country genetic evaluation could also increase the overall accuracy of evaluation because of increases in pedigree information and records. For example, some breeds that are evaluated in Australia and some countries in Europe have traits recorded, such as reproductive and ultrasound carcass information, that may not be available on the same breed in Canada and the U.S. Combining the data from these countries could possibly provide EPDs for Canada and U.S. sires for traits that are limiting in North America. The bottom line is this: if breeders in Canada and the U.S. perceive that there is an economic benefit to multi-country evaluation, then they will support the concept.

There are also some challenges that must be met before international genetic evaluation becomes a widespread reality. If a multi-country evaluation involves the merging of data bases from several countries for the computation of EPDs, some important decisions must be made before this can occur. Breed associations in the different countries must decide where the analysis will be conducted, how to report the results from the analysis and how to share information to answer breeder questions. Breeders do not like the idea of data from their breed association being assembled and analyzed by some genetic evaluation center or university in another country, nor do they particularly like breed association personnel from another country having access to their information, so the breed associations in all countries involved will have to be prepared to compromise and keep focused on the end result--- a multi-trait evaluation that breeders in all participating countries trust and will use. Another practical problem that must be solved before multi-country evaluation can be implemented is the identification of common animals across countries. Breed associations must work together to assist in the identification of animals. Breed associations in all countries should maintain the identification or registration number of the country of origin for any animal that is imported from another country.

There are also some analysis questions that need to be researched and answered before multi-country evaluation is fully implemented. The most important question that must be resolved is deciding if sires that have progeny or maternal grandprogeny in different countries rank the same for EPDs in all the countries. This basic question will help to decide if a joint evaluation that combines the data from all countries can be conducted or if traits in different countries should be considered as different traits. It must also be determined whether heritablilites, genetic correlations and phenotypic variances are similar across countries. The answers to the above questions will provide information as to the type of models that will be used to analyze the data, and will indicate whether one set of common EPDs can be used across all the countries or whether EPDs will need to be different for each country. Meyer (1995) examined the New Zealand and Australian Angus populations and concluded that the genetic parameters across the two countries were very similar and that the correlations between the breeding values of sires with fairly high accuracies in both countries agreed with their expectations. Furthermore, Meyer (1995) stated that a joint evaluation that considered the Angus populations in the two different countries as one single population would increase the accuracy of evaluation for animals that had progeny across the two countries. In some recent unpublished research conducted at the University of Georgia, the Hereford populations from Canada, Uruguay and the U.S. were randomly sampled to form ten weaning weight data within each country that contained an average of approximately 20,000 weaning weight records. The parameters averaged across the data sets are presented in table 1. The direct and maternal heritabilites are similar across the three countries. The differences among all the parameters do not appear to be large enough to be concerned about heterogeneous heritabilites or (co)variances. Research will continue with these three populations to determine if sires with progeny and grandprogeny in each of the countries are ranking the same across the three countries.

Before an international analysis can be conducted, there must be enough common sires used across the two countries to "connect" both populations. For example, a couple of years ago the Uruguayan and the joint Canadian-U.S. Hereford populations were examined. At that time 88,758 weaning weight records were available in the Uruguayan data set after editing. There were 303 sires that had 13,069 progeny records in the Uruguayan data set and these sires also had 168,020 progeny in the joint Canadian-U.S. data set. There were 187 maternal grandsires that had 13,518 grandprogeny records in the Uruguayan data set that also had 171,018 grandprogeny records in the joint Canadian-U.S. data set. It would appear from this information that the Hereford population in Uruguay is connected to the population in Canada and the U.S. However, there is no criteria currently available to determine the minimum amount of "connectedness" that must exist between countries before multi-country analyses can be implemented. Research is needed to quantify the effects of low amounts of "connectedness" on the genetic values produced in a multi-country evaluation.

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Table 1. The Average Parameter Estimates From an Analyses of 10 Hereford Weaning Weight Data Sets From Each of Three Countries

Parameter[a]	AHA	CHA	U
$\sigma^2_A(h^2_A)$	668.6 (.24)	610.8 (.20)	700.4 (.23)
$\sigma_{AM}(r_{am})$	-233.3 (-.42)	-188.4 (-.35)	-315.3 (-.50)
$\sigma^2_M(h^2_M)$	454.1 (.16)	483.7 (.16)	557.6 (.18)
σ^2_{PE}	461.4	626.5	482.9
σ^2_E	1468.6	1467.4	1631.2
σ^2_P	2819.4	3000.0	3056.7

[a]σ = direct variance, σ_{AM} = covariance between direct and maternal effects, σ^2_M = maternal variance, σ^2_{PE} = maternal permanent environmental variance, σ^2_E = error variance, σ^2_P = phenotypic variance, h^2_A = direct heritability, r_{am} = genetic correlation between direct and maternal effects and r_{am} = maternal heritability.

CURRENT RESEARCH ON GENETIC EVALUATION OF CARCASS TRAITS

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Introduction

Genetic evaluation research on carcass traits at the Lethbridge Research Centre utilizes a combination of industry and experimental data. Current projects focus on: the determination of appropriate composite lean yield and related lean growth traits; determination of appropriate selection methods for composite traits (selection on the composite itself versus a selection index of the component traits); including maternal genetic effects in carcass trait genetic evaluation models; contribution of preweaning growth and maternal effects for prediction of carcass trait breeding values; and development of testing programs for live animal ultrasound measured traits. A short summary of research findings to date are included in the next section.

Research Findings

Development of genetic evaluation, selection and testing procedures for carcass and meat quality traits.

N. Caron and R.A. Kemp

A total of 3994 carcass records from the Canadian Charolais Conception to Consumer (C to C) program (an organized progeny test) were available. Calves were born and raised to weaning in several commercial herds in Western Canada from 1975 to 1996. At weaning, all calves were placed in one commerical feedlot until reaching the desired slaughter end point (fat thickness). All calves were progeny of 170 Charolais sires mated to cows of various breed types. Measurements of carcass weight (CW), ribeye area (REA) and average fat thickness (FAT) were used to predict lean yield (LY) as follows: LY(%) = 57.96 - (.027 CW, kg) + (.212 REA, cm^2) - (.703 FAT, mm). Then, LY was used to calculate four composite lean yield measures using the following equations:

1) lean carcass weight (LW, kg) = CW LY,
2) lean growth rate 1 (LGR1, g/d) = [(CW LY) - (BW DP LY)] $(AGE)^{-1}$,
3) lean growth rate 2 (LGR2, g/d) = (CW LY) $(AGE)^{-1}$, and
4) lean growth rate 3 (LGR3, g/d) = ADG DP LY

where BW, DP, AGE and ADG are birth weight, dressing percentage (constant at 60%), age at slaughter and post-weaning average daily gain, respectively. The model included contemporary group and dam breed type as fixed effects. Records were preadjusted for age at slaughter within year. For carcass traits, heritabilities were .20, .36 and .30 for CW, REA and FAT, respectively, and were similar to previous reports. Heritabilities for composite traits were moderate and ranged from .24 for LGR3 to .40 for LY. Among the composite traits, LY was most closely associated to composition of gain (REA and FAT) while LGR3 was least associated. LGR2 appeared to make an acceptable compromise between composition of gain and growth rate, and therefore, a good biological index. Another alternative would be to select for LY as it was relatively uncorrelated to most component traits (CW and BW) although a possibly antagonistic genetic association with marbling should be investigated. In this case, LY could be incorporated into an economic selection index along with EPD for other traits (e.g. growth) currently evaluated.

Maternal (co)variance components for carcass trait breeding values among crossbred beef cattle.

D.H. Crews, Jr. and R.A. Kemp

To test the significance of maternal components of (co)variance in beef carcass trait breeding value estimation, data from Limousin-sired crossbred steers (n = 1015) and heifers (n = 957) out of 15 different types of F1 and back-cross dams and born between 1981-1986 at two locations were analysed using four animal models in which zero to three maternal (co)variance components were estimated. Model 1 included only direct genetic effects and model 2 included direct and maternal components with the direct by maternal covariance constrained to zero. Model 3 was similar to model 2 without the constraint on the direct by maternal covariance. Model 4 included the terms of model 3 plus a maternal permanent environmental component. Carcass traits analysed included hot carcass weight (HCW), average fat thickness (FAT), ribeye area (REA), marbling score (MAR) and percent carcass lean yield (PLY). Likelihood ratio test statistics were used to compare relative improvement in model fit as an increasing number of maternal components were included in the model. Likelihood values of models 2, 3 and 4 did not improve ($P < .60$) fit compared to model 1 for HCW. Only a minor increase in likelihood ($P < .16$) was observed between models 1 and 2 for PLY. Improvement ($P < .09$) in model fit was observed for FAT, REA and MAR in model 2 versus model 1, however, the direct by maternal covariance and maternal permanent environmental variances for these traits were not different ($P > .80$) from zero. Direct heritability for FAT, REA, MAR and PLY was reduced from 10 to 20 percent in model 2 versus model 1. Maternal heritability estimates were .09, .06, .09 and .05 for FAT, REA, MAR and PLY, respectively. Correlations among breeding values from models 1 through 4 were greater than .99, .96, .97, .94 and .96 for HCW, FAT, REA, MAR and PLY, respectively. These results indicate that although maternal components may be different from zero for some carcass traits, breeding values estimated using models containing maternal components would be similar to those estimated with models including only direct effects.

Contributions of preweaning growth information and maternal effects for prediction of carcass trait breeding values among crossbred beef cattle.

D.H. Crews, Jr. and R.A. Kemp

Preweaning and carcass trait records from crossbred steers (n = 1015) and heifers (n = 957) were used to estimate genetic parameters and to investigate the efficacy of maternal effects and preweaning growth information for improving estimation of EBV for carcass traits of crossbred beef cattle. Dams (n = 775) representing three F1 and twelve back-cross combinations involving the Charolais, Hereford, Angus, Simmental and Shorthorn breeds were mated over six years to Limousin bulls (n = 36) at two locations in western Canada. Four animal models, involving from zero to four maternal (co)variances were used to analyse four carcass traits. Rank and simple correlations indicated that maternal effects were relatively unimportant for estimation of direct carcass trait breeding values. Direct heritabilities were .28, .12 and .16 for birth weight, preweaning daily gain and weaning weight, and were .20, .35, .50 and .38 for hot carcass weight, fat thickness, ribeye area and percent lean yield, respectively. Maternal heritabilities were .21, .22 and .40 for birth weight, preweaning daily gain and weaning weight, respectively. Estimated genetic correlations between percent lean yield and hot carcass weight, fat thickness and ribeye area were -.05, -.85 and .39, respectively, and .30 between hot carcass weight and ribeye area. Direct genetic effects for birth weight had moderate (.51 to .54) correlations with direct effects for carcass weight, ribeye area and percent lean yield. Direct genetic effects for fat thickness were negatively correlated with direct effects for birth weight (-.44), preweaning daily gain (-.15) and weaning weight (-.25). Maternal genetic effects for preweaning traits had near zero correlations with direct genetic effects for fat thickness and percent lean yield. Ratios of breeding value prediction error variance from multivariate versus univariate models for carcass traits were constructed and deviations from their expectation were tested using GLM procedures. Adding preweaning growth information to sire and dam genetic evaluations for carcass traits slightly decreased prediction error variance for breeding values and would be recommended when information on carcass traits is limited.

Deposition patterns of carcass yield traits measured using ultrasound in composite bulls and heifers.

D.H. Crews, Jr., R.A.Kemp, N.H. Shannon and R.E.Carlson

Serial ultrasound measures were collected from composite bulls (n = 150) and heifers (n = 201) born in 1995 to examine the deposition of carcass yield traits from weaning in late October (229 d of age) to approximately 425 d of age. During the post-weaning period, animals were managed on a typical replacement regime (196 d) where bulls gained 1.15 kg per d and heifers gained .7 kg per d. Live weight (LWT) and ultrasonic measures of back fat (FAT) and ribeye area (REA) were recorded every 28 d during the post-weaning period. Ultrasound measures were made using an Aloka SSD-1100 Flexus real time ultrasound unit with a 17.5 cm linear 3.5 MHZ probe attached. Digitized images were analysed using Jandel SigmaScan Pro software. Percent lean yield (PLY)

was estimated using a constant dressing percent of .60 to scale LWT to an approximate carcass weight equivalent as: 57.34 - (.032 (LWT .60)) + (.212 REA) - (.681 FAT). To test for heterogeneity of slopes between sexes, a model including sex, linear and quadratic effects of age and the interaction of sex with linear and quadratic age was fit. Heterogeneity ($P < .01$) of slopes was detected for LWT, FAT and PLY, indicating the necessity to nest age coefficients within sex in the final model. No important ($P <$ .07) sex by age interactions were detected for REA and therefore were removed from the final model. The main effect of sex were important ($P < .01$) for ultrasound traits and PLY. Sex effect solutions indicated differences of 58.5 kg for LWT ($P < .27$), -10.1 mm for FAT ($P < .01$), 8.64 cm^2 for REA ($P < .01$) and 9.23 percent for PLY ($P < .01$), where bulls were heavier, had less FAT and larger REA. Linear coefficients for age differed (P $< .01$) between bulls and heifers for FAT and PLY. Quadratic effects of age in the final bull and heifer equations for LWT, FAT and REA were positive but were negative for PLY. Estimated lean yield differed by approximately two percent between bulls and heifers at 425 d of age. With the exception of REA, deposition of carcass yield traits was different with respect to sex and age within sex during the post-weaning period of composite bulls and heifers.

Phenotypic associations among serial ultrasound and carcass measures of composite beef steers.

D.H. Crews, Jr., R.A. Kemp, N.H. Shannon and R.E. Carlson

Ultrasound and carcass records from composite steers (n = 120) were used to estimate phenotypic correlations and the usefulness of serial ultrasound to predict carcass merit. Composite steers in each of two years were fed following weaning (late October) until slaughter (458 d of age) when live weight and ultrasound back fat reached a minimum of 500 kg and 7 mm, respectively. Ultrasound measures recorded at a mean age of 371 d (YR) and prior to slaughter (SL) were used. Carcass traits included hot carcass weight (CW), fat thickness (BF), ribeye area (REA), Warner-Bratzler shear force (WBS), percent intramuscular fat (IMF) and marbling score (MAR). Also, percent lean yield (PLY) was estimated. Ultrasound measures included backfat thickness (YRF and SLF) and ribeye area (YRR and SLR). Percent lean yield at YR (YRY) and SL (SLY) was computed using live weight and ultrasound measures of BF and REA. In each year, an unrelated nutritional trial was imposed during feeding. Residual correlations were estimated from a linear model including the effects of year, nutritional treatment and their interaction. Correlations ($P < .03$) between YRF and SLF with BF were .75 and .68., with IMF were .33 and .31, with MAR were 0 and .20 and with WBS were 0 and 0, respectively. Correlations between YRR and SLR with REA were .50 and .78, respectively. Correlations between YRR and SLR with MAR, IMF and WBS were not different from zero. Correlations between YRY and SLY with PLY were .59 and .76, with IMF were -.19 and -.20, respectively, but were near zero with MAR and WBS. Correlations between YRF with SLF, YRR with SLR and YRY with SLY were .66, .50 and .65, respectively. Ultrasound measures of BF had similar associations with BF at YR and SL. Correlations between ultrasound measures at YR and SL were moderate. All correlations between ultrasound and carcass quality traits were low to non-existent.

Ultrasound measures taken near yearling ages must be interpreted with care when inferences about carcass traits are desired.

Summary

Genetic evaluation research on carcass traits will continue at the Lethbridge Research Centre. An increased emphasis on utilization of live animal ultrasound measures in genetic evaluation will result in development of appropriate models and estimation of genetic and non-genetic relationships among serial ultrasound and carcass and meat quality traits using progeny and sib data. In addition, development of appropriate sex-specific ultrasound traits and testing regimens will be investigated. Development of selection criteria and selection indexes associated with lean and carcass yield and lean growth rate will also continue. As a component of the selection index work, an economic analysis aimed at determining appropriate economic weights for the major carcass and meat quality traits will also commence in the near future.

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ACROSS-BREED EPD TABLES FOR 1998 ADJUSTED TO A 1996 BASE

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INTRODUCTION

This report is the 1998 update of estimates of sire breed means from data of the Germplasm Evaluation project at the U.S. Meat Animal Research Center (MARC) adjusted to a 1996 base using EPDs from the most recent national cattle evaluations.

Changes from the 1997 update (Van Vleck and Cundiff, 1997) are:

1) Birth weights were available for 124 more Hereford, 117 more Angus, and 21 more Gelbvieh calves. New Hereford bulls (11) and Angus bulls (11) used in Cycle VI had calves with birth and weaning weights. About 20 Hereford and 19 Angus bulls used in Cycle IV also had new calves in Cycle VI with birth and weaning weights used in this update. The increase in Gelbvieh calves with birth, weaning and yearling weights was due to one additional Gelbvieh bull having a reported EPD.
2) The Gelbvieh sire also had five daughters having 18 of his grand progeny that had weaning weights for the maternal analyses. Additional daughters (16, 6 and 11, respectively) of Hereford, Angus, and Brahman sires also had progeny with weaning weights in the maternal analyses. Previous daughters also had more records so that the total gains were 120 Hereford, 93 Angus and 97 Brahman grand progeny.
3) Changes in the national Simmental genetic evaluations are reflected in this report. A trial run was done in the summer of 1997 (Bruce Cunningham, personal communication).
4) The model for analyses of BWT, WWT, and YWT were changed to reflect recent research (Van Vleck and Cundiff, 1997-1998). Sex of calf by age of dam by breed of dam combination was included to account for apparent interaction. Similarly, separate regressions on calendar day of birth were done for each breed of dam to account for confounding of calving seasons with breed of dam.

METHODS

The calculations are as outlined in the 1996 BIF Guidelines. The basic steps were given by Notter and Cundiff (1991) with refinements by Núñez-Dominguez et al. (1993), Cundiff (1993, 1994), Barkhouse et al. (1994, 1995), and Van Vleck and Cundiff (1997, 1998). All calculations were done with programs written in Fortran language with estimates of variance components, regression coefficients, and breed effects obtained with the MTDFREML package (Boldman et al., 1995). All breed solutions were reported as a difference from Angus. The table values to add to within-breed EPDs are relative to Angus.

For completeness, the basic steps in the calculations will be repeated.

Models for Analysis of MARC Records

The fixed effects in the models for birth weight, weaning weight (205-d) and yearling weight (365-d) were: breed of sire (12), dam line (Hereford, Angus, MARC III Composite) by sex (female, male) by age of dam (2, 3, 4, 5-9, 10 yr) combination (26), year of birth (70-76, 86-90, 92-94 and 97 for BWT and WWT) and a separate covariate for day of year at birth of calf for each breed of dam. Dam of calf was included as a random effect to account for correlated maternal effects for cows with more than one calf (3091 dams for BWT, 2876 for WWT, 2604 for YWT). For estimation of variance components and to estimate breed of sire effects, sire of calf was also used as a random effect (412).

Variance components were estimated with a derivative-free REML algorithm. At convergence, the breed of sire solutions were obtained as were the sampling variances of the estimates to use in constructing prediction error variance for pairs of bulls of different breeds.

For estimation of coefficients of regression of progeny performance on EPD of sire, the random sire effect was dropped from the model. Pooled regressions, regressions by sire breed, by dam line, and by sex of calf were obtained. These regressions are monitored as accuracy checks and for possible genetic by environment interactions. The pooled regression coefficients were used as described later to adjust for genetic trend and bulls used at MARC.

The fixed effects for the analyses of maternal effects included breed of maternal grandsire (12), maternal grand dam line (Hereford, Angus, MARC III), breed of natural service mating sire (15), sex of calf (2), birth year-GPU cycle-age of dam subclass (62), and mating sire breed by GPU cycle by age of dam subclass (34) with covariate for day of year of birth. The subclasses are used to account for confounding of years, mating sire breeds, and ages of dams. Ages of dams were (2, 3, 4, 5-9, 10 yr). For estimation of variance components and estimation of breed of maternal grandsire effects, random effects were maternal grandsire (367) and dam (1816 daughters of maternal grandsires). For estimation of regression coefficients of grand progeny weaning weight on maternal grandsire EPD for weaning weight and milk, random effects of both maternal grandsire and dam (daughter of MGS) were dropped from the model.

Adjustment of MARC Solutions

The calculations of across-breed adjustment factors rely on solutions for breed of sire or maternal grandsire from records at MARC and on within-breed EPDs. The records from MARC are not included in within-breed EPD calculations.

The basic calculations for BWT, WWT, and YWT are as follows:

MARC breed of sire solution adjusted for genetic trend:

$$M_i = MARC\ (i) + b[EPD(i)_{1996} - EPD(i)_{MARC}]$$

Breed table factor to add to EPD for bull of breed i:

$$A_i = (M_i - M_x) - (EPD(i)_{1996} - EPD(x)_{1996})$$

where,

MARC(i) is solution from mixed model equations with MARC data for sire breed i,

$EPD(i)_{1996}$ is the average within-breed EPD for breed i for animals born in 1996,

$EPD(i)_{MARC}$ is the weighted (by number of progeny at MARC) average of EPD of bulls of breed i having progeny with records at MARC,

b is the pooled coefficient of regression of progeny performance at MARC on EPD of sire (for 1998: 1.08, .90, and 1.18 for BWT, WWT, YWT),

i denotes breed i, and

x denotes the base breed x, which is Angus in this report.

The calculations to arrive at the Breed Table Factor for milk are more complicated because of the need to separate the direct effect of the maternal grandsire breed from the maternal (milk) effect of the breed.

MARC breed of maternal grandsire solution for WWT adjusted for genetic trend:

$$MWWT(i) = MARC(i)_{MGS} + b_{wwt}[EPD(i)_{96WWT} - EPD(i)_{MARCWWT}] + b_{MLK}[EPD(i)_{96MLK} - EPD(i)_{MARCMLK}]$$

MARC breed of maternal grandsire solution adjusted for genetic trend and direct genetic effect:

$$MILK(i) = [MWWT(i) - .5\ M(i)] - [MWWT - .5\ M]$$

Breed table factor to add to EPD for MILK for bull of breed i:

$$A_i = [MILK(i) - MILK(x)] - [EPD(i)_{96MLK} - EPD(i)_{MARCMLK}]$$

where,

$MARC(i)_{MGS}$ is solution from mixed model equations with MARC data for MGS breed i for WWT,

$EPD(i)_{96WWT}$ is the average within-breed EPD for WWT for breed i for animals born in 1996,
$EPD(i)_{MARCWWT}$ is the weighted (by number of grand progeny at MARC) average of EPD for WWT of MGS of breed i having grand progeny with records at MARC,

$EPD(i)_{96MLK}$ is the average within-breed EPD for MILK for breed i for animals born in 1996,

$EPD(i)_{MARCMLK}$ is the weighted (by number of grand progeny at MARC) average of EPD for MILK of MGS of breed i having grand progeny with records at MARC,

b_{WWT}, b_{MLK} are the coefficients of regression of performance of MARC grand progeny on MGS EPD for WWT and MILK (for 1998: .51 and 1.22),

$M(i) = M_i$ is the MARC breed of sire solution from the first analysis for WWT direct adjusted for genetic trend,

MWWT and M are unneeded constants corresponding to unweighted averages of MWWT(i) and M(i) for i = 1,...,12, the number of sire and maternal grandsire breeds.

RESULTS

Tables 1, 2, and 3 (for BWT, WWT and YWT) summarize the data from, and results of, MARC analyses to estimate breed of sire differences and the adjustments to the breed of sire effects to a 1996 base. The last column of each table corresponds to the "breed table" factor for that trait. The number of MARC progeny with records was the same for 1998 as for 1997 except for an increase in Herefords of 124, Angus of 117, and 21 Gelbvieh sired calves and 11, 11, and 1 additional bulls, respectively, for the three breeds. Changes from 1997 are not great except for Simmental which in the last year made changes in their genetic evaluation procedures. Other smaller changes could also be due to any changes in edits or genetic parameters used for the National Cattle Evaluations.

Table 4 summarizes the calculations for the table adjustment for MILK EPDs. Because daughters of the MGS are still producing calves and some bulls were reported for the first time, some new grand progeny had records; 120 more Hereford, 93 more Angus, 97 more Brahman, and 18 Gelbvieh grand progeny of the newly reported sire. Changes in 1998 compared to 1997 were less than 4 lb with most from 0 to 2 lb except for Simmental which had a major change in the evaluation model.

Table 5 summarizes the average BIF accuracy for bulls with progeny at MARC weighted by number of progeny or grand progeny. Table 6 reports the estimates of variance components from the records that were used in the mixed model equations to obtain breed of sire and breed of MGS solutions. Neither Table 5 nor Table 6 changed much from 1997.

Table 7 updates the coefficients of regression of MARC progeny on EPD for BWT, WWT and YWT which have theoretical expected values of 1.00. The standard errors of the specific breed regression coefficients are large relative to the regression coefficients. One noticeable pattern, which may have a biological basis, is the decrease in the Brahman regression from birth to yearling age with regression coefficients of 1.59 for BWT, 1.09 for WWT, and .78 for YWT. Brahman sired calves from purebred Brahman dams are known to be smaller than calves from dams of other breeds. Changes in regressions by sire breed compared to 1997 are larger than expected. They may be due to different modeling of fixed effects and calendar birth day covariates this year.

The regressions by sex for YWT EPD changed from last year so that the female regression (1.13) is smaller than the male regression (1.23) whereas in 1997 the reverse was found (1.29 and 1.19). This change was thought to be due to joint adjustment for sex, age of dam and dam breed. However, when YWT records of progeny of the additional Gelbvieh bull were deleted, the regressions also were 1.13 and 1.23. Because all other records from MARC were the same as in 1997, the reason for the change in regressions on EPD by sex must be due to changes in EPD from 1997 to 1998. The regression on EPD for Hereford cows increased to .83 ± .11 with more progeny and/or the change in modeling of sex and age of dam or of separate covariates for calendar day of birth compared to the small regression of .45 ± .12 reported in 1997. Similarly, the regression of grand progeny performance on MGS EPD for WWT (Table 8) increased for Hereford dams to be closer to the theoretical regression of .50 (i.e., .41 ± .08 in 1998 compared to .26 ± .09 in 1997) with the addition of about 10% more grand progeny of Hereford maternal grandsires.

The coefficients of regression of grand progeny on MGS EPD for WWT and MILK are shown in Table 8. The theoretical expected values of the regression coefficients are .50 for WWT and 1.00 for MILK. The standard errors for regression coefficients associated with heifers and steers overlap for milk EPD.

Prediction Error Variances of Across-Breed EPD

The standard errors of differences in the solutions for breed of sire and breed of MGS differences from the MARC records can be adjusted by theoretical approximations to obtain variances of adjusted breed differences (Van Vleck, 1994: Van Vleck and Cundiff, 1994). These variances of estimated breed differences can be added to prediction error variances of within-breed EPDs to obtain prediction error variances (PEV) or equivalently standard errors of prediction (SEP) for across-breed EPDs (Van Vleck and Cundiff 1994, 1995). The variances of adjusted breed differences are given in the upper triangular part of Table 9 for BWT, lower triangular part of Table 9 for YWT, upper triangular part of Table 10 for direct WWT, and lower triangular part of Table 10 for MILK. How to use these to calculate standard errors of prediction for expected progeny differences of pairs of bulls of the same or different breeds was discussed in the 1995 BIF proceedings (Van Vleck and Cundiff, 1995).

Even though the variances of estimates of adjusted breed differences look large, especially for YWT and MILK, they generally contribute a relatively small amount to standard errors of predicted differences. For example, suppose for WWT a Salers bull has an EPD of 15.0 with prediction error variance of 75 and a Hereford bull has an EPD of 30.0 with PEV of 50. The difference in predicted progeny performance is (Salers adjustment + Salers bull's EPD) - (Hereford adjustment + Hereford bull's EPD):

$$(29.6 + 15.0) - (3.3 + 30.0) = 44.6 - 33.3 = 13.6.$$

The prediction error variance for this difference is (use upper Table 10 at intersection of row for HE and column for SA):

V(Salers breed - Hereford breed) + PEV(Salers bull) + PEV(Hereford bull):

$$22.4 + 75 + 50 = 147.4$$

with

standard error of prediction $\sqrt{147.4} = 12.1$.

If the difference between the Salers and Hereford breeds in 1996 was estimated perfectly, the variance of the estimate of the breed difference would be 0 and the standard error of prediction between the two bulls would be:

$\sqrt{0 + 75 + 50} = 11.2$ which is only slightly smaller than 12.1.

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Table 1. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1996 base and factors to adjust within breed EPDs to Angus equivalent - BIRTH WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Ave. Base EPD Breed 1996 (2)	Ave. Base EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1996 Base + Ang (6)	Adjust to 1996 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	78	982	86	3.7	2.5	89	4.3	91	5.0	4.0
Angus	79	793	85	2.7	2.1	85	.0	86	.0	.0
Shorthorn	25	181	87	1.9	1.0	92	7.1	93	7.5	8.3
Brahman	28	422	100	1.5	1.0	99	13.6	99	13.5	14.7
Simmental	28	422	85	3.8	3.5	94	8.7	94	8.4	7.3
Limousin	20	387	80	1.0	-1.2	90	4.6	92	6.4	8.1
Charolais	63	583	88	1.8	.8	95	9.8	96	10.3	11.2
Maine-Anjou	15	174	94	-.2	1.2	96	11.5	95	9.4	12.3
Gelbvieh	25	386	89	-.2	-1.3	92	6.5	93	7.2	10.1
Pinzgauer	16	435	84	-.1	-.4	92	6.7	92	6.4	9.2
Tarentaise	7	199	80	2.4	1.7	90	5.1	91	5.2	5.5
Salers	27	189	85	.9	1.2	91	5.6	90	4.7	6.5

Calculations:
(4) = (5) + (1, Angus)
(6) = (4) + b[(2) - (3)] with b = 1.08
(7) = (6) - (6, Angus)
(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 2. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1996 base and factors to adjust within breed EPDs to Angus equivalent - WEANING WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Ave. Base EPD Breed 1996 (2)	Ave. Base EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1996 Base + Ang (6)	Adjust to 1996 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	78	925	511	29.5	16.7	492	3.0	504	4.9	3.3
Angus	79	722	489	27.9	17.3	489	.0	499	.0	.0
Shorthorn	25	170	521	12.3	7.4	508	18.9	512	13.8	29.4
Brahman	28	358	541	10.2	6.3	513	24.2	517	18.1	35.8
Simmental	27	368	470	33.7	13.7	511	21.7	529	30.2	24.4
Limousin	20	338	445	8.1	-9.3	497	8.1	513	14.2	34.0
Charolais	62	506	491	12.0	2.2	516	26.9	525	26.1	42.0
Maine-Anjou	15	155	460	1.9	.8	513	23.7	514	15.1	41.1
Gelbvieh	25	355	484	5.1	-3.6	516	27.3	524	25.5	48.3
Pinzgauer	16	415	478	.6	-4.1	498	8.5	502	3.1	30.4
Tarentaise	7	191	476	11.3	-4.8	500	10.6	514	15.6	32.2
Salers	27	176	525	10.1	8.2	509	19.7	510	11.8	29.6

Calculations:
(4) = (5) + (1, Angus)
(6) = (4) + b[(2) - (3)] with b = .90
(7) = (6) - (6, Angus)
(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 3. Breed of sire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1996 base and factors to adjust within breed EPDs to Angus equivalent - YEARLING WEIGHT (lb)

Breed	Number Sires	Number Progeny	Raw MARC Mean (1)	Mean EPD Breed 1996 (2)	Mean EPD MARC Bulls (3)	Breed Soln at MARC + Ang (4)	Breed Soln at MARC vs Ang (5)	Adjust to 1996 Base + Ang (6)	Adjust to 1996 Base vs Ang (7)	Factor to adjust EPD to Angus (8)
Hereford	68	762	848	50.5	24.6	836	-7.5	867	-4.8	-4.4
Angus	68	576	844	50.9	27.3	844	.0	872	.0	.0
Shorthorn	25	168	918	19.2	14.3	875	31.2	881	9.0	40.7
Brahman	28	312	841	17.2	10.4	813	-30.6	821	-50.5	-16.8
Simmental	27	332	795	51.6	11.5	868	23.5	915	43.1	42.4
Limousin	20	334	740	15.3	-14.1	831	-13.3	866	-6.4	29.2
Charolais	62	468	849	21.1	4.2	884	40.1	904	32.2	62.0
Maine-Anjou	15	154	791	2.7	2.7	878	33.7	878	5.7	53.9
Gelbvieh	25	353	819	9.6	-6.0	864	20.5	883	11.0	52.3
Pinzgauer	16	347	838	.7	-8.0	841	-2.9	851	-20.6	29.6
Tarentaise	7	189	807	20.7	-4.1	833	-11.2	862	-9.8	20.4
Salers	27	173	898	16.5	14.0	869	25.4	872	.5	34.9

Calculations:
(4) = (5) + (1, Angus)
(6) = (4) + b[(2) - (3)] with b = 1.18
(7) = (6) - (6, Angus)
(8) = (7) - (7, Angus) - [(2) - (2, Angus)]

Table 4. Breed of maternal grandsire solutions from MARC, mean breed and MARC EPDs used to adjust for genetic trend to 1996 base and factors to adjust within-breed EPDs to Angus equivalent - MILK (lb)

				Raw MARC	Mean EPD				Breed Soln at MARC MWWT		Adjust to 1996 Base			Factor to adjust MILK EPD
		Number			Breed		MARC				MWWT		MILK	
Breed	Sr	Gpr	Daughters	Mean (1)	WWT (2)	MILK (3)	WWT (4)	MILK (5)	+ Ang (6)	vs Ang (7)	+ Ang (8)	vs Ang (9)	(10)	to Angus (11)
Hereford	63	1325	349	473	29.5	9.2	11.2	.6	475	-12.5	494	-9.8	-14.9	-9.6
Angus	65	872	242	487	27.9	11.9	11.1	4.9	487	.0	504	.0	-2.6	.0
Shorthorn	22	251	69	527	12.3	2.5	7.3	7.6	516	29.0	512	8.2	-1.4	10.7
Brahman	28	482	155	517	10.2	5.0	6.1	3.3	526	39.2	530	26.2	14.5	24.0
Simmental	27	796	152	513	33.7	9.0	13.7	11.0	522	35.1	530	25.8	8.0	13.6
Limousin	20	764	150	477	8.1	2.4	-9.3	.1	484	-2.7	496	-8.1	-17.9	-5.7
Charolais	56	901	195	501	12.0	5.6	1.5	2.0	503	15.9	513	8.5	-7.2	1.7
Maine-Anjou	14	355	63	536	1.9	.0	.6	-.9	522	34.9	524	19.4	9.2	23.8
Gelbvieh	25	653	143	537	5.1	1.9	-3.7	-.3	526	39.2	533	29.2	13.8	26.4
Pinzgauer	15	545	133	504	.6	-1.0	-1.7	6.4	508	21.2	500	-3.8	-8.0	7.5
Tarentaise	6	341	78	513	11.3	2.0	-6.0	4.8	516	28.8	521	17.1	6.6	19.2
Salers	25	351	87	534	10.1	1.5	6.9	5.7	516	29.1	513	8.4	-.1	12.9

Calculations:
(6) = (7) + (1, Angus)
(8) = (6) + b_{WWT} [(2) - (4)] + b_{MLK} [(3) - (5)] with b_{WWT} = .51 and b_{MLK} = 1.22
(9) = (8) - (8, Angus)
(10) = [(9) - Average (9)] - .5[(7, Table 2) - Average (7, Table 2)]
(11) = (10) - (10, Angus) - [(3) - (3, Angus)]

Table 5. Mean weighted[a] accuracies for birth weight (BWT), weaning weight (WWT), yearling weight (YWT), maternal weaning weight (MWWT) and milk (MILK) for bulls used at MARC

Breed	BWT	WWT	YWT	MWWT	MILK
Hereford	.65	.64	.54	.61	.50
Angus	.77	.75	.70	.68	.66
Shorthorn	.80	.78	.66	.80	.77
Brahman	.55	.59	.41	.58	.41
Simmental	.97	.97	.97	.97	.96
Limousin	.96	.95	.93	.95	.92
Charolais	.63	.60	.52	.60	.53
Maine-Anjou	.39	.43	.24	.45	.28
Gelbvieh	.66	.59	.55	.68	.63
Pinzgauer	.85	.68	.62	.70	.64
Tarentaise	.95	.95	.93	.95	.95
Salers	.83	.76	.63	.74	.76

[a]Weighted by number of progeny at MARC for BWT, WWT, and YWT and by number of grand progeny for MWWT and MILK.

Table 6. REML estimates of variance components (lb^2) for birth weight (BWT), weaning weight (WWT), yearling weight (YWT), and maternal weaning weight (MWWT) from mixed model analyses

	Direct			Maternal
Analysis[a]	BWT	WWT	YWT	MWWT
Direct				
Sires (412) within breed (12)	11.7	158	728	
Dams (2876) within breed (3)	29.5	1018	1406	
Residual	68.0	1553	4267	
Maternal				
MGS (367) within MGS breed (12)				220
Daughters within MGS (1816)				879
Residual				1249

[a](Numbers) for weaning weight.

Table 7. Pooled regression coefficients (lb/lb) for weights at birth (BWT), 205 days (WWT), and 365 days (YWT) of F_1 progeny on sire expected progeny difference and by sire breed, dam breed, and sex of calf

	BWT	WWT	YWT
Pooled	1.08 ± .06	.90 ± .07	1.18 ± .07
Sire breed			
Hereford	1.09 ± .11	.83 ± .10	1.06 ± .10
Angus	.94 ± .14	.56 ± .14	1.09 ± .13
Shorthorn	.82 ± .44	.74 ± .43	1.02 ± .34
Brahman	1.59 ± .28	1.09 ± .29	.78 ± .26
Simmental	1.34 ± .31	1.07 ± .28	1.17 ± .27
Limousin	1.11 ± .39	1.22 ± .47	1.87 ± .50
Charolais	1.10 ± .18	.94 ± .22	1.26 ± .20
Maine-Anjou	-.03 ± .51	.60 ± .57	.79 ± .73
Gelbvieh	.77 ± .24	.90 ± .42	.88 ± .33
Pinzgauer	1.24 ± .17	1.49 ± .22	1.66 ± .17
Tarentaise	.78 ± .90	.75 ± .54	1.42 ± .61
Salers	1.22 ± .39	1.07 ± .53	1.17 ± .57
Dam breed			
Hereford	1.09 ± .10	.83 ± .11	1.14 ± .11
Angus	1.16 ± .08	.96 ± .09	1.15 ± .08
MARC III	.90 ± .13	.83 ± .16	1.41 ± .16
Sex of calf			
Female	1.11 ± .08	1.05 ± .09	1.13 ± .09
Male	1.06 ± .08	.74 ± .09	1.23 ± .08

Table 8. Pooled regression coefficients (lb/lb) for progeny performance on maternal grandsire EPD for weaning weight (MWWT) and milk (MILK) and by breed of maternal grandsire, breed of maternal grandam, and sex of calf

Type of regression	MWWT	MILK
Pooled	.51 ± .06	1.22 ± .08
Breed of maternal grandsire		
Hereford	.63 ± .08	.86 ± .13
Angus	.64 ± .12	.99 ± .21
Shorthorn	.30 ± .35	.52 ± .39
Brahman	.71 ± .24	1.21 ± .51
Simmental	.52 ± .24	.73 ± .56
Limousin	.67 ± .35	2.48 ± .34
Charolais	.09 ± .17	1.79 ± .26
Maine-Anjou	-.51 ± .63	.31 ± 1.26
Gelbvieh	.51 ± .30	1.28 ± .37
Pinzgauer	.67 ± .19	.46 ± .58
Tarentaise	.17 ± .58	.77 ± .76
Salers	1.13 ± .36	2.67 ± .38
Breed of maternal grandam		
Hereford	.41 ± .08	1.48 ± .14
Angus	.61 ± .07	1.17 ± .11
MARC III	.35 ± .15	.69 ± .23
Sex of calf		
Female	.55 ± .07	1.31 ± .11
Male	.48 ± .07	1.13 ± .11

Table 9. Variances (lb^2) of adjusted breed differences to add to sum of within breed prediction error variances to obtain variance of differences of across breed EPDs for bulls of two different breeds[a].
Birth weight above diagonal and yearling weight below diagonal

Breed	HE	AN	SH	BR	SI	LI	CH	MA	GE	PI	TA	SA
HE	.0	.4	1.0	.7	1.1	1.1	.7	1.7	.	.9	2.7	.9
AN	34.6	.0	1.0	.7	1.1	1.2	.7	1.8	1.	1.0	2.8	1.0
SH	69.2	71.7	.0	1.4	1.6	1.7	1.1	2.2	1.	1.4	3.3	1.1
BR	53.8	55.0	104.3	.0	1.5	1.5	1.1	2.1	1.	1.2	2.9	1.4
SI	72.9	76.0	109.8	108.5	.0	.9	.8	2.3	1.	1.6	3.4	1.6
LI	75.0	78.4	113.0	110.7	59.8	.0	.9	2.4	1.	1.6	3.4	1.6
CH	47.3	50.3	73.7	82.3	57.5	60.6	.0	1.9	1.	1.1	3.0	1.0
MA	120.3	123.3	154.1	152.7	159.1	161.5	133.6	.0	1.	2.1	3.9	2.2
GE	65.1	68.1	90.4	97.1	103.7	105.1	72.6	113.3	.	1.3	3.2	1.3
PI	66.6	70.9	98.0	89.7	107.8	110.4	79.2	147.1	89.	.0	2.7	1.4
TA	180.2	185.6	219.2	199.1	222.6	225.8	197.4	259.8	208.	179.3	.0	3.3
SA	66.8	70.2	79.3	102.2	108.1	111.4	72.1	152.2	89.	97.3	217.4	.0

[a]For example, a Hereford bull has within breed PEV of 300 for YWT and that for a Shorthorn bull is 200.
Then the PEV for the difference in EPDs for the two bulls is 69.2 + 300 + 200 = 569.2 with SEP = 23.9.

Table 10. Variances (lb^2) of adjusted breed differences to add to sum of within breed prediction error variances to obtain variance of difference of across breed EPDs for bulls of two different breeds. Weaning weight direct above diagonal and MILK below the diagonal

Breed	HE	AN	SH	BR	SI	LI	CH	MA	GE	PI	TA	SA
HE	.0	9.9	23.3	15.0	22.4	23.4	14.6	36.1	19.7	18.2	46.1	22.4
AN	25.5	.0	24.6	16.2	23.8	24.8	16.0	37.4	21.1	20.0	48.4	24.0
SH	56.7	58.6	.0	33.8	36.4	37.8	25.4	49.6	30.2	31.3	61.4	27.9
BR	36.2	37.6	76.5	.0	32.7	33.7	24.8	45.5	29.0	24.0	50.8	32.8
SI	53.1	55.2	86.4	73.9	.0	18.2	16.9	49.8	32.6	32.2	60.9	35.7
LI	57.5	59.8	91.0	78.5	54.0	.0	18.2	50.7	33.2	33.4	62.2	37.1
CH	32.9	34.8	60.9	53.2	43.8	48.4	.0	41.7	23.0	23.7	53.1	24.7
MA	73.5	76.1	106.4	93.0	104.7	109.2	83.7	.0	32.9	43.8	72.1	48.9
GE	44.3	46.2	71.1	63.7	74.4	78.9	51.1	74.6	.0	26.6	56.6	29.7
PI	56.3	59.6	87.2	69.7	88.6	93.1	66.3	105.7	75.3	.0	44.5	30.9
TA	133.8	137.8	169.5	144.5	167.5	172.1	146.6	183.4	155.5	147.1	.0	60.7
SA	47.8	50.4	68.9	67.9	78.0	82.6	52.6	97.9	62.9	79.1	161.0	.0

COMMITTEE SESSION

PRODUCER TECHNOLOGY APPLICATIONS COMMITTEE

MINUTES
PRODUCER TECHNOLOGY APPLICATIONS COMMITTEE MEETING
JULY 2, 1998
Calgary
Alberta, Canada

The meeting was called to order by Sally Dolezal, Oklahoma State University, at 2:00 p.m., on July 2, 1998, at the Convention Center, Calgary, Alberta. Dolezal welcomed participants and described the format of BIF committee meetings. She encouraged all those present to be active in the committee discussion and to provide input for future meetings. The Producer Technology Applications Committee is the newest addition to the BIF committees, designed to encourage interaction between producers, allied industry, and university/extension personnel. The committee's charge is to "showcase" producers who have made improvements in beef cattle selection, breeding, production, management, and (or) marketing through the implementation of BIF guidelines and concepts.

Two new BIF fact sheets submitted to the Board of Directors were described by Dolezal as follows: "Heparin-binding proteins on sperm serve as indicators of fertility of bulls" (Lead author - Roy Ax); "Selection and management practices to increase consistency in beef cattle" (Lead authors – Darrh Bullock and Keith Bertrand).

Dolezal served as moderator for the program outlined below:

Drovers 1997 Quality Survey
Greg Henderson, Editor/Associate Publisher, Drover's Journal

Rancher's Approach to Cow-Calf Strategic Alliances
Joe Paschal, Ph.D., Texas Agricultural Extension Service

Producer Applications: Costs, Inputs, and Profitability
Matt Cherni, D.V.M., Padlock Ranch, Ranchester, WY

Canadian Producer Perspective: Panel Discussion
Neil Harvie, Alberta Cattle Commission, Cochrane, AB
Arno Doerkson, Alberta Cattle Commission, Gem, AB

Canadian producers Neil Harvie, Cochrane, AB, and Arno Doerksen, Gem, AB, discussed their breeding programs and use of beef cattle data for carcass improvement and alliance development. Greg Henderson provided a summary publication that was distributed to all persons in attendance. The presentation by Joe Paschal will be summarized in the proceedings. After a question and answer period, Dolezal adjourned the committee meeting at 5:00 p.m.

Respectfully submitted,
Sally L. Dolezal, Chair

PRODUCER PERSPECTIVES OF BEEF QUALITY

By Greg Henderson
Associate Publisher/Editor, Drovers

Producers say they recognize the need for improving quality, but their actions say they're still paid for pounds.

To determine producer views of beef quality and how quality goals affect production Drovers, in cooperation with Kansas State University (KSU) and the Beef Improvement Federation (BIF), surveyed 4,600 producers from various industry segments. Overall, producers generally recognize the need to improve the quality of beef and they are aware of many of the ways to accomplish that goal. However, the lack of an industry-wide marketing system that recognizes superior carcass merit encourages cattlemen to produce pounds rather than carcass quality. Producing pounds remains a key ingredient for maintaining ranch profitability

Methodology

Three segments of producers plus the membership of BIF were chosen to receive the survey. Producer names were selected at random from the mailing list of Drovers. Fifteen hundred cow-calf operators, 900 stocker operators and 500 feedyard operators were selected to receive the survey

Cow-calf operators and BIF members received identical surveys, while stocker operators and feedyards received a separate survey. Survey questions specific to cow-calf operators were asked only of cow-calf and BIF members, while certain questions specific to stocker operators and feedyards were asked only of those segments.

All surveys were mailed during the summer of 1997, and all surveys included a letter explaining who was conducting the survey and how the results would be used. A postage-paid return envelope was included with each survey. BIF members received their surveys and postage-paid envelopes with their July BIF newsletter.

Questions in the surveys were developed with the assistance of then KSU extension beef specialist Larry Corah, KSU graduate student Dalton Nix, and other members of KSU animal science department. (Dr. Corah is now director of production systems with the National Cattlemen's Beef Association). Additional assistance in developing the questionnaire was provided by BIF's executive secretary Ron Bolze who was also KSU northwest Kansas extension beef specialist, Colby, KS. (Dr. Bolze is now Coordinator of Progeny Tests for Carcass Merit for the Certified Angus Beef Program.) Other BIF members also provided input as the survey was developed. Completed surveys were tabulated and recorded at KSU by Dalton Nix. All expenses for the project were paid by Drovers.

Survey results.

Twenty percent (300) of the cow-calf producers surveyed responded to the survey, while 12 percent (204) of BIF members responded. Fifteen percent (135) of stocker operators and 16 percent (80) of feedyard operators responded.

The results were often encouraging, while other responses underscore the reality that change is slow and often painful.

For instance, it's encouraging that more than 90 percent of producers from the various segments believe the beef industry needs to place more emphasis on carcass traits. And three-fourths of those producers say they are currently receiving an economic benefit by making improvements to the quality of their cattle. Of those who are not currently finding an economic benefit from quality improvements, three-fourths believe they will in the future.

But while producers recognize the need to improve carcass traits, less than one-third of respondents say they emphasize carcass traits over growth traits in their own operations. That response typifies answers to questions about the importance producers place on quality. On one hand they recognize the need for quality improvements, but when it comes to selecting bulls or buying feeder cattle, growth and performance remain priorities.

Results of the survey, however, are consistent with our current marketing system: the majority of producers are still paid for pounds so they select cattle accordingly.

Q. Does the Industry Need More Emphasis on Carcass Traits

	YES	NO
Cow-Calf Producers	90%	10%
Stocker Operations	90%	10%
BIF Membes	93%	7%
Feedyard Operations	93%	7%

Quality traits

While the majority of producers recognize the need for quality improvements, general quality traits have varying degrees of importance to different beef production segments. When asked to rank 6 quality traits, cow-calf producers and members of the Beef Improvement Federation both placed "uniformity or consistency" first, "muscling" second and "yield grade" third. "Uniformity or consistency" was ranked fourth and fifth by stocker operators and feedyard owners, respectively. Stocker and feedyard operators placed "yield grade" first.

"Marbling", "beef tenderness" and "lack of carcass defects", traits routinely associated with necessary beef quality improvements, were generally ranked lower than the pounds-producing traits. In fact, "lack of carcass defects" was ranked sixth by all four groups.

To determine selection practices, we asked cow-calf operators and BIF members to rank 7 traits. Both groups said "calving ease or birth weight" was most important to them. "Growth" was ranked second by cow-calf operators and third by BIF members. "Structural soundness" was ranked second by BIF members and third by cow-calf operators. Both groups ranked "maternal ability/milk" fourth. "Color or breed" and "size" was ranked low by both groups. But it's important to note that "carcass traits" also ranked low. BIF members placed "carcass traits" fifth and cow-calf operators placed the trait seventh out of 7.

To determine selection practices when buying stocker and feeder cattle, we asked stocker operators and feedyard owners to rank 8 quality traits. Not surprisingly "health status" and "growth potential" were ranked first and second by both groups. "Carcass traits potential" again was ranked low by both groups, sixth by stocker operators and fifth by feedyard owners.

Stocker operators and feedyard owners were also asked to rank five terms used to define quality they might use when buying stocker or feeder cattle. "Uniformity" topped the rankings by stocker operators, and placed second among feedyard owners. "Conformation" ranked first among feedyards and second among stocker operators. "Predictability" placed third among stocker operators and "potential for superior quality grade" fourth. Feedyards placed "potential for superior quality grade" third and "predictability" fourth. Both groups ranked "performance" fifth.

Q. On which Trait Do you Place More Emphasis in Your Operation

	GROWTH	CARCASS
Cow-Calf Producers	76%	24%
Stocker Operations	72%	28%
BIF Membes	67%	33%
Feedyard Operations	72%	28%

Q. Which of the following statements best describe the management practices for your beef cattle operaiton? (answers are percentages of respondents)

	Cow-Calf			BIF			Stocker			Feedyard		
	Yes	No	Plan to	Yes	No	Plan to	Yes	No	Plan to	Yes	No	Plan to
Keep financial records	79	21	3	85	15	11	76	24	15	92	8	6
Keep performance records	44	56	16	89	11	7	44	56	21	77	23	9
Regular use a computer	44	56	25	81	19	8	51	49	15	65	35	12
Use Internet	13	87	21	46	54	26	15	85	22	28	72	28
Use preventive health program	92	8	3	99	1	0	90	10	5	96	4	1
USE EPDs	74	26	5	94	6	2	-	-	-	-	-	-
Use ionophore	-	-	-	-	-	-	57	43	3	74	26	1
Calves are preconditioned	61	39	7	78	22	3	-	-	-	-	-	-
Have collected carcass data	-	-	-	-	-	-	52	48	13	63	37	6
Calves are weaned	65	35	1	86	14	4	-	-	-	-	-	-
Buy stocker/feeders with known genetics	-	-	-	-	-	-	32	68	15	54	46	9
Individually ID cows	83	17	4	98	2	0	-	-	-	-	-	-
Buy source verified catte from ranch of origin	-	-	-	-	-	-	46	53	12	53	47	6
Retain ownership from birth to slaughter	30	70	11	54	46	12	-	-	-	-	-	-
Keep health treatment records	-	-	-	-	-	-	61	39	17	84	16	6
AI used on heifers	28	72	6	73	27	3	-	-	-	-	-	-
Use Implants	-	-	-	-	-	-	79	21	3	83	17	3
Heat synchronization heifers	27	73	9	61	39	5	-	-	-	-	-	-
Use dewormer	-	-	-	-	-	-	92	8	3	97	3	1
AI mature cows	26	74	3	65	35	2	-	-	-	-	-	-
Heat synchronization mature cows	22	78	4	55	45	0.5	-	-	-	-	-	-
Calves are impanted	60	40	4	43	67	2		-	-	-	-	-
Collect carcass data on calves	25	75	18	72	28	12	-	-	-	-	-	-
Use time-controlled or rotational grazing	75	25	5	92	8	3	-	-	-	-	-	-

Quality Traits in Order of Importance

Cow-Calf producers
1. Uniformity or consistency
2. Muscling
3. Yield grade
4. Beef tenderness
5. Marbling
6. Lack of Carcass defects

BIF Members
1. Uniformity or consistency
2. Muscling
3. Yield grade
4. Marbling
5. Beef Tenderness
6. Lack of carcass defects

Stocker Operations
1. Yield grade
2. Muscling
3. Marbling
4. Unformity or consistency
5. Beef tenderness
6. Lack of carcass defects

Feedyard Operations
1. Yield grade
2. Marbling
3. Beef tenderness
4. Muscling
5. Uniformity or consistency
6. Lack of carcass defects

Ranking of Bull Selection Traits

(asked only of cow-calf producers and BIF members)

Cow-calf producers

1. Calving ease or birth weight
2. Growth
3. Structural soundness
4. Maternal ability/milk
5. Color or breed
6. Size (weight, height, etc.)
7. Carcass traits

BIF Members

1. Calving ease or birth weight
2. Structural soundness
3. Growth
4. Maternal ability/milk
5. Carcass traits
6. Color or breed
7. Size (weight, height, etc.)

Benefits and premiums

While the beef industry has placed great emphasis on issues such as carcass traits and quality assurance, much work remains to encourage producers to implement practices that will create improvements. When asked "Which of the following practices are you using to improve the quality of your herd?", just 37 percent of cow-calf producers and 26 percent of BIF members say they are selecting bulls using EPDs for carcass traits. Further, just 29 percent of cow-calf producers and 21 percent of BIF members select breeds with carcass end points in mind. Most producers also haven't evaluated select breeds with carcass end points in mind. Most producers also haven't evaluated carcass data. Just 12 percent of cow-calf operators and 25 percent of BIF members claim to have collected carcass data on their production. And its somewhat alarming that just 18 percent of cow-calf operators and 24 percent of BIF members say they follow Beef Quality Assurance guidelines. However, on another question, 85 percent of cow-calf operators and BIF members say they have changed "vaccination procedures/location" in the last two years.

Apparently the benefits of quality are more readily apparent to stocker operators and feedyards. Fifty-six percent of stocker operators and 62 percent of feedyards say they regularly seek cattle that have been preconditioned with vaccinations and weaning management. Asked whether they prefer cattle that have been weaned prior to sale or vaccinated prior to sale, the answers were nearly a toss up. Fifty-six percent of stocker operators prefer cattle that are weaned prior to sale while 44 percent prefer vaccinated cattle. Fifty-one percent of feedyards prefer weaned cattle with 49 percent preferring vaccinated cattle.

Premiums are an important message to calf producers, and many stocker and feedyard operators are apparently sending that message. When asked if they regularly pay a premium for preconditioned stocker/feeder cattle, 52 percent of stocker operators and 56 percent of feedyards responded by checking yes.

How much are they willing to pay? Fifty-four percent of stocker operators and 56 percent of feedyards who say they pay premiums are willing to pay up to an additional $3 per hundredweight. Forty-six percent of stocker operators and 44 percent of feedyards are willing to ante up $3 to $6 per hundredweight.

Q. Do you prefer cattle that have been weaned prior to sale or cattle that have been vaccinated prior to sale

	Weaned	Vaccinated
Stocker Operations	56%	44%
Feedyard Operations	51%	49%

Q. Do you regularly pay a premium for preconditioned cattle?
Q. How much of a premium are you willing to pay?

	No	Yes	
		$ 0 to 3 per cwt.	*$ 3 to 6 per cwt*
Stocker Operations	48%	52%	
		54%	*46%*
Feedyard Operations	44%	56%	
		56%	*44%*

Alliances

Producer displeasure with traditional marketing systems has apparently caused many to take action on their own behalf. Nearly one-fourth of all respondents to our survey say they are involved in some type of alliance to market their production. That includes 12 percent of cow-calf producers, 40 percent of BIF members, 23 percent of stocker operators and 25 percent of feedyard owners.

Cow-calf producers tend to make their alliances with seedstock suppliers, breed associations and feedyards, while 40 percent of feedyard alliances are with packing companies. However, 21 percent of those involved in an alliance say that arrangement is with a formal alliance of beef producers.

While three-fourths of our respondents say they are not presently involved in an alliance, 49 percent of those produces say they are "likely", "very likely", or "extremely likely" to join an alliance in the future.

Q. Which of the Following Practices are you Using to improve the Quality of Your Herd?

	Cow-Calf		BIF		Stocker		Feedyard	
	Yes	No	Yes	No	Yes	No	Yes	No
Select bull using EPDs for carcass trait	37		26		N/A		N/A	
Collect carcass data on some or all of your production	12		25		N/A		N/A	
Select breed with carcass end points in mind	29		21		N/A		N/A	
Follow Beef Quality Assurance Guidelines	18		24		N/A		N/A	
Other, please specify	4		4		N/A		N/A	
When buying stocker/feeder cattle, do you regularly seek cattle that have been preconditioned with vaccines and weaning management?	N/A	N/A	N/A	N/A	56	44	52	48

Ranking of Importance for Genetics Information

Cow-calf producers
1. Purebred or seedstock supplier
2. Breed Association
3. Beef cattle publications or trade journals
4. Extension agent or university personnel
5. Veterinarian
6. AI technician
7. Neighbor

BIF Members
1. Extension agent or university personnel
2. Purebred or seedstock supplier
3. Breed association
4. Beef cattle publications or trade journals
5. AI technician
6. Neighbor
7. Veterinarian

Ranking of Importance for Beef Industry Information

Stocker operations
1. Veterinarian
2. Beef cattle publications or trade journals
3. Nutritionists
4. Other producers
5. Animal health product representative
6. State or national beef cattle organization
7. Extension agent or university personnel

Feedyard operations
1. Nutritionist
2. Veterinarian
3. Beef cattle publications or trade journals
4. Animal health product representative
5. Other producers
6. Extension agent or university personnel
7. State, or national beef cattle organization

Q. What, if any, management changes or improvements have you made in the following areas in the past two years?
(in percent)

	Cow-Calf		BIF		Stocker		Feedyard	
	Yes	No	Yes	No	Yes	No	Yes	No
Vaccination procedures/location	85	15	85	15	85	15	88	12
Timing of animal health practices	69	31	72	28	69	31	79	21
Modified handling facilities	64	36	55	45	67	33	67	33
Education of employee or family	64	36	81	19	64	36	86	14
Altered branding or identification methods	31	69	28	72	27	73	34	66
Changed purchased feed/supplementation	56	44	62	38	40	60	63	37
Altered processing practices	N/A	N/A	N/A	N/A	40	60	63	37
Selecting more cattle influenced by British genetics	N/A	N/A	N/A	N/A	56	44	63	37
Selecting more cattle influenced by continental genetics	N/A	N/A	N/A	N/A	21	79	21	79
Altered days on feed	N/A	N/A	N/A	N/A	39	61	48	52
Altered grazing practices	49	51	51	49	N/A	N/A	N/A	N/A
Selecting for smaller cows	29	79	48	52	N/A	N/A	N/A	N/A
Altered calving season dates	33	67	37	63	N/A	N/A	N/A	N/A

Demographic Information (in percent)

	Cow-Calf	BIF	Stocker	Feedyard
What is Your Age				
Under 30 years	6	8	8	6
30 to 44	25	24	28	35
45 to 59	39	41	34	36
60+	30	27	30	22
What is the Highest Level of Education Completed				
Grade school	1	1	5	1
High School graduate	24	4	28	27
Some college	23	8	22	26
College graduate	37	39	33	37
Graduate degree	15	48	12	9
What is Your Job Description?				
Owner/co-owner/partner	92	85	92	79
Manager	7	12	6	16
Employee	1	1	0	4
Paid consultant	0	1	1	0
Other, please specify	0	2	1	1
What is the Number of Beef Cows owned by this Operation?				
None	0	1	24	49
1 to 99	10	32	11	14
100 to 249	51	27	34	11
250 to 499	26	22	20	11
500 to 999	7	7	6	9
1,000 +	6	11	5	6
How Many Stocker Cattle Do you Sell Annually?				
None	16	39	20	44
1 to 99	24	34	12	3
100 to 249	40	12	29	1
250 to 499	10	8	18	8
500 to 999	5	2	11	7
1000 +	5	5	10	37
How Many Fed Cattle Do you Sell Annually?				
None	54	32	13	1
1 to 99	22	36	11	1
100 to 999	20	25	65	10
1,000 to 4,999	4	5	11	28
5,000 to 9,999	0	1	0	16
10,000+	0	2	0	44

A RANCHER'S APPROACH TO STRATEGIC ALLIANCES

Joe C. Paschal, Ph.D.
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In an effort to increase the value of their cattle or at least be paid for the quality of the cattle they produce, cattlemen in all parts of the U.S. and Canada are increasingly interested in marketing alliances. There are currently over 50 different alliances (Table 1) which include cow-calf producers, stocker operators, feedyards, beef processors and retailers. Most have been established in the past 5 years, but several have their origins in the late 1980s. An alliance is a cooperative arrangement between various sectors of the industry. It approaches vertical integration, but it retains the independence of the operators of the different segments. Cow calf producers can pool their genetics for added market clout while feedyard operators can set up alliances with producers, processors and/or retailers.

A recent survey of 20 alliances conducted by Beef Today (January 1997) reported that a total of 1.275 million head of cattle were projected to be marketed through them that year. Most of the current alliances (43) are involved in merchandising live animals and/or carcass beef but at least 7 are marketing alliances (Table 2) for live animals based on vaccination verified marketing programs. Calves marketed through these vaccination alliances brought $3.44 more per hundred weight if managed according to VAC 24 or VAC 45 requirements (Beef, August 1997). Of the alliances surveyed, a total of 23 included a breed name in their company name, most notably Angus (70%).

An analysis of these alliances revealed some interesting characteristics. A total of 33% require contracts, 10% require membership (with fees ranging from a per head charge to $600 life membership), and 60% are open to anyone. One out of four are for Angus or Angus types only and 30% of the others prefer Angus genetics. In contrast, 85% avoid Bos indicus genetics. Half don't charge participants for feeding cattle through their program unless carcass data is collected.

Table 1. List of Alliances Formerly and Currently Merchandising Beef

Ada Angus Beef	Maverick Ranch Beef
Angus Alliance	MFA AllianceAdvantage
Beef America First Choice and Special Reserve	Monfort Angus Beef
Beef - Charolais	Monfort Integrated Genetics
Beef Works	Moorman's Value Trac Program
Belle Brook Belgian Blue	Omaha Steaks Angus Beef
B3R Premium Beef	Piedmontese Association of the U.S.
Cenex/Land O' Lakes	Precision Beef Alliance
Certified Angus Beef	Premium Gold Angus Beef
Certified Hereford Beef	Red Angus Association of America
Chef's Exclusive	Red Angus Feeder Certification Program

Coleman Natural Products
Decatur Beef Alliance
Excel Corporation Angus Pride
Farmland Angus Beef
Farmland Supreme Beef Alliance
Gelbvieh Alliance
Hyplains Black Angus Beef
Lean Limousin
Mangus-Murco, Inc.
Rancher's Renaissance
Sterling Beef Program
Sysco Imperial/Supreme Angus Beef
Taylor Packaging Co. ,Inc. Angus Beef
Tennessee Belgian Blue
U. S. Premium Beef
Wal Mart Angus Beef
Western Beef Alliance

Table 2. Vaccination Verified Marketing Programs

Superior Livestock Video Value Added Calf Program
Producers Livestock Video Value Added Calf Program
Pfizer Select Value Added Calf Program
Hi Pro Producers Edge Program
Southeast Pride Certified Calf Health
Vet Advantage
Schwertner Select

All of the alliances focus on quality and yield grade targets within a range of carcass weights. Three-fourths offer premiums based on quality grade with 15% targeting Prime, 30% Choice, and 15% Select for premiums. For yield grade, 85% offer premiums but only for yield grades 1 and 2. Discounts for quality grade are also given by 75% of the alliances, 30% discounting for Select and 35% discounting for Standard grading carcasses. Similarly, 85% offer discounts for yield grades, 60% for 3 or higher (4 or 5) and 35% for 4 or higher (5). A total of 60% offer discounts for extremes in carcass weights which varied with ranges of 535-950 to 700-750 pounds. Specific monetary premiums and discounts varied by alliance but it appears that more money is lost by having cattle that had numerically higher yield grades (4 or 5) than lower quality grades (Select or Standard). The yield grade differences ranged from $10.00 to $20.00/cwt. discount for a yield grade of 4 or 5 while quality grades lower than Choice merited a $2.00 - $5.00 discount usually. Other alliance targets that merited premiums included feeding vitamin E to improve shelf life and consistency of color and all natural beef..

Before ranchers commit to participate in an alliance, they should know the performance of their cattle in the feedyard and their grade in the beef. One of the ways producers can obtain this information is through one of the beef "feed-out' programs offered through many state Extension Service. The Texas A&M University Ranch to Rail Program has been feeding small groups of cattle for producers in Texas and most of the southern U.S. since 1991. Almost 1,500 ranches have sent over 17,000 head of steers through the program to collect information on feedyard performance (average daily gain, cost of gain, morbidity) and carcass data (all quality and yield grade factors). The program begins in October of each year with a minimum consignment of 5 head of steers weighing between 500 and 800 pounds. The steers are weighed, processed, assigned a market value, and sorted by weight, frame, and fleshiness to approximately 100 head pens for feeding. All costs (except the nomination fee of $15.00 per head) are carried by the feedyard and deducted from the carcass value at the conclusion of the program. cattle are fed at Randall County Feedyard near Amarillo (in the Texas Panhandle) and at Hondo Creek Cattle Co. Feedyard near Edroy in South Texas.

The 1,904 steers from 166 ranches in the 1997-98 program averaged a 2.77 lb/day average daily gain at a cost of gain of $56.40/cwt. the cattle. The steers were sold on a carcass basis using a grid for different USDA quality and yield grades. A total of 36% of the cattle graded Choice and 52% graded Select with 81% being yield grade 1 or 2. The average medicine cost was $5.82 per head with 81% of the ranches having some sick steers. those steers that became sick gained .3 pounds per day less, had a higher total cost of gain ($71.15 vs. $59.93/cwt.), had an average of $22.73 in medicine expense, and lost $101.57 per head. The sick steers graded 23% Choice, 60% Select, and 17% Standard to the healthy steers 42% Choice, 51% Select, 7% Standard. The sick steers, if they could have been identified initially, were worth $10.56 less/cwt. due to poor gains and grades. A recent survey of participants of the South program indicated that 53% changed their bulls to improve the feedyard performance and carcass merit of their calves on the basis of their Ranch to Rail results. Participants in alliances must have this type of data available to them to avoid any surprises in their cattle.

Harlan Ritchie (1998) stated "Alliances will probably have as their targets a "High Quality" market calling for mid-Choice or higher quality grades, a market for High Select and low Choice with acceptable tenderness, a market for a lean and well muscled Select also of acceptable tenderness, and a "Natural or Organic" market which may remain the smallest (but fastest growing) segment". These broad categories allows for all cattle breeds currently in the U.S. to find a marketing niche.

FRANK BAKER MEMORIAL SCHOLARSHIP AWARD RECIPIENT ESSAYS

SEXED SEMEN AND FUTURE APPLICATIONS IN THE BEEF INDUSTRY

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Introduction

The concept of predetermining sex of offspring in altering the male:female sex ratio is an age-old phenomenon (Windsor et al., 1993); however, not until recently is such a concept scientifically feasible. Methods, such as sexing embryos and sexing semen, hold the most promise for commercial application in the beef industry. Sexing embryos, although effective, is costly due to increased resources associated with embryo transfer; thus, putting it out of the reach of most commercial cattlemen. In order for a sexed semen technology to be adopted by beef producers, the process would need to involve procedures similar to today's conventional artificial insemination. Current sexed semen technology has opened the door to the possibility of predetermining the sex of progeny and applying such technology commercially in the beef industry.

Literature Review

Sexed Semen Technology

Many different technologies have lain claim to being able to sort spermatozoa on the basis of producing a desired sex of progeny (Kiddy and Hafs, 1971; Amann, 1989). Unfortunately, most of these technologies have been unable to produce repeatable results. Approximately eight patents on sexed semen exist in the United States, and of those, only one has been demonstrated to separate X- and Y-bearing sperm (Seidel, 1997)

Currently, the most promising commercially viable sexed semen technology involves resolving differences in DNA content for X-and Y-bearing sperm using a flow cytometer/cell sorter (Seidel, 1997; Johnson et al., 1995). This technology is based on the premise that in cattle the only difference in gametes is the presence of either X or Y chromosome. The Y- chromosome is smaller and contains approximately 4% less DNA than the X-chromosome (Johnson et al., 1995; Johnson et al., 1989).

Flow cytometer/cell sorter technology is used to separate sperm on the basis of DNA content (Seidel, 1997; Johnson et al., 1995). A DNA-binding dye (Hoechst 33342) is placed into a solution containing sperm. Because X-bearing sperm contain approximately 4% more DNA than Y-bearing sperm, they absorb more stain. After staining, the sperm pass through the flow cytometer/cell sorter which uses a laser at a specific wavelength to excite the DNA-binding dye and a detector to read the resulting fluorescence. Based on the amount of fluorescence detected, a computer categorizes the sperm into one of three categories: 1) probable X-bearing sperm; 2) probably Y-bearing sperm or 3) indeterminable. An excess of positive or negative charge is then assigned to each droplet based on the above category. Using electrostatic plates, each droplet is then directed into its respective group.

One of the limitations to the above procedures is the speed at which sorting takes place. There is a delicate balance between the number of sperm sorted per second and the accuracy of the sorting. Seidel (1997) reported sorting speeds of up to 600 sperm per second of each sex with 90% purity. Conventional artificial insemination utilizes 20 x 10^6 sperm per dose of semen; however, such numbers would require large amounts of time to achieve with current sex semen procedures, making the procedure commercially impractical at this time (Seidel, 1997). Nevertheless, the 600 sperm per second is much greater than the 100 sperm per second reported two years ago (Seidel, 1996). There appears to be promise in developing faster sorting procedures.

Another potential solution to sorting speeds of current sexed semen procedures involved the use of low-dose semen. Dr. Seidel and coworkers evaluated lowering the sperm concentration of insemination doses in 225 Holstein heifers (1995). Semen from three Holstein bulls was extended to concentrations of 1 x 10^5 or 2.5 x 10^5 sperm per .1 ml inseminate as well as 2.5 x 10^6 total sperm per .25 ml inseminate (control.). The heifers were bred in the uterine horn ipsilateral to the side with the largest follicle as determined by ultrasound 12 hours postestrus. Pregnancy examination via ultrasound occurred 42-45 d after estrus. Resulting pregnancy rates were 41, 52 and 56% for the 1 x 10^5, 2.5 x 10^5 and 2.5 x 10^6 concentrations of sperm, respectively. A reduction in numbers of sperm required per inseminate while still achieving acceptable pregnancy rates would make commercial application of sexed semen feasible.

Utilizing low-dose technology, research groups at Colorado State University and USDA-ARS, Beltsville, teamed up to examine artificial insemination using X-and Y-bearing bovine sperm (Seidel et al., 1996). Semen was collected from bulls at the Atlantic Breeders Cooperative and then sent to Beltsville, Maryland, where it was to be sexed. Once samples were sorted by flow cytometer and stored at either ambient temperature or 5 degrees C, samples were flown to Colorado. Heifers and dry cows detected in estrus were then inseminated (9 to 29 hours post sorting) deep in to the uterine horns ipsilateral to the ovary with the largest follicle as determined by ultrasonography at the time of insemination (1 to 2 x 10^5 sperm per inseminate). Females inseminated with semen stored at ambient temperatures failed to become pregnant (n=10). In contrast, 14 of 29 females inseminated with the semen stored at 5 degrees C were pregnant at four weeks of gestation with 12 remaining pregnant at eight weeks. Of the 22 females inseminated within 10 hours post-sorting, 11 were pregnant at eight weeks; however, only one of seven inseminated 17 to 24 hours post-sorting was pregnant at eight weeks. Of the twelve pregnant at eight weeks, ten were of the predicted sex, one was not of the predicted sex, and one was unclear as determined by ultrasonography. Additional heifers were inseminated (n=33) with .05 ml of inseminate into each horn without the use of ultrasonography. Only three were pregnant at four weeks and only one at eight weeks. Compared to previous groups, heifers were inseminated with semen from a different set of bulls 18 to 29 hours post-sorting. Similarly, 38 heifers were inseminated approximately 22 hours post-sorting (another bull) resulting in zero pregnancies at eight weeks post-insemination. This particular study suggests that bulls (i.e. source of semen) may be a significant source of variation affecting sorting ability and sperm viability after sorting. It also points out the importance of the time of insemination post-sorting. In this particular study, it appeared that fertility drastically decreased by 17 hours post sorting.

More recently a study was conducted to compare low dose sorted and unsorted cooled inseminates along with conventional frozen semen inseminate (Seidel et al., 1998). In the summer of 1997, 102 yearling Angus heifers were randomly assigned to one of three treatments (cooled sexed semen - female with ~90% purity, cooled unsorted semen, or frozen unsorted semen). Concentrations were 1.63 x 10^6 live sperm/ml in extender, 1.63 x 10^6 progressively motile sperm/ml in extender, and 15.6 x 10^6 motile sperm/dose post thaw for cooled sexed semen, cooled unsorted semen, and frozen unsorted semen, respectively. Treatments were balanced over three bulls and two inseminators in a ratio of 3:2:2 insemination for sexed semen and two controls (frozen and cooled unsorted semen). Pregnancy was determined via ultrasonography 31-34 days post-insemination and again at 64-67 days with fetal sex being determined at this time. Pregnancy rate was not significantly different (P>.01) between treatments (44, 54, and 55% for sexed semen, cooled control, and frozen control, respectively). Ninety-five percent of the fetuses were female in the sexed semen group with 67% being female in the control groups (combined). It was felt that this trial demonstrated two things: the efficacy of low-dose insemination into the uterine horns; and the successful alteration of the sex ratio in beef cattle using flow cytometer technology and artificial insemination.

Sexed semen technology is here. With future developments in flow cytometer technology and improvements in sorted semen handling techniques, commercially viable sexed semen is feasible.

Application of Sexed Semen Technology in the Beef Cattle Industry.

Controlling the sex ratio in beef cattle production has considerable potential. Sexed semen would allow cattlemen to produce the optimum proportion of males and females in order to take advantage of phenotypic as well as genetic differences in sex-influenced, sex-limited and sex-linked traits and would provide an opportunity to increase selection pressure and optimize genetic gain (Foote and Miller, 1971).

Research in animal breeding and genetics has revealed a number of genetic antagonisms between traits of economic importance (Koots et al., 1994). Traits such as early growth and desired carcass composition appear to be genetically antagonistic with traits such as fertility and mothering ability (Splan et al., 1998: MacNeil et al., 1984). In order to handle such antagonisms, common practice has been to develop sire lines and maternal lines. Terminal sire lines provide the genetics for growth and carcass while material lines provide the necessary maternal performance to make optimum use of environmental resources to produce a high value product for the marketplace.

Crossbreeding systems using terminal and maternal bred lines have been applied to circumvent the aforementioned antagonism between growth/carcass traits and reproduction. Crossbreeding allows producers to utilize breed complementarity for growth and carcass while at the same time taking advantage of heterotic effects for traits related to female reproduction and mothering ability. Rotational-crossing systems, composite breeding, and rota-terminal crossing systems represent mating systems which use breed complementarity and heterosis (Bourdon, 1997).

In the case of the rota-terminal crossing system, a rotational system is maintained to provide replacement females while the terminal component is maintained to produce market offspring. Traditionally, 40 to 50% of the cow herd (typically cows 2, 3, and 4 years of age) are dedicated to producing replacements (twice as many cows as needed replacements) while the remainder of the herd (cows 5+ years of age) is bred to a terminal sire(s) (BIF, 1996; Gregory and Cundiff, 1980). Production inefficiencies occur in both the rotation as well as the terminal component. Under natural sex ratios, twice as many females are required to be bred as number of replacements needed; thus 50% of the calf crop represents males with maternal genetics that are not optimum for meat production (feeder cattle). Conversely, 50% of the calf crop on the terminal end represent females that are not as profitable in the production of beef compared to their male contemporaries. Additionally, male market offspring typically bring more value than female offspring in most years (Cattle Fax, 1997).

Using sexed semen in combination with a rota-terminal crossing system offers the opportunity for producers to use maternal lines to produce replacements with half as many cows as under natural sex ratios. Sexed semen would also allow the producer to breed maternal cows (typically the younger females, especially first-calf heifers) with X-bearing sperm. This would promote less calving difficulty, shorter gestation lengths, and longer post-partum intervals prior to the beginning of the subsequent breeding season (Seidel et al, 1997; Green et al., 1997; Pace, 1994). On the terminal side, the producer would be able to transfer more females to the terminal component; thus, increasing the number of male market offspring produced each year.

Researchers at Washington State University used a deterministic model to examine a straightbred mating system, a rotational system using terminal sires, and a three-breed terminal system (Haaland-Holmes, unpublished). Each system maintained a maternal line of cows (female sex preferred) while the rest of the cows were mated to produce market calves (male sex preferred). Sex ratios examined included 50:50, 60:40, 70:30, 80:20, and 90:10. The number of cows required to produce replacement females decreased by 44 to 46% as the proportion of preferred sex of calf increased from 50 to 90%. Along those same lines, the number of cows bred in the market line increased; thus, the number of male offspring marketed increased, leading to an increase in average weaning weight sold and total revenue in all mating systems. It would appear that sexing semen offers potential economic gains in crossbreeding programs where maternal and terminal lines are used.

Using the Colorado Beef Cattle Production Model (CBCPM) to simulate a rota-terminal crossing system utilizing Angus-Hereford crossbred dams and Charolais terminal sires at five levels of sex control (50, 62.5, 75, 87.5, and 100%), Lauren Hyde and Rick Bourdon of Colorado State University conducted a similar study to examine the effects of sex control on herd structure in a rota-terminal crossing system (1998). Results were in agreement with that of Haaland-Holmes (unpublished). As the level of sex control increased, a greater number of producing females was transferred to the terminal part of the system. At levels of sex control including and beyond 75%, females were transferred to the terminal part of the system one year earlier allowing them to produce one more market calf during their lifetime. Such a result suggests that the sexing technology not be absolutely 100% in order for it to be economically feasible.

Using sexed semen, producers would be able to take advantage of physiological differences between the sexes (in addition to or combination with crossbreeding systems). Sexed semen would allow cattlemen to take advantage of sex-limited and sex-influenced traits. The maintenance of a maternal line built around milk and mothering ability represents an example of exploiting sex- limited traits. Emphasis is placed on those traits measured on the female to develop the maternal line. In comparison, sex-influenced traits deal more with the physiological differences in production characteristics between the sexes. Males have been documented as having higher growth rates with better feed efficiency and more desirable carcasses than their female counterparts (Berg and Butterfield, 1976). According to Notter et al. (1979 a,b,c), the efficiency advantage of males over females is the range of three to seven percent, depending upon the production system. The availability of sexed semen would allow producers to eliminate the production inefficiencies associated with feeding heifers. The opportunity might also exist here to eliminate excess use of growth promotants to overcome inadequacies associated with feeding heifers as well as those males with material genetics (Green et al., 1997).

Factors Affecting Application

Currently, there are several factors limiting the application of sexed semen in the beef industry. The primary limitations include the degree by which the sex ratio is altered, fertility, the cost of technology, convenience, and tradition along with ethical and moral considerations (Foote and Miller, 1971). Many of these limitations are currently being addressed by research facilities such as Colorado State University in conjunction with XY, Inc. and USDA-ARS, Beltsville, Maryland.

The flow cytometer technology continues to improve along with the accuracy by which sexing occurs. Current procedures result in 90% purity as previously mentioned. In addition, fertility is improving along with new advances in sexing protocols. Pregnancy rates have been approximately 80% of those reported for conventional methods (Seidel et al., 1998). Finally, none of the advances matter unless the producer gets a live, normal calf on the ground. The breeding of large numbers of females under field conditions is needed to document that calves are normal and that embryonic death is not higher than normal (Seidel, 1997).

The cost of technology and convenience represent two major barriers to commercially viable sexed semen. The current costs of technology keeps sexed semen well beyond the reach of most cattlemen. However, there exists a target of providing sexed semen at a cost no more than $10 above that of unsexed semen (Seidel, 1997). Such a target is feasible due to expected reductions in overhead costs as sexing procedures become more efficient. Currently, sexed semen is available in a cooled state rather than frozen; however, there appears to be no major barriers to cryopreservation beyond finding the right recipe (Seidel, 1997). Also the current procedure for insemination with sexed semen involves uterine horn breedings, requiring a skilled technician. As advances in the sexed semen technology and post-sorting handling becomes available, there is little doubt that sexed semen procedures will become functionally similar to current conventional artificial insemination procedures.

Conclusions and Implications to Genetic Improvement in Beef Cattle.

Advances and new development surrounding flow cytometry and sorted sperm handling appear to be paving the way for future application of sexed semen technology in the beef cattle industry. Although barriers (sorting speed, cost of the technology, and convenience exist at the present time, there are potential solutions to those problems in the near future. Seidel (1997) reported that sexed semen could be available for artificial insemination in three years. This stresses the point that researchers are looking toward the future with the goal of having a commercially viable product available to cattlemen in the near future.

Commercially viable sexed semen would allow for increased production of male feeder cattle in the commercial setting. Producers would be able to better utilize growth and carcass genetics in the production of male market offspring while capitalizing on maternal genetics and environment provided by the cow through the utilization of designated maternal lines. Such an application would eliminate production of feeder females that often lead to inefficiencies compared to their terminal male counterparts. Conversely, producers will have the opportunity to eliminate production of excess males with maternal genetics that preclude them as inefficient producers of meat for the consumer market. Sexed semen appears to have the potential of eliminating, or at least providing potential solutions for, a few of the inconsistencies identified in the most current NBQA (1995).

Along similar lines, sexed semen would allow seedstock producers to produce the optimum proportion of males and females according to his individual production system and clientele. Seedstock producers would be able to produce select male progeny (potential sire) from superior genetics by combining proven sire with top producing cows. He could then produce replacements for his herd as well as for clientele from his next best set of cows. Sexed semen allows the producer to place greater selection pressure on his herd.

Adoption of sexed semen technology will depend on individual production systems. Those with current artificial insemination programs will be the first to benefit from the new technology (Pace, 1994); however, it is important to note here that it is estimated that only about three to five percent of the cows in the United States are artificially inseminated each year (Taylor, 1994). For those not currently using AI, the availability of sexed semen may provide the economic incentive as well as genetic gain for producers to adopt artificial insemination into their production system.

The potential benefits of commercially available sexed semen include more efficient beef production, more efficient allocation of beef genetics, and the propagation of a "value-added" product that brings with it the quality and consistency that the beef consumer desires. Sexed semen technology has the potential of making beef a more competitive product in the meat market.

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Frank Baker Award
Stephen Doyle

SCROTAL CIRCUMFERENCE: A PREDICTOR FOR REPRODUCTION?

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Introduction

Improving reproductive efficiency of beef herds generally increases profitability and is often expressed in terms of reduced overhead costs and more pounds of calf weaned. Reproductive traits in females can be difficult to measure, or are measured late in life, and are generally lowly heritable. Influences due to environment, as well as interactions between environment and genetics, also compound the difficulty of selecting for fertility traits (Martin et al., 1992). However, higher selection intensity may be applied to bulls and this is emphasized by the widespread use of artificial insemination. According to Brinks (1994), approximately 90% of genetic change over time is due to sire selection. This advantage is primarily due to the tendency of males to have multiple progeny, whereas females have a limited number of offspring per year.

Identification and use of heritable measures in bulls could provide a means by which to genetically improve reproductive potential in female offspring. Scrotal circumference (SC) has been suggested as an indicator for female fertility traits. It is easily measured, highly repeatable, and indicative of puberty in bulls. Positive relationships have been detected between scrotal circumference and reproductive traits in female relatives. Notter (1988) concluded that selection for earlier puberty in one sex should result in a reduction of age of puberty in the other since the hormonal factors (i.e., control and feedback of major hormones) that promote early reproductive development were similar in both sexes.

Review of Literature

Male Reproduction Traits and Puberty

Critical aspects of a sire's role in achieving high pregnancy rates are optimal production of sperm, libido, and breeding-mating ability (Bellows and Short, 1994). Large scrotal circumference, low back fat thickness, low levels of primary sperm defects, as well as a low number of mounts combined with a moderate number of services (during libido testing) are expected to improve fertility of beef bulls. The Breeding Soundness Exam (BSE) is used to quantify the reproductive potential of a bull (table 1). A physical examination, taking body condition, feet and legs, eyes, and overall health into account comprises a portion of the BSE. Other components of the test include examination of the reproductive tract, semen evaluation, and mating desire. Seminal traits measured are volume, color, motility, and morphology (Ball et al., 1983). Brinks (1994) suggested that the BSE should be used to cull bulls that are rated unsatisfactory, retest those that are classified as questionable, and to select yearling bulls to genetically improve reproductive efficiency in both bull and heifer offspring.

Scrotal circumference is an integral part of the BSE score. However, there have been mixed results concerning the relationship between SC and other components of the BSE. Some researchers have failed to detect significant relationships between SC and libido (Swaenpoel et al., 1986; Chenoweth et al., 1988) or between SC and sperm output, especially among bulls with normal sized testes (Almquist et al., 1976, Makarechian et al., 1985). Conversely, Foote (1977) calculated a positive correlation of 0.81 between SC and sperm output in Holstein bulls. Other studies have concluded that SC was favorably correlated with most seminal characteristics (Brinks et al., 1978; Knights et al. 1984). Smith et al. (1989) found positive genetic correlation between SC and percent abnormalities and negative genetic correlation with motility. There has been general agreement in the literature that seminal traits (e.g. abnormalities, motility morphology, concentration) improve with age (Smith et al., 1989; Lunstra et al., 1982)

The estimates of heritabilities of seminal traits have been null to moderate (0.3) (Abadia et al., 1976; Knights et al., 1984). In contrast, the estimates for SC are moderate to high (table 2) and fall between 0.20 and 0.78; thus significant genetic improvement can be made with selection for this trait. Moser et al. (1995) suggested that the best method for improving the fertility in herd sires is to select for high yearling SC.

Breed Differences

Puberty in the bull, as defined by Barber and Almquist (1975), is the age at which an ejaculate containing at least 50 x 10^6 total spermatozoa with 10% progressive motility is first produced. Lunstra et al. (1978) found SC to be a more accurate predictor of puberty than either age or weight. Although significant differences existed between bulls for age and weight, SC was approximately 28 cm at puberty irregardless of breed. In consideration of these differences, Coulter et al. (1987) recommended minimum scrotal circumferences for 6 different breeds at a variety of ages (table 3).

Major characteristics of semen quality improve linearly during the first 12 to 16 weeks after reaching the original criteria for puberty. Lunstra et al. (1993) suggested a new criteria for puberty that raised the requirements for concentration and progressive motility to 500 million and 50% respectively. The requirements for the redefined puberty signified the values at which it was economically feasible to use young bulls for collection for artificial insemination. The results of evaluation of SC in both Bos taurus and indicus using this revised definition of puberty, agreed with previous findings that Bos taurus bulls reach puberty at a significantly younger age (334 days vs 404 days) and lower body weight (922 lb vs. 1004 lb.) than do Bos indicus. However, it was determined that pre-pubertal scrotal circumference increased at the same linear rate (0.4 cm/day) and puberty (revised criterion) was reached at a common scrotal circumference of 32 cm in both specie-types.

Adjustment factors for SC can account for differences in age of bulls and age of dam between bulls (table 4). The adjustment for age of dam is known as a mature dam equivalent and the formula for mature dam equivalent 365 day SC is: actual SC + age adjustment value (to 365 d) x (365-actual age in days) + age of dam adjustment (Brinks

1994). Breed differences are also adjusted for and are calculated by multiplying the breed factor by the difference of the actual age from one year. Kress et al. (1996) calculated age of dam and bull age adjustment factors of five composites. Compared with results attained in purebred populations, these composites needed a smaller adjustment due to age of dam and a greater adjustment for bull's age.

Female Reproduction Traits.

Due to the low heritability of fertility traits, genetic improvement from selection is slow. Although this is true, there are other obstacles blocking the improvement of reproduction. Azzam et al. (1988) concluded that there are interactions among calf, sire and dam and these influences interfere with accurate measurements of reproductive traits. Age of puberty (first estrus) in heifers is economically important to the cattle industry as it signifies the earliest age that an animal may enter the breeding herd. However, the importance of age of puberty (AOP) is dependent upon how efficiently replacement females can be integrated into the existing system. The current breeding potential of heifers, in conjunction with environmental factors (e.g., nutrition) should be considered when examining the overall effect of genetic differences in AOP. In situations where there are limited resources, the genetic potential of individuals can become extremely important and may be reflected in the size of the calf crop. In females, AOP can only be measured through repeated palpation of the ovaries or assay of circulating hormone levels. Both methods suggested for assessing puberty are impractical to most, if not all, breeders. Often measurements of reproductive traits of females, such as identification of those cycling at the beginning of the breeding season and first-calf pregnancy rates, are obtained too late in an animal's life to be helpful in selection (Notter, 1988). A heifer is expected to breed and conceive early in the first breeding season, maintain a viable pregnancy, calve without difficulty, rebreed and conceive early in the first breeding season and wean healthy calves (Bellows and Short, 1994). As a consequence of these demands, age of puberty (first estrus) in heifers can be critical in herds where calving at 2 years of age is the norm.

Scrotal Circumference is an Indicator of Female Reproduction.

Scrotal circumference has a high negative (hence beneficial) genetic correlation with AOP in female relatives (table 5). This result has led many to conclude that AOP in heifers and SC in young bulls are essentially the same trait. Gregory et al. (1995) reported favorable correlations between SC and AOP (-0.91) and Morris et al. (1993) observed that selection for high SC resulted in a greater decrease in AOP of heifers than selection on AOP alone. Due to moderate heritability for SC (0.26) and age at first estrus (AFE) (0.48) as well as a large negative correlations between the two traits (-1.00), selection for SC should result in a correlated response in AFE (King et al., 1983).

There has also been comparable variation observed in AOP of heifers. In a between breeds comparison by Gregory et al. (1995) for puberty traits, adjusted age of puberty varied significantly between breed group means (table 6). There was a 61 day range in which the different breeds reached puberty. Braunviehs (350 days) and Herefords (411 days) represented the extremes around an overall mean of 376 days. Coinciding with these findings was the difference in percentage reaching puberty by the start of the breeding season. It was suggested that there is a high association among breeds between AOP and breed history of selection for milk production. Smith et al. (1989) inferred that bulls with larger SC would sire better milking daughters.

In experiments examining reproductive characteristics of males and females, Land (1973) estimated a correlation of 0.97 between testis weight and ovulation rate in mice. He also determined that the testis diameter in sheep was larger in breeds (Finnish Landrace) with higher ovulation rates. There have been numerous other studies that examined the relationship between reproductive traits in the two sexes. Martin et al. (1992) determined that AOP is significant to reproductive efficiency as most heifers are bred to calve as 2-year-olds. To reach the goal of calving as a 2-year-old, heifers need to reach puberty before 15 months of age. A heifer calving at 2 years of age has the advantage of a greater lifetime efficiency when compared to those that are 3-year-old first calf heifers. Earlier ages and dates of calving were favorable consequences of decrease in AOP (Smith et al., 1989). There was a 21 day decrease in the AFE of an Angus herd selected for increased SC in the last 2 years of a 6 year experiment when compared to the control herd (Morris et al., 1997). Genetic correlations between average SC and yearling and lifetime pregnancy rate estimated by Morris et al. (1994) were 0.53 and 0.34, respectively.

Scrotal circumference can also be utilized as an indicator for reproductive traits in progeny. Improvements can be observed as a decreased age of puberty or first calving, or as an increase in calving rate. Brinks et al. (978) inferred that young bulls with about average scrotal circumference and semen morphology should produce female offspring that reach puberty at younger ages. Toelle and Robinson (1985) found positive associations between sires with larger SC and their female progeny that include increase in calving rate and decrease in the age of first calving. The genetic correlation between SC and yearling heifer pregnancy rate or calving interval from 2 to 3 years of age in Hereford heifers with their sires were 0.93 and 0.2 respectively.

Studies by Moser et al. (1996) contrasted high and low SC and scrotal circumference EPDs. It was concluded that selecting bulls with higher scrotal circumference EPDs produced daughters that reached puberty at significantly earlier ages in both purebred and crossbred populations and was more effective than selecting on phenotype. Another benefit expected was larger percentages of heifers cycling early in the season. Recommendations for inclusion of scrotal circumference EPDs by breed associations were made for the purpose of furnishing producers with a tool to aid in the improvement of reproductive traits in their herds.

Growth Traits

There have been a multitude of favorable associations of scrotal circumference with growth traits (table 7). In general, both weaning and yearling weight tend to be moderately to highly correlated with scrotal circumference. There is also a low association between birth weight and SC, suggesting that earlier puberty is compatible with faster growth in beef bulls. Notter (1981) noted that selection for larger testicular size tended to decrease the growth rate since earlier maturing animals would be favored. However, citing an average genetic correlation of approximately 0.43 between body weight traits and SC (Neely et al., 1982; Knights et al., 1984: Nelsen et al. 1986; Bourdon and Brinks, 1986), Notter (1988) concluded that a positive relationship exists between size and SC. This result raises the issue of consequences of selecting for larger SC. Selection for larger SC relative to body size can result in a reduction in mature size, whereas not adjusting for body size could result in larger animals. Notter et al. (1985) discussed scaling SC measures in sheep to remove effects of body size and implied that scaling could allow for selection for SC independent of body weight.

Heterosis

Crossbreeding experiments have produced a wealth of conclusions regarding heterosis effects related to reproductive traits. Gregory et al. (1991) reported that heterosis was significant for adjusted AOP in all generations for each of three composite populations ($P < 0.1$) as were SC and paired testicular volume. These composites were comprised of Hereford and Angus bred with Brown Swiss, Charolais, and Limousin in MARC I, Gelbvieh and Simmental in MARC II, and Pinzgauer and Red Poll in MARC III. However, a portion of the differences among breeds for SC can be attributed to 368-day weight breed differences. Despite this finding, there is still important variation between breeds in testicular measurements that are independent of weight. Heterosis maintained for SC in males and puberty traits in females was in close agreement with the genetic expectation for retained heterozygosity (table 8). These findings uphold the hypothesis that puberty traits are influenced by dominance effects (Gregory et al. 1995; Anderson et al. 1996).

Expected Progeny Differences

Several breed associations, including Angus, Limousin, and Hereford, are currently using EPDs for scrotal circumference as an indicator of fertility. Golden et al. (1996) advocated collection of the necessary information by breed associations to begin producing EPDs for pregnancy and scrotal circumference. The question of how to use yearling SC data in regards to heifer puberty arose. The SC information available was utilized in the calculation of pregnancy EPDs (multiple trait model). The SC EPD is also being made available and if used in conjunction with the pregnancy EPD, the accuracy of selecting bulls for a higher probability of pregnancy in yearling daughters is lower than if the pregnancy EPD has been used alone. However, they were concerned that if the SC EPD was not available, breeders might not collect that information. Also, beyond the application of selection, the SC EPD may also be used to assist in explaining heifer pregnancy EPDs.

Conclusions and Implications to Genetic Improvement of Beef Cattle.

Scrotal circumference is highly repeatable, easy to measure and moderately heritable. Estimated heritabilities suggest that improvement can be made through selection. A majority of genetic change over time is orchestrated through the sire due to his ability to produce many offspring in a relatively short period of time as compared to females. The Breeding Soundness Examination is used as a prediction of reproductive performance and scrotal circumference makes up a significant portion of the score. Insufficient testicular size is the most frequent explanation as to classification of questionable or unsatisfactory in a BSE.

Favorable associations exist between scrotal circumference and a multitude of traits including growth traits for both the bull and his progeny. Age of puberty in heifers is highly correlated with scrotal circumference and these traits are viewed as being the same trait by some researchers. In restricted breeding seasons, age of puberty has a significant effect on herd production, especially in heifers expected to calve as 2-year-olds. Other favorable associations with scrotal circumference include age of first estrus, yearling pregnancy rate and lifetime pregnancy rate. Bulls with larger scrotal circumference are expected to produce female offspring with a shorter calving interval, earlier first day of calving, and improved milking ability.

Breed differences, including those between the subspecies were encountered in a portion of the literature reviewed. The claim that scrotal circumference is an accurate predictor of puberty in young bulls is substantiated by the similarity of size between bulls of different weights and ages. The significance of heterosis for scrotal circumference was partially related to 368-day weight, yet there is a notable amount of variation between breeds as well as retained heterozygosity. The presence of heterosis effects supports the theory regarding the presence of dominance in reproductive traits.

Scrotal circumference is a valuable indicator trait for reproduction. Some breeds associations currently have an EPD published for this trait in their sire evaluation. There have been numerous recommendations to provide this to the producer. The primary objective of making SC EPDs available would be to offer a method for improving pubertal and some reproductive traits. Until it is possible to select for traits such as puberty and calving interval directly, the use of indicator traits offers a valid means to aid in improving economically important traits. However, there needs to be information to accompany these EPDs. Producers need to understand that they are not just tying to increase scrotal circumference and that there is a range in which scrotal circumference should fall.

Table 1: Scoring System for the BSE

Scoring	Criteria	very good	good	fair	poor
SC	12-14 mos	>34 cm	30-34 cm	<30 cm	<30 cm
by	15-20 mos	>36 cm	31-36 cm	<31 cm	<31 cm
age	21-30 mos	>38 cm	32-38 cm	<32 cm	<32 cm
	>30 mos	>39 cm	34-39 cm	<34 cm	<34 cm
Score	SC	40	24	10	10
Semen Morphology					
Primary Abnormalities		<10	10-19	20-29	>29
Total Abnormalities		<25	26-39	40-59	>59
Score for morphology		40	24	10	3
Gross Motility		Rapid Swirling	Slower Swirling	General Oscill'n	Sporadic Oscill'n
Ind'l		Rapid linear	Moderate linear	Slow linear to erratic	Very slow - erratic
Score for Motility		20	12	10	3

Table 2: Heritability Estimates for Scrotal Circumference in Yearling Beef Bulls

Source		h2 estimate	se	
Coulter et al	1976	0.67		
King et al	1983	0.26	.023	
Knights et al	1984	0.35	0.06	
Nelsen et al	1986	0.41		
Smith et al.	1989	0.40	0.09	
Gregory et al	1995	0.43	0.04	
Coulter & Foote	1979	0.78	0.07	age
Latimer et al	1982	0.36	0.16	adjusted
Lunstra	1982	0.52		estimates
Neely et al.	1982	0.44	0.24	
Bourdon & Brinks	1986	0.49	0.06	
Lunstra et al.	1988	0.41	0.06	
Notter et al.	1993	0.23	0.06	

Table 3: Minimum SC for Several Breeds and Corresponding Means at 1 & 2 years of age.
Coulter et al. (1987)

age mo.	sim	ang	char	p.hf	h.hf	sh	lim
12-14	33	32	32	31	31	31	30
15-20	35	34	34	33	33	33	32
21-30	36	35	35	34	34	34	33
>30	37	36	36	35	35	35	34
Mean sc: 1 yo	36 (0.2)	33.9 (0.1)	33.1 (0.1)	32.3 (0.2)	32.99 (0.1)	32.5 (0.2)	30.3 (0.3)
Mean sc: 2 yo	38.8 (0.1)	37.2 (0.09)	36.3 (0.09)	35.6 (0.04)	36.1 (0.03)	34.9 (0.11)	32.2 (0.18)

sim = Simmental
ang = Angus
char = Charolais
p.hf = Polled Hereford
h.hf = Horned Hereford
sh = Shorthorn
lim = Limousin

Table 4: SC Adjustments

Breed	205 adj	365 adj	adj cm/day
Angus	0.0856	0.0374	0.034
Red Angus	0.0585	0.0324	
Brangus	0.0861	0.0708	0.026
Charolais	0.0767	0.0505	0.013
Gelbvieh	0.0839	0.0505	
Hereford	0.0416	0.0425	0.036
Polled Hereford	0.0969	0.0305	
Limousin	0.0465	0.059	0.026
Salers	0.0594	0.0574	
Simmental	0.0854	0.0543	0.034

Dam age	Adjust
>=5 years	0.0 cm
4 years	0.4 cm
3 years	0.8 cm
2 years	1.3 cm

US Marc Progress Report: 1985, Lunstra, Gregory, & Cundiff
Adjutment Factors for the Effects of Bull Age and Age of Dam on Scrotal Circumference in yearling beef bulls between 300 and 400 days of age.

Adjustment factors for different breeds to adjusted for 205 or 365 days of age: Geske, Schalles, Zeellner, Bourdon, 1994

Table 5: Correlations between SC and AOP in Heifers

Source	r(SC, AOP/AFE)
Brinks et al. 1978	-0.71
King et al. 1983	-1.00
Kress et al. 1994	-0.48
Gregory et al. 1995	-0.91

Table 6: Reproductive Characters of Different Breeds of Beef Heifers

Breed	PR %	2yo CR %	AOP
Angus	78	75	393
Hereford	64	62	411
Red Poll	81	77	359
Limousin	55	53	408
Charolais	72	67	391
Pinzgauer	82	79	360
Brown Swiss	83	80	350
Gelbvieh	86	83	353
Simmental	82	81	363

Factors Affecting Calf Crops
PR% = pregnancy rate
2 yo CR% = calving rate of 2 year old heifers
AOP = age of puberty

Breed	%4`0 d	%452 d	adj. SC	adj. AOP
Limousin	44.0	79.3	29.7	408
Charolais	60.6	86.5	31.4	391
Hereford	39.9	82.8	31.7	411
Pinzgauer	92.1	96.6	32.7	360
Simmental	86.8	98.0	32.9	363
Angus	57.4	93.3	33.1	393
Braunvieh	94.2	100.0	33.2	350
Gelbvieh	92.9	99.1	33.4	353
Red Poll	88.6	97.4	33.9	359
Mean	72.9	92.6	32.4	376

%410 d = % heifers reaching puberty by start of breeding season
% 452 d = % heifers reaching puberty by end of breeding season
adj. AOP = age of puberty adjusted to 100% puberty basis
adj. SC = scrotal circumference adjusted to common age

Table 7: Correlations between SC and growth traits

growth trait	Simmental	a. Simple Santa Gertrudis	Hereford	
initial mass	0.32**	0.31**	0.36**	Swanepoel et al. 1986
adg	0.13	0.12	0.14	
ada	0.14*	0.15*	0.18*	
fcr	0.06	0.05	0.13	
final mass	0.38**	0.37**	0.38**	
age	0.15*	0.13*	0.18*	
Breed group	r(sc,bw)	r(sc,bw,ft)	r(,sc,ft)	
m1	0.57**	0.57**	0.10	Sharma and Berg 1982
m2	0.72**	0.72**	-0.08	
m3	0.73**	0.73**	0.05	
m4	0.85**	0.85**	0.22*	
tx	0.77**	0.75**	0.29*	
pooled	0.74**	0.74**	0.19*	
		b. Genetic		
	r(sc,yw)	r(sc,yre)	r(sc,yft)	
Brangus	0.42	0.53	-0.73	Johnson et al. 1991
	R(sc,bir)	R(sc,wean)	R(sc,year)	
Angus	0.10	0.00	0.68	Knights et al. 1984
hf/ang/rang	0.08	0.56	0.63	Smith et al. 1989
mean	0.08	0.33	0.51	Koots et al. 1991
mean	-0.02	0.00	0.10	Lunstra et al. 1985
Hereford	0.22	0.20	0.37	Bourdon et al 1986

adg: avg daily gain
ada: adg/day of age
fcr: feed conversion ratio
bw: body weight
ft: back fat thickness; yft: yearling ft
yw: yearling weight
yre: yearling rib eye est
bir: birth weight
*: $p<0.05$
**: $p<0.01$
m1: Angus, Charolais Welsh Black
m2: Hereford, Brown Swiss, Simmental
m3 - easy calving: Angus Jersey, Tarantaise, Red Poll, Longhorn
m4: all purpose: Hereford, Red Angus, Limousin Beefmaster
tx: terminal brreed: Charolais, Maine Anjou, Chianina, Holstein

Table 8: Heterosis Effects on Puberty in Females & Scrotal Circumference in Males for Mean Heterosis for MARC I, II and III
Gregory et al. (1995)

composite	% 410d	%452d	adj AOP	SC
F1 - PB	23.8	7.5	-21	1.3
F2 - PB	19.5	5.6	-18	0.9
F3/4 - PB	16.1	3.3	-17	1.1
O - E	-2.0	-2.4	1	0.1

%410d = % females reaching puberty by 410 d
(start of breeding season)
% 452 = % females reaching puberty by 452 d
(end of breeding season)
adj AOP = adjusted to 100% puberty basis
O - E = linear contrasts of observed and expected heterosis to test hypothesis that retained heterosis is proportional to retained heterozygosity

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Frank Baker Award
Shannon Schafer

BIF POSTER COMPETITION ABSTRACTS

CORRELATIONS BETWEEN YEARLING AND PRE-SLAUGHTER ULTRASOUND MEASURES AND CARCASS TRAITS OF COMPOSITE BEEF STEERS.

D.H. Crews, Jr., R.A. Kemp, N.H. Shannon and R.E. Carlson, Agriculture and Agri-Food Canada Research Station, Lethbridge, Alberta T1J 4B1 Canada.

Ultrasound and carcass records from composite (.25 Charolais, .25 Simmental, .44 British, .06 Limousin) steers (n = 120) were used to estimate phenotypic correlations and the usefulness of serial ultrasound to predict carcass merit. Steers were born in 1995 and 1996 at the Onefour Research Substation of Agriculture and Agri-Food Canada, and, following weaning in late October until designated for slaughter when live weight and back fat reached 1100 lb and .30 in, respectively. Ultrasound measures recorded at a mean age of 371 d (YR) and prior to slaughter (SL) were used. Carcass traits included hot carcass weight (HCW), back fat thickness (FAT), ribeye area (REA), Warner-Bratzler shear force (WBS), percent intramuscular fat (IMF) and marbling score (MAR). Also, percent lean yield was estimated using the formula: 57.34 (.032 LWT) + (.212 REA) (.681 FAT). Ultrasound measures included back fat thickness (YRFAT and SLFAT) and ribeye area (YRREA and SLREA). Percent lean yield at YR (YRPLY) and SL (SLPLY) was computed using live weight adjusted to a carcass weight equivalent using a constant dressing percentage of .60, and ultrasound measures of back fat thickness and ribeye area. During the feedlot period, steers were randomly assigned to be fed a control or experimental diet as part of an unrelated nutrition trial. Residual correlations were estimated from a fixed linear model including year of birth, nutritional treatment and their interaction. Correlations ($P < .05$) between YRFAT and SLFAT with FAT were .75 and .68, with IMF were .33 and .31, with MAR were zero and .20 and with WBS were zero and zero, respectively. Correlations between YRREA and SLREA with REA were .50 and .78, respectively. Correlations between YRREA and SLREA with carcass quality measures (MAR, IMF and WBS) were near zero. Correlations between YRPLY and SLPLY with PLY were .59 and .76, with IMF were .19 and .20, respectively, but were near zero with MAR and WBS. Correlations between ultrasound measures of back fat and ribeye area at YR and SL were above .60. Associations between fat thickness and ribeye ultrasound measures and carcass quality measures were low to non-existent. Ultrasound measures taken near yearling ages must be interpreted with care when inferences about carcass traits are desired.

ARTIFICIAL INSEMINATION OF ANGUS HEIFERS WITH UNFROZEN SEXED SEMEN

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The objectives were to determine if use of unfrozen sexed semen adversely affects fertility and embryo/fetus viability and if current sexing technology indeed alters the sex ratio. Semen was collected from three 14-26 month old Angus bulls, and sperm were incubated at 75 X 10^6 sperm/ml in TALP with 38 μM Hoechst 33342 for one hour at 34° C. Sperm were sorted into probable X- and Y- bearing populations with a Cytomation MoFlo® flow cytometer/cell sorter operating at 50 psi using 2.9% Na citrate as sheath fluid. Approximately 500 live, X-bearing sperm/sec were collected at >90% purity into Cornell Universal Extender (CUE), centrifuged, and then suspended at 1.63 X 10^6 live sperm/ml (sexed semen). A second semen treatment included cooled, unsorted semen suspended similarly to sexed semen at 1.63 X 10^6 motile sperm/ml (liquid control). Both the cooled, sexed and cooled, unsorted semen treatments were loaded into .25 ml straws and then transported approximately 240 km in a temperature-controlled cooler at 3 to 5° C. A third semen treatment included frozen semen (frozen control) from the same three bulls. Angus heifers (N=102) from the John E. Rouse Colorado State University Beef Improvement Center, Saratoga, WY, were synchronized using the MGA/prostaglandin protocol. Heifers were then randomly assigned to one of three semen treatments balanced over three bulls and two inseminators at a ratio of 3:2:2 for sexed semen and the liquid and frozen controls. Heifers were inseminated each evening approximately 6 to 24 hours after observed estrus. Insemination procedures for both cooled, sexed and cooled, unsorted semen treatments included depositing 3 X 10^5 live sperm, half into each uterine horn using an IMV blue sheath, within approximately 9 hours of sorting. Standard artificial insemination procedures were followed for the frozen control (mean of 15.6 X 10^6 motile sperm/dose post-thaw). Pregnancy was determined via ultrasonography 31-34 days post-insemination and again at 64-67 days when fetal sex was also determined. Results are presented in the table.

Treatment	No. Heifers Bred	No. Pregnant d31-34	No. Pregnant d64-67	No. Female Calves Born
Sexed Semen	45	20 (44%)	19 (42%)	18 (95%)[a]
Liquid Control	28	15 (54%)	15 (54%)	8 (53%)[b]
Frozen Control	29	16 (55%)	15 (52%)	11 (73%)[ab]

[ab]Sex ratios with different superscripts differ (P<.01).

Although the pregnancy rate for sexed semen was approximately 80% of that for the controls, this difference was not statistically significant (P>.10). One case of early embryonic death was detected with the sexed semen treatment as well as one with the frozen control. All pregnancies detected at 64-67 days went to term. All calves resulting from sexed semen were born alive and were morphologically normal. The sex ratio was 95% females for sexed semen and 63% for the two controls (combined). We have altered the sex ratio significantly using artificial insemination of cooled sexed semen without significantly decreasing fertility and embryo/fetus viability.

PHENOTYPIC RELATIONSHIPS BETWEEN REPRODUCTIVE FITNESS AND COMPOSITION TRAITS OF LIMOUSIN CATTLE.

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Abstract

Phenotypic relationships between composition traits and indicators of fertility were evaluated from Limousin field data as part of ongoing research at Running Creek Ranch, Elizabeth, CO. Yearling reproductive tract score of 1,575 heifers and scrotal circumference of 1,247 bulls were used in the analysis. Traits measured included yearling weight (YW, kg), reproductive tract score (RTS) of heifers, scrotal circumference (SC) of bulls, body condition score (BCS), and muscle score (MS). Dam age (AOD) was categorized for dams 2, 3, 4 to 10, and >10 yr. Percent Limousin (PL) was assorted into classes according to North American Limousin Foundation procedures. Yearling MS were grouped as light (MS<2), average (MS=2) or heavy muscled (MS>2). Heifer BCS ranged between 5 and 8, while all bulls had BCS between 4 and 7. Reproductive tract ordinal scores of heifers ranged from 1 (infantile) to 5 (palpable corpus luteum) with higher scores indicating greater reproductive tract maturity. For reproductive tract score analyses, heifers were either grouped as cycling (n=1134, RTS≥4) or non-cycling (n=442, RTS<4). Logistic regression analyses were performed on heifers using SAS® to model the dichotomous response variable (cycling vs. non-cycling) as a function of continuous and several categorical explanatory variables. The final model for heifer analysis included the main effects of heifer age (AGE, days), AOD, YW, PL, year (YR), MS, BCS. The model for scrotal circumference analysis was similar, with the addition of the YW by MS interaction. Percent Limousin and additional interactions, including quadratic terms for YW and AGE, were not important in either model (P>.1). In general, increases in YW, AGE and BCS favorably affected both the probability of cycling and scrotal circumference. Odds ratio estimates for cycling of BCS(6) and BCS(7) heifers relative to BCS(5) were 8.272 and 3.333 (p<.0003), respectively. Regression coefficients for WT and AGE on SC were .021, cm/kg and .015, cm/day, respectively. Solutions for SC on BCS increased .6 cm for a BCS increase from 5 to 6 and 1.2 cm for an increase from 5 to 7 (p<.05). There were sex effects of muscularity on reproductive fitness traits. Favorable odds ratio estimates for MS(2) and MS(3) heifers on RTS were 1.905 and 1.896 relative to MS=1 (p<.05). Average and heavy muscled heifers did not differ in probability of cycling (p>.5). However, heavier muscled bulls had significantly smaller scrotal measurements than average and light muscled bulls (p<.05). Solutions of SC for light and average muscled bulls were .783 ± .335 and .485 ± .136, cm. Coefficients for SC on WT by MS were .018 ± .005 and .007 ± .003, cm/kg for MS(1) and MS(2), respectively. These data suggest average muscularity can be maintained in Limousin cattle without significant reduction in reproductive fitness, given adequate age, weight and body condition. Selection against muscular heifers, or for the most muscular bulls, tends to have detrimental effects on yearling indicators of fertility.

Keywords: Beef cattle, Puberty, Composition

USE OF RELATED TRAITS IMPROVES ACCURACY OF EPD'S FOR SCROTAL CIRCUMFERENCE.

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This study evaluated the effect of including concomitant body weight (BW) measurements and/or a random dam effect in genetic models for scrotal circumference (SC). SC and BW measurements at 10 and 12 months were collected at the Brandon (Manitoba) and Mannyberries (Alberta) research stations on 1547 multibreed (25% Charolais, 25% Simmental, 44% Hereford-Angus, 6% Limousin) calves born from 1983 to 1994. Single (SC) or multiple trait (SC & BW) models in combination with an uncorrelated random dam effect were constructed. In total, four models were compared: model 1 (SC; no dam effect), model 2 (SC & BW; no dam effect), model 3 (SC; with dam effect) and model 4 (SC & BW; with dam effect). Appropriate animal model and variance component estimation procedures were used. Age at the time of measurement of SC & BW was used as a covariate. Significant ($P<0.05$) fixed effects included in each model were location, breed-cross type, location-year, direct and maternal heterosis, and age of dam. When BW was included as a correlated trait (model 1 vs. 2) EPD accuracy increased by 1.62 and 1.0%, for 10 and 12-month SC, respectively. These results indicate that EPD accuracy could be improved by including BW when conducting genetic evaluations for SC. When the dam component was included (model 3 vs. 4), EPD accuracy increased by 2.33 and 1.23% for 10 and 12-month SC, respectively. Based on these results, a two-trait (SC & BW) animal model with a random dam component may be appropriate for evaluating SC in beef cattle. Variance components were estimated using the suggested model (model 4). Estimates of direct heritability were 57 and 66% while the proportions of total variance explained by the dam component were 1 and 2% for 10 and 12-month SC, respectively. Genetic correlations between SC & BW were 0.38, and 0.76 at 10 and 12 months while phenotypic correlations were 0.46 and 0.36, respectively. The genetic correlation between 10 and 12-month SC was 0.97 while the phenotypic correlation was 0.88. The rank correlation between 10 and 12-month SC EPD was 0.89. The proportion of phenotypic variance explained by genetic effects and genetic correlations between SC and BW tended to increase with age. The genetic correlation between SC and BW at 12 months, in this study, was higher than the literature average of 0.47. The estimate of direct heritability for 12-month SC was also higher than the average literature value of 48% for age-adjusted yearling SC. Other researchers have reported higher heritabilities for growth traits in composite than in purebred cattle. Possible causes may be larger genetic variances (due to multibreed composition), lower environmental variances (due to controlled research conditions) and choice of genetic models. Measurements of SC taken at 10 or 12 months represent essentially the same trait genetically and animals are expected to rank very similarly for 10 and 12-month SC EPD with either trait responding to selection.

EVALUATION OF A PANEL OF DNA MICROSATELLITE MARKERS FOR USE IN INDIVIDUAL IDENTIFICATION OF BEEF CATTLE.

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Recent progress in gene mapping has provided the beef cattle industry with microsatellite markers DNA useful for genotyping. DNA genotypes could provide the basis for unique individual animal identification (ID). Unique animal ID is necessary to provide needed carcass feedback information to producers for use in genetic improvement programs. This project tested nine markers suggested by the International Society of Animal Genetics (ISAG) to prove their efficiency in identifying individual animals. To test the markers, Hereford cattle (n=90) were sampled from three sources. The cattle population was unique because most of the animals were inbred (F_x from 0 to 52%), which provided a more stringent test of the markers. Whole blood was collected from the animals and DNA was extracted from each sample. Each animal was genotyped with the nine ISAG markers (***BM1824, SPS115, ETH3, ETH10, ETH225, TGLA122, TGLA53, TGLA126, and INRA23***). To determine the ability of these nine markers to provide a unique genotype for each animal, allelic frequencies for each marker were calculated. Assuming Hardy-Weinberg equilibrium, these frequencies were used to determine the occurrence of the most common cumulative genotype over all nine loci (4.3×10^{-5}). Using this frequency, the probability that any two random individuals in this population possess identical genotypes would be no greater than 2.0×10^{-9}. The total number of possible genotypes with the nine markers was also calculated (3.1×10^{10}). These data indicate that these nine microsatellite markers are effective for individual animal identification and suggest that the cattle industry could pursue microsatellite DNA genotyping as the basis for an individual animal identification system.

COMPARISON OF DEPOSITION OF CARCASS YIELD TRAITS MEASURED USING ULTRASOUND FOLLOWING WEANING AMONG COMPOSITE BULLS AND HEIFERS.

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Serial ultrasound measures were collected on composite (.25 Charolais, .25 Simmental, .44 British, .06 Limousin) bulls (n = 150) and heifers (n = 201) born in 1995 to examine the deposition of carcass yield traits from weaning in late October (229   1 d of age) to approximately 425 d of age. Following weaning, animals were managed on a typical replacement regime (196 d) where bulls gained 2.5 lb per d and heifers gained 1.5 lb per d. Live weight (LWT) and ultrasound measures of back fat (FAT) and ribeye area (REA) were recorded every 28 d during the postweaning period. Ultrasound measures were made using an Aloka SSD-1100 Flexus real time ultrasound unit with a 17.5 cm linear 3.5 MHz probe attached. Digitized images were analyzed using Jandel SigmaScan Pro software. Percent lean yield (PLY) was estimated using the equation: 57.34   (.032   (LWT   .60)) + (.212   REA)   (.681   FAT). For PLY estimation, a constant dressing percent of .60 was used to adjust LWT to an approximate carcass weight equivalent. To test for differences in deposition patterns between sexes, a model was fit including sex, linear and quadratic age covariates and their interactions. Significant ($P < .01$) interactions between sex and age covariates were detected for all traits except REA. Therefore, in final models for LWT, FAT and PLY, linear and quadratic age covariates were nested within sex. In the final models, solutions for the average effect of sex indicated differences of 128 lb for LWT ($P < .27$), -.40 in for FAT ($P < .01$) and 1.34 in^2 for REA ($P < .01$), where bulls were heavier, had less fat, larger ribeye area, and therefore higher PLY. Linear and quadratic age coefficients differed ($P < .05$) between bulls and heifers for FAT and PLY, and indicated a higher rate of fat deposition in heifers. Linear age coefficients were similar between sexes for LWT, but the quadratic coefficients indicated a greater ($P < .01$) rate of gain in bulls. The quadratic age coefficient for REA was positive ($P < .01$) for bulls and heifers, indicating that muscle growth was still increasing at the end of the postweaning period. Estimated lean yield was approximately 2 percent higher for bulls than heifers at 425 d of age. With the exception of REA, deposition of carcass yield traits was different with respect to age and sex during the postweaning growth period of composite bulls and heifers.

CARCASS TRAITS IN CANADIAN CHAROLAIS: GENETIC PARAMETERS AND SELECTION CRITERIA.

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A total of 3994 carcass trait records from the Conception to Consumer program (an organized progeny test) were used to estimate genetic parameters. Calves were born and raised to weaning ($\bar{x}$=215.6d) in several commercial herds in Western Canada from 1975 to 1996. At weaning, all calves were placed in one commercial feedlot until reaching the desired slaughter endpoint (fat thickness). All calves were progeny of 170 Charolais sires mated to cows of various breed types. Measurements on carcass weight (CW), ribeye area (REA) and average fat thickness (FAT) were used to predict lean yield (LY), a composite trait, using the following equation:

Lean yield (%) LY $= 57.96 - .027CW + .212REA - .703FAT$

The latter trait was used to derive 4 other composite traits as follows:

Lean carcass weight (kg) LW $= CW \times LY$
Lean growth rate 1 (kg/day) LGR1 $= [(CW \times LY) - (BW \times DP \times LY)] / AGE$
Lean growth rate 2 (kg/day) LGR2 $= (CW \times LY) / AGE$
Lean growth rate 3 (kg/day) LGR3 $= ADG \times DP \times LY$

where BW, DP, AGE and ADG are birth weight, dressing percentage (constant at 60%), age at slaughter and post-weaning average daily, respectively. The model included contemporary group and dam breed type as fixed effects. Records were preadjusted for age at slaughter within year. For carcass traits, heritabilities were in agreement with previous reports with .20, .36 and .30 for CW, REA and FAT, respectively. Heritabilities of composite traits were moderate and ranged from .24 for LGR3 to .40 for LY. Among composite traits, the one most associated to composition of gain (REA and FAT) was LY while LGR3 was least associated. On the other hand, LGR2 constitutes an acceptable compromise between composition of gain and growth rate which makes it a good choice as a biological index. Another alternative would be to select on LY as it was relatively uncorrelated to most secondary traits (CW and BW) although possible changes in marbling need to be monitored. In this case, LY would be incorporated in an economic index along with EPD's of other traits (e.g. growth) currently evaluated.

BIF MINUTES

MINUTES OF BEEF IMPROVEMENT FEDERATION ANNUAL BOARD OF DIRECTORS MEETING

Calgary Marriott
Calgary, Alberta, Canada
June 30,1998

The annual meeting of the Beef Improvement Federation Board of Directors was held on June 30, 1998 at the Calgary Marriott in Calgary, Alberta. Board members in attendance were Gary Johnson; President, Jed Dillard; Vice-President, Ron Bolze; Executive Director, Willie Altenburg, Kent Anderson, Don Boggs, John Crouch, Larry Cundiff, Sally Dolezal, Sherry Doubet, S.R. Evans, Galen Fink, Ronnie Green, Burke Healey, John Hough, Robert Hough, Roger Hunsley, Herb McLane, Connee Quinn, Ronnie Silcox, James Smith and Norm Vincel. Board members not in attendance were Larry Corah and Roy McPhee. Also in attendance were Don Hutzel, in coming NAAB representative, Jim Gibb, National Cattlemen's Beef Association and Gina Grosenick, Host Committee.

President Johnson called the meeting to order at approximately 2:15 pm following a Board tour of the Cargill Packing Plant near High River, Alberta. The agenda was cleared with no additions or changes. Hunsley moved to approve as distributed the minutes of the October 11, 1997 Mid-Year Board Meeting. Vincel seconded and the motion carried.

Financial Report - Bolze distributed copies of the Statement of Assets, Liabilities and Revenues (cash basis) as well as the Statement of Revenues and Expenditures (cash basis) for FY 97 and interim reports for FY 98 (through June 30). Hunsley moved and Dillard seconded to approve the financial reports. Motion carried. Crouch moved to transfer accounts and books to in-coming Executive Director Boggs based upon the financial reports with no formal audit. Altenburg seconded and the motion carried. Bolze indicated that checking account will be transferred following convention and savings will be transferred when certificate of deposit matures in September.

1998 Convention report – McLane and Gina Grosenick gave an update on the 1998 convention. All was running smoothly with over 400 registered by Tuesday pm. The Board applauded the host committee for the excellent job they had done with pre-convention planning and hospitality.

Membership – Bolze reported 31 state BCIAs and 26 breed associations had paid 1998 dues. Eleven voting members from 1997 had not yet paid dues for 1998 even though two notices had been sent. Additionally, 18 associate and sustaining memberships had been paid.

1999 Convention Report – Vincel reported on plans for the 1999 convention scheduled for June 16-19,1999 in Roanoke, VA. Norm Vincel of VA/NC Select Sires and Dr. John Hall of Virginia Tech will co-chair the convention, which will be held at the Hotel

Roanoke and Conference Center. The host committee will bring theme ideas and preliminary program to the mid-year board meeting. Information regarding the 1999 convention is on the web at http://www.conted.vt.edu/bif/vt.htm .

2000 Convention – Boggs read a letter from Dr. Twig Marston of Kansas State University inviting BIF to hold its 2000 convention in Wichita, KS. Crouch moved and Hunsley seconded to accept the Kansas invitation and to ask Marston to attend mid-year with proposed dates and other planning information. Motion carried.

Educational Activities Committee – Quinn and Green presented a proposal from Wahoo Productions, Inc. to produce of series of four educational videos. The proposed series would include videos on 1) Genetics, 2) Performance Data, 3) EPD's and 4) Putting it All Together. Considerable discussion ensued on the need for the videos, distribution methods, writing and editing responsibilities, and potential funding sources. Altenburg moved to survey BIF participants at the Wednesday luncheon on usefulness of the proposed video series. Fink seconded, motion passed.

NAILE Beef Judging Awards – Boggs brought forth a request from Dr. David Hawkins, Superintendent of the Intercollegiate judging contest at the North American International Livestock Exposition, requesting continued sponsorship of the award for High Team in Performance Cattle. Bolze indicated a similar request would likely be coming from the NAILE 4-H Contest as well. Cost in the past has been approximately $300. Hunsley moved and Dillard seconded to continue support. Motion carried.

Homepage/Electronic Communication – Board discussed need for improvement in homepage and desire to increase its usefulness in disseminating BIF information. Vincel moved to move the management of the homepage to the Executive Director and provide funds for development of a high quality, active homepage. Quinn seconded and the motion carried.

Foreign Translation of BIF Materials – Boggs notified board of requests for Spanish translations of BIF materials. Hunsley informed the Board of a 12 –14 page booklet in Spanish that had been developed by the US Beef Breeds Council. It was also suggested that some of the Brahman-based breeds might also have translated educational materials. Hunsley volunteered to check with USBBC on possible funding for translating other BIF materials.

Student Contests – Cundiff reported six students had submitted essays for the Frank Baker Scholarship Awards. Green reported that seven posters had been entered in the poster contest and would be displayed outside of the meeting rooms during the convention. Awards for both contests will be presented at the Thursday Awards Luncheon.

Awards Committee – Vincel reported on the activities of the Awards Committee. Eleven commercial producers and 11 seedstock producers were nominated this year.

News releases for these award winners as well as recipients of the Ambassador, Continuing Service and Pioneer Awards have been prepared.

Nominating Committee – Crouch reported the following nominations: President – Jed Dillard, Vice-President – Willie Altenburg. Nominations were closed and a unanimous ballot cast.

Director Caucuses – Vincel reported the following term expirations: East – Dillard's second; West – McPhee's second; At-Large – Healey's second; Breeds – Crouch's second, Hunsley's first. Additionally, Robert Hough is eligible for re-election to a 2-year first term and Sherry Doubet is eligible for re-election to a 1-year term replacing Jim Doubet. Vincel reminded caucus leaders that only paid member organizations could vote and that nominees must be members of paid member organizations.

Historian – Johnson informed the Board that Dr. Richard Wilham had resigned from his position of BIF Historian following his retirement from Iowa State University. Hough moved and Healey seconded that Crouch be named BIF Historian. Motion carried.

Canadian Ex-Officio Member – Agriculture Canada is no longer involved in the Canadian Genetic Evaluation process and thus is no longer the appropriate organization to appoint the Canadian ex-officio board member. Healey moved that the By-Laws be amended to replace Agriculture Canada with the Canadian Beef Breeds Council as the appointing organization. Hough seconded and the motion carried. Notice is hereby given to all member organizations that this amendment to the by-laws will be voted upon at the 1999 Annual BIF Meeting.

Mid-Year Board Meeting – Fink moved and Dillard seconded to hold the next board meeting on October 10, 1998 at the Airport Hilton In Kansas City, MO. Motion carried.

1999 Program Committee – Johnson asked Dillard to appoint the program committee for the 1999 Annual Meeting. Altenburg will chair; members are Dillard, Boggs, Quinn, Anderson, Evans, Green, Vincel, Dolezal, and Fink. The program will meet on the afternoon of Friday, October 9, 1998 at the American-International Charolais Association in Kansas City.

President Johnson adjourned meeting at 5:30 pm.

Beef Improvement Federation
1998-1999 Board of Directors

MINUTES OF BEEF IMPROVEMENT FEDERATION POST-CONVENTION BOARD OF DIRECTORS MEETING

July 2, 1998

President Jed Dillard called the meeting to order at approximately 5:30 pm, July 2, 1998.

Director Election Results -East – Richard McClung; West – Gini Chase; At-Large – Jimmy Holliman, Breeds – Sherry Doubet, Bob Weaber, Robert Hough and Bruce Cunningham. Don Hutzel was appointed by NAAB.

International Committee on Animal Recording (ICAR) Report – Dr. Keith Bertrand, University of Georgia, reported on the ICAR meeting held in Australia. ICAR is working to put together a "BIF Guidelines-type" of document for standardizing data collection and analysis in the international community. Bertrand notified Board members that they might be called upon to contribute to this effort. Bertrand is a member of the ICAR – Beef Working Committee and will keep BIF updated on ICAR activities.

1998 Convention – McLane reported that the final registration count would be over 500. The Board thanked Herb and his staff for a job well done with a round of applause.

Standing Committee Reports – None of the committee meetings at this year's convention required Board action.

Mid-Year Board meeting – Boggs announced the site of the mid-year meeting would be the Airport Hilton in Kansas City, MO on October 10, 1998. Program Committee will meet on Friday afternoon, October 9, at the American-International Charolais Association offices.

Future Conventions – Dillard reported on requests to host future conventions. Proposed sites are:
1999 – Roanoke, VA; 2000 – Wichita, KS; 2001 – Corpus Christi, TX; 2002 – Florida. It was suggested that the Board discuss methods for soliciting and identifying host sites at the mid-year meeting.

Education Committee Report – Green reported the results of the video survey. Respondents overwhelmingly supported the concept. Dillard asked the committee to refine their proposal and including potential funding sources (partners, grants, sales, etc) for further discussion at he mid-year meeting. Doubet was added to the committee.

Fact Sheets – Green reported that only a few of the proposed new fact sheets have been completed and asked that committee chairs attempt to get their assigned fact sheets completed. Boggs and Dolezal will review old fact sheets to determine revision needs.

Dillard adjourned the meeting at 6:45 pm

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Beef Improvement Ontario
6986 Wellington Rd 124 RR #7
Guelph, Ontario Canada N1H 6J4
519/767-2665 519/767-2502 F

Jennifer Stewart-Smith
Beefbooster Cattle Alberta, LTD
#226 1935 32nd Ave NE
Calgary, Alberta Canada T2E 7C8
403/291-9771 403/291-9559 F

Wendell Schronk
Beefmaster Breeders United
6800 Park Ten Blvd 290 W
San Antonia TX 78213
210/732-3132 210/732-7711 F

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214 - 6715 8th St NE
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403/571-3580 403/571-3599 F

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403/730-0305 403/278-8490 F

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403/250-8640 403/291-5624 F

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#450 1207 11th Ave SW
Calgary, Alberta Canada T3C 0M5
403/245-6923 403/244-3128 F

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5160 Skyline Way NE
Calgary, Alberta Canada T2E 6V1
403/275-2662

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Taylors Black Simmentals
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Rodney Roberson
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BIF 1998 AWARD PRESENTATIONS

SEEDSTOCK BREEDERS HONOR ROLE OF EXCELLENCE

John Crowe	CA	1972	Joseph P. Dittmer	IA	1975
Dale H. Davis	MT	1972	Dale Engler	KS	1975
Elliot Humphrey	AZ	1972	Leslie J. Holden	MT	1975
Jerry Moore	OH	1972	Robert D. Keefer	MT	1975
James D. Bennett	VA	1972	Frank Kubik, Jr.	ND	1975
Harold A. Demorest	OH	1972	Licking Angus Ranch	NE	1975
Marshall A. Mohler	IN	1972	Walter S. Markham	CA	1975
Billy L. Easley	KY	1972	Gerhard Mittnes	KS	1976
Messersmith Herefords	NE	1973	Ancel Armstrong	VA	1976
Robert Miller	MN	1973	Jackie Davis	CA	1976
James D. Hemmingsen	IA	1973	Sam Friend	MO	1976
Clyde Barks	ND	1973	Healey Brothers	OK	1976
C. Scott Holden	MT	1973	Stan Lund	MT	1976
William F. Borror	CA	1973	Jay Pearson	ID	1976
Raymond Meyer	SD	1973	L. Dale Porter	IA	1976
Heathman Herefords	WA	1973	Robert Sallstrom	MN	1976
Albert West III	TX	1973	M.D. Shepherd	ND	1976
Mrs. R. W. Jones, Jr.	GA	1973	Lowellyn Tewksbury	ND	1976
Carlton Corbin	OK	1973	Harold Anderson	SD	1977
Wilfred Dugan	MO	1974	William Borror	CA	1977
Bert Sackman	ND	1974	Robert Brown	TX	1977
Dover Sindelar	MT	1974	Glen Burrows	NM	1977
Jorgensen Brothers	SD	1974	Henry, Jeanette Chitty	NM	1977
J. David Nichols	IA	1974	Tom Dashiell	WA	1977
Bobby Lawrence	GA	1974	Lloyd DeBruycker	MT	1977
Marvin Bohmont	NE	1974	Wayne Eshelman	WA	1977
Charles Descheemacker	MT	1974	Hubert R. Freise	ND	1977
Bert Crame	CA	1974	Floyd Hawkins	MO	1977
Burwell M. Bates	OK	1974	Marshall A. Mohler	IN	1977
Maurice Mitchell	MN	1974	Clair Percel	KS	1977
Robert Arbuthnot	KS	1975	Frank Ramackers, Jr.	NE	1977
Glenn Burrows	NM	1975	Loren Schlipf	IL	1977
Louis Chestnut	WA	1975	Tom & Mary Shaw	ID	1977
George Chiga	OK	1975	Bob Sitz	MT	1977
Howard Collins	MO	1975	Bill Wolfe	OR	1977
Jack Cooper	MT	1975	James Volz	MN	1977

A. L. Frau		1978
George Becker	ND	1978
Jack Delaney	MN	1978
L. C. Chestnut	WA	1978
James D. Bennett	VA	1978
Healey Brothers	OK	1978
Frank Harpster	MO	1978
Bill Womack, Jr.	AL	1978
Larry Berg	IA	1978
Buddy Cobb	MT	1978
Bill Wolfe	OR	1978
Roy Hunt	PA	1978
Del Krumwied	ND	1979
Jim Wolf	NE	1979
Rex & Joann James	IA	1979
Leo Schuster Family	MN	1979
Bill Wolfe	OR	1979
Jack Ragsdale	KY	1979
Floyd Mette	MO	1979
Glenn & David Gibb	IL	1979
Peg Allen	MT	1979
Frank & Jim Wilson	SD	1979
Donald Barton	UT	1980
Frank Felton	MO	1980
Frank Hay	CAN	1980
Mark Keffeler	SD	1980
Bob Laflin	KS	1980
Paul Mydland	MT	1980
Richard Tokach	ND	1980
Roy & Don Udelhoven	WI	1980
Bill Wolfe	OR	1980
John Masters	KY	1980
Floyd Dominy	VA	1980
James Bryany	MN	1980
Charlie Richards	IA	1980
Blythe Gardner	UT	1980
Richard McLaughlin	IL	1980
Bob Dickinson	KS	1981
Clarence Burch	OK	1981
Lynn Frey	ND	1981
Harold Thompson	WA	1981
James Leachman	MT	1981
J. Morgan Donelson	MO	1981
Clayton Canning	CAN	1981
Russ Denowh	MT	1981
Dwight Houff	VA	1981
G. W. Cronwell	IA	1981
Bob & Gloria Thomas	OR	1981
Roy Beeby	OK	1981
Herman Schaefer	IL	1981
Myron Aultfathr	MN	1981
Jack Ragsdale	KY	1981
W. B. Williams	IL	1982
Garold Parks	IA	1982
David A. Breiner	KS	1982
Joseph S. Bray	KY	1982
Clare Geddes	CAN	1982
Howard Krog	MN	1982
Harlin Hecht	MN	1982
William Kottwitz	MO	1982
Larry Leonhardt	MT	1982
Frankie Flint	NM	1982
Gary & Gerald Carlson	NS	1982
Bob Thomas	OR	1982
Orville Stangl	SD	1982
C. Ancel Armstrong	KS	1983
Bill Borror	CA	1983
Charles E. Boyd	KY	1983
John Bruner	SD	1983
Leness Hall	WA	1983
Ric Hoyt	OR	1983
E. A. Keithley	MO	1983
J. Earl Kindig	MO	1983
Jake Larson	ND	1983

Harvey Lemmon	GA	1983	Bernard F. Pedretti	WI	1985
Frank Myatt	IA	1983	Arnold Wienk	SD	1985
Stanley Nesemeier	IL	1983	R. C. Price	AL	1985
Russ Pepper	MT	1983	Clifford & Bruce Betzold	IL	1986
Robert H. Schafer	MN	1983	Gerald Hoffman	SD	1986
Alex Stauffer	WI	1983	Delton W. Hubert	KS	1986
D. John & Lebert Shultz	MO	1983	Dick & Ellie Larson	WI	1986
Phillip A. Abrahamson	MN	1984	Leonard Lodden	ND	1986
Ron Beiber	SD	1984	Ralph McDanolds	VA	1986
Jerry Chappel	VA	1984	W.D. Morris/James Pipkin	MO	1986
Charles W. Druin	KY	1984	Roy D. McPhee	CA	1986
Jack Farmer	CA	1984	Clarence VanDyke	MT	1986
John B. Green	LA	1984	John H. Wood	SC	1986
Ric Hoyt	OR	1984	Evin & Verne Dunn	CAN	1986
Fred H. Johnson	OH	1984	Glenn L. Brinkman	TX	1986
Earl Kindig	VA	1984	Jack & Gini Chase	WY	1986
Glen Klippenstein	MO	1984	Henry & Jeanette Chitty	FL	1986
A. Harvey Lemmon	GA	1984	Lawrence H. Graham	KY	1986
Lawrence Meyer	IL	1984	A. Lloyd Grau	NM	1986
Donn & Sylvia Mitchell	CAN	1984	Matthew Warren Hall	AL	1986
Lee Nichols	IA	1984	Richard J. Putnam	NC	1986
Clair K. Parcel	KS	1984	R.J. Steward/P.C. Morrissey	PA	1986
Joe C. Powell	NC	1984	Leonard Wulf	MN	1986
Floyd Richard	ND	1984	Charles & Wynder Smith	GA	1987
Robert L. Sitz	MT	1984	Lyall Edgerton	CAN	1987
Ric Hoyt	OR	1984	Tommy Branderberger	TX	1987
J. Newbill Miller	VA	1985	Henry Gardiner	KS	1987
George B. Halterman	WV	1985	Gary Klein	ND	1987
David McGehee	KY	1985	Ivan & Frank Rincker	IL	1987
Glenn L. Brinkman	TX	1985	Larry D. Leonhardt	WY	1987
Gordon Booth	WY	1985	Harold E. Pate	IL	1987
Earl Schafer	MN	1985	Forrest Byergo	MO	1987
Marvin Knowles	CA	1985	Clayton Canning	CAN	1987
Fred Killam	IL	1985	James Bush	SD	1987
Tom Perrier	KS	1985	R.J. Steward/P.C. Morrissey	MN	1987
Don W. Schoene	MO	1985	Eldon & Richard Wiese	MN	1987
Everett & Ron Batho	CAN	1985	Douglas D. Bennett	TX	1988

Don & Diane Guilford & David & Carol Guilford	CAN	1988
Kenneth Gillig	MO	1988
Bill Bennett	WA	1988
Hansell Pile	KY	1988
Gino Pedretti	CA	1988
Leonard Lorenzen	OR	1988
George Schlickau	KS	1988
Hans Ulrich	CAN	1988
Donn & Sylvia Mitchell	CAN	1988
Darold Bauman	WY	1988
Glynn Debter	AL	1988
William Glanz	WY	1988
Jay P. Book	IL	1988
David Luhman	MN	1988
Scott Burtner	VA	1988
Robert E. Walton	WA	1988
Harry Airey	CAN	1989
Ed Albaugh	CA	1989
Jack & Nancy Baker	MO	1989
Ron Bowman	ND	1989
Jerry Allen Burner	VA	1989
Glynn Debter	AL	1989
Sherm & Charlie Ewing	CAN	1989
Donald Fawcett	SD	1989
Orrin Hart	CAN	1989
Leonard A. Lorenzen	OR	1989
Kenneth D. Lowe	KY	1989
Tom Mercer	WY	1989
Lynn Pelton	KS	1989
Lester H. Schafer	MN	1989
Bob R. Whitmire	GA	1989
Dr. Burleigh Anderson	PA	1990
Boyd Broyles	KY	1990
Larry Earhart	WY	1990
Steven Forrester	MI	1990
Doug Fraser	CAN	1990
Gerhard Gueggenberger	CA	1990
Douglas & Molly Hoff	SD	1990
Richard Janssen	KS	1990
Paul E. Keffaber	IN	1990
John & Chris Oltman	WI	1990
John Ragsdale	KY	1990
Otto & Otis Rincker	IL	1990
Charles & Rudy Simpson	CAN	1990
T.D. & Roger Steele	VA	1990
Bob Thomas Family	OR	1990
Ann Upchurch	AL	1991
N. Wehrmann/R. McClung	VA	1991
John Bruner	SD	1991
Ralph Bridges	GA	1991
Dave & Carol Guilford	CAN	1991
Richard/Sharon Beitelspacher	SD	1991
Tom Sonderup	NE	1991
Steve & Bill Florshcuetz	IL	1991
R. A. Brown	TX	1991
Jim Taylor	KS	1991
R.M. Felts & Son Farm	TN	1991
Jack Cowley	CA	1991
Rob & Gloria Thomas	OR	1991
James Burns & Sons	WI	1991
Jack & Gini Chase	WY	1991
Summitcrest Farms	OH	1991
Larry Wakefield	MN	1991
James R. O'Neill	IA	1991
Francis & Karol Bormann	IA	1992
Glenn Brinkman	TX	1992
Bob Buchanan Family	OR	1992
Tom & Ruth Clark	VA	1992
A. W. Compton, Jr.	AL	1992
Harold Dickson	MO	1992
Tom Drake	OK	1992
Robert Elliott & Sons	TN	1992
Dennis, David, Danny Geffert	WI	1992

Eugene B. Hook	MN	1992
Dick Montague	CA	1992
Bill Rea	PA	1992
Calvin & Gary Sandmeier	SD	1992
Leonard Wulf & Sons	MN	1992
R. A. Brown	TX	1993
Norman Bruce	IL	1993
Wes & Fran Cook	NC	1993
Clarence/Elaine/Adam Dean	SC	1993
D. Eldridge & Y. Adcock	OK	1993
Joseph Freund	CO	1993
R. B. Jarrell	TN	1993
Rueben, Leroy, Bob Littau	SD	1993
J. Newbill Miller	VA	1993
J. David Nichols	IA	1993
Miles P. "Buck" Pangburn	IA	1993
Lynn Pelton	KS	1993
Ted Seely	WY	1993
Collin Sander	SD	1993
Harrell Watts	AL	1993
Bob Zarn	MN	1993
Ken & Bonnie Bieber	SD	1994
John Blankers	MN	1994
Jere Caldwell	KY	1994
Mary Howe di'Zerega	VA	1994
Ron & Wayne Hanson	CAN	1994
Bobby F. Hayes	AL	1994
Buell Jackson	IA	1994
Richard Janssen	KS	1994
Bruce Orvis	CA	1994
John Pfeiffer Family	OK	1994
Calvin & Gary Sandmeier	SD	1994
Dave Taylor / Gary Parker	WY	1994
Bobby Aldridge	NC	1995
Gene Bedwell	IA	1995
Gordon & Mary Ann Booth	WY	1995
Ward Burroughs	CA	1995

Chris & John Christensen	SD	1995
Mary Howe de'Zerega	VA	1995
Maurice Grogan	MN	1995
Donald J. Hargrave	CAN	1995
Howard & JoAnne Hillman	SD	1995
Mack, Billy, Tom Maples	AL	1995
Mike McDowell	VA	1995
Tom Perrier	KS	1995
John Robbins	MT	1995
Thomas Simmons	VA	1995
D. Borgen & B. McCulloh	WI	1996
Chris & John Christensen	SD	1996
Frank Felton	MO	1996
Galen & Lori Fink	KS	1996
Cam, Spike, Sally Forbes	WY	1996
Mose & Dave Hebbert	NE	1996
C. Knight & B. Jacobs	OK	1996
Robert C. Miller	MN	1996
Gerald & Lois Neher	IL	1996
C. W. Pratt	VA	1996
Frank Schiefelbein	MN	1996
Ingrid & Willy Volk	NC	1996
William A. Womack, Jr.	AL	1996
Alan Albers	KS	1997
Gregg & Diane Butman	MN	1997
Blaine & Pauline Canning	CAN	1997
Jim & JoAnn Enos	IL	1997
Harold Pate	AL	1997
E. David Pease	CAN	1997
Juan Reyes	WY	1997
James I. Smith	NC	1997
Darrel Spader	SD	1997
Bob & Gloria Thomas	OR	1997
Nicholas Wehrmann & Richard McClung	VA	1997
James D. Bennett Family	VA	1998
Dick & Bonnie Helms	NE	1998
Dallis & Tammy Basel	SD	1998

Duane L. Kruse Family	IL	1998	Earl & Nedra McKarns	OH	1998
Abigail & Mark Nelson	CA	1998	Tom Shaw	ID	1998
Airey Family	MB	1998	Wilbur & Melva Stewart	AB	1998
Dave & Cindy Judd	KS	1998	Adrian Weaver & Family	CO	1998

SEEDSTOCK BREEDER OF THE YEAR

John Crowe	CA	1972	Henry Gardiner	KS	1987
Mrs. R. W. Jones	GA	1973	W.T. "Bill" Bennett	WA	1988
Carlton Corbin	OK	1974	Glynn Debter	AL	1989
Leslie J. Holden	MT	1975	Doug & Molly Hoff	SD	1990
Jack Cooper	MT	1975	Summitcrest Farms	OH	1991
Jorgensen Brothers	SD	1976	Leonard Wulf & Sons	MN	1992
Glenn Burrows	NM	1977	R. A. "Rob" Brown	TX	1993
James D. Bennett	VA	1978	J. David Nichols	IA	1993
Jim Wolfe	NE	1979	Richard Janssen	KS	1994
Bill Wolfe	OR	1980	Tom & Carolyn Perrier	KS	1995
Bob Dickinson	KS	1981	Frank Felton	MO	1996
A.F. "Frankie" Flint	NM	1982	Bob & Gloria Thomas	OR	1997
Bill Borror	CA	1983	Wehrmann Angus Ranch	VA	1997
Lee Nichols	IA	1984	Flying H Genetics	NE	1998
Ric Hoyt	OR	1985	Knoll Crest Farms	VA	1998
Leonard Lodoen	ND	1986			

Dick and Bonnie Helms
Flying H Gelbvieh
Seedstock Producer Co-winner

Knoll Crest Farms
James Bennet Family
Paul and Tracey Bennett
Mr. and Mrs. James Bennett
Seedstock Producer Co-winner

KNOLL CREST FARMS AND FLYING H GENETICS NAMED CO-WINNERS OF THE "1998 BIF OUTSTANDING SEEDSTOCK PRODUCER AWARD"

Calgary, Alberta, Canada - For the third time in the 30 year history of the Beef Improvement Federation (BIF), co-winners were named to receive BIF's Outstanding Seedstock Producer Award. Honored at the BIF Convention held in Calgary, Alberta, were the James Bennett Family of Knoll Crest Farms and Dick and Bonnie Helms of Flying H Genetics.

Knoll Crest Farms, located near Red House, in Virginia's Central Piedmont area, is one of the significant beef seedstock breeding establishments in the U.S. Knoll Crest Farms is owned by the James D. Bennett family, that includes James and three sons, Paul, Jim, and Brian. Paul serves as President and Brian as Secretary/Treasurer. Paul is in charge of the management and marketing of the produce of the registered cowherd, numbering 500 head (85 Polled Hereford, 190 Angus, and 230 Gelbvieh). Jim is in charge of growing forages and other feeds for the herd on some 2,300 owned acres and some additional leased land. Brian is in charge of equipment purchases, maintenance, and all farm financial records.

The Knoll Crest operation started when James Bennett's father, Paul D. Bennett, bought his first registered Polled Hereford cows in 1944. Under James Bennett's management, the Polled Hereford herd was greatly increased and brought into national prominence.

The 1980's brought a new generation of people and cattle to what became Knoll Crest Farms Incorporated in 1987. As a third generation of Bennetts committed to full-time employment, the increase of land and cattle became a necessity. Paul came back to the farm in 1983 after graduating in Animal Science at Virginia Tech. Paul's innovative approach to the future of Knoll Crest Farm's seedstock production added a second breed of cattle, which was not only a new breed being introduced at Knoll Crest Farms, but also the first Gelbvieh cattle to be brought into Virginia. To better serve the Knoll Crest Farms' bull customers, Angus were added as a third breed in 1991, with a base of proven females.

Cattle have been sold into 40 states and numerous foreign countries. Knoll Crest farms has increased its embryo transfer program and marketed over 750 embryos internationally last year. Twenty-nine KCF bred sires have gone into AI studs and 56 KCF bred sires are listed in three breeds' most recent sire summaries.

As the market has grown, the challenges to produce better cattle have grown. The Bennett's have taken advantage and have captured an important share of the top level seedstock market. The Bennett's consistent commitment over the years to develop a breeding program around the needs of the commercial producer has been the stabilizing force that has helped Knoll Crest Farms stay on track and stay in the seedstock business for 54 years, involving three generations of the Bennett family.

There appears to be no doubt that this same commitment can allow this operation to continue to serve the beef industry into the distant future.

Flying H Genetics is a family owned and managed ranch and farm operation near Arapahoe in southwest Nebraska. The operation began in 1976 after Dick Helms and wife Bonnie moved back, following college. The Helms went into debt purchasing the place they call home from an uncle on contract. Starting with such a high debt load meant the Helms had to spend and invest wisely. Slowly expanding their farming and cattle operation, they added Gelbvieh cattle to the operation in 1982 as a way to generate more income from the same acres. Seedstock production is a form of intensive agriculture since they are adding value to the cattle they sell. The operation continued to grow, not driven by the desire to be bigger, but by the need to be more efficient, and to justify an annual sale. In 1992, after two years of study and research, the Flying H changed its name from Flying H Gelbvieh to Flying H Genetics, and added the GelPLUS division to its seedstock offerings. GelPLUS is a trademarked composite breeding seedstock production system that uses AI and cooperator herds to build hybrid bulls to be used in composite crossbreeding systems.

As they gained experience, they wanted to assure their customers of the quality for their genetics, so they developed their 16 Quality Standards. These minimum standards for sixteen different traits are the basis of their selection and culling programs. This disciplined approach has greatly improved the consistency and predictability of their bulls. They strongly feel that any bull they sell should be an industry improver, not just a cow settler.

Although the challenge of seedstock production is their first love, the other main enterprise in their operation is crops. Raising corn, soybeans, oats, milo, and hard red winter wheat on both irrigated and dryland acres complement the cattle quite well. The crops add diversification, cash income, feed for the cows, crop residue for winter feed, and year-round labor needs for three full-time employees, now helping Flying H Genetics. Dick, Bonnie, Bryan, and Kyle Helms produce genetics that will benefit the beef industry for years to come.

As is true with all family stories, it couldn't have happened without the support of family friends, neighbors, and employees. They acknowledge this support and say thank you to all who've helped them build a life in Nebraska agriculture.

The Beef Improvement Federation believes it is most appropriate to honor two such deserving producers with their 1998 BIF Outstanding Seedstock Producer Award.

1998 BIF SEEDSTOCK NOMINEES

Basel Red Angus Ranch
Dallis and Tammy Basel
Union Center, South Dakota

Dallis Basel took over his father's place in 1981 and along with wife, Tammy, currently operate on about 4,500 acres. About 500 acres is alfalfa and hay ground and the rest pasture. They currently have a herd of 130 registered Red Angus cows of which about half is artificially inseminated every year. They also manage 90 commercial cows, 60 registered Polled Rambouillet ewes and 120 commercial ewes. They feed about 30 bull calves at home and sell them by private treaty in the spring. The heifer calves are wintered in a feedlot, then brought back home to breed and summer and sold as bred heifers in the fall. The steer calves are sold off of the cow in early October.

Dallis has been a breed representative at the Black Hills Stock Show. He was president of the Red Angus Breeders of South Dakota, for four years, currently serving as a director. As Red Angus representative to the South Dakota Beef Breeds Council, Dallis served as the secretary/treasurer for two years. Also, he has served on the board of directors for the South Dakota Cattlemen's Association for one year and is currently serving on the board for the Central Meade County Community Center.

Dallis and Tammy Basel were nominated by the South Dakota Beef Breeds Council.

DeKap Angus Farm
Duane L. Kruse Family
Lanark, Illinois

DeKap Angus Farm is located in far northwestern Illinois. This farm is a diversified family farm with rotated crops and livestock. Les Kruse concentrated on feeding cattle in the forties and fifties.

In the sixties, his son, Duane, improved the facilities to increase efficiency of the feeding system and manure handling. Good quality, reasonably priced feeder cattle became difficult to find, so the cow herd was added to provide the desired quality of cattle. Currently, the herd consists of 80 Angus cows and 20 bred heifers that trace back to the original stock from Kenmar Farms of Lanark, that were purchased in 1968. Genetics have come from the herds of Pioneer, Glengarry, Roger Boyle, Bradmar, Summitcrest and other outstanding performance herds in the Midwest.

Weaning weights were taken in 1976. In 1978, Duane began using the University of Illinois Beef Performance Testing Program. Their test weights have increased over 40% for heifers and bulls. Duane believes 700 pound heifers and 775 pound bulls are the optimum for his midwest resources and weather. Yearling weight increases have also been 40%. Duane has ultrasounded his yearlings for the last four years. This year's results show a ribeye area ratio of 1.3 square inces per one hundred pounds for both bulls and heifers, with outstanding marbling.

The DeKap Angus herd offers its customers improved genetics that result in a quality product for the consumer. The consistent quality and production, plus the resale value of their cattle, has given Duane's customers a competitive edge in over twenty states across the country.

Duane Kruse was nominated by the Illinois Beef Association and the University of Illinois Cooperative Extension Service.

Five Star Land and Livestock
Abigail and Mark Nelson
Wilton, California

Abigail and Mark Nelson of Five Star Land and Livestock, are fourth generation breeders of registered Angus cattle. Abbie's great grandfather, Thomas Ryan, was one of the first to import Angus from Scotland. Thomas' son, Earl, and his brother-in-law, Charles Escher, acquired the W.A. McHenry herd and with it the great sire, Earl Marshall. They bred some of the best cattle in the early 1900's, and both are members of the Angus Hertiage Foundation. For the past twenty years, the ranch as been located in Sacramento County, California. Their goal is to genetically refine the Angus breed to suit demands of commercial cow-calf producers. The herd has been in continuous production, with records, from the mid 1850's. While maintaining birth weight, weaning and yearling weights have increased more that 20%, since 1984. A.I. conception rates have improved from below 50% in the 1950's to 92% in 1997. Abbie and Mark are now evaluating their bulls for carcass value, using the National Angus Sire Evaluation and ultrasound as tools. They assist customers in value-based marketing of commercial cattle. The Five Star Land and Livestock land base consists of 100 acres of irrigated pasture, two hundred twenty acres of winter range and two leased ranches. They calve eighty-five cows in the spring and fifty in the fall. Bulls are sold in October at a ranch production sale, the Heritage Bull Sale, an innovative multi-breed sale with the Orvis Hereford Ranch. Females are sold by private treaty and in the Signature Sale hosted at the ranch in June.

Abigail and Mark Nelson were nominated by the California Beef Cattle Improvement Association and the University of California.

Flying H Genetics
Dick and Bonnie Helms
Arapahoe, Nebraska

Flying H Genetics is a family owned and managed ranch and farm operation in southwest Nebraska. The operation began in 1976, after Dick Helms and wife Bonnie moved back, following college. The Helms went into debt purchasing the place they call home, from an uncle, on contract. Starting with such a high debt load meant the Helms had to spend and invest wisely. Slowly expanding their farming and cattle operation, they added Gelbvieh cattle to the operation in 1982, as a way to generate more income from the same acres. Seedstock production is a form of intensive agriculture since they are adding value to the cattle they sell. The operation continued to grow, not driven by the desire to be bigger, but by the need to be more efficient, to justify an annual sale. In 1992, after two years of study and research, the Flying H changed its name from Flying

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Although the challenge of seedstock production is their first love, the other main enterprise in their operation is crops. Raising corn, soybeans, oats, milo and hard red winter wheat on both irrigated and dryland acres complement the cattle quite well. The crops add diversification, cash income, feed for the cows, crop residue for winter feed and year round labor needs for three full-time employees, now helping Flying H Genetics. Dick, Bonnie, Bryan and Kyle Helms produce genetics that will benefit the beef industry for years to come.

As is true with all family stories, it couldn't have happened without the support of family, friends, neighbors and employees. They acknowledge this support and say thank you to all who've helped them build a life in Nebraska agricultre.

Dick and Bonnie Helms were nominated by the American Gelbvieh Association.

HTA Charolais
Airey Family
Rivers, Manitoba, Canada

HTA Charolais Farm is located about 30 minutes northwest of Brandon, Manitoba (6.5 miles west of Rivers). HTA Charolais is a family operation, consisting of Harry and Joan Airey and sons Raymond and Shawn, daughter Lori-Anne with her husband, Darch Heapy, on a dairy farm in the same area. They farm three sections and rent some summer pasture. They run about 100 purbred Charolais cows (calving 75 cows and 24 heifers this year) and grow a lot of grain. The price of land is getting prohibitive, so expansion is difficult. The solution has been to become more productive with what they have.

HTA has always been performance minded. They purchased their first Charolais bull from the Douglas Bull Test Station in 1971. The resulting calf crop convinced them that this was the way to go. They gradually switched from commercial cows to pruebred, with the purchase of quality percentage and purebred cows. This year, nearly twenty percent (49/248) of the Charolais bulls at Douglas, were sired by HTA bulls or bulls owned by HTA (HTA tests 10 bulls a year at Douglas). In addition, there are 29 HTA raised bulls in the current sire summary.

HTA enrolled in the Canada Agriculture ROP program in 1973 and stayed with it until the demise of ROP in 1993. HTA also joined the Canadian Charolais Association CHARM (Charolais Herd and Record Management) program in 1987. Thus, they were invovled in both programs for many years. HTA currently uses the home computer version of CHARM, which allows all the features of the Canadian Charolais Association office service on the farm.

In 1988, the Aireys were awarded the Premiere Purebred Producer Award, for Manitoba by Manitoba Agriculture.

Harry and Joan Airey were nominated by the Canadian Charolais Association.

Judd Ranch, Inc.
Dave and Cindy Judd
Pomona, Kansas

Judd Ranch, Inc., is a family owned and operated seedstock production business. Managed by Dave and Cindy Judd and their sons Nick and Brent, the ranch is located near Pomona, Kansas. Since starting their business in 1982, the Judds have set their sights on improving the herd quality, increasing ranch efficiency and providing genetics commercial producers demand.

Meeting these goals has meant using production tehcnologies, keeping meticulous records, analyzing production standards and practicing stringent culling requirements. Through A.I. and embryo transfer, JRI has propagated their top genetics and continue to raise the bar of performance levels. Careful selection of genetics and planned matings, have allowed JRI to meet goals of increasing weaning and yearling weights, while lowering birth weights, reaching a set criteria for ribeye area and increasing fertility. Achievements in herd improvements have not gone unnoticed as Judd Ranch, Inc. was honored by the American Gelbvieh Association, as having the number one Dam of Merit Program in 1997.

The improvements in Judd Ranch, Inc. genetics are made available to commercial and purebred breeders through two annual production sales. The bull sale held in the spring, features an average of 180 lots and over 100 lots are sold in the annual fall female sale.

Pressure is placed on producing cattle in an efficient manner, complimenting the ranch's natural environment. This pressure has allowed the ranch to be efficient in meeting it's goal of producing high performing, purebred cattle. This goal of balancing the production ability of the land with the needs of the cattle, promises to provide the next generation of Judds the opportunity to continue to make improvements in an already successful program.

Dave and Cindy Judd were nominated by the Kansas Livestock Association.

Knoll Crest Farm
The James D. Bennett Family
Red House, Virginia

Knoll Crest Farm, located in Virginia's Central Peidmont area, is one of the significant beef seedstock breeding establishments in the U.S. Knoll Crest Farm is owned by the James D. Bennett family, that includes James and three sons, Paul, Jim and Brian. Paul serves as President and Brian as Secretary/Treasurer. Paul is in charge of the management and marketing of the produce of the registered cow herd, numbering 500 head (85 Polled Hereford, 190 Angus and 230 Gelbvieh). Jim is in charge of growing forages and other feeds for the herd on some 2,300 owned acres and some additional leased land. Brian is in charge of equipment purchases, maintenance and all farm financial records.

The Knoll Crest operation started when James Bennett's father, Paul D. Bennett, bought his first registered Polled Hereford cows in 1944. Under James Bennett's management, the Polled Hereford herd was greatly increased and brought into national prominence.

The early 1980's brought a new generation of people and cattle to what became Knoll Crest Farm Incorporated in 1987. As a third generation of Bennetts committed to full-time employment, the increase of land and cattle became a necessity. Paul came back to the farm in 1983, after graduating in Animal Science at Virginia Tech. Paul's innovative approach to the future of Knoll Crest Farm's seedstock production, added a second breed of cattle, which was not only a new breed being introduced at Knoll Crest Farm, but also the first Gelbvieh cattle to be brought into Virginia. To better serve the Knoll Crest Farm bull customers, Angus were added as a third breed in 1991, with a base of proven females.

Cattle have been sold into 40 states and numerous foreign countries. Knoll Crest Farm has increased its embryo transfer program and marketed over 750 embryos internationally last year. Twenty-nine KCF bred sires have gone into A.I. studs and 56 KCF bred sires are listed in three breeds most recent sire summaries. The 37 KCF bred sires in the 1998 Gelbvieh Sire Summary posted the following EPD averages and percentile ranks:

	CE	BW	WW	YW	MILK	TM	DCE	SC
EPD's	103	-1.2	+12	+21	+3	+9	105	+8.5
Breed Rank (%)	30	27	17	13	35	20	15	3

As the market has grown, the challenges to produce better cattle have grown. The Bennetts have taken advantage and have captured an important share of the top level seedstock market. The Bennetts' consistent commitment over the years to develop a breeding program around the needs of the commercial producer has been the stabilizing force that has helped Knoll Crest Farm stay on track and stay in the seedstock business for 54 years, involving three generations of the Bennett family. There appears to be no doubt that this same commitment can allow this operation to continue to serve the beef industry into the distant future.

The James D. Bennett Family was nominated by the Virginia Beef Cattle Improvement Association.

Shamrock Vale Farms
Earl and Nedra McKarns
Kensington, Ohio

Earl was raised on a dairy/beef farm in northeast Ohio. After high school and four years in the Navy, he started farming full time on his 137 acre farm with 12 Holstein cows. Over the years, he increased his farm to 550 acres, enlarged his dairy herd to 75 cows and started a small registered Angus herd in the late 70's. He expanded his Angus herd by retaining his own replacement heifers. In 1991, the dairy cattle and 250 acres were dispersed.

The only source of new genetics entering his closed herd is through A.I. sires (balanced for all EPD traits, easy fleshing and moderate frame). His marketing plan is to sell all 4-year-old cows each fall for seedstock and also the top half of the bull calves for breeding purposes.

Earl's registered Angus farm, known as Shamrock Vale Farms, consists of 360 acres and 150 spring-calving cows. The complete herd of 400 head are grazed on a rotational-intensive system. The cattle are moved every 12 hours during the growing season. The farm is completely seeded to a year-around grass and hay program. To minimize erosion and enhance gain, a system was developed to supply water in each paddock.

Earl currently serves on the Meat Export Federation Board of NCBA, on the Select Sires Beef Sire Committee, is president of the Ohio Forage & Grassland Council, serves on the board of the Ohio Beef Council, the County Soil & Water Conservation Board, is past-president of the Ohio Cattlemen's Association and is active in his church and community.

Earl and Nedra McKarns were nominated by the Buckeye Beef Improvement Federation.

Shaw Hereford Ranch
Tom Shaw
Caldwell, Idaho

In 1946, Tom and Mary Shaw started in the seedstock business with one registered Hereford heifer. This was the start of the Shaw Hereford Ranch, which is now located in southwest Idaho, approximately ten miles west of Caldwell. This location has been the headquarters for the past 39 years. Summers are spent at their mountain ranch north of Caldwell, near Cascade.

Along with their sons, Tim and Greg and their families, the Shaws presently run 500 registered Horned Hereford cows, 50 registered Polled Hereford cows, 50 registered Red Angus cows, 50 registered Black Angus cows and 50 commercial cows, which they use for carcass testing. Their cows are primarily calved out in February and March, but about 100 of them are calved in September and October, to meet the demand of their customers who would rather buy fall bulls.

This family operation consists of 750 irrigated acres at the Caldwell headquarters and another 1,000 sub-irrigated acres in Cascade. In addition, they rent about 800 acres of pasture each year. Tom and Mary Shaw were nominated by the Idaho Cattle Association.

Stewart Farming, Ltd.
Wilbur and Melva Stewart
Big Valley, Alberta, Canada

Wilbur Stewart was born in 1927 and married Melva in 1954. Stewart Farming, Ltd. is located in central Alberta. The farm was incorporated in 1966 and importation of Limousin cattle from France began in 1970. In total, 12 females were imported. Their goal at that time was to build a herd of 200 registered females and 100 or more marketable bulls. During the first years of breeding Limousin cattle, the Stewarts used a Hereford base for upbreeding as well as Fullblood genetics. Percentage males were "blue tagged" and carcass data collected at slaughter. During this time, they tested other Continental European breeds in the same way, doing progeny testing for other importers.

Since the 1970's, the Stewarts have concentrated soley on Limousin genetics and have expanded the cattle operation to include 2,500 Limousin based commercial cattle. The Stewarts purchase over 1,000 Limousin and Limousin cross calves each year and collect feedlot and carcass data as they are fed out. Their registered herd has always been on performance test, achieving approximately 97% above average weaning and yearling gain status. Very recently, Limousin Sire Evaluation in Canada has changed to North American E.P.D.'s. The Stewarts are working closely with the National Unique Identification system through the Canadian Beef Breeds Council and Canadian Cattlemen's Association and will use it for genetic quality development. Their current farm operation is managed by family members, including three sons, and consists of over 30,000 acres, including 2,500 acres of pedigreed seed, production on 10,000 acres of grain and forage, 20,000 acres of grazing land, mostly native prairie, fescue grasslands.

Wilbur and Melva Stewart were nominated by the Canadian Limousin Association.

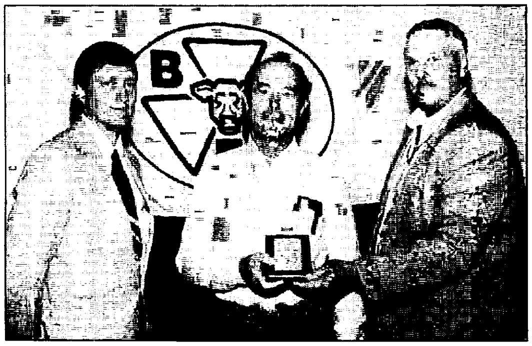
Weaver Ranch, Inc.
Adrian Weaver and Family
Ft. Collins, Colorado

The headquarters of the Weaver Angus Ranch is at Fort Collins, Colorado. Adrian Weaver bought and moved there in 1969, from their former headquarters at Tie Siding, Wyoming, where they still maintain summer pasture. They also have summer pasture and hay ground at Virginia Dale, Colorado, which has been in the family since 1886 and was designated a Colorado Centennial Farm at the State Fair in 1995. In 1988, Adrian bought the Cottonwood Ranch at Sedgwick, Colorado. He maintains from 600 to 700 registered cows at these locations, calving March 25 through May 15.

The main cow herd is operated at the Cottonwood Ranch in Sedgewick, which runs about 500 head. The Fort Collins ranch is used for older cows and developing heifers. Adrian moves from the Fort Collins ranch to Tie Siding, WY, for summer pasture, then on to late summer and fall pasture at the Virginia Dale, CO, location. Meadow hay is harvested at Virginia Dale, before they graze there.

Adrian has always believed carcass traits were important and has focused selection toward these traits. Weaver Ranch, Inc. was selected by Farmland Industries as one of the original Farmland Supreme Beef Alliance Seedstock Suppliers in December, 1996.

Weaver Angus Ranch was nominated by the Colorado Cattlemen's Association and the Larimer County Stockgrowers.



Duane Kruse
Dekap Angus, Ill.

Mark and Abbie Nelson
Five Star Land and Livestock

Flying H Genetics
Dick and Bonnie Helms
Seedstock Producer Co-winner

Harry and Joan Airey

Shamrock Vale Farms
Earl and Nedra McKarns

Shaw Hereford Ranch
Tom and Mary Shaw

Wilbur Stewart

COMMERCIAL PRODUCER HONOR ROLL OF EXCELLENCE

Chan Cooper	MT	1972
Alfred B. Cobb, Jr.	MT	1972
Lyle Eivens	IA	1972
Broadbent Brothers	KY	1972
Jess Kilgore	MT	1972
Clifford Ouse	MN	1973
Pat Wilson	FL	1973
John Glaus	SD	1973
Sig Peterson	ND	1973
Max Kiner	WA	1973
Donald Schott	MT	1973
Stephen Garst	IA	1973
J.K. Sexton	CA	1973
Elmer Maddox	OK	1973
Marshall McGregor	MO	1974
Lloyd Mygard	MD	1974
Dave Matti	MT	1974
Eldon Wiese	MN	1974
Lloyd DeBruycker	MT	1974
Gene Rambo	CA	1974
Jim Wolf	NE	1974
Henry Gardiner	KS	1974
Johnson Brothers	SD	1974
John Blankers	MN	1975
Paul Burdett	MT	1975
Oscar Burroughs	CA	1975
John R. Dahl	ND	1975
Eugene Duckworth	MO	1975
Gene Gates	KS	1975
V. A. Hills	KS	1975
Robert D. Keefer	MT	1975
Kenneth E. Leistritz	NE	1975
Ron Baker	OR	1976
Dick Boyle	ID	1976
James D. Hackworth	MO	1976
John Hilgendorf	MN	1976
Kahau Ranch	HI	1976
Milton Mallery	CA	1976
Robert Rawson	IA	1976
William A. Stegner	ND	1976
U.S. Range Exp. Station	MT	1976
John Blankers	MN	1976
Maynard Crees	KS	1977
Ray Franz	MT	1977
Forrest H. Ireland	SD	1977
John A. Jameson	IL	1977
Leo Knoblauch	MN	1977
Jack Pierce	ID	1977
Mary & Stephen Garst	IA	1977
Todd Osteross	ND	1978
Charles M. Jarecki	MT	1978
Jimmy G. McDonnal	NC	1978
Victor Arnaud	MO	1978
Ron & Malcolm McGregor	IA	1978
Otto Uhrig	NE	1978
Arnold Wyffels	MN	1978
Bert Hawkins	OR	1978
Mose Tucker	AL	1978
Dean Haddock	KS	1978
Myron Hoeckle	ND	1979
Harold & Wesley Arnold	SD	1979
Ralph Neill	IA	1979
Morris Kuschel	MN	1979
Bert Hawkins	OR	1979
Dick Coon	WA	1979
Jerry Northcutt	MO	1979
Steve McDonnell	MT	1979
Doug Vandermyde	IL	1979
Norman, Denton, & Calvin Thompson	SD	1979
Jess Kilgore	MT	1980
Robert & Lloyd Simon	IL	1980

Lee Eaton	MT	1980
Leo & Eddie Grubl	SD	1980
Roger Winn, Jr.	VA	1980
Gordon McLean	ND	1980
Ed Disterhaupt	MN	1980
Thad Snow	CAN	1980
Oren & Jerry Raburn	OR	1980
Bill Lee	KS	1980
Paul Moyer	MO	1980
G. W. Campbell	IL	1981
J. J. Feldmann	IA	1981
Henry Gardiner	KS	1981
Dan L. Weppler	MT	1981
Harvey P. Wehri	ND	1981
Dannie O'Connell	SD	1981
Wesley & Harold Arnold	SD	1981
Jim Russell & Rick Turner	MO	1981
Oren & Jerry Raburn	OR	1981
Orin Lamport	SD	1981
Leonard Wulf	MN	1981
Wm. H. Romersberger	IL	1982
Milton Krueger	MO	1982
Carl Odegard	MT	1982
Marvin & Donald Stoker	IA	1982
Sam Hands	KS	1982
Larry Campbell	KY	1982
Lloyd Atchison	CAN	1982
Earl Schmidt	MN	1982
Raymond Josephson	ND	1982
Clarence Reutter	SD	1982
Leonard Bergen	CAN	1982
Kent Brunner	KS	1983
Tom Chrystal	IA	1983
John Freitag	WI	1983
Eddie Hamilton	KY	1983
Bill Jones	MT	1983
Harry & Rick Kline	IL	1983

Charlie Kopp	OR	1983
Duwayne Olson	SD	1983
Ralph Pederson	SD	1983
Ernest & Helen Schaller	MO	1983
Al Smith	VA	1983
John Spencer	CA	1983
Bud Wishard	MN	1983
Bob & Sharon Beck	OR	1984
Leonard Fawcett	SD	1984
Fred & Lee Kummerfeld	WY	1984
Norman Coyner & Sons	VA	1984
Franklyn Esser	MO	1984
Edgar Lewis	MT	1984
Boyd Mahrt	CA	1984
Neil Moffat	CAN	1984
William H. Moss, Jr.	GA	1984
Dennis P. Solvie	MN	1984
Robert P. Stewart	KS	1984
Charlie Stokes	NC	1984
Milton Wendland	AL	1985
Bob & Sheri Schmidt	MN	1985
Delmer & Joyce Nelson	IL	1985
Harley Brockel	SD	1985
Kent Brunner	KS	1985
Glenn Harvery	OR	1985
John Maino	CA	1985
Ernie Reeves	VA	1985
John R. Rouse	WY	1985
George & Thelma Boucher	CAN	1985
Kenneth Bentz	OR	1986
Gary Johnson	KS	1986
Ralph G. Lovelady	AL	1986
Ramon H. Oliver	KY	1986
Kay Richardson	FL	1986
Mr. & Mrs. Clyde Watts	NC	1986
David & Bev Lischka	CAN	1986
Dennis & Nancy Daly	WY	1986

Carl & Fran Dobitz	SD	1986
Charles Fariss	VA	1986
David J. Forster	CA	1986
Danny Geersen	SD	1986
Oscar Bradford	AL	1987
R. J. Mawer	CAN	1987
Rodney G. Oliphant	KS	1987
David A. Reed	OR	1987
Jerry Adamson	NE	1987
Gene Adams	GA	1987
Hugh & Pauline Maize	SD	1987
P. T. McIntire & Sons	VA	1987
Frank Disterhaupt	MN	1987
Mac, Don & Joe Griffith	GA	1988
Jerry Adamson	NE	1988
Ken/Wayne/Bruce Gardiner	CAN	1988
C. L. Cook	MO	1988
C. J. & D. A. McGee	IL	1988
William E. White	KY	1988
Frederick M. Mallory	CA	1988
Stevenson Family	OR	1988
Gary Johnson	KS	1988
John McDaniel	AL	1988
William A. Stegner	ND	1988
Lee Eaton	MT	1988
Larry D. Cundall	WY	1988
Dick & Phyllis Henze	MN	1988
Jerry Adamson	NE	1989
J. W. Aylor	VA	1989
Jerry Bailey	ND	1989
James G. Guyton	WY	1989
Kent Koostra	KY	1989
Ralph G. Lovelady	AL	1989
Thomas McAvoy, Jr.	GA	1989
Bill Salton	IA	1989
Lauren & Mel Schuman	CA	1989
Jim Tesher	ND	1989
Joe Thielen	KS	1989
Eugene & Ylene Williams	MO	1989
Phillip, Patty & Greg Bartz	MO	1990
John J. Chrisman	WY	1990
Les Herbst	KY	1990
Jon C. Ferguson	KS	1990
Mike & Diana Hooper	OR	1990
James & Joan McKinlay	CAN	1990
Gilbert Meyer	SD	1990
DuWayne Olson	SD	1990
Raymond R. Peugh	IL	1990
Lewis T. Pratt	VA	1990
Ken & Wendy Sweetland	CAN	1990
Swen R. Swenson Cattle	TX	1990
Robert A. Nixon & Son	VA	1991
Murray A. Greaves	CAN	1991
James Hauff	ND	1991
J. R. Anderson	WI	1991
Ed & Rich Blair	SD	1991
Reuben & Connee Quinn	SD	1991
Dave & Sandy Umbarger	OR	1991
James A. Theeck	TX	1991
Ken Stielow	KS	1991
John E. Hanson, Jr.	CA	1991
Charles & Clyde Henderson	MO	1991
Russ Green	WY	1991
Bollman Farms	IL	1991
Craig Utesch	IA	1991
Mark Barenthsen	ND	1991
Rary Boyd	AL	1992
Charles Daniel	MO	1992
Jed Dillard	FL	1992
John & Ingrid Fairhead	NE	1992
Dale J. Fischer	IA	1992
E. Allen Grimes Family	ND	1992
Kopp Family	OR	1992
Harold/Barbara/Jeff Marshall	PA	1992

Clinton E. Martin & Sons	VA	1992
Lloyd & Pat Mitchell	CAN	1992
William Van Tassel	CAN	1992
James A. Theeck	TX	1992
Aquilla M. Ward	WV	1992
Albert Wiggins	KS	1992
Ron Wiltshire	CAN	1992
Andy Bailey	WY	1993
Leroy Beitelspacher	SD	1993
Glenn Calbaugh	WY	1993
Oscho Deal	NC	1993
Jed Dillard	FL	1993
Art Farley	IL	1993
Jon Ferguson	KS	1993
Walter Hunsuker	CA	1993
Nola & Steve Kleiboeker	MO	1993
Jim Maier	SD	1993
Bill & Jim Martin	WV	1993
Ian & Alan McKillop	ON	1993
George & Robert Pingetzer	WY	1993
Timothy D. Sutphin	VA	1993
James A. Theeck	TX	1993
Gene Thiry	MB	1993
Fran & Beth Dobitz	SD	1994
Bruce Hall	SD	1994
Lamar Ivey	AL	1994
Gordon Mau	IA	1994
Randy Mills	KS	1994
W. W. Oliver	VA	1994
Clint Reed	WY	1994
Stan Sears	CA	1994
Walter Carlee	AL	1995
Nicholas Lee Carter	KY	1995
Charles C. Clark, Jr.	VA	1995
Greg & Mary Cunningham	WY	1995
Robert & Cindy Hine	SD	1995
Walter Jr. & Evidean Major	KY	1995
Delhert Ohnemus	IA	1995
Olafson Brothers	ND	1995
Henry Stone	CA	1995
Joe Thielen	KS	1995
Jack Turnell	WY	1995
Tom Woodard	TX	1995
Jerry & Linda Bailey	ND	1996
Kory M. Bierle	SD	1996
Mavis Dummermuth	IA	1996
Terry Stuart Forst	OK	1996
Don W. Freeman	AL	1996
Lois & Frank Herbst	WY	1996
M/M George A. Horkan, Jr.	VA	1996
David Howard	IL	1996
Virgil & Mary Jo Huseman	KS	1996
Q. S. Leonard	NC	1996
Ken & Rosemary Mitchell	CAN	1996
James Sr/Jerry/James Petik	SD	1996
Ken Risler	WI	1996
Merlin Anderson	KS	1997
Joe C. Bailey	ND	1997
William R. "Bill" Brockett	VA	1997
Arnie Hansen	MT	1997
Howard McAdams, Sr & Howard McAdams, Jr.	NC	1997
Rob Orchard	WY	1997
Bill Peters	CA	1997
David Petty	IA	1997
Rosemary Rounds & Marc & Pam Scarborough	SD	1997
Morey & Pat Van Hoecke	MN	1997
Randy & Judy Mills	KS	1998
Mike & Priscilla Kasten	MO	1998
Amana Farms Inc.	IA	1998
Terry & Dianne Crisp	AB	1998
Jim & Carol Faulstich	SD	1998
James Gordon Fitzhugh	WY	1998
John B. Mitchell	VA	1998

Holzapfel Family	CA	1998
Mike Kitley	IL	1998
Wallace & Donald Schilke	ND	1998
Doug & Ann Deane and Patricia R. Spearman	CO	1998

COMMERCIAL PRODUCER OF THE YEAR

Chan Cooper	MT	1972	Charles Fariss	VA	1986
Pat Wilson	FL	1973	Rodney G. Oliphant	KS	1987
Lloyd Nygard	ND	1974	Gary Johnson	KS	1988
Gene Gates	KS	1975	Jerry Adamson	NE	1989
Ron Blake	OR	1976	Mike & Diana Hopper	OR	1990
Steve & Mary Garst	IA	1977	Dave & Sandy Umbarger	OR	1991
Mose Tucker	AL	1978	Kopp Family	OR	1992
Bert Hawkins	OR	1979	Jon Ferguson	KS	1993
Jess Kilgore	MT	1980	Fran & Beth Dobitz	SD	1994
Henry Gardiner	KS	1981	Joe & Susan Thielen	KS	1995
Sam Hands	KS	1982	Virgil & Mary Jo Huseman	KS	1996
Al Smith	VA	1983	Merlin & Bonnie Anderson	KS	1997
Bob & Sharon Beck	OR	1984	Randy & Judy Mills	KS	1998
Glenn Harvey	OR	1985	Mike & Priscilla Kasten	MO	1998

Mike and Priscilla Kasten
Commercial Producer Co-winner

Doyle Creek Cattle Co.
Randy and Judy Mills and daughter Sarah

DOYLE CREEK CATTLE COMPANY AND 4-M RANCH NAMED CO-WINNERS OF THE "1998 BIF OUTSTANDING COMMERCIAL PRODUCER AWARD"

Calgary, Alberta, Canada - For the first time in the 30 year history of the Beef Improvement Federation (BIF), co-winners were named to receive BIF's Outstanding Commercial Producer Award. Honored at the BIF convention held in Calgary, Alberta, were Randy and Judy Mills of Doyle Creek Cattle Company and Mike and Priscilla Kastens of 4-M Ranch.

Dedication to the improvement of the beef cattle industry is what drives Randy Mills to achieve excellence in his commercial cow-calf operation. Doyle Creek Cattle Company, located in the Flint Hills of Kansas near Florence, uses the principles of total quality management, while incorporating cutting edge technologies to speed genetic improvement and improve profitability.

With a genetically uniform cowherd as a basis, Mills uses AI, embryo transfer, and the service of full brother herd bulls to make genetic improvements. A detailed computerized record keeping system allows for measurement of individual production levels. Using a principled approach, Mills analyzes the various sources to drive culling decisions. This approach allows for the elimination of negative outliers within the cowherd. Through stringent culling procedures, continual improvement of the base cowherd, and carcass data collection through retained ownership, achieving the goal of producing an end product that consumers will desire is growing near.

Adding value to cattle produced on the ranch is achieved through detailed marketing plans. Embryo transfer provides large numbers of genetically similar calves. Bulls from these matings are used in the breeding program and heifers not retained for replacements are sold through a heifer development program. Retained ownership of the steers and marketing them through an alliance provides access to carcass data.

The complete grass-based operation is efficient and self supportive. With the exception of limited supplemental protein, all forages are produced on the ranch. Emphasis is placed on improving the ecology of the ranch so it can be continued by future generations. With the goal of constantly improving to meet future demands, Doyle Creek Cattle Company is positioned to be a leader in the beef industry for generations to come.

The 4-M Ranch was established by Mike and Priscilla Kasten in June of 1974 with the purchase of land near Millersville, in southeast Missouri. The original herd consisted of registered Polled Herefords from various 4-H projects and 130 mixed cows purchased with the land. Performance testing and AI are management practices instituted from the beginning. In 1979, the herd was totally dispersed due to brucellosis. A new herd was started in 1980 with 300 Angus-Holstein and Hereford-Holstein heifer calves raised on a bottle. The herd has been certified brucellosis-free since 1983. With the exception of

45 Simmental-Angus-Hereford cross heifers purchased in 1985, no other females have been purchased. Since 1980, Angus bulls have been used exclusively.

The ranch consists of 1,300 acres that are owned and an additional 1,300 leased acres. Between 450 and 500 females, including heifers, are bred annually. Three fourths of the cows calve in the fall, leaving one fourth to calve in the spring, with the goal of moving eventually to 100% fall calving.

For the past twenty-four years, complete performance records, including birth weights, weaning weights, yearling weights, and frame scores have been taken. Starting in 1989, carcass data has been collected in conjunction with Sydensticker Angus Farms for progeny testing and herd improvement purposes. To date, fifteen bulls have received carcass EPD proofs based on data contributed from 4-M Ranch.

A new program, called Beef Management Alliance, was initiated two years ago. In this program, bulls are leased to producers and their entire calf crop is purchased back. Genetic control is maintained in these herds by 4-M Ranch. This includes providing replacement females and keeping individual performance data on the animals enrolled in the program. Ownership is retained on the steers through the feedlot and the heifers are raised to be sold as replacement females. Currently there are 340 cows in the program.

The Beef Improvement Federation believes it is most appropriate to honor two such deserving producers with their 1998 BIF Outstanding Commercial Producer Award.

1998 BIF COMMERCIAL NOMINEES

Amana Farms, Inc.
Amana, Iowa

The ancestors of the Amana people first came to the United States in 1842, settling near Buffalo, New York. The group soon sought land further west and in 1855, established the Amana Colonies in eastern Iowa. By 1865, seven villages were established on nearly 26,000 acres.

On arrival in America, the group adopted a religious communal way of life. The communal ways lasted until 1932. Since then the religious and economic aspects of the community have been separate. The businesses were then put into a corporation now known as the Amana Society, which the commune members now hold in stock.

The Amana Farms Beef Division is just one of the divisions of the Amana Society, Inc. A cow herd of 2,200 Gelbvieh/Angus cross bred cows as well as a 500 head stocker operation is maintained on the farms 6,000 acres of pasture. The Beef Division manager is responsible for developing a yearly budget, as well as monthly forecasts predicting the financial success of the business.

Producing replacement heifers, producing feeder cattle or developing bred heifers are the different focuses addressed by the 3 herd supervisors. 80% of the cows calve in April and May. The remaining 20% calve in August and September.

The operation also has a 3,000 head feed lot, which it uses to finish its calves, develop its breeding heifers and to custom feed cattle. The Amana Society also markets beef under its own brand name in Midwestern grocery stores.

The Amana Farms, Inc. was nominated by the American Gelbvieh Association.

Crisp Ranches, Ltd.
Terry & Dianne Crisp
Monitor, Alberta, Canada

Crisp Ranches started from a quarter section of land filed by Terry's grandfather in 1913. Now in its 4th generation, it has grown to 19,000 acres and runs about 750 cows. It is situated in a dryer area of East Central Alberta, East of Consort.

In 1939, Terry's father started the farming operation with a half section of deeded land and a half section of lease, plus 122 milk cows. The milk cow were soon replaced with a Hereford and Shorthorn base herd. By the late 50's, the base had changed to a predominantly Hereford cow herd bred to Angus. All calves were shipped by rail to Ontario.

Terry and Dianne were married in 1964 and with his parents, formed Crisp Ranches, Ltd. in 1965.

In 1967, Terry took an A.I. course and started breeding Charolais on a black baldy base cow herd. This prompted the desire for individual cow records. First it was started by doing it by hand and then moved on to the Federal ROP program. By 1980, the frustration of time delay and errors, prompted Terry to buy a computer and he had a custom ROP program made. Now he was able to put the newly weaned cows through the chute and the next day do the culling and weaning index and also the previous years feed index.

The things that most affected the herd improvement over time were; identifying each cow and her calf, cross breeding with proven A.I. bulls and selection of replacements using performance records.

In the last 3 years, they have moved toward split Spring/Fall calving groups of 350 head each.

With the purchase of the new computer program, they hope to establish a link with the computer and the electronic animal ID at the chute, to improve the efficiency and accuracy on keeping performance records. With the new technology coming on stream, the beef industry is on the verge of some interesting and exciting times.

Terry and Dianne Crisp were nominated by the Canadian Charolais Association.

Daybreak Ranch
Jim and Carol Faulstich
Highmore, South Dakota

Jim and Carol Faulstich own and operate a diversified ranch north of Highmore, South Dakota, that was purchased from Jim's parents, January 1, 1973. The main enterprise on the Daybreak Ranch centers around 250 head of Red Angus crossbred cows. This all red cow herd has been developed from a disciplined two breed rotational cross breeding system, alternating Red Angus with other maternal breeds, which include Gelbvieh and South Devon. Faulstich's have used some form of production records since 1973, beginning with hand written records and a balance beam scale, progressing to a computerized scale, Chaps program and retaining ownership of the steers to get complete individual carcass information. Their steers are sold on a value based carcass grid at approximately 13 months of age, weighting 1200-1250 pounds and grading 92% Choice and Prime in 1997. Heifer calves that are not kept for herd replacements, are sold as breeding replacement heifers. They have also entered into an agreement to produce a select group of composite bulls.

Resource conservation has always been important and has resulted in the implementation of planned rotational grazing, well water development in each pasture, wildlife areas and numerous shelter belts planted over the years. Three hay sheds have been constructed to conserve the quality of about 1000 ton of hay.

Other aspects of the diverse operation include dry land and irrigated no till farming, hay production for feed and cash crop and a flock of 250 registered and commercial Targhee sheep.

Both Jim and Carol graduated from SDSU in Brookings and have three daughters that have been involved in the operation. They are Jennifer (SDSU graduate) and James Matkins of Rapid City, Jacquie, a fourth year pharmacy major at SDSU and Jill, a Junior at Highmore High School.

Jim has been on and is a past president of the Hyde County School Board and is on the Hyde County Weed Board, is President of the County 4-H Livestock Committee, Past President of the Dakota Area Targhee Breeders, has been on Our Savior Lutheran Church Council, as well as other organizations and committees. Carol is the past president of Our Savior's Council as well as active in many other church and community organizations and is an active 4-H leader.

Jim and Carol Faulstich were nominated by the South Dakota Beef Breeds Council.

Fitzhugh Ranch
James Gordon Fitzhugh
Douglas, Wyoming

The Fitzhugh Ranch, located nine miles south of Douglas, Wyoming, is a family operated ranch managed by Jim and Marilyn, son Dana and wife Bobbe and granddaughters Megan and Shelby.

This ranch was homesteaded by Gordon V. Fitzhugh, in 1874 and land patented in 1881 under squatter rights, consisting of 595 acres. It was purchased by his son, Gordon M. Fitzhugh, in 1931 and enlarged by purchased and leased land, to it's present size of 6,700 acres. The ranch was sold to his son, James Gordon Fitzhugh in 1978. The state of Wyoming honored it as a Wyoming Centennial 100 Year Ranch, dated 1874-1990, during the State Fair of 1990.

In 1968, an adjoining ranch was leased by Jim that added another 6400 acres to the operation. Included in the total acreage is 400 acres of irrigated land, 120 acres of dry land hay and the balance in pasture.

This acreage provides for 400 plus mother cows, predominately Red Angus, and 80 replacement heifers. The top 10% of the bull calves are retained for sale at the ranch in March. The cows are bred for a 45-day breeding season with calving starting the first week in February. They strive to calve and sell a 93% (based on cows bred) calf crop by October 1st, less the 40% of heifer calves that are retained as replacements.

The capacity of the ranch has been greatly increased by Jim and Dana, with sagebrush control, water development and management of pastures and reseeding of hayland.

Jim and Marilyn Fitzhugh were nominated by Wyoming Beef Cattle Improvement Association.

Falling Springs Farm
John B. Mitchell
Hot Springs, Virginia

John B.Mitchell, along with his wife, Maudie and family, own and operate Falling Springs Farm at Hot Springs, Virginia. The farm was established in 1969 and operates in both Bath and Allegheny counties. Falling Springs Farm includes about 4,000 acres of land and 1,100 head of cattle which include 10 registered Salers cows, 35 registered Angus cows, 375 commercial cows, replacement heifers and steers.

John Mitchell is not a farmer by upbringing or training, but by choice. He was raised in Roanoke, Virginia, was educated by the Virginia Military Institute at Lexington, where he played quarterback on the football team, on scholarship. His degree was in engineering. After graduation, he worked for a time with the Corp. of Engineers. He soon became a principal in a construction firm, Hammond-Mitchell Construction

Company, where he is still involved. The company is currently being actively operated by his son.

The cattle operation at Falling Springs Farm started with a small group of Angus cows and continued to grow until 1984, at which time purebred Salers bulls were imported from Europe. The progeny of these bulls were the basis for the development of the commercial Salers-Angus herd and also formed the basis for a purebred Salers herd. John Mitchell thinks the Salers breed is one of the best for his environment and is a strong advocate of cross-breeding. He uses Angus and Salers blood predominately in the cow herd and in the feeder cattle produced.

Marketing has developed into one of the more interesting parts of the operation. John had developed an alliance with bull customers and purchases their cross-bred calves, backgrounds them and sells them. He has sold backgrounded feed lot ready cattle, direct to feed lot operations, has partnered with cattle feeders or has owned loads of cattle through the feeding phase, right to the rail.

John Mitchell has developed as a leader in the cattle industry. He served on the Board and as president of the American Salers Association in 1990 and 1991 and served on the Board of the Virginia Beef Expo and as it's president in 1993. He currently serves on the Board of Directors of the Virginia Beef Cattle Improvement Association. He is heavily involved in church and community activities and is a staunch family man. John and his wife, Maudie, are the parents of two grown children, a son and a daughter. They have two grandchildren.

The Mitchells' motto for genetic selection is "Meat, Milk and Easy Doing Cattle".

John and Maudie Mitchell were nominated by the Virginia Beef Cattle Improvement Association.

Holzapfel Ranch
Holzapfel Family
Willows, California

The Holzapfel Ranch found it's roots in 1936, when Edith Holzapfel imported ten Angus cows from Canada. These hardy cows thrived in the hills of Moraga, California. After the marriage of Jerald Holzapfel, the herd moved to Willows, California, where it has expanded over the years, to 850 mother cows, 350 of which are pastured in Arlington, Oregon. The cows fall calve at both locations, followed by a 45 day breeding season. In 1988, an A.I. program was started, that increased weaning weights and uniformity of the calf crop, while breeding costs decreased. The A.I. program has grown to the extent that every female is AI'd at least once. The cows have developed into an efficient herd which utilizes inexpensive forage bases with minimum supplementation. The Arlington cows utilize dryland pasture in the summer and ryegrass straw in the winter. The Willows cows utilize forage from the rice farming operation in the winter and graze irrigated pastures in the summer. Rice straw is put up immediately after rice harvest to maximize the feed value and is fed in the winter. The improved genetic base helped to expand the operation to include a commercial bull market that grows yearly. Of all the advances, made while trying to survive the fluctuating cow cycles, the genetic improvement has been the most rewarding. It perpetuates the solid tradition of the superior females that Edith Holzapfel initiated 60 years ago, when the cows were first branded with the Key brand.

Holzapfel Ranch was nominated by the California Beef Cattle Improvement Association.

4-M Ranch
Mike and Priscilla Kasten
Millersville, Missouri

The 4-M Ranch was established in June of 1974 with the purchase of land in Bollinger County in southeast Missouri. The original herd consisted of registered Polled Herefords from various 4-H projects and 130 mixed cows, purchased with the land. Performance testing and A.I. are management practices instituted from the beginning. In 1979, the herd was totally dispersed, due to brucellosis. A new herd was started in 1980 with 300 Angus-Holstein and Hereford-Holstein heifer calves raised on a bottle. The herd has been certified brucellosis free since 1983. With the exception of 45 Simmental-Angus-Hereford cross heifers purchased in 1985, no other females have been purchased. Since 1980, Angus bulls have been used exclusively.

The ranch consists of 1,300 acres that are owned and an additional 1,300 leased acres. Between 450 and 500 females, including heifers, are bred annually. Three fourths of the cows calve in the fall, leaving one fourth to calve in the spring, with the goal of moving eventually to 100% fall calving.

For the past twenty-four years, complete performance records, including birth weights, weaning weights, yearling weights and frame scores, have been taken. Starting in 1989, carcass data has been collected in conjunction with Sydensticker Angus Farms, for progeny testing and herd improvement purposes. To date, fifteen bulls have received carcass EPD proofs, based on data contributed from 4-M Ranch.

A new program, called Beef Management Alliance, was initatied two years ago. In this program, bulls are leased to producers and their entire calf crop is purchased back. Genetic control is maintained in these herds by 4-M Ranch. This includes providing replacement females and keeping individual performance data on the animals enrolled in the program. Ownership is retained on the steers through the feedlot and the heifers are raised to be sold as replacement females. Currently there are 340 cows in the program.

Mike and Priscilla Kasten were nominated by the Missouri Beef Cattle Improvement Associtation.

Mike Kitley
Flora, Illinois

The Kitley family has been raising cattle on their Clay County farm nearly 90 years. Mike has been involved in the cattle operation with his father, Roy, for 38 years. Mike and Cathy have two 15 year old sons, Troy and Tracy, who are now actively involved in the cattle business. The boys are starting their own registered Gelbvieh herd. Daughter Jamie has also been quite active in the family beef cow operation. The main objective of the Kitley cow-calf operation is to utilize the resources available, mainly rolling farm land with family labor. They rotation graze on tall fescue pastures and utilize corn stalks in the fall. Calving season is December, with cows bred A.I. from the end of February to April 20th, when cows are turned out to pasture. This way cows are bred before the family gets involved in corn and soybean planting. The Kitley's use a two breed rotational cross-breeding system using Angus bulls on Simmental sired cows, Simmental bulls on Angus sired cows. Mike is starting to incorporate Gelbvieh bulls into the breeding program. In 1976, the average 205 day weight was 444 lbs., in 1995, the average 205 day weight was 512 lbs. They had 35 cows in 1976, today's herd average is 91 cows. Feeder calves have been placed in a retained ownership program the last 10 years, in a custom feedlot in southern Illinois. The Kitleys have been active in school, church and other local community activities, including 4-H and Farm Bureau.

The Kitley's were nominated by the University of Illinois Cooperative Extension Service.

Doyle Creek Cattle Company
Randy and Judy Mills
Florence, Kansas

Dedication to the improvement of the beef cattle industry is what drives Randy Mills to achieve excellence in his commercial cow-calf operation. Doyle Creek Company, located in the Flint Hills of Kansas, uses the principles of total quality management, while incorporating cutting edge technologies to speed genetic improvement and improve profitability.

With a genetically uniform cowherd as a basis, Mills uses A.I., embryo transfer and the service of full brother herd bulls, to make genetic improvements. A detailed computerized record keeping system allows for measurement of individual production levels. Using a principled approach, Mills analyzes the various sources to drive culling decisions. This approach allows for the elimination of negative outliers within the cowherd. Through stringent culling requirement, continual improvement of the base cowherd and carcass data collection through retained ownership, achieving the goal of producing an end product consumers will desire, is growing near.

Adding value to cattle produced on the ranch, is achieved through detailed marketing plans. Embryo transfer provides large numbers of genetically similar calves. Bulls from these matings are used in the breeding program and heifers not retained for replacements are sold through a heifer development program. Retained ownership of the steers and marketing them through an alliance provides access to carcass data.

The complete grass-based operation is efficient and self supportive. With the exception of limited supplemental protein, all forages are produced on the ranch. Emphasis is placed on improving the ecology of the ranch so it can be continued by future generations. With the goal of constantly improving to meet future demands, Doyle Creek Cattle Company is positioned to be a leader in the beef industry for generations to come.

Randy and Judy were nominated by the Kansas Livestock Association.

Schilke Brothers
Wallace and Donald Schilke
Alamo, North Dakota

The Schilke Brothers farming and ranching operation is located northwest of Wildrose, in divide country, which in extreme northwest North Dakota. Principle income sources are from the cattle and dryland durum wheat production. They operate on the original farmstead, which was purchased by their grandfather in 1916. Shorthorn cows were run up to the time their father passed away in 1958. In 1967, the Schilke Brothers, started back in the beef business, with the purchase of Hereford and Angus cows. Twenty Charolais x Hereford cross heifers were purchased in 1981, at which time they were using Charolais and Simmental bulls. The cowherd has remained closed since 1981. Replacements have been selected for growth, milk and ability to produce pounds of calf on low quality forages. The cowherd now numbers in excess of 100 cows. Traditionally, they have calved in March, with a 60 day calving season. They have tried calving earlier, but March works better with their facilities and labor. Currently they exclusively use Red Angus bulls that meet their EPD criteria for milk and growth.

Wallace and Donald Schilke were nominated by the North Dakota Beef Cattle Improvement Association.

L Cross Ranch
Doug & Ann Deane and Patricia R. Spearman
Del Norte, Colorado

The L Cross Ranch lies on the west side of the San Luis Valley of south central Colorado. The San Luis Valley is often called the largest, highest (elevation), productive alpine valley in the world. The ranch is approximately 200 miles southwest of Denver, Colorado, near Highway 285. The little outpost of La Garita, Colorado, is located near the center of the ranch. The elevation at the ranch headquarters is approximately 8,000 feet. The highest pasture on the ranch is above 12,000 feet. The summers are cool and the winter harsh.

The L Cross Ranch has been owned and operated by Doug and Ann Deane, Patricia Spearman and Michael and Caren Spearman since 1928.

The L Cross is comprised of approximately 8,000 acres of deeded land and approximately 51,000 acres of public lands. Roughly ½ is dryland pastures. The cowherd is made up of 400-500 Hereford cows. Annually these cows are exposed to registered Angus bulls, resulting in black baldy calves. The black baldie heifer calves are retained for marketing the following year as bred replacement females. The main production goal of the L Cross Ranch is to raise high quality replacement females for the beef industry.

The calving season begins about the 10th of February and winds down around April 15th. The cows and calves spend the summer months in the mountains.

L Cross Ranch was nominated by the Colorado Cattlemen's Association

AMBASSADOR AWARD RECIPIENTS

Warren Kester	Beef Magazine	MN	1986
Chester Peterson	Simmental Shield	KS	1987
Fred Knop	Drovers Journal	KS	1988
Forrest Bassford	Western Livestock Journal	CO	1989
Robert C. DeBaca	The Ideal Beef Memo	IA	1990
Dick Crow	Western Livestock Journal	CO	1991
J. T. "Johnny" Jenkins	Livestock Breeder Journal	GA	1993
Hayes Walker, III	America's Beef Cattleman	KS	1994
Nita Effertz	Beef Today	ID	1995
Ed Bible	Hereford World	MO	1996
Bill Miller	Beef Today	KS	1997
Keith Evans	American Angus Association	MO	1998

KEITH EVANS RECEIVES THE BEEF IMPROVEMENT FEDERATION'S "1998 AMBASSADOR AWARD"

Calgary, Alberta, Canada -The Beef Improvement Federation (BIF) honored Keith Evans with the Ambassador Award at the group's annual convention held July 2, 1998, at the Calgary Convention Centre. Evans was selected for the honor for his years of dedication and contributions to the beef industry while working at the American Angus Association.

As a 1956 graduate of the University of Missouri-Columbia with a degree in agricultural journalism, Evans began his career in 1959 as a writer and photographer for the *Chicago Daily Drovers Journal*, which was then published in the Chicago Stock Yards. Evans met his wife, Shirley Jean Peterson, in Chicago, and they married in 1960. He left the *Chicago Daily Drovers Journal* to join the American Angus Association as public relations assistant.

"I told my wife, Shirley, in 1962, that we would take the Angus job and move to St. Joseph for three or four years until something better came along," Evans said. "There proved to be nothing better for this Missouri farm boy, who loved to write, take pictures, travel, and work with farm and ranch people who raise Angus cattle. I've had opportunities that many people only dream of."

At the association, Evans wrote and produced motion pictures and had articles appear in all major farm and livestock publications. He directed the American Angus Association's national advertising program from 1968-1998, and in 1978, he was named director of communications and public relations for the association.

Under Evans' direction, the association won numerous national advertising awards. The two motion pictures he wrote and helped produce won national CINE Golden Eagle awards. The Merchandising column in the *Angus Journal* was started by Evans in 1984. Its goal was "to help Angus breeders better understand advertising and marketing, and to do a more effective job of herd advertising," Evans said. The Livestock Publications Council named these columns the best regular column, and the column also won numerous other awards. These columns are in print as two books titled "How to Sell Angus Cattle," and a third book is planned.

Evans also edited the *Angus Beef Bulletin*, a tabloid publication that is distributed to some 43,000 commercial beef cattle producers who use Angus bulls, since 1985. He wrote numerous promotional and educational booklets for the American Angus Association, conducted marketing seminars and spoke on advertising and marketing. He was a four-time national advertising awards judge for the National Agri-Marketing Association (NAMA).

He worked closely with Angus cattle associations and societies around the world and with their international organization, the World Aberdeen-Angus Secretariat. He took part in every World Angus Forum since the first one was held in the United States in

1973. At the 1997 World Angus Forum in Sydney Australia, he spoke on herd and association advertising.

After more than 35 years with the American Angus Association, Evans retired on April 15, 1998. He plans to do free-lance writing, present programs on advertising and marketing, and continue to write advertising and marketing columns for selected publications.

BIF is pleased and honored to recognize the many contributions of Keith Evans by presenting him with the BIF Ambassador Award.

PIONEER AWARD RECIPIENTS

Jay L. Lush	IA	1973
John H. Knox	NM	1974
Ray Woodward	ABS	1974
Fred Wilson	MT	1974
Charles E. Bell, Jr.	USDA	1974
Reuben Albaugh	CA	1974
Paul Pattengale	CO	1974
Glenn Butts	PRT	1975
Keith Gregory	MARC	1975
Braford Knapp, Jr.	USDA	1975
Forrest Bassford	WLJ	1976
Doyle Chambers	LA	1976
Mrs. Waldo Emerson Forbes	WY	1976
C. Curtis Mast	VA	1976
Dr. H. H. Stonaker	CO	1977
Ralph Bogart	OR	1977
Henry Holsman	SD	1977
Marvin Koger	FL	1977
John Lasley	FL	1977
W. L. McCormick	GA	1977
Paul Orcutt	MT	1977
J. P. Smith	PRT	1977
James B. Lingle	WYE	1978
R. Henry Mathiessen	VA	1978
Bob Priode	VA	1978
Robert Koch	MARC	1979
Mr. & Mrs. Carl Roubicek	AZ	1979
Joseph J. Urick	USDA	1979
Bryon L. Southwell	GA	1980
Richard T. "Scotty" Clark	USDA	1980
F. R. "Ferry" Carpenter	CO	1981
Clyde Reed	OK	1981
Milton England	TX	1981
L. A. Moddox	TX	1981
Charles Pratt	OK	1981
Otha Grimes	OK	1981
Mr. & Mrs. Percy Powers	TX	1982
Gordon Dickerson	NE	1982
Jim Elings	CA	1983
Jim Sanders	NV	1983
Ben Kettle	CO	1983
Carroll O. Schoonover	WY	1983
W. Dean Frischknecht	OR	1983
Bill Graham	GA	1984
Max Hammond	FL	1984
Thomas J. Marlowe	VA	1984
Mick Crandell	SD	1985
Mel Kirkiede	ND	1985
Charles R. Henderson	NY	1986
Everett J. Warwick	USDA	1986
Glenn Burrows	NM	1987
Carlton Corbin	OK	1987
Murray Corbin	OK	1987
Max Deets	KS	1987
George F. & Mattie Ellis	NM	1988
A. F. "Frankie" Flint	NM	1988
Christian A. Dinkle	SD	1988
Roy Beeby	OK	1989
Will Butts	TN	1989
John W. Massey	MO	1989
Donn & Sylvia Mitchell	CAN	1990
Hoon Song	CAN	1990
Jim Wilton	CAN	1990
Bill Long	TX	1991
Bill Turner	TX	1991
Frank Baker	AR	1992
Ron Baker	OR	1992
Bill Borror	CA	1992
Walter Rowden	AR	1992
James W. "Pete" Patterson	ND	1993

Hayes Gregory	NC	1993
James D. Bennett	VA	1993
O'Dell G. Daniel	GA	1993
M. K. "Curly" Cook	GA	1993
Dixon Hubbard	USDA	1993
Richard Willham	IA	1993
Dr. Robert C. DeBaca	IA	1994
Tom Chrystal	IA	1994
Roy A. Wallace	OH	1994
James S. Brinks	CO	1995
Robert E. Taylor	CO	1995
A. L. "Ike" Eller	VA	1996
Glynn Debter	AL	1996
Larry V. Cundiff	NE	1997
Henry Gardiner	KS	1997
Jim Leachman	MT	1997
John Crouch	MO	1998
Bob Dickinson	KS	1998
Douglas MacKenzie Fraser	AB	1998

Doug Fraser Family
Pioneer
Ron Bolze, Murray Fraser, Verna (Fraser) Nielsen,
Cam Fraser, 'Sis' Fraser, Gary Johnson

John and Judy Crouch
Pioneer

Robert Dickinson
Pioneer

PIONEER AWARD
DOUGLAS (DOUG) MACKENZIE FRASER
1935-1995

Calgary, Alberta, Canada -

The Beef Improvement Federation (BIF) is honoured to announce the naming of Doug Fraser as a posthumous recipient of the Pioneer Award. The announcement was made at the 30th Annual BIF Annual Meeting and Research Symposium in Calgary. The award is given to individuals of outstanding merit who have contributed to the breeding and selection of performance beef cattle.

Doug ranched near Hussar, Alberta, and was a breeder of Horned Hereford cattle for fifty years. His wife and friend, "Sis", and their family were partners in the operation. The ranch continues to be operated by sons, Murray and Cam and now includes black Angus cattle, a project started prior to Doug's passing. Fraser Herefords, later to be known as the F-R Ranch, was a strong believer in, and promoter of, performance testing. The F-R herd was one of the first to be enrolled in the provincial performance beef program. This long-standing involvement culminated in Doug receiving the Alberta Beef Cattle Performance Award and the Canadian Beef Cattle Performance Award in 1989.

Doug served his industry and gave unselfishly of his time to improve many organizations. He was president of the Canadian Hereford Association (CHA) and sat on the CHA Cattle Performance Committee. He was instrumental in the CHA's genetic evaluation program and a number of research projects. He initiated the Canadian Hereford Beef Program which resulted in successful marketing promotions with Canada Safeway. He sat on the founding committee of the Canadian Beef Breeds Council, which ultimately led the way to the privatization of Canadian genetic evaluations. He chaired the Alberta Hereford Sire Progeny Test Program and was a committee member that initiated the building of the Hereford Test Centre at Innisfail.

Dedicated to providing service and quality, Doug strived to establish good communication with commercial cattlemen. An avid listener, he responded with a positive attitude to change. Doug also participated in several committees formed by the Canadian Cattlemen's Association where he represented the seedstock sector, studying the improvement of meat quality and consistency.

Described as an individual who treated people with honesty and integrity in day to day living and in business, Doug was trusted and respected throughout the industry. He touched many lives with his friendship, sense of humor, and the high standard of principles he practiced in life. A man of vision, Doug foresaw and implemented many positive changes in the cattle industry.

Doug Fraser's philosophy is embodied in the principles espoused by the Beef Improvement Federation, and his inclusion in the honour roll of recipients of the Pioneer Award is a testimony to his contribution to the beef cattle performance industry.

Doug Fraser
1935-1995

JOHN CROUCH RECEIVES THE BEEF IMPROVEMENT FEDERATION "1998 PIONEER AWARD"

Calgary, Alberta, Canada - The Beef Improvement Federation (BIF) honored John Crouch with the Pioneer Award at the Convention held July 2, 1998, at the Calgary Convention Centre. The honor recognizes his work toward the improvement of beef cattle genetics and contributions through his years of service to the Angus breed.

John R. Crouch is director of performance programs for the American Angus Association. Crouch oversees the Angus Herd Improvement Records (AHIR) program as well as the genetic evaluation program for Angus Sire Evaluation.

The national Angus evaluation program currently contains records on more than 120,000 sires and more than one million females. Since Crouch began his current position in 1981, the Angus database has grown from less than one million records to in excess of 6.2 million. In 1981, the department processed 179,000 weights and in 1997, 576,574 weights were processed.

The industry's increased emphasis on beef cattle performance, coupled with Crouch's warm, personable nature and knowledge of beef breeding and genetics, has made him one of the most popular speakers in the beef industry. He has lectured for beef cattle seminars in 39 states, Canada, Mexico, Australia, New Zealand, Scotland, Chile, Argentina, Brazil, Zimbabwe, and South Africa.

Crouch has been actively involved in the Beef Improvement Federation (BIF) and has served on its board of directors for four three-year terms. He has chaired BIF's live animal and carcass evaluation committee and the ultrasound proficiency committee.

He began his current position in 1981, but his tenure with the American Angus Association began in 1974, when he served as regional manager for the states of Georgia, Florida, North Carolina, and South Carolina. He also serves as director of regional managers.

Crouch grew up on a registered Angus farm near Jonesboro, TN, and is a 1963 graduate of the University of Tennessee-Knoxville, with a bachelor's in Animal Husbandry. There, he was a member of the first-place livestock judging team at the 1962 International Livestock Exposition in Chicago, IL.

After graduation, he served as a lieutenant in the United States Army. He returned home briefly to manage the family Angus operation and then managed three registered beef cattle operations before joining the American Angus Association in 1974.

BIF is pleased and honored to recognize the many contributions of John Crouch by presenting him with the BIF Pioneer Award.

BOB DICKINSON RECEIVES BIF PRESTIGIOUS PIONEER AWARD

Calgary, Alberta, Canada - Bob Dickinson of Gorham, Kansas, was presented the Beef Improvement Federation's prestigious Pioneer award at the BIF annual meeting held in Calgary, Alberta. Bob served as BIF president for two terms and was named BIF Seedstock Producer of the Year in 1981.

A Simmental breeder for over 26 years, Bob was a leader in the Simmental performance movement in the Association's formative years. A strong performance advocate, Bob served as chairman of the American Simmental Association Breed Improvement Committee and was instrumental in the development and implementation of calving ease EPDs. Bob was elected as the American Simmental Association President in 1981. As a result of his dedication and service to the American Simmental Association, Bob Dickinson received the prestigious Golden Book Award from the World Simmental Federation in 1988. The Dickinson operation, under Bob's strong performance leadership, has also developed an outstanding Angus herd utilizing the BIF performance and EPD tools available.

Active in Kansas Livestock Association functions, the Dickinsons have performance tested and sold more bulls from the Kansas Bull Test Station in Beloit than any other breeder in the state. Dickinson was named Kansas Conservationist of the Year in 1975.

Bob and his wife, Jan, have four children who have been raised working on the purebred cattle operations and remain active in agriculture in their careers.

BIF is pleased and honored to recognize the many contributions of Bob Dickinson by presenting him with the 1998 Pioneer Award.

CONTINUING SERVICE AWARD RECIPIENTS

Clarence Burch	OK	1972	Ken W. Ellis	CA	1986
F. R. Carpenter	CO	1973	Earl Peterson	MT	1986
E. J. Warwick	DC	1973	Bill Borror	CA	1987
Robert DeBaca	IA	1973	Daryl Strohbehn	IA	1987
Frank H. Baker	OK	1974	Jim Gibb	MO	1987
D. D. Bennett	OR	1974	Bruce Howard	CAN	1988
Richard Willham	IA	1974	Roger McCraw	NC	1989
Larry V. Cundiff	NE	1975	Robert Dickinson	KS	1990
Dixon D. Hubbard	DC	1975	John Crouch	MO	1991
J. David Nichols	IA	1975	Jack Chase	WY	1992
A. L. Eller, Jr.	VA	1976	Leonard Wulf	MN	1992
Ray Meyer	SD	1976	Henry W. Webster	SC	1993
Don Vaniman	MT	1977	Robert McGuire	AL	1993
Lloyd Schmitt	MT	1977	Charles McPeake	GA	1993
Martin Jorgensen	SD	1978	Bruce E. Cunningham	MT	1994
James S. Brinks	CO	1978	Loren Jackson	TX	1994
Paul D. Miller	WI	1978	Marvin D. Nichols	IA	1994
C. K. Allen	MO	1979	Steve Radakovich	IA	1994
William Durfey	NAAB	1979	Dr. Doyle Wilson	IA	1994
Glenn Butts	PRI	1980	Paul Bennett	VA	1995
Jim Gosey	NE	1980	Pat Goggins	MT	1995
Mark Keffeler	SD	1981	Brian Pogue	CAN	1995
J. D. Mankin	ID	1982	Harlan D. Ritchie	MI	1996
Art Linton	MT	1983	Doug L. Hixon	WY	1996
James Bennett	VA	1984	Glenn Brinkman	TX	1997
M. K. Cook	GA	1984	Russell Danielson	ND	1997
Craig Ludwig	MO	1984	Gene Rouse	IA	1997
Jim Glenn	IBIA	1985	Keith Bertrand	GA	1998
Dick Spader	MO	1985	Richard Gilbert	TX	1998
Roy Wallace	OH	1985	Burke Healey	OK	1998
Larry Benyshek	GA	1986			

KEITH BERTRAND RECEIVES THE "1998 BIF CONTINUING SERVICE AWARD"

Calgary, Alberta, Canada - The Beef Improvement Federation (BIF) honored Dr. Keith Bertrand with the Continuing Service Award at the 30th Annual Meeting and Research Symposium held in Calgary, Alberta on June 30 - July 3, 1998.

Keith Bertrand grew up in northwest Florida and received a B.S. in Animal Science from the University of Florida in 1978. He completed his M.S. in Animal Breeding at Iowa State University in 1981 and received a Ph.D. in Animal Breeding with a graduate minor in Statistics from Iowa State in 1983. Dr. Bertrand served as a Postdoctoral Associate at the University of Georgia from 1983 to 1986. Dr. Bertrand was appointed Assistant Professor in 1986 and is currently a Professor at the University of Georgia where he teaches introductory Animal Science and graduate Animal Breeding courses. Keith and his wife, Jean, have two daughters, Elizabeth and Maria.

Keith Bertrand has been very active in the BIF Genetic Prediction Committee over the past ten years where he has made several presentations and has had a major impact on development of National Cattle Evaluation procedures. Dr. Bertrand is one of the authors of the National Evaluation Section of BIF's Guidelines for Uniform Beef Improvement Programs which is used internationally as a standard reference on beef performance programs.

For the last 20 years, Keith Bertrand has devoted much of his life to genetic prediction in beef cattle. As a graduate student, he studied sire by region interactions in national sire evaluations. This postdoctoral work was heavily involved with development of National Cattle Evaluation procedures. As a faculty member at the University of Georgia, Dr. Bertrand has coordinated computation of EPDs for over a dozen different breeds of beef cattle and played a leading role in the development of international genetic evaluations. Currently, Dr. Bertrand and his co-workers at the University of Georgia handle genetic evaluation for five U.S. breed associations, four international (United States - Canadian) breeds, and two South American breed associations. In addition to coordinating existing national and international cattle evaluation programs, Dr. Bertrand is conducting research directed toward development and improvement of carcass evaluation. Dr. Bertrand has developed a well-deserved reputation as an international authority on genetic prediction in beef cattle.

BIF is pleased and honored to recognize the many contributions of Keith Bertrand by presenting him with the BIF Continuing Service Award.

RICHARD GILBERT RECEIVES THE "1998 BIF CONTINUING SERVICE AWARD"

Calgary, Alberta, Canada - The Beef Improvement Federation (BIF) honored Dr. Richard P. Gilbert with a Continuing Service Award at the convention held in Calgary, Alberta.

Richard grew up on a sizeable commercial livestock ranch in Montana, which laid the groundwork for his broad knowledge of the beef cattle industry. Richard spent the early 1990's in Canada, involved with the commercialization of agricultural research ideas. He provided education and assistance in the practical application of technologies to a variety of settings. In 1993, Richard accepted the Executive Secretary position with the Red Angus Association of America, headquartered in Denton, Texas. In this leadership role, Richard has been credited with the development of a strategic planning process for the association. The strategic plan has led the association through the development and implementation of several new programs and services offered by the association such as Total Herd Reporting, the new Stayability EPD, carcass EPDs, and the Red Angus Commercial Marketing Program.

The Red Angus Association developed and implemented Total Herd Reporting in 1995 and the program has become one of the most comprehensive performance programs in the industry. Total Herd Reporting accounts for the performance and production of all registered Red Angus on an annual basis.

Over the past five years, the association has continued to be a leader with the development of the Stayability EPD as well as EPDs for the carcass traits of marbling, backfat and ribeye area.

The Red Angus Commercial Marketing Program, which was outlined in the Association's Strategic Plan, now offers a full range of marketing services to Red Angus commercial bull customers. A system of source and genotypic verification which is USDA approved serves as the basis of the marketing program and is thought to be the first of its kind in the industry.

BIF is pleased and honored to recognize the many contributions of Richard Gilbert by presenting him with the BIF Continuing Service Award.

BURKE HEALEY RECEIVES THE "1998 BIF CONTINUING SERVICE AWARD"

Calgary, Alberta, Canada - The Beef Improvement Federation (BIF) honored Burke Healey with a Continuing Service Award at the convention held in Calgary, Alberta.

Burke Healey is the owner-operator of Southern Cross Ranch, in Davis, Oklahoma. The Healey family holds a proud tradition in the Hereford breed, the beef industry, and the development of performance records. Burke operated and co-owned Healey Brothers Flying L Ranch at Davis, with his brother Skip Healey from 1950 - 1988. Since 1988, Burke has operated Southern Cross Ranch (1/2 of the Flying L operation) with his children. This operation involves 100 registered Herefords and a commercial cow unit spanning 3,500 acres in southern Oklahoma.

Burke graduated from Oklahoma State University in Animal Science in 1955, after having studied business at Duke University. Through the many years of the Flying L Hereford Ranch, Burke and his brother Skip pursued the performance "mystery" of the beef industry at that time. They were charter members or played active roles in organizations such as the American Beef Cattle Performance Registry, Performance Registry International, Hereford Total Performance Records, Oklahoma Beef Cattle Improvement Association, and Oklahoma Beef Incorporated, just to name a few. The Healeys were not afraid to discuss genetic improvement ideas with other breeders, industry leaders, and commercial cattle producers even when "performance" was not well accepted. The Flying L cattle were part of feedlot and carcass tests in the early 1960's. Burke stressed that a successful cattle breeder must have a plan along with the conviction that the plan will work. This was evident in Burke's contribution to data collection and interpretation of linear measurements. He emphasized that frame size in animal evaluation was just one tool in evaluating growth rate. Burke gave a presentation in 1979 at BIF about his findings, indicating that "measurements are a tool - not a goal'.

Burke is highly respected in the beef industry for his ability to meticulously evaluate a program or task, followed by a careful, fact-based plan of action. He has served in many positions at state and national levels. This is evidenced by his service and leadership contributions in other organizations such as National Cattlemen's Beef Association, Cattlemen's Beef Promotion and Research Board, Beef Industry Long Range Planning Task Force and Oversight Committee, Beef Industry Council, American Hereford Association, National Academy of Sciences, and Forum for Animal Agriculture. Burke served 12 years on the Oklahoma State University Board of Regents. In 1980, he received the OSU Graduate of Distinction honor.

Burke was the first recipient of the BEEF Magazine "Trailblazer" Award in 1994. He is profiled in Bob deBaca's book, "Courageous Cattlemen" as one of fifty cattlemen and researchers who most influenced America's performance movement. A quote from this book describes Burke's unique contribution - "Thinking is Burke Healey's long suit. Hereford are his cattle. Persistence and study are his tools. Perfection is his goal. And the world has been his market." Burke and his endeavors are strongly supported by his wife, Tina, and their seven children. BIF is pleased and honored to recognize the many contributions of Burke Healey by presenting him with the 1998 BIF Continuing Service Award.

Keith Bertrand

Tina and Burke Healy
Continuing Service

BIF 1998 ATTENDANCE

1998 CONVENTION ATTENDEES

Bill Able
American International Charolais Assoc.
Kansas City, MO

Gail Adams
Wehrmann Angus
N. Wilkesboro, NC

Mary Adolf
National Cattlemen's Beef Assoc.
Englewood, CO

Harry Airey
Canadian Charolais Assoc.
Calgary, AB

Joan Airey
Calgary, AB

Leanne Akins
Western Beef Development Centre
Saskatoon, SK

Douglas Allen
Canadian Angus Association
Calgary, AB

Beecher Allison
NC State University
Waynesville, NC

William Altenburg
ABS Globel
Ft. Collins, CO

Sharon Altenburg
ABS Globel
Ft. Collins, CO

Dan Anders

Kent Anderson
N. American Limousin
Englewood, CO

Jim Armstrong
Sask Agriculture & Food
Tisdale, SK

Jerry Arnold
Coffee Creek Ranch
Valentine, NE

Roy Ax
University of Arizona
Tucson, AZ

Mike Baker
Cornell University
Ithaca, NY

Geoff Barker
Canadian Limousin Assoc.
Calgary, AB

Tim Barnes
Montevideo, Uruguay

Philip Barrett-Lennad
Becton Stock Farm
Sheridan , WY

John Basarab
Alberta Agriculture,Food & Rural Affairs
Edmonton, AB

Simon Beamish
New Zealand Beef Council
Hastings, NZ

Kindra Beitelspacher
Beef Magazine
Minneapolis, MN

Wendy Belcher
Canadian Gelbvieh Assoc.
Calgary, AB

Barry Bennett
Canadian Simmental Assoc.
Calgary, AB

Tracy Bennett
Knoll Crest Farm Inc.
Red House, VA

Paul Bennett
Knoll Crest Farm Inc.
Red House, VA

James Bennett
Knoll Crest Farms
Red House, VA

Barbara Bennett
Knoll Crest Farms
Red House, VA

Reynold Bergen
Manitoba Agriculture
Winnipeg, MB

Keith Bertrand
University of Georgia
Athens, GA

Greg Blair
Scotiabank
Calgary, AB

Don Boggs
S. Dakota State University
Brookings, SD

Wayne Bollum
BEEF
Minneapolis, MN

Ron Bolze
Certified Angus
Colby, KS

Jerry Bornemann
Durand, MI

Rick Bourdon
Colorado State University
Ft. Collins, CO

Dean Boyd
Canadian Blonde d'Aquitaine Assoc.
Calgary, AB

Mike Boyd
Mississippi State Univ.
Starkville, MS

Paul Brackelsberg
Iowa State University
Ames, IA

Lee Bradshaw
JSCA

Glenn Brand
Beef Information Centre
Calgary, AB

Kellie Breen
Davis, CA

Mindy Brink
Westminister, CO

Tom Brink
American Gelbvieh Assoc.
Westminister, CO

Rob Brown
R.A. Brown Ranch
Throckmorton, TX

Anne Brunet
The Semex Alliance
Calgary, AB

Dean Bryant
Roseda Farm
Monkton, MD

Curtis Bryant
Roseda Farm
Monkton, MD

John Buba
Canadian Simmental Assoc.
Calgary, AB

Warren Burgevitz
Nutrena Feeds
Lethbridge, AB

Sara Buxkemper
American Simmental Assoc.
Ballinger, TX

Wilfred Campbell
Beef Information Centre
Tompkins, SK

Richard Carlson
Canadian Charolais Assoc.
Calgary, AB

Ronda Carlson
AAFC-Lethbridge Research Centre
Lethbridge, AB

Clay Carlson
University of Arizona
Tucson, AZ

Nicolas Caron
AAFC-Lethbridge Research Centre
Lethbridge, AB

Neil Carruthers
Canadian Angus Association
Calgary, AB

Hollis Chapman
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Baton Rouge, CA

Jane Chastain
Stonebrook Angus Farm
Bloomington, IW

Stan Christensen
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Calgary, AB

Keith Coates
Calgary, AB

Sam Comstock
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Fort Collins, CO

Curly Cook
Cloud Creek Cattle Co.
Crawford, GA

Ryan Copithorne
CI Ranches Ltd.
Calgary, AB

Cherie Copithorne-Barnes
Lanie S.A.
Montevideo, Uruguay

Larry Corah
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Manhattan, KS

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Hugh Crawford
Sandrift Galloways
Carmangay, AB

Stuart Crawford
Sandrift Galloways
Carmangay, AB

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Lloydminister, SK

Denny Crews
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Monitor, AB

Dianne Crisp
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Monitor, AB

John Crouch
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St Joseph, MO

Larry Cundiff
MARC
Clay Centre, NE

Laura Cundiff
Clay Centre, NE

Bruce Cunningham
American Simmental Assoc.
Bozeman, MT

Lee Curkendall
Ag Info Link

Dan Currie
Harding Land & Cattle Co. Inc.
Terry, MT

Cindy Daley
Chico, CA

Dave Daley
California State University
Chico, CA

David Danciger
Tybar Angus Ranch
Carbonadale, CO

Emma Danciger
Tybar Angus Ranch
Carbonadale, CO

Russ Danielson
N. Dakota State University
Fargo, ND

Helen Danielson
Fargo, ND

Dale Dannels
Lindsey Land & Cattle Co.
Olsburg, KS

Ray Davisson
Stettler, AB

Daniel de Mattos
University of Georgia
Athens, GA

Jacques DeCorby
Canadian Hereford Assoc.
Calgary, AB

Cindy Delaloye
Canadian Beef Grading Agency
Calgary, AB

Ray Depalme
Salers Assoc. of Cda.
Red Deer, AB

Bob Dickinson
Gorham, KS

Jan Dickinson
Gorham, KS

Tina Diebold
IAC
Three Forks, MO

Bill Dillabaugh
AA Angus
Coleville, SK

Jed Dillard
Monticello, FL

David Dockter
Select Sires
Mandan, ND

Troy Dodd
Integrated Genetic Management Inc.
Canyon, TX

Joerg Dodenhoff
Iowa State University
Ames, IA

Garner Doebald
Canadian Charolais Assoc.
Calgary, AB

Arno Doerksen
Alberta Cattle Commission
Calgary, AB

Sally Dolezal
Oklahoma State University
Stillwater, OK

Bernard Dore
The Semex Alliance
Calgary, AB

Patrick Doyle
Colorado State University
Ft. Collins, CO

Roger Eakins
University of Missouri
Jackson, MO

Michelle Edwards
University of Guelph
Guelph, ON

Richard Eldershaw
Rangers Valley Cattle Station
Glenn Innes, NSW

Antonio Elias Calles
Washington State University
Pullman, WA

Ike Eller
Virginia Tech
Blacksburgh, VA

Carolyn Eller
Blacksburgh, VA

Clair Engle
Penn State University
University Park, PA

Dale Engstrom
Alberta Agriculture
Edmonton, AB

Mark Enns
University of Arizona
Tucson, AZ

Sharrone Evans
Canadian Simmental Assoc.
Calgary, AB

John Evans
Colorado State University
Fort Collins, CO

Larry Evans
Agri-Tech International
Airdrie, AB

June Evans
Greenwood, MS

S.R. Evans, Jr.
Greenwood, MS

Dwayne Faidley
Colorado State University
Fort Collins, CO

Doug Fee
Canadian Angus Association
Calgary, AB

Roberta Feeley
Grassi Point Charolais
Courtenay, BC

Tom Feeley
Grassi Point Charolais
Courtenay, BC

Frank Felton
Felton Ranch
Maryville, MO

Lynn Felton
Felton Ranch
Maryville, MO

Robert Felsman
University of Arkansas
Pine Bluff, AR

Mirabel Fernandez
UMN
St. Paul, MN

Briger Feuz
PE AgGen
Salt Lake City, UT

Galen Fink
Fink Beef Genetics
Manhattan, KS

Claudio Fioretti
Estancias Y Cabana Las Lilas
Buenos Aires, Argentina

Glenn Fischer
Allflex
Dallas, TX

Zack Florence
Alberta Research Council
Vegreville, AB

Kathy Flundra
Shoderee Ranch Red Angus
Pincher Creek, AB

Holly Foster
California State University

Ron Foxcroft

Bob Freer
Antek
Armidale, NSW
Australia

Brian Freeze
Lethbridge Research Centre
Lethbridge, AB

Gary Friesen
Royal Bank of Canada
High River, AB

Wayne Gamble
Cdn. Western Agribition
Regina, SK

Henry Gardiner
Gardiner Angus Ranch
Ashland, KS

Mark Gardiner
Gardiner Angus Ranch
Ashland, KS

Maxine Garrison
Micro Chemical
Amairillo, TX

Louis Gasbarre
USDA
Beltsville, MD

Charles Gaskins
WSU
Pullman, WA

Douglas Gerber
Gerber Polled Herefords
Richmond, IN

Maxine Gerber
Gerber Polled Herefords
Richmond, IN

Jim Gibb
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Englewood, CO

Wendell Gibbs
Alabama BCIA
Montgomery, AB

Bruce Gordon
Alta Genetics
Balzac, AB

Lynn Gordon
Red Angus Association
Denton, TX

Jim Gosey
University of Nebraska
Lincoln, NE

Lowell Gould
Leachman Cattle Company
Billings, MT

Lori Gould
Leachman Cattle Company
Billings, MT

Stan Grad
Soderglen
Airdrie, AB

Harvey Graham
Beef Improvement Ontario
Guelph, ON

Joan Graham
Guelph, ON

Polly Grant
Colorado State University
Ft. Collins, CO

Ronnie Green
Colorado State University
Fort Collins, Co

Jane Green
Colorado State University
Fort Collins, Co

Scott Greiner
Virginia Tech
Blacksburgh, VA

Lori Greiner
Blacksburgh, VA

Jim Griffin
Murphy Family Farms
Rose Hill, NC

Alana Groeneveld
Alta Genetics
Balzac, AB

Gaylene Groeneveld
Simmental Country
Calgary, AB

Randall Grooms
TAMU
Tyler, TX

Gina Grosenick
Canadian Cattlemen's Assoc.
Calgary, AB

Randy Guthrie
N.C. State University
Bahama, NC

John Hall
VA Tech
Blackburg, VA

Olivia Hattam
California State University, Chico
Chico, CA

Mabel Hamilton
Canadian Beef Breeds Council
Innisfail, AB

Joanne Handley
OMAFRA
Fergus, ON

Harry Haney
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Airdrie, AB

Susan Hardin
Moorman's Inc.
Monroe, GA

Rick Hardin
Moorman's Inc.
Monroe, GA

Jeff Harding
Harding Land & Cattle Co. Inc.
Terry, MT

Joan Hare
Monticello, FL

Mary Harriman
Midwestern Cattle Services
Hermann, MO

Bob Harriman
Midwestern Cattle Services
Hermann, MO

Neil Harvie
Glenbow Ranching
Cochrane, AB

Cindy Hauck
Cdn. Western Agribition
Regina, SK

David Hawkins
MI State University
Mason, MI

Kathleen Hawkins
MI Beef Commission
Mason, MI

Burke Healey
Southern Cross Ranch
Davis, OK

Tina Healey
Southern Cross Ranch
Davis, OK

Rod Heitschmidt
Range Ecologist
Miles City, MT

Dick Helms
Flying H Genetics
Arraphaoe, NE

Jim Henderson
Bar Pipe Farms
Okotoks, AB

Greg Henderson
Drovers
Lenexa, KS

Kern Hendrix
Purdue University
West Lafayette, IN

Lois Herbst
Herbst Lazy TY Cattle Co.
Shoshoni, WY

Shauna Hermel
Angus Journal
St. Joseph, MO

Todd Hermel
St. Joseph, MO

William Herring
University of Missouri
Columbia, MO

Andy Herring
Texas Tech University
Lubbock, TX

Terry Hockaday
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Calgary, AB

Herbert Hoeptner
Hoeptner Herefords
Eagle Point, OR

David Hoffman
University of Missouri
Harrisonville, MO

David Holden
Westwind Angus
Valier, MT

Kathleen Holliman
Marion Junction, AL

Bret Holliman
Marion Junction, AL

Jimmy Holliman
Auburn University
Marion Junction, Al

Audrey Horkoff
Cdn. Western Agribition
Regina, SK

Stacy Horrocks
WTAMU
Canyon, TX

John Hough
American Hereford Assoc.
Kansas City, MO

Bob Hough
Red Angus Assoc.
Denton, TX

Leon Houghton
Purdue University
West Lafayette, In

Patsy Houghton
Heartland Cattle Company
McCook, NE

Barbara Hounshell
Hounshell Farms
Wytheville, VA

Buster Hounshell
Hounshell Farms
Wytheville, VA

Brian House
Select Sires
Plain City, OH

Frank Howeth
Brock III Farms
Weatherford, TX

Craig Huffhines
American Hereford Assoc.
Kansas City, MO

Roger Hunsley
American Shorthorn Assoc.
Omaha, NE

Richard Huntrods
Purdue University
Bedford, In

Don Hutzel
NOBA
Tiffin, OH

Lauren Hyde
Colorado State University
Ft. Collins, CO

Aime Jacob
Charolais Association, Quebec
Ste Sabine, PQ

Loren Jackson
International Brangus Assoc.
San Antonio, TX

Delyn Jensen
Alberta Agriculture
Hanna, AB

Kee Jim
Feedlot Health Management Service
Okotoks, AB

Jerilyn Johnson
Beef Today
Stewartsville, MO

Diann Johnson
Kansas City, MO

Gary Johnson
Johnson Farms
Dwight, KS

Jody Johnson
Johnson Farms
Dwight, KS

Jim Johnson
VA Cattlemen's Assoc.
Daleville, VA

Martha Johnson
Daleville, VA

Dennis Johnston
Rancher's Choice Group
Conquest, SK

Howard Jones
Georgia Cattlemen
Orano Beach, FL

Sandi Jones
Olds College
Olds, AB

Debra Julien
Leachman Cattle Co.
Billings, MT

Christopher Kaiser
University of Missouri
Columbia, MO

Mike Kasten
Millersville, MO

David Keeley
Beefbooster Management Ltd.
Calgary, AB

Dale Kelly
Canadian Charolais Assoc.
Calgary, AB

Linda Kelly
University of Arizona
Ft. Thomas, AZ

Bob Kemp
AAFC-Lethbridge Research Centre
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In appreciation of Gary Johnson (left), outgoing president, and passing the gavel to Jed Dillard, incoming president.

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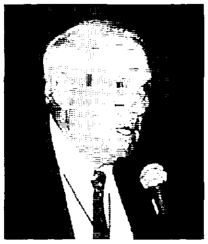

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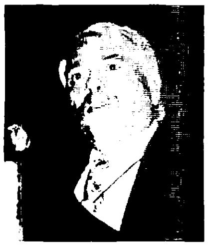

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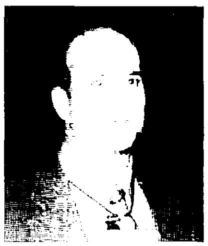

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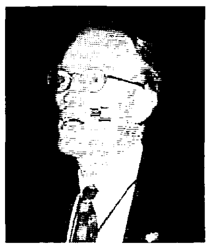

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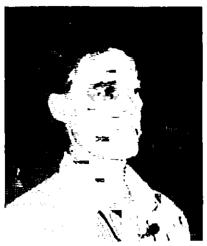

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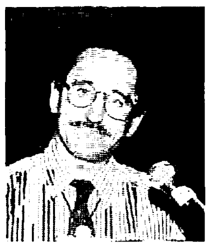

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