SECTION 4

Performance Programs

NALF Generation III Information System

Introduction

The primary function of the North American Limousin Foundation is to maintain the herd book of pedigree and performance information for Limousin breeders in North America. As the breed has evolved and expanded, so has the need to upgrade procedures for collecting, submitting and processing animal information. For the purpose of positioning its members favorably in an increasingly competitive seedstock industry, the North American Limousin Foundation encourages a thorough understanding of the Generation III system.

Overview - A Year in the Life of NALF Record Keeping

Generation III is basically an "information highway" for breeders and users of Limousin genetics. The primary goal is to comprehensively describe characteristics of Limousin cattle in a timely and accurate manner, such that appropriate selection decisions can be made.

The primary vehicles on the Limousin information highway are the multiple and single application for entry forms (see pages B-9 and D-4). Limousin breeders can choose to use either of these forms when submitting information. Data items included on the forms are identical. The only cattle that cannot be processed using these forms are those produced through embryo transfer. A SPECIAL FORM IS REQUIRED FOR ET CALVES - SEE THE SECTION ON EMBRYO TRANSPLANT CALVES FOR INFORMATION, page F-1 and F-2.

Cow Inventory - Birth Report

While animal information can be reported at any time, NALF suggests that data be reported following each phase of production, after calving, following weaning and again after yearling data are collected. For most breeders, the multiple application for entry is the form of choice. The primary vehicle is the Cow Inventory - Birth Report. Limousin breeders receive these report forms automatically just prior to the start of the calving season with their current cow herd inventory and other information pre-printed for added convenience. See example on page D-2. As calving season progresses, breeders are asked to collect as much calving data as possible from newborn calves. While some data items are mandatory for registration, others are optional. Required items are identified with an asterisk in the list of Generation III calving data fields listed here, however the mandatory items are identified by red print on the actual Generation III form.

DAM HERD ID/FC BREED
***DAM TATTOO/FC BIRTH YEAR**
***DAM REGISTRATION/FC ID**
DAM STATUS
***CALF'S SIRE REGISTRATION**
***A.I. FROM/TO**
***CALF TATTOO**
***YEAR CODE**
***LOC**
CALF HERD ID
***BIRTH DATE**
BIRTH GROUP
***SEX**
TYPE
H/P/S
COLOR
BIRTH WT
EASE
CALF NAME

Fig. D-1: Cow Inventory – Birth Report

NORTH AMERICAN LIMOUSIN FOUNDATION
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Englewood, CO 80155
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I hereby certify and declare that the below is true and correct and I desire to have the same recorded in the North American Limousin Foundation record, in consideration of which I agree to abide and be bound by the by-laws, rules, and regulations of the Foundation and amendments thereto:

MEMBER #: N 99991 HERD PREFIX: NALF

Jane Doe

Information highlighted in RED is required for registration

APPLICANT SIGNATURE _____ DATE _____

DAM TAG	DAM TATTOO (Herd Prefix, ID, Year Code)	*DAM REGISTRATION (Prefix & Number)	DAM STATUS	SIRE'S REGISTRATION (Prefix & Number)	Check If A.I. Calf	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr.
	NALF 17A Y	NPF 112345				

CALF BIRTH INFO.	CALF TATTOO (Herd Prefix, ID, Year Code)	LOC	CALF TAG	BIRTH DATE Mo. Day Yr.	**BIRTH GRP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)
	NALF J			99								

CALF WEAN INFO.	WEANING DATE Mo. Day Yr.	***WEAN GRP	FOSTER/CREEP	WEANING WT.	WEANING HIP HT.	CALF DOC.	DAM WT @ WN	DAM COND	Animal will be registered unless this box is checked	Do Not Register	Transfer Included

DAM TAG	DAM TATTOO (Herd Prefix, ID, Year Code)	*DAM REGISTRATION (Prefix & Number)	DAM STATUS	SIRE'S REGISTRATION (Prefix & Number)	Check If A.I. Calf	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr.
	NALF 923X	NPF 11111111				

CALF BIRTH INFO.	CALF TATTOO (Herd Prefix, ID, Year Code)	LOC	CALF TAG	BIRTH DATE Mo. Day Yr.	**BIRTH GRP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)
	NALF J			99								

CALF WEAN INFO.	WEANING DATE Mo. Day Yr.	***WEAN GRP	FOSTER/CREEP	WEANING WT.	WEANING HIP HT.	CALF DOC.	DAM WT @ WN	DAM COND	Animal will be registered unless this box is checked	Do Not Register	Transfer Included

DAM TAG	DAM TATTOO (Herd Prefix, ID, Year Code)	*DAM REGISTRATION (Prefix & Number)	DAM STATUS	SIRE'S REGISTRATION (Prefix & Number)	Check If A.I. Calf	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr.
	JWLI 354Y	NFF 5555555				

CALF BIRTH INFO.	CALF TATTOO (Herd Prefix, ID, Year Code)	LOC	CALF TAG	BIRTH DATE Mo. Day Yr.	**BIRTH GRP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)
	NALF J			99								

CALF WEAN INFO.	WEANING DATE Mo. Day Yr.	***WEAN GRP	FOSTER/CREEP	WEANING WT.	WEANING HIP HT.	CALF DOC.	DAM WT @ WN	DAM COND	Animal will be registered unless this box is checked	Do Not Register	Transfer Included

DAM TAG	DAM TATTOO (Herd Prefix, ID, Year Code)	*DAM REGISTRATION (Prefix & Number)	DAM STATUS	SIRE'S REGISTRATION (Prefix & Number)	Check If A.I. Calf	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr.

CALF BIRTH INFO.	CALF TATTOO (Herd Prefix, ID, Year Code)	LOC	CALF TAG	BIRTH DATE Mo. Day Yr.	**BIRTH GRP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)

CALF WEAN INFO.	WEANING DATE Mo. Day Yr.	***WEAN GRP	FOSTER/CREEP	WEANING WT.	WEANING HIP HT.	CALF DOC.	DAM WT @ WN	DAM COND	Animal will be registered unless this box is checked	Do Not Register	Transfer Included

Each of these items are defined in more detail later in this section of the Members Manual, beginning on page D-4.

Immediately following calving season, the Cow Inventory - Birth Report forms, with recorded birth information, should be sent into the NALF office for processing of birth data. For the purpose of timely information exchange, breeders are asked to drive in the fast lane and report birth information as soon as possible after calving season is completed. If you do not want to register calves at this time, you must check the "Do Not Register" box located in the far right-hand column of the Cow Inventory - Birth Report. Keep in mind, if you don't plan to register the calves, NALF still wants all available performance information and will record it for a $2.50 fee per head or $5.00 for non-members, which applies to the registration costs. Calves that die within 72 hours of birth are processed free of charge. Complete data reporting is essential for calculation of reliable genetic values.

Calving Report - Weaning Update

The Limousin information highway travels in two directions, both to and from Limousin breeders and NALF. Upon receipt of the birth data, NALF will record all the pedigree and birth information, and return a Calving Report - Weaning Update, see example included on page D-3. This is actually the same vehicle as the Cow Inventory - Birth Report, but with the previously submitted calving information included. If you have chosen to register the calves following calving season, you will also receive a "Performance Record" for each animal (see description of Performance Record on page D-11).

Information on the calving report should be checked for errors and then used for submitting weaning data to NALF. Make corrections to errors and return with the weaning data. Note: if the error pertains to an animal that is already recorded, also return the registration certificate at that time. Typically, following calving, cow-calf pairs are eventually sorted into one or more breeding pastures where they remain until collection of weaning data. By definition, each of these breeding pasture groups becomes a contemporary group. By noting the pairs which are in various breeding groups and the range in calf age within each group, plans can be made as to when to collect weaning information. These notes can then be used to designate management practices from calving to weaning (WEAN GROUP AND FOSTER/CREEP, see detailed discussion, page D-7).

Remember, if there is a 90-day age range among calves in any one group, there is only one possible day to collect weaning weights, such that all calves are within age limits. In order for calf weaning information to be used for calculation of genetic values (EPDs - Expected Progeny Differences), all calves in a group must be weighed on the same day, when the youngest calf in the group is at least 160 days old and the oldest calf in the group is no more than 250 days of age. DO NOT WEIGH AND MEASURE EACH CALF ON THE EXACT DAY IT IS 205 DAYS OLD as you will end up with a series of contemporary groups comprised of one animal. The date-calculation wheel included with your original NALF Member's

Fig. D-2: Calving Report – Weaning Update

APPLICANT:
MEMBER #: N 001000 HERD PREFIX: EXAM
JOHN DOE
SOMEWHERE, USA 00001
INVOICE # 123456

NORTH AMERICAN LIMOUSIN FOUNDATION
Box 4467
Englewood, CO 80155
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I hereby certify and declare that the below is true and correct and I desire to have the same recorded in the North American Limousin Foundation record, in consideration of which I agree to abide and be bound by the by-laws, rules, and regulations of the Foundation and amendments thereto.

APPLICANT SIGNATURE _____ DATE _____

CALVING REPORT - WEANING UPDATE

DAM HERD ID/FC BREED	DAM TATTOO/FC BIRTH YR	DAM REGISTRATION/FC ID	DAM STATUS	CALF'S SIRE REGISTRATION	AI/FROM	TO
1001A	EXAM 1001 A	NPF-123456		NPM-456743	11/27/93	

	CALF TATTOO	YEAR CODE	LOC	CALF HERD ID	BIRTH DATE	BIRTH GROUP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)	
CALF BIRTH	EXAM	421 D	R	1001D	09/07/94		B	S	P	1	88	A	EXAM DALLAS	NPM-230111

	WEANING DATE	WEAN GROUP	FOSTER/ CREEP	WEANING WT	WEANING HT	DISPO-SITION	DAM WT @ WN	DAM COND	YEARLING DATE	YEAR GROUP	YEARLING WT	YEARLING HT	SCROTAL	PELVIC HORIZ	PELVIC VERT	TRANS INCL	REG NOW
CALF WN / YR																	

DAM HERD ID/FC BREED	DAM TATTOO/FC BIRTH YR	DAM REGISTRATION/FC ID	DAM STATUS	CALF'S SIRE REGISTRATION	AI/FROM	TO
112A	EXAM 112 A	NPF-234567		NPM-456743	11/27/93	

	CALF TATTOO	YEAR CODE	LOC	CALF HERD ID	BIRTH DATE	BIRTH GROUP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)	
CALF BIRTH	EXAM	420 D	R	112D	09/05/94		B	S	P	1	72	A	EXAM DENIM 420	NPM-230112

	WEANING DATE	WEAN GROUP	FOSTER/ CREEP	WEANING WT	WEANING HT	DISPO-SITION	DAM WT @ WN	DAM COND	YEARLING DATE	YEAR GROUP	YEARLING WT	YEARLING HT	SCROTAL	PELVIC HORIZ	PELVIC VERT	TRANS INCL	REG NOW
CALF WN / YR																	

DAM HERD ID/FC BREED	DAM TATTOO/FC BIRTH YR	DAM REGISTRATION/FC ID	DAM STATUS	CALF'S SIRE REGISTRATION	AI/FROM	TO
5160A	EXAM 016A	NPF-567897		NPM-456743	11/20/93	02/05/94

	CALF TATTOO	YEAR CODE	LOC	CALF HERD ID	BIRTH DATE	BIRTH GROUP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)	
CALF BIRTH	EXAM	422 D	L	5601D	09/22/94		H	S	P	1	82	A	EXAM DREAM GIRL 422D	NPF-230220

	WEANING DATE	WEAN GROUP	FOSTER/ CREEP	WEANING WT	WEANING HT	DISPO-SITION	DAM WT @ WN	DAM COND	YEARLING DATE	YEAR GROUP	YEARLING WT	YEARLING HT	SCROTAL	PELVIC HORIZ	PELVIC VERT	TRANS INCL	REG NOW
CALF WN / YR																	

DAM HERD ID/FC BREED	DAM TATTOO/FC BIRTH YR	DAM REGISTRATION/FC ID	DAM STATUS	CALF'S SIRE REGISTRATION	AI/FROM	TO
	3 CALVES LISTED FOR WEANING UPDATE					

	CALF TATTOO	YEAR CODE	LOC	CALF HERD ID	BIRTH DATE	BIRTH GROUP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)
CALF BIRTH													

	WEAN GROUP	FOSTER/ CREEP	WEANING WT	WEANING HT	DISPO-SITION			YEARLING HT			TRANS INCL	REG
CALF WN / YR												

Manual was designed to help determine when to collect weaning and yearling data. Failure to collect weaning data at the appropriate time will result in a NOTIFICATION letter (see page B-11 and B-12) and delay processing of performance information.

The "Do Not Register" box must be left blank if you wish to register calves when submitting weaning data. Please refer to page A-10 for a breakdown of registration fees for different animal ages. Again, even if you don't plan to register an animal, please submit the performance data.

The following weaning data are not required for registration; however, they are important in that NALF's genetic evaluation system is based upon this information, particularly the items marked with an asterisk:

***WEANING DATE**
***WEAN GROUP**
***FOSTER/CREEP**
***WEANING WEIGHT**
WEANING HEIGHT
DISPOSITION
DAM WEIGHT AT WEANING
DAM CONDITION

Again, each of these items are described in more detail later, beginning on page D-7.

Weaning Summary - Yearling Update

After weaning information has been processed, a Weaning Summary – Yearling Update will be returned with space provided to report yearling information (see example on page D-10). The Weaning Summary should be checked to insure that all weaning group and performance information has been accurately processed. At the end of each Weaning Summary, the average adjusted 205 day weaning weight ratios for calves from each sire are summarized. If animals have been registered, an updated Performance Record (see page D-11) with the latest EPDs and accuracies will be provided.

As with weaning data, the collection and submission of yearling performance information is optional, but recommended. The following are yearling data items included in the Generation III system. Again, those marked with an asterisk are of particular importance:

***YEARLING DATE**
***YEAR GROUP**
***YEARLING WEIGHT**
***YEARLING HEIGHT**
***YEARLING SCROTAL MEASUREMENT**
PELVIC HORIZONTAL MEASUREMENT
PELVIC VERTICAL MEASUREMENT

Once again, certain guidelines apply for collection of yearling performance information. In order for data to be used in the genetic evaluation system, animals must be between 330 and 450 days of age when yearling information is collected, and 140 days must have elapsed since weaning data were collected. As with collection of weaning data, all animals in a group must be evaluated on the same day, not on the exact yearling birthday of each animal. All of the above yearling performance traits must also be evaluated on the same day. Failure to comply with these guidelines renders the data unfit for

inclusion in the genetic evaluation and results in a NOTIFICATION letter from the NALF office, and will delay processing (see pages B-11 and B-12).

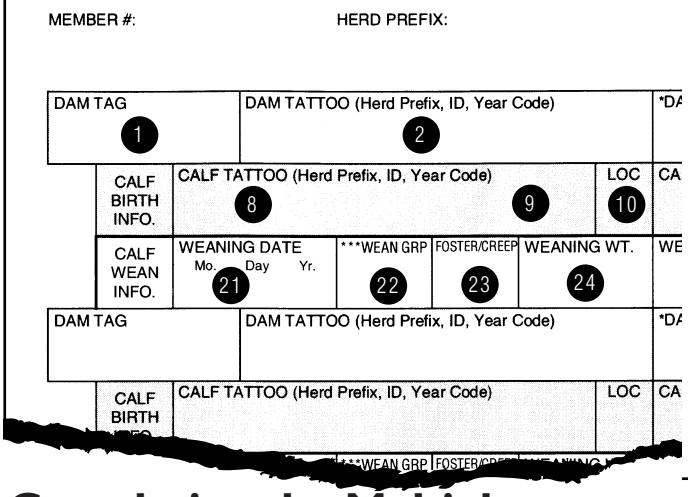
Yearling performance information should be sent to the NALF office as soon as possible after it has been collected. After processing, NALF will send a Yearling update which lists all birth, weaning and yearling information and provides averages for adjusted 365 day weight ratios by sire. If the animals are registered, an updated Performance Record will be provided with updated EPDs and accuracy values. Features of the Performance Record are discussed later, see page D-11.

A Note About Important Data Submission Cut-off Dates

Performance data from calves does not contribute to the calculation of EPDs for parents of the calves until it is processed through the National Limousin Genetic Evaluation at the University of Georgia. Also, in order for the accuracies of EPDs to be upgraded from "P" or "P+" to a numeric value, performance and group information must be evaluated by the University of Georgia. Check with the NALF office to learn of the cut-off dates, before which data must be submitted and processed error-free in order to be included in the next National evaluation.

The Limousin information highway includes the exchange of pedigree and performance information between each individual member and NALF, between NALF and the University of Georgia and between NALF and all users of Limousin genetics through the National Limousin Genetic Evaluation Manual and other NALF reports sent to commercial users of Limousin genetics. Because accurate information is essential for determination of genetic merit, a detailed explanation of each data item on the single and multiple application forms is provided here. **Note:** All items in red on the actual form and shown in this section with an asterisk must be completed in order for the application to be processed.

Fig. D-3: Sample Multiple Application Form



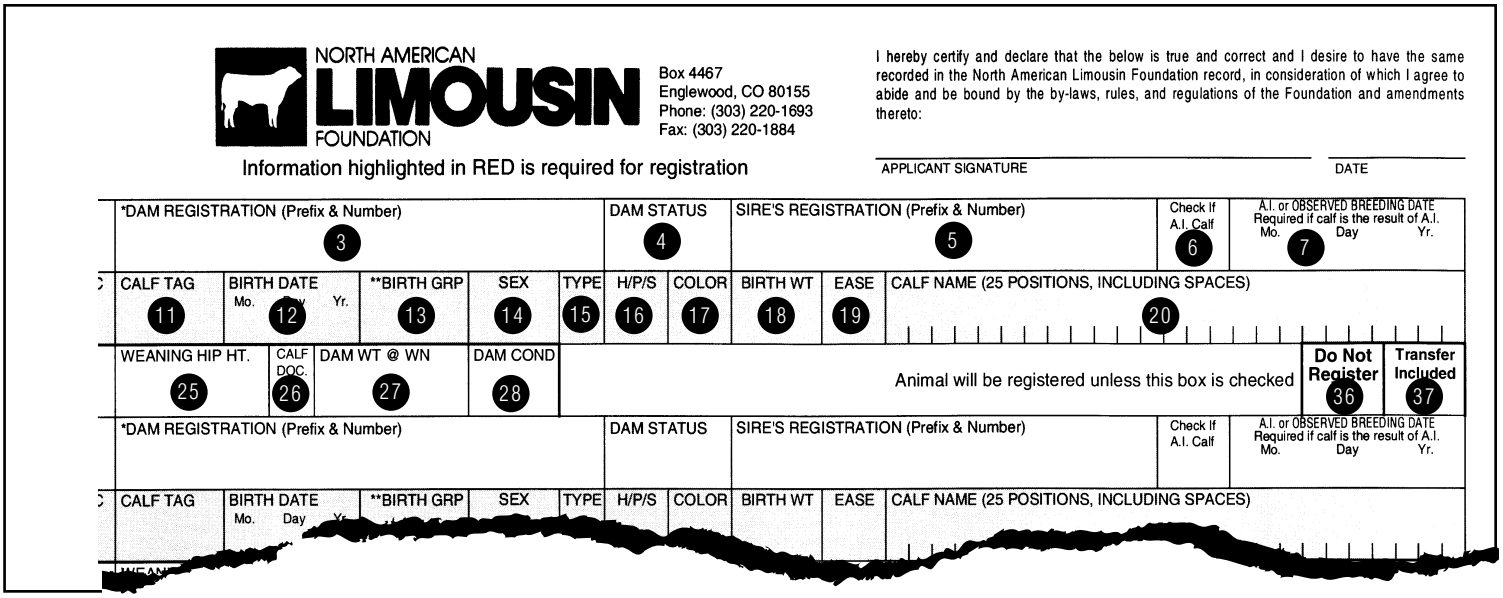
Completing the Multiple Application Form

1. **DAM HERD ID** – Ear tag number used to identify a registered dam in your herd. Maximum of 6 numbers and letters. (If dam is a foundation cow, see #3).
   NOTE: If you haven't previously reported herd dam I.D.s, you can do so in this position when you report the calf. Keep in mind the herd inventory reports you receive are sorted according to these herd I.D. numbers first; in the absence of herd I.D. numbers, the reports are listed according to tattoo numbers.

   Remember, you can use up to six characters for the herd I.D. Also, if you're expecting to receive a herd inventory report sorted in logical chronological order, here is how to make it happen: always make sure all of the I.D. numbers you report utilize the same number of digits, i.e. if the largest I.D. number you are using is 2000 (four digits), then you would report I.D. #1 as 0001 (again four digits). Likewise, if the largest I.D. number

Fig. D-4: FC Breed Codes

1	– Angus	A	– Simmental	H	– Holstein	Q	– Salers
2	– Hereford	B	– Beefmaster	I	– Gelbvieh	R	– Red Poll
3	– Shorthorn	C	– Scotch Highland	J	– Jersey	S	– Brown Swiss
4	– Red Angus	D	– South Devon	K	– Murray Grey	T	– Texas Longhorn
5	– Brahman	E	– Red Brangus	L	– Limousin	U	– Guernsey
6	– Santa Gertrudis	F	– Milking Shorthorn	M	– Maine Anjou	V	– Tarentaise
7	– Charolais	G	– Galloway	N	– Charbray	W	– Normande
8	– Brangus			O	– Senepol	X	– Unknown
9	– Polled Hereford			P	– Pinzgauer		



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APPLICANT SIGNATURE _____ DATE _____

Information highlighted in RED is required for registration

*DAM REGISTRATION (Prefix & Number) 3					DAM STATUS 4		SIRE'S REGISTRATION (Prefix & Number) 5		Check If A.I. Calf 6	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr. 7
CALF TAG 11	BIRTH DATE Mo. 12 Day Yr.	**BIRTH GRP 13	SEX 14	TYPE 15	H/P/S 16	COLOR 17	BIRTH WT 18	EASE 19	CALF NAME (25 POSITIONS, INCLUDING SPACES) 20	
WEANING HIP HT. 25	CALF DOC. 26	DAM WT @ WN 27	DAM COND 28	Animal will be registered unless this box is checked					Do Not Register 36	Transfer Included 37
*DAM REGISTRATION (Prefix & Number)					DAM STATUS		SIRE'S REGISTRATION (Prefix & Number)		Check If A.I. Calf	A.I. or OBSERVED BREEDING DATE Required if calf is the result of A.I. Mo. Day Yr.
CALF TAG	BIRTH DATE Mo. Day Yr.	**BIRTH GRP	SEX	TYPE	H/P/S	COLOR	BIRTH WT	EASE	CALF NAME (25 POSITIONS, INCLUDING SPACES)	

you report is 999 (three digits), then you need to report #1 as 001 (three digits also). Etc., etc. This may sound like a small point, but it will pay you big dividends in convenience and time.

***FC BREED** – Used to identify the breed makeup of a foundation cow (FC) that is the dam of the calf to be submitted. Use the breed codes in Fig. D-4 on page D-4.

SPECIAL NOTE: If the sire or dam of the calf to be recorded is a registered animal of another breed, please note the breed and provide the animal's registration number of the respective breed and submit a copy of the dam's or sire's registration certificate. Also, remember NALF and the Canadian Limousin Association calculate blood percentage differently. For a complete explanation, please see the registration section in this manual, page B-5.

2. ***DAM TATTOO –** Registered dams, must have herd prefix, tattoo, and year letter code. You can find the Dam's complete tattoo on her registration certificate. Please refer to page A-3 for information about obtaining a herd prefix. Information about tattooing is provided on page E-2. The letters I, O and Q are not used as NALF year letter codes.

Year	Letter	Year	Letter
1990	Y	2001	L
1991	A	2002	M
1992	B	2003	N
1993	C	2004	P
1994	D	2005	R
1995	E	2006	S
1996	F	2007	T
1997	G	2008	U
1998	H	2009	V
1999	J	2010	W
2000	K		

FC BIRTH YEAR – For foundation cows, enter the birth year of the cow. If available, also provide the month and day of birth.

3. ***DAM REGISTRATION –** For registered dams, enter the complete registration number of the dam including the three-letter registration prefix (i.e. NPF, NFF, NXF, etc.). The registration prefixes are described in more detail on page B-7.

FC ID – For foundation cows, enter the eartag number being used for this cow.

4. **DAM STATUS** – Used to inform NALF of the status of this cow or heifer for the calf crop being reported. Status codes enable NALF to keep an accurate record of each herd's current inventory and monitor factors affecting longevity. For status codes that describe reasons for culling, enter the code which indicates the primary cause.

NOTE: Leave space blank if cow or heifer produced a calf and information is included.

- **A** cow used as embryo donor or recipient
- **B** cow or heifer did not conceive or aborted, but has been retained for breeding
- **C** cow or heifer did not conceive or aborted, was culled and should be removed from herd inventory
- **D** cow had calf that died at birth or within 72 hours following birth due to calving difficulty but was retained for breeding
- **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
- **F** cow had calf that died at or following birth for reasons other than calving difficulty but was retained for breeding

****G** cow had calf that died at or following birth for reasons other than calving difficulty, was culled and should be removed from the herd inventory

****H** cow was culled because of unacceptable disposition, remove from herd inventory

****I** cow was culled due to teat and/or udder problems, remove from herd inventory

****J** cow was culled due to old age, including no teeth, remove from herd inventory

****K** cow was culled due to unsoundness of feet and legs, remove from herd inventory

****L** cow was culled because of inferior calf weaning weight, remove from herd inventory

M cow was sold with papers, submit transfer to NALF

****N** cow was sold without papers and should be removed from herd inventory

****O** cow died or was sold to slaughter for reasons other than those listed above.

**** Please return Registration Certificate to NALF; cow will be removed from herd inventory.**

5. *CALF'S SIRE REGISTRATION – Enter complete registration number including three-letter prefix (i.e. NPM, NFM, etc.)

6. *CHECK IF A.I. CALF – Check box if dam was A.I. serviced.

7. *A.I. or OBSERVED BREEDING DATE (Required if calf is the result of A.I.) – For A.I. or observed breeding, enter month (Mo.), day and year (Yr.).

8. *CALF TATTOO – The individual tattoo given to each calf. As described above, the tattoo consists of a herd prefix (typically 4 letters) and up to 4 numbers.

9. *YEAR CODE – The year letter code for the birth year of the calf. See year letter codes listed on page D-5.

10. *LOC – Location of tattoo: L = left ear, R = right ear, B = both ears.

11. CALF HERD ID (optional) – Your herd ID (tag number) for the calf. Maximum of 6 letters and numbers. Please refer to Note on Item 1 of these instructions for making the best use of your I.D. numbers.

12. *BIRTH DATE – Calf's birth date (month, day, year)

13. BIRTH GROUP – Different birth group codes will cause calves to be separated into different birth contemporary groups. If groups of cows on the same operation were managed differently nutritionally, during the last trimester of gestation, birth weights, calving ease scores and gestation lengths may be affected. Thus, different groups should be designated. If more than one herd prefix is represented in the same birth contemporary group (i.e. father/son, brothers, partnerships, etc. managing cattle together), then all calves should be coded as being in the same birth group and submitted at the same time in the same package. **Please attach a cover letter stating that calves should be included in the same birth group if calves with different herd prefixes are listed on separate forms.** Different groups should be designated on the form(s) as 1, 2, 3, etc. NALF will separate the calf crop into additional birth groups based on season of birth, sex and percent Limousin.

14. *SEX – H = heifer, B = bull, S = steer. If applications are filled out at weaning time, bull calves that are castrated at weaning should be listed as bulls. Bulls castrated at weaning should be recorded as steers when yearling information is submitted. Bull calves castrated before 3 months of age should be listed as steers at weaning.

15. TYPE – S = Single calf, TS = twin same sex, TO = twin opposite sex, TR = triplet. In multiple births of mixed sexes, the females cannot be registered until proven a breeder or blood typed with the freemartin test (please see Blood Typing section beginning on page F-1).

16. H/P/S

H = Horned: Bone-like growths that are firmly attached to the skull. May not appear in Limousin until 6 or 7 months old. Calves that are dehorned by any means must be recorded as horned.

P = Polled or Smooth Polled: No horns, scurs or horn-like growths on the skull and never dehorned with paste, hot iron, mechanical or surgical means.

S = Polled with Scurs: Small bone-like growths that are in the hide and are not firmly attached to the skull. Animals never dehorned. Scurs may be present on only one side of the skull and can appear as late as 12 or 13 months of age. Horned, polled and scurred status may be reported when weaning or yearling data is submitted on this form.

17. COLOR

1 = Red, no white other than underline
2 = Black, no white other than underline
3 = Red with white on face or body
4 = Black with white on face or body
5 = Cream color
6 = Other colors not listed above

18. BIRTH WT. – Actual birth weight in pounds taken within 48 hours of birth. Do not submit estimated weights. If accurate weights are not available, leave this space blank. Do not estimate birth weight with a hoof or girth tape.

19. EASE – Calving ease code:

A = unassisted, calf born unobserved or without assistance
B = Some assistance, calf was assisted but not by mechanical calf puller
C = mechanical assistance, mechanical calf puller used
D = cesarean, calf taken by surgical cesarean
E = abnormal presentation, calf backwards, breach or other abnormal presentation requiring assistance

20. CALF NAME – Names cannot exceed 25 spaces. If left blank, NALF will use herd prefix and tattoo for name. Breeders may use naming system of their choice. It is suggested that the herd prefix and tattoo be included in the name if possible. Name may be changed, except for bulls after progeny have been submitted to NALF or semen has been sold. Additional rules apply to name changes, please refer to Registration Section, page B-11, for name change policies.

21. WEANING DATE – Month, day and year the calf weaning weight was taken. All calves with the same management codes (wean group and foster/creep codes) which are to be included by NALF in the same weaning contemporary group should be weighed on the same day. For extremely large groups that cannot all be processed on the same day, please indicate in a cover letter that all calves are to be in the same weaning group. The maximum spread in weigh days for these groups is 5 days.

22. WEAN GROUP – Different WEAN GROUP codes will cause the calves to be separated into different weaning contemporary groups. NALF forms the weaning groups for breeders based on the WEANING DATE, WEAN GROUP, FOSTER/CREEP, SEX and percent Limousin blood information stored in the NALF computer. If you have calves that were handled in different groups (good vs. poor pasture), you must indicate these groups as 1, 2, 3, etc. It is the breeders responsibility to separate the calf crop into different groups

Fig D-5: Determining Docility (Disposition) Score

DOCILITY SCORE	DESCRIPTION
1 DOCILE	mild disposition, gentle and easily handled, stands and moves slowly during processing, undisturbed, settled, somewhat dull, does not pull on headgate when in chute, exits chute calmly
2 RESTLESS	quieter than average but slightly restless, may be stubborn during processing, may try to back out of chute, pulls back on headgate, some flicking of tail, exits chute promptly
3 NERVOUS	typical temperament, manageable but nervous and impatient, a moderate amount of struggling, movement and tail flicking, repeated pushing and pulling on headgate, exits chute briskly
4 FLIGHTY (WILD)	jumpy and out of control, quivers and struggles violently, may bellow and froth at mouth, continuous tail flicking, defecates and urinates during processing, frantically runs fenceline and may jump when penned individually, exhibits long flight distance (see glossary for definition) and exits chute wildly
5 AGGRESSIVE	may be similar to score 4 but with added aggressive behavior, fearful, extreme agitation, continuous movement which may include jumping and bellowing while in chute, exits chute frantically and may exhibit attack behavior when handled alone
6 VERY AGGRESSIVE	extremely aggressive temperament, "killers", pronounced attack behavior

Fig D-6: Determining Condition Score
(Richards, et al.)

CONDITION SCORE	DESCRIPTION
1 EMACIATED	Cow is extremely emaciated with no palpable fat detectable over spinous processes, transverse processes, hip bones or ribs. Tail-head and ribs project quite prominently.
2 POOR	Cow still appears somewhat emaciated but tail-head and ribs are less prominent. Individual spinous processes are still rather sharp to the touch but some tissue cover exists along the spine.
3 THIN	Ribs are still individually identifiable but not quite as sharp to the touch. There is obvious palpable fat along spine and over tail-head with some tissue cover over dorsal portion of ribs.
4 BORDERLINE	Individual ribs are no longer visually obvious. The spinous processes can be identified individually on palpation but feel rounded rather than sharp. Some fat cover over ribs, transverse processes and hip bones.
5 MODERATE	Cow has generally good overall appearance. Upon palpation, fat cover over ribs feels spongy and areas on either side of the tail-head now have palpable fat cover.
6 HIGH MODERATE	Firm pressure now needs to be applied to feel spinous processes. A high degree of fat is palpable over ribs and around tail-head.
7 GOOD	Cow appears fleshy and obviously carries considerable fat. Very spongy fat cover over ribs and around tail-head. In fact, "rounds" or "pones" beginning to be obvious. Some fat around vulva and in crotch.
8 FAT	Cow very fleshy and over-conditioned. Spinous processes almost impossible to palpate. Cow has large fat deposits over ribs, around tail-head and below vulva. "Rounds" or "pones" are obvious.
9 EXTREMELY FAT	Cow obviously extremely wasty and patchy and looks blocky. Tail-head and hips buried in fatty tissue and "rounds" or "pones" of fat are protruding. Bone structure no longer visible and barley palpable. Animal's mobility may even be impaired by large fatty deposits.

based on differences in management and nutrition which calves may be exposed to from shortly after birth to weaning age.

23. FOSTER/CREEP – Indication for foster dam or creep fed.
F = Foster Dam
C = Dam with creep for 6 weeks or more.

24. WEANING WT. – Actual weight in pounds on the date indicated in the weaning date field. Each calf must be individually weighed when it is between 160 and 250 days of age, inclusive. NALF will adjust all calves to a standard 205 day weight and adjust weight for age of dam differences. Do not weigh all calves on the exact date when each calf is 205 days of age.

25. WEANING HT. – Actual hip height in inches measured at the hip bone on the day the weaning weight was taken. NALF will calculate a 205 day adjusted hip height and a frame score.

26. DISPOSITION – Calf docility score at the time weaning data are collected. To be assigned while processing cattle. See Fig. D-5 on page D-7.

27. DAM WT. AT WN. – Actual weight in pounds of the calf's dam within a week of the day the calf's weaning weight was taken. Because dam weights can change dramatically shortly after weaning, weights should be collected as close as possible to the same day that calf weaning weights are collected. This enables NALF to use the calf weaning group information to also serve as cow weight groups. Ideally, dam condition scores (Figure D-6) should be reported along with the dam weights.

28. DAM COND. – Condition score of dam within a week of the day the calf's weaning weight was taken. Dam condition scores may be reported regardless of whether or not it is possible to obtain a cow weight. Use the condition scoring system in Fig. D-6 on page D-8.

29. YEARLING DATE – Month, day and year the calf yearling weight was taken. All calves in one contemporary group should be weighed the same day. For large groups which cannot be weighed on the same day, please indicate on a cover letter that they are all in the same contemporary group with maximum 5 day spread for weigh days.

30. YEAR GROUP – Different YEAR GROUP codes will cause the calves to be separated into different contemporary groups. If you have calves that were managed in different groups (i.e., high concentrate feeding vs. high roughage feeding), you must indicate additional yearling groups as 1, 2, 3, etc. It is the breeders responsibility to separate the calf crop into different groups by management and nutrition. NALF will separate the calf crop into additional groups based on date weighed, sex, foster/creep and percent Limousin.

31. YEARLING WT. – Actual weight in pounds on the date indicated in the YEARLING DATE field. Each calf must be individually weighed when it is between 330 and 450 days of age, inclusive, and at least 140 days after weaning weights were collected. NALF will adjust all calves to a standard 365 day yearling weight and calculate yearling weight ratios.

32. YEARLING HT. – Actual hip height in inches measured between the hooks on the day the yearling weight was taken. NALF will calculate a yearling adjusted frame score. For more information about calculation of frame scores, refer to Breeder Information section, page E-14.

33. SCROTAL – Actual scrotal circumference in centimeters, measured on the same day other yearling information is collected. NALF will calculate an adjusted 365 day yearling scrotal circumference. Additional information regarding scrotal circumference can be found in the Breeder Information section, page E-12.

34. PELVIC HORIZ. – Actual pelvic horizontal measurement in centimeters taken on the day the yearling weight was taken. NALF will calculate adjusted 365 day pelvic area. Pelvic measurements are discussed in more detail in the Breeder Information section, page E-13.

35. PELVIC VERT. – Actual pelvic vertical measurement in centimeters taken on the day the yearling weight was taken. NALF will calculate adjusted 365 day pelvic area. Page E-13 provides additional information about pelvic measurements.

36. DO NOT REGISTER – Indicate whether or not animal is to be registered by using this box – check this box if you do NOT want animal to be registered.

37. TRANS. INCL. – Check this box if the animal being recorded is to be transferred at the same time. An "Application for Transfer" form must also be completed. These forms are available from the NALF office and are discussed in detail in the Transfer section beginning on page C-1. (On single application forms, be sure to complete the "Transfer to" section.)

If you have any questions about reporting animal information and registration using Generation III forms, or about collection and submission of performance data, please contact the NALF office.

Fig. D-7: Weaning Summary and Yearling Update

N 001000A EXAM (1)
JOHN DOE
RR 963 BOX 444
SOMEWHERE, USA 00001

NORTH AMERICAN LIMOUSIN FOUNDATION
Box 4467
Englewood, CO 80155
Phone: (303) 220-1693
Fax: (303) 220-1884

WEANING SUMMARY AND YEARLING UPDATE

(2) WEANING SUMMARY 10/10/00
CONTEMPORARY GROUP 123456-001
PAGE WITHIN GROUP 1
BULLS 82-100%

BIRTH DATE / CALF ID	CALF TATTOO / CALF REGISTRATION	SIRE REGISTRATION / DAM REGISTRATION	COLOR / AGE OF DAM	H/P/S / EASE	ACT BW / ADJ BW	WEANING: ACT WN WT / WN AGE	WEANING: ADJ 205 WT / 205 RATIO	WEANING: WN HIP HT / WN FR SCORE	WEANING: CALF DISP	WEANING: DAM WT / DAM COND	ACTUAL YEARLING DATA: DATE WEIGHED	WEIGHT (LBS)	HIP HEIGHT (IN)	SCROTAL (CM)	PELVIC (CM)	REF NOW
10/10/99 (3)	EXAM 01J (4)	NFM 9999999 (5)	RED	P	80	500	506	46.2	1	1240						
018C	NFF 1000000	NFF 666987	5	(6)	81	207	103	6.1		7		(8)				
10/04/99	EXAM 02J	NFM 443789	BLK	H	79	560	575	49.0	2	1100						
019C	NFF 1000001	NFF 345678	7	A	79	205	99	6.6		6						
AVE ADJ WTS ----------(HERD SIZE= 2)					80		541	(9)								

FOR ALL ANIMALS IN THIS CONTEMPORARY GROUP TO BE IN AGE LIMITS AT YEARLING TIME THEY MUST BE WEIGHED BETWEEN 1/2/00 AND 4/1/00 INCLUSIVE. (TO BE IN AGE LIMITS AT YEARLING TIME THERE MUST BE AT LEAST 140 DAYS BETWEEN WEANING AND YEARLING WEIGH DATES AND THE ANIMAL MUST BE 330-450 DAYS OF AGE.)

(10)

* * * * OVERALL SIRE AVERAGE * * * *

NFM 9999999	TOPPER					1 PROGENY					* * *	RATIO	* * *			
NFM 443789	BLACK TOPPER					1 PROGENY						100				

...DE COMBINED FROM ALL CONTEMPORARY ... (GROUPS)

Weaning Summary and Yearling Update

As producers submit weaning information, NALF processes the data and returns the Weaning Summary and Yearling Update. The information in the report is as follows (note, the numbered items correspond with the numbers on example forms):

1 **Owner Information –** The upper left corner includes the membership number, membership code, name, and address of the owner of the progeny listed.

2 **Contemporary group –** In the opposite corner appears all information that is specific to this particular contemporary group. Listed is the date the summary was printed, the contemporary group number, the page number of the summary and the make-up of the contemporary group (sex, percent Limousin, etc.).

3 **Birth Date/Calf ID –** The calf ID listed corresponds to the ear tag number submitted at the time of weaning.

4 **Calf Tattoo/Calf Registration –** All calves in the contemporary group that have had weaning data submitted are listed with their tattoo and NALF designated registration number. In the case of calves that are not registered, a number with the prefix URF (unregistered female) or URM (unregistered male) will appear as the registration number.

5 **Sire Registration/Dam Registration –** The sire and dam for each calf are listed by NALF registration number.

6 **Calf Description –** Information reported for the calf at birth is displayed in the center columns of the Weaning Summary. This includes the calf's color, horned/polled/scurred status, birth weight, adjusted birth weight (calculated by NALF), calving ease score, and age of dam.

7 **Weaning Data –** A summary of the reported weaning information appears in the center section of the report. The data includes both the actual and adjusted weaning weights, adjusted weaning weight ratio, frame score, hip height, and the age of the calf. Also included is the disposition score of the calf and the weight and condition of the dam at the time of weaning.

8 **Actual Yearling Data –** Space is provided on the summary for the owner to record yearling information to be reported back to NALF. The date weighed, actual weight, hip height, scrotal circumference and pelvic dimensions may all be reported. A column is also provided for the owner to specify calves he or she may wish to register at the time with NALF.

9 **Group Averages –** The average adjusted birth and weaning weights for the contemporary group appear at the end of the Weaning Summary.

10 **Overall Sire Average** – At the bottom of the report is listed the average adjusted weaning weight ratios for the progeny of each sire represented in the report. These ratios are calculated across contemporary groups for the entire calf crop.

Fig. D-8: Performance Record

NORTH AMERICAN LIMOUSIN FOUNDATION
PERFORMANCE RECORD

WULFS RAMBLER 8400X (ANIMAL NAME) | FI 8400 X L (TATTOO / LOCATION) | (HERD ID) | NPM-0729432 EMBRYO (REGISTRATION NUMBER)

BULL	PUREBRED	RED	SCURS	04/17/1989	286057 - 05/11/2000	6992 (P)	03/30/1990
SEX	% LIMOUSIN	COLOR	H/P/S	BIRTHDATE	INVOICE NO.	BLOODTYPE CASE NO.	OWNERSHIP DATE

BREEDER: N 000545 A FI
LEONARD WULF & SONS
RR 3 BOX 235
MORRIS, MN 56267-1530

CURRENT OWNER: N 010308 A DBJP
MARTIN FARMS
WILLIAM P MARTIN
PO BOX 368
MASON, TN 38049

BREEDING INFORMATION: TYPE | AI/PE IN | PE OUT | SIRE

EPD Date: 10/29/1999
Issue Date: 05/11/2000

-- Expected Progeny Differences --

	GL	BW	WW	YW	MA	TM	SC	DOC	ST	CW	REA	FAT	MARB
Individual's EPDs:	-2.2	1.7	23	42	2	14	0.2	10	18	14	.36	-.02	-.04
Accuracies:	.96	.97	.96	.93	.92		.92	.81	.19	.62	.55	.53	.59
Pedigree	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC	EPD/ACC
YKCC ATLANTIC 397N	0.4	4.6	21	38	0	11	0.1	13	21	23	.69	-.02	-.05
NXM-331562 LLLL LLL7 H	.95	.96	.95	.94	.93		.91	.70	.88	.47	.42	.39	.44
POLLED PACK LEADER 1182U	-1.4	6.6	23	48	5	17	0.6	3	25	20	.20	-.02	.00
NPM-561456 LLLL LLL* S	.96	.96	.96	.94	.93		.92	.78	.82	.58	.52	.49	.55
MISS WOLFETTE 1150N	-0.5	3.4	10	15	5	10	0.1	-1	18	2	-.17	.00	.08
NPF-355535 LLLL LLL* P	.66	.75	.71	.68	.67		.60	.31	.41	.29	.26	.24	.27
PUREPRIDE 17F	0.4	-2.1	-16	-26	2	-6	-0.2	6	11	9	.03	-.01	.09
CFM-797 LLLL LLLL H	.70	.86	.85	.75	.80		.43	.18	.76	.14	.13	.12	.14
T TRI PURECHO 100K	-1.3	-3.6	-3	-8	10	9	0.0	1	14	17	.23	-.01	.04
NPF-229311 LLLL LLL1 H	.55	.60	.55	.52	.58		.53	.28	.38	.28	.26	.23	.26
T TRI DANECHO 530E4	-1.5	-1.7	3	2	4	6	0.2	1	10	12	.09	.01	.03
NXF-116320 LLLL LL12 H	.27	.42	.33	.32	.21		.27	.12	.26	.12	.10	.10	.11

Individual's Performance	CE	GL	BW	WW	W HIP	DOC	YW	Y HIP	SC	PH	PW	PA	MW	CS
Actual:	A		97	610			1130							
Adjusted:	--	--	97	695	FS	CGA	1208	FS		--	--		--	--
Ratio:	--	--	--	98			98		--	--	--	--	MEAS DATE	
# of Contemporaries:	--	--		4	--	--	3	--	--	--	--	--		
Progenys Performance Count:	4932	5042	5028	3968	801	1042	2449	885	761	--	--	672	109	265
Average Ratio:	--	--	101	101	--	--	101	--	--	--	--	--	--	--

Daughter's Progeny Performance Number of Calves from Daughters: 1308 Average Adjusted Weaning Weight Ratio: 100

NALF's New Performance Record

NALF's new performance record is likely the single most informative document ever produced for individual Limousin animals. Along with animal ownership, EPD and pedigree information, the new performance record includes a comprehensive summary of individual, progeny and daughters progeny performance.

While most of the abbreviations used on the performance record for the traits are commonly understood, the following is a complete description of the acronyms listed under the section titled "Expected Progeny Differences":

GL — Gestation Length (days)
DOC — Docility (probability units)
BW — Birth Weight (lbs.)
ST — Stayability (probability units)
WW — Weaning Weight (lbs.)
CW — Carcass Weight (lbs.)
YW — Yearling Weight (lbs.)
REA — Ribeye Area (sq. in.)
MA — Milking Ability (lbs.)
FAT — Fat Thickness (in.)
TM — Total Maternal (lbs.)
MARB — Marbling Score (units USDA score)
SC — Scrotal Circumference (cm)

In addition to the trait abbreviations listed above, under the sections of the performance record titled "Individual's Performance" and "Progeny Performance" several additional acronyms appear and are defined as follows:

CE — Calving Ease Score (A, B, C, D, and E)
W HIP — Weaning Hip Height (in.)
FS — Frame Score (calculated for both weaning and yearling hip heights)
DOC and **CGA** — Docility Score and Contemporary Group Average Docility Score
Y HIP — Yearling Hip Height (in.)
PH — Pelvic Height (cm)
PW — Pelvic Width (cm)
PA — Pelvic Area (sq. cm)
MW — Mature Weight (lbs. — last recorded cow weight)
CS — Condition Score (last recorded score)
MEAS DATE — Measurement Date for Mature Weight & Condition Score of Cow

Computationally, NALF's new Performance Record includes the following enhancements:

- incorporation of continuous age of dam adjustment factors for calculation of adjusted birth weights and adjusted 205-day weaning weights (see pages E9, E10 and E11 of the NALF Members Manual for more information)
- calculation and printing of adjusted birth weight ratios (lower ratios are desired and indicate genetics for lower birth weight of individual compared to within herd contemporaries)
- immediate computation of "P+" accuracy EPDs for birth weight (previously, "P+" EPDs for birth weight were not computed until after submission of weaning data
- calculation of pedigree EPDs for a given trait, as long as the animal's sire has an EPD with numeric accuracy and either the dam has an EPD with at least "P" accuracy or the maternal grandsire has an EPD with numeric accuracy (previously, dams were required to have numeric accuracy)
- for animals entering the NALF herdbook and passing through batch processes, computation and printing of pedigree EPDs ("P" accuracy) for carcass traits (as long as the criteria provided above are met)
- interim EPDs for yearling weight with "P+" accuracy are no longer computed prior to submission and processing of yearling data

Fig. D-9: Yearling Summary

N99991
NALF
P O Box 4467
Englewood, CO 80155

NORTH AMERICAN LIMOUSIN FOUNDATION
Box 4467
Englewood, CO 80155
Phone (303) 220-1693
Fax (303) 220-1884

YEARLING SUMMARY 10/11/99
CONTEMPORARY GROUP 123567-001-001
BULLS 82-100%
1 WEANING SUMMARY 234567-001-001

YEARLING SUMMARY

BIRTH DATE / CALF ID	CALF TATTOO / CALF REGISTRATION	SIRE REGISTRATION / DAM REGISTRATION	COLOR / AGE OF DAM	H/P/S / EASE	ACT BW / ADJ BW	WEANING: ACT WN WT / WN AGE	ADJ 205 WT / 205 RATIO	WN HIP HT / WN FR SCORE	CALF / DISP	DAM WT / DAM COND	YEARLING: ACT YR WT / YR AGE	ADJ 365 WT / 365 RATIO	YR HIP HT / YR FR SCORE	YR SCROTAL / 365 ADJ SCROTAL	YR PEL H / YR PEL V	PEL AREA / 365 PA
10/1/99	NALF 99J	NPM 999999	BLK	A	67	500	505	46	3		930	1017	51.0	32.4		
99	NFM 2233001	NPF 555555	2	A	71		105	6.1		5	353	101	6.5	29.4	2	
10/7/99	NALF 513J	CFM 1234	RED	P	56	645	640	48	1	1000	980	1015	50	38	15	
203	NPM 9999999	NFF 897800	5	A	57	207	100	6.1		7	349	104	6.2	37.5	16	
HERD AVERAGE 365 DAY ADJ WT ----------						(HERD SIZE = 2)						1016	3			
	*******	OVERALL SIRE AVERAGES				*******		*****	RATIO		*****					
	NPM 999999	BLACK TOPPER				1 PROGENY					100		4			
	CFM 1234	TOPPER				1 PROGENY					100					

(RATIOS LISTED ARE COMBINED FROM ALL CONTEMPORARY GROUPS EXCEPT TRANSPLANT GROUPS)

Yearling Summary

The Yearling Summary includes all the information previously reported in the Weaning Summary and Yearling Update. The summary date refers to the actual date the summary was printed and not the date weights were recorded. As before, each summary refers to a specific contemporary group and includes only those animals in that group.

1 **Weaning Summary Number** – The invoice number for the weaning summary for the listed progeny appears in the upper right corner, just below the contemporary group information.

2 **Yearling Data** – The listed yearling information includes the actual yearling weight and age at which the weight was recorded, adjusted yearling weight and ratio, hip height, frame score, scrotal circumference (actual and adjusted), and the pelvic dimensions. For the pelvic area, both the vertical and horizontal measurements are reported along with the calculated area and adjusted area.

3 **Herd Average** – As with the weaning summary, average adjusted weights are reported for the contemporary group.

4 **Overall Sire Average** – At the bottom of the report the average adjusted yearling weights and weight ratios for the progeny of each sire represented are listed. These ratios are calculated across contemporary groups for the entire calf crop of that breeder.

Fig. D-10: Dam Summary

LIMOUSIN FOUNDATION
Box 4867
Englewood, CO 80155
Phone: (303)220-1693
Fax: (303)220-1884

LIFETIME PRODUCE OF DAM SUMMARY
Page: 1 Date: 05/11/00

WULF'S BUTTERFINGER 1020A Birth Adj 205 Dam 365 365

Dam Tattoo	Sire Reg. #	%LM	Date	CE	BWT	HPS	AWW	AOD	WT	AYW	PELV

<-------------- EPD and Accuracy ---------->

Reg. #	Name	GL	RAT	CLR	RAT	DOC	CS	RAT	SC	GL	BW	WW	YW	MA	TM	SC	ST	DOC
FI 1020A H	NPM-333594 PB 03/08/91	B	75	P	589	2		844	184	0.0	-0.3	15	30	13	21	-0.1		
NPF-867358	BLACK OX JR 9119N	284		RED	107			101		.42	.48	.40	.34	.39		.35		
--- PROGENY																		
FI 1020C B	NPM-790669 PB 04/01/93	B	98	H	721	2		1238	206	2.2	1.6	17	29			0.1		
NPM-1038492	MR SY EXTRA REFLECTION	307		RED	116			104	35.2	.31	.36	.29	.25			.30		
FI 1020D B	NPM-951344 PB 04/10/94	A	101	P	681	3		1189	213	-1.1	3.8	24	40	-1	11	0.3		7
NPM-1123651	WULFS POLLED IMPACT 4244B	281		RED	117			113	32.8	.32	.59	.48	.17	.15		.07		P
SLVL 410E B	NPM-951344 PB 04/18/95	A	87	H	687	4		1192		0.2	1.9	22	39	-2	9	0.2		7
NPM-1250048	WULFS POLLED IMPACT 4244B	290		RED	120			115	33.8	.32	.36	.29	.25	P		.30		P
SLVL6181F H	NPM-968249 PB 03/29/96	A	88	P	584	5		911		-1.0	1.3	23	41	11	23	0.0		19
NPF-1330096	WULFS QUARTERBACK 4222B			BLK	115			115		P	.36	.29	.26	P		P		P

AVERAGE RATIO:	117	112
NUMBER OF CALVES:	4	4

MPPA: 112.4
NUMBER OF CALVES: 4

AVG CALVING INTERVAL: 364 DAYS
AGE AT FIRST CALVING: 755 DAYS

WULF'S BUTTERFINGE

Dam Summary

Dam Information – *This section of the report includes information about the dam.*

1 Name of Dam – The name designated to the particular animal at the time of registration appears near the top-left of the Dam Summary.

2 Dam Identification – The upper left-hand area of the Dam Summary identifies the cow by her herd I.D., registration number, birth date, and tattoo code.

3 Horned/Polled and Color – The dam's horned/polled status (HPS) and color (CLR) are provided along with the status codes for these traits for each progeny.

4 Expected Progeny Differences (EPDs) – The most current EPDs and their corresponding accuracy values are printed just below the EPD date information. The EPDs reported include: gestation length, birth weight, weaning weight, yearling weight, milking ability, total maternal, scrotal circumference, stayability and docility. See the section on EPDs beginning on page D-20.

Calf Information

5 Calving History – Information on all of the cow's progeny, regardless of registration status, **that were reported** to NALF appear in the center of the summary. Also listed, in addition to the calf's tattoo and sire are the animal's birth date, calving ease score, sex, gestation length, age of dam, color and horned/polled/scurred information. Trait ratios for each calf's weaning weight and yearling weight are also reported.

6 Production History – The Dam Summary includes the average weaning weight and yearling weight ratios for all bull and heifer progeny.

7 Most Probable Producing Ability (MPPA) – The cow's MPPA is also calculated. MPPA is an indication of the within herd rank of the cow based on the average weaning weight ratio of her progeny. Because MPPAs do not take into account the growth influence of the sire, differences may exist between two similar cows that are mated to different sires.

8 Average Calving Interval and Age at First Calving – The Dam Summary includes reproductive performance history in the form of the age at first calving and the average number of days between calvings.

The Dam Summary may be ordered from NALF at any time. To maximize the accuracy of the summary, NALF suggests that breeders report the performance of all of a cow's progeny, regardless of their registration status or percent Limousin. Dam summaries are issued to the current owner of the animal at no charge. If the dam summary is requested by someone other than the owner of record, there is a $2.00 charge.

NALF's Performance Program

Introduction

By design, the NALF Generation III Information System provides the raw material (pedigree and performance information) for NALF's Performance Program. Together, this information comprehensively describes performance characteristics of Limousin cattle. In order to take full advantage of the NALF Performance Program, users of Limousin genetics should be knowledgeable of the program's features.

Basic Genetics

For purposes of laying a foundation for understanding the Performance Program, a brief discussion of "Basic Animal Breeding" may help producers understand the processing of performance information.

The actual performance of any given animal, be it birth weight, weaning weight or any other measurement, is determined by the genetic makeup of the animal and the environment to which it is exposed (see figure D-11). Information arrives at the NALF office in the form of actual performance, which must then be adjusted for environmental effects and further processed to arrive at genetic values in the form of Expected Progeny Differences (EPDs), which are defined and discussed later.

Depending upon the trait, typically an animal's performance is adjusted for the effects of the animal's age and the age of its dam. Specific age and age of dam adjustment procedures are discussed later. Differences in the performance of groups of animals exposed to different environments/management practices are accounted for through the formation of contemporary groups, and through taking into account the genetic ties between groups. Contemporary groups are formed by NALF according to the group and management information reported by Limousin breeders.

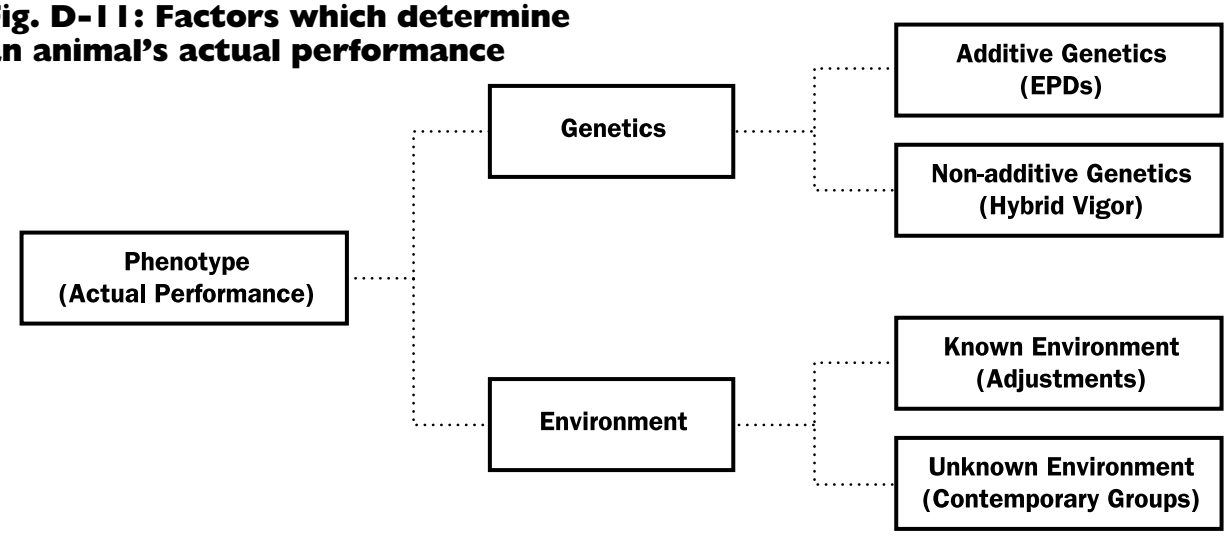
Contemporary Groups

One key to determining an animal's genetic merit, is to accurately separate genetic and environmental effects on performance. Contemporary groups define an animal's environment, and allow genetics to be separated from environment. It follows that differences in the performance of animals which are treated alike (in the same contemporary group) can most likely be attributed to genetic differences between the two animals.

So, what do you need to know about contemporary groups? The only requirement of Limousin breeders is that they report accurate group information to the NALF office on the Generation III forms. Specifically, information regarding birth groups (BIRTH GROUP), weaning groups (WEAN GROUP), creep vs. no creep and yearling groups (YEAR GROUP) are used by the NALF computer along with sex, percentage Limousin, birth date, and weigh date information to automatically form contemporary groups.

Putting it all together, a contemporary group is a group of cattle of the same sex, within the same percentage Limousin group, that were born within a 90 day period, that have been managed

Fig. D-11: Factors which determine an animal's actual performance



alike and weighed on the same date (except for birth weight). Currently, animals are grouped according to the following percentage Limousin:

1. 37% to 49% Limousin
2. 50% to 68% Limousin
3. 69% to 81% Limousin
4. 82% to 100% Limousin

Remember, if certain individual animals or groups of animals are given preferential treatment, experience sickness or injury which has an effect on their performance, or perform differently for managerial or environmental reasons, then different group codes must be designated for these animals. As a side note, do not weigh individual animals exactly when they turn 205 or 365 days of age. Rather, collect individual weights for all animals of a group on the same calender date, when the youngest and oldest animals of the group are within the age limit guidelines explained later in this section.

In order to use an animal's own performance in any given trait for the calculation of EPDs for that animal, the animal must be in a contemporary group. Just as EPDs are comparisons between animals, animals must be evaluated in groups in order for their performance to be compared to the performance of other animals. What's important in the EPD calculations is how individual animals compare to the average performance of the group of animals in which the animal competed. Head-to-head comparisons of animals on a level playing field form the basis of EPD calculations.

A useful within-herd tool which allows easy comparisons of animal performance are the trait ratios which are part of the weaning and yearling summaries. Trait ratios are calculated for weaning and yearling weight according to the following formula:

$$\text{Ratio} = \left(\frac{\text{Individual's Adjusted Weight}}{\text{Average Adjusted Weight of Group}} \right) \text{X } 100$$

As an example, a bull calf which had an adjusted weaning weight of 630 lbs. in a group which averaged 600 lbs. would have an adjusted 205 day weight ratio of 105. The ratio of 105 indicates that the bull was 5% heavier than the average of the group.

NALF encourages breeders to report performance information on all cattle produced in order to make the comparisons include as many animals as possible. While it only takes two animals to make a valid group, reporting information on only the best calves will diminish the comparative performance of the animals reported and could diminish the accuracy of their EPDs. With that in mind, performance information should be reported on all animals, even those which you do not intend to register; the information is processed free of charge.

Fig D-12: Comparison of ratios for animals when information is reported for all animals versus when only the top animals have weights reported.

Heifer Number	Adjusted 205 Day Weight	Adjusted 205 Day Weight Ratio Group of 10	Adjusted 205 Day Weight Ratio Group of 5
1	543	107	103
2	531	105	101
3	525	104	100
4	519	103	99
5	510	101	97
6	500	99	
7	497	98	
8	490	97	
9	485	96	
10	463	91	

Using ratios, let's take a closer look at how reporting performance on only the best animals may adversely influence the ratios of the animals from which performance was reported. As an example, refer to the adjusted 205 day weight ratios of animals reported in a group of 10, as compared to the ratios if only the top 5 animals in the group were reported, provided in table D-12.

If data on all 10 head were reported, ratios of the heaviest 5 heifers would be 107, 105, 104, 103 and 101. On the other hand, if only the heaviest 5 heifers are reported, you'd get ratios of 103, 101, 100, 99 and 97. Reporting complete performance information on all animals gives us a clearer picture of genetic differences between animals. This goes for all traits.

Adjusted Birth Weight and Calving Ease

Birth weight has been identified as the single most influential factor contributing to calving difficulty. Subjective calving ease codes used by NALF include:

A = Unassisted or unattended
B = Some assistance - non-mechanical assistance
C = Mechanical assistance

D = Caesarean section
E = Abnormal presentation, i.e. breach, leg back, etc.

In order to maintain its reputation as an easy-calving breed, Limousin breeders are encouraged to place selection pressure on birth weight. Birth weights should be taken within 48 hours following birth. For the purpose of transforming actual birth weight data into EPDs for birth weight, the raw data must first be adjusted for age of dam, since young dams typically have progeny with lower birth weights than mature dams. The objective of the age of dam adjustment is to correct the actual birth weight for the environmental influence of age of dam, on the day the calf is born. Approximate Limousin age of dam adjustment factors for bull and heifer calves, which are added to the actual birth weight by the NALF computer, are listed below:

Age of Dam (Years)	Pounds of Adjustment Bulls	Heifers
2	+6	+5
3	+4	+3
4	+2	+2
5	+1	+1
6 to 11	0	0
12 & older	+1	+1

NALF and the University of Georgia (UG) utilize a sophisticated procedure for adjusting birth weights. Rather than considering age of dam rounded to the nearest year of age, NALF and the UG adjust birth weights for age of dam, according to the dam's age in days, on the day the calf was born. For more information on age of dam adjustments, please refer to the Breeder Information section of this manual, page E-9.

NALF and the UG form birth weight contemporary groups based on Herd Prefix or Birth Group, Sex, Percent Limousin, Year and Season. Another environmental factor which influences birth weight is the season of year in which the calf was born. Typically, calves born in the Spring are heavier than calves born in the Fall. To account for the effects of season, the UG forms birth weight contemporary groups based on season of birth, as defined below:

Season 1 = December 1 to February 15
Season 2 = February 16 to May 30
Season 3 = June 1 to August 31
Season 4 = September 1 to November 30

Adjusted 205 Day Weaning Weights

Weaning weights are used to evaluate genetics for early growth and milk production. In order for calves of the same sex and percent Limousin, with the same weaning group (WEAN GROUP) and creep vs no creep management codes to be in the same weaning contemporary group determined by the NALF computer, all calves in the group must be:

1) weighed on the same date,
2) at least 160 days of age and not older than 250 days of age.

The Date Calculation Wheel provided with your original Member's Manual should be used to determine the range in possible dates appropriate for collection of weaning weights, such that all calves are within the prescribed 90-day age range. If you have more than a 90-day range in birth dates, select a date when the largest number of calves or the oldest calves will be within the 90-day group, or weigh subsets of the cattle on two separate dates. It is not necessary to actually wean the calves on the date weaning weights are collected. Male calves castrated at weaning should be reported as bull calves when weaning data are reported. If castrated prior to three months of age, male calves should be reported as steers when weaning data are reported.

As a reminder, scales used for collection of weaning and yearling weights should be balanced before you begin processing cattle, and checked after each animal is weighed.

For purposes of calculating Adjusted 205 Day Weights, the actual weaning weights are adjusted for age and age of dam (AOD) according to the following formula:

$$\text{Adjusted 205 Day Weight} = \left(\left(\frac{\text{Actual Weaning Weight} - \text{Actual Birth Weight}}{\text{Age in Days}}\right) \times 205\right) + \text{Actual Birth Weight} + \text{Continuous AOD Adjustment}$$

If actual birth weights were not reported, standard birth weights of 80 lbs. for heifers and 85 lbs. for bulls are used for this calculation. These standard weights are used only for purposes of calculating adjusted 205 and 365 day weights.

Adjustments for AOD are made to help make adjusted 205 day weaning weights comparable across various ages of dams represented within a contemporary group, since younger dams typically express lower levels of milk production

than mature dams. The NALF computer utilizes continuous AOD adjustment factors for weaning weight. These correspond closely to the weights provided below:

Age of Dam (Years)	Pounds of Adjustment Bulls No Creep	Bulls Creep	Heifers No Creep	Heifers Creep
2	53	50	42	40
3	32	32	26	25
4	16	18	13	14
5	6	8	5	6
6	.7	2	.6	1.6
7 & 8	0	0	0	0
9	.2	.2	.1	.1
10	3	3	2.7	2.7
11 & older	9	9	8.4	8.4

Similar to AOD adjustments for birth weight, NALF and the UG use a refined procedure for making AOD adjustments to weaning weights. Again, NALF and the UG consider the AOD in units of days, rather than rounding the age of dam to the nearest year of age. For a detailed description of the age of dam adjustments, please turn to pages E-10 and E-11.

Adjusted 365 Day Yearling Weights

Yearling weight is the trait most closely associated with growth potential through market age. In order for yearling weights and other yearling measures to be used for calculation of adjusted weights, measures and yearling EPDs, the yearling data must be:

1 taken at least 140 days after the weaning weight was measured,
2 taken when the youngest animal in the group is at least 330 days of age and when the oldest animal is a maximum of 450 days old,
3 accompanied by a yearling group (YEAR GROUP) code,
4 taken on the same date for all yearling traits.

Again, the data calculation wheel can be used to determine when yearling weights should be taken to insure that as many animals as possible are eligible to be placed into yearling contemporary groups. If animals are treated differently from weaning to yearling ages, they must be designated with different yearling group codes (YEAR GROUP). For male calves castrated at weaning age, the sex code should be changed to steer when yearling data are reported.

If guidelines are met, each animal's postweaning average daily gain (ADG) is calculated and used along with the adjusted 205 day weaning weight to arrive at the adjusted 365 day weight according to the first pair of formulas given in Fig. D-13.

Occasionally, animals have a yearling weight submitted, but have not had a weaning weight collected. In such cases, adjusted 365 day weights are computed using the second pair of formulas in Fig. D-13.

Adjusted Yearling Scrotal Circumference

Adjusted yearling scrotal circumference (SC) has been shown to be a good indicator of age at puberty. Younger age at puberty has been linked to higher conception rates and earlier calving dates in females, an increase in the quality and quantity of semen produced by bulls (with large SC), and a host of related measures of production. Yearling adjusted scrotal circumference in males and age at first estrous in females have been identified as virtually the same traits. Consequently, daughters of bulls that excel in yearling scrotal circumference can be expected to reach puberty earlier. See page E-12 for more detail.

For the purpose of making scrotal measurements comparable within a contemporary group, measurements are adjusted for the effects of age and age of dam. Scrotal circumferences should be measured:

Fig D-13: Formulas

$$\textbf{Postweaning ADG} = \frac{\text{Actual Yearling Weight - Actual Weaning Weight}}{\text{Number of Days Between Weights}}$$

$$\textbf{Adjusted 365 Day Weight} = (\text{Postweaning ADG X 160 days}) + \text{Adjusted 205 Day Weaning Weight}$$

$$\textbf{Average Daily Gain (ADG) Birth to Yearling} = \frac{\text{Actual Yearling Weight - Birth Weight*}}{\text{Number of Days Between Weights}}$$

$$\textbf{Adjusted 365 Day Weight} = (\text{ADG} * 365) + \text{Birth Weight} + \text{AOD Adjustment}$$

**If a birth weight is not available, a standard 80 lbs. is used for heifers and 85 lbs. is used for bulls.*

1 using the same age guidelines as are used for yearling weight
2 using a tape calibrated in centimeters (available from NALF)
3 by the same person for all animals within each group
4 according to the recommended technique described in the Scrotal Circumference LimGuide included on page E-12

NALF adjusts actual scrotal circumference measurements to a standard 365 day age and mature dam equivalent. Research has shown that the yearling scrotal measurements of bulls from young dams (2 and 3-year-olds) and old dams (11 and older) are smaller for environmental reasons and should be adjusted upward. Presumably, this effect is due to lower milk production for cows in these age categories. The following formula is used to calculate adjusted yearling scrotal circumferences:

Yearling Adjusted SC = Actual SC + .0467 cm/day (365 – Age) + SC AOD Adjustment

Age of Dam (AOD) (Years)	Centimeters (cm) of Scrotal Circumference (SC) Adjustment
2	+.52
3	+.42
4 to 10	0
11 & older	+.35

For additional information regarding collection and use of scrotal circumference data, please refer to page E-12. The Breeder Information section beginning on page E-1 also includes information regarding culling decisions for weaning age bulls.

Adjusted Yearling Pelvic Area

Most calving difficulty results when the size of the fetus is too large relative to the size of the dam's pelvic dimensions. While research shows that birth weight is over four times more important than pelvic size in determining calving difficulty, pelvic area is still the most important maternal genetic factor which is easily measured.

Pelvic area is an internal measurement which requires rectal palpation with a measuring device. Measurements should be taken at the same time animals are evaluated for other yearling traits. The same guidelines for age apply to collecting pelvic data as do the guidelines for collecting yearling weights which were previously described. For all animals within each group, the same technician should collect all pelvic measurements. NALF recommends using a device called the Rice Pelvimeter to measure the height and width of the pelvis, although other devices are available. Even though the shape of the pelvis is not square, research has shown that pelvic area can be expressed in square (sq.) centimeters by simply multiplying the pelvic height times the pelvic width:

Pelvic Area = Pelvic Height X Pelvic Width

For the purpose of comparing animals, pelvic areas are adjusted to a constant 365 days of age using the following formula:

Adjusted 365 Day Pelvic Area = Actual Pelvic Area + Growth Coefficient X (365 - Actual Age) *Growth

**The growth coefficient is .27 sq.cm/day for heifers and .25 sq.cm/day for bulls.*

In the short-run, breeders are advised to use pelvic information as a culling tool to eliminate females with exceptionally small areas. Once enough pelvic data is collected, NALF intends to investigate using this information for the calculation of EPDs for maternal calving ease. For a more complete discussion of how to interpret and use pelvic information, refer to page E-13.

Frame Scores

Frame scores are actually hip heights which have been adjusted for age and converted to a numeric scale. Limousin breeders may report hip heights (expressed in inches) for weaning and/or yearling age cattle. NALF recommends that height measurements be collected at the same time other weaning and yearling performance data are collected. Page E-14 provides a detailed description of how to collect hip height measurements.

The frame score can be useful in describing the maturity pattern and projected mature size of cattle. Along with mature weight and milk production information, frame sizes can be used as indicators of nutritional maintenance requirements and slaughter endpoints.

Fig D-14: Frame Scores

Bull Formula:

Frame Score = -8.6955 + .3755 (Height) - .02063 (Days of Age) + .0000051 (Days of Age)^2 + .0001521 (Height) (Days of Age)

Heifer Formula:

Frame Score = -10.9325 + .4251 (Height) - .01645 (Days of Age) + .0000048 (Days of Age)^2 + .0000928 (Height) (Days of Age)

Since bulls and heifers typically grow and mature at different rates, the formulas used for calculating frame scores are different for each sex. NALF automatically calculates frame scores for animals when hip heights are reported. Formulas used for frame score calculations are in Fig. D-14 on page D-18.

For quick reference, Limousin Frame Score Charts for bulls and heifers are provided on page E-14 of this manual. The Limousin Directions Recommendations Manual suggests that breeders target the production of frame score 5, 6 and 7 animals as optimums for most production environments.

Disposition Scores

Disposition or docility is defined as the ease with which animals yield to handling or treatment and their submissiveness to training or management. Problems associated with docility represent a risk to the safety of handlers, an animal welfare concern, added potential costs for appropriate handling equipment, a potential liability to meat quality, a threat of reduced performance in related traits, and a serious public relations problem.

Specific behaviors of interest include; the reaction of animals while processed through a squeeze chute, maternal instincts at or around the time of calving, newborn calf vigor, reproductive behaviors such as serving capacity, and an animal's foraging behaviors. Since these are distinctly different behaviors, different strategies are necessary to quantify differences among animals.

The scoring system provided on page D-7 is designed to subjectively evaluate differences in behavior during the time animals are processed under uniform conditions through a squeeze chute. Because an animal's behavior can be influenced by past experiences, the NALF scoring is to be conducted at the same time other weaning data are collected. Again, the same age guidelines are used for disposition scoring as the ones used for collection of weaning data described earlier. At this time, the need for adjustment factors has not been determined.

Dam Weight and Condition Score at Weaning

NALF implemented collection of dam weight and condition scores to provide data to describe genetic differences in mature size and fleshing ability within the Limousin breed. Since a cow's weight and condition can fluctuate depending upon her stage of production, NALF requires that this information be collected at the same time weaning data are collected. Because it is often difficult to collect both weaning data from calves and process cows on the same day, cow information is useful as long as it is collected within a week of the date the calf's weaning data was collected. The condition scoring system is described on page D-8.

While it is recommended that both dam weight and condition information be collected, if it is not possible to weigh cows, collection of condition score data alone is still useful. Currently, adjustment factors for these traits have not yet been developed. In the long run, it is NALF's intention to develop EPDs for these traits to enable breeders to more easily select for optimum sizes and adequate levels of fleshing ability.

Accurate Data Is Imperative

The performance data collected and submitted by Limousin breeders is by far the most important element in NALF's overall genetic evaluation program. Reliable genetic values are only possible if the raw data from which they are derived is provided by breeders. As a review, accurate performance information is a function of:

1 Honest and accurate weights and measures collected according to the guidelines for age and measurement techniques,
2 Complete and accurate birth, weaning, yearling and creep vs. no creep group information from which NALF forms contemporary groups, and
3 Timely submission of data, appropriate adjustments and further processing for the calculation of EPDs.

EPDs: A User's Manual

Introduction

Buying the "right" bulls is the key to genetic improvement, and to a satisfying experience with Limousin genetics. The secret to buying the "right" bulls is making smart use of expected progeny differences (EPDs). EPDs represent the most reliable performance information available for selection. Understanding how to interpret EPDs for Limousin cattle is the first step toward buying the "right" bulls.

In basic terms, an EPD predicts the difference in performance of future offspring of a parent, as compared to offspring from other parents. EPD calculations utilize all available pedigree and performance information, and account for; differences in environment from which data were submitted, the heritabilities and genetic relationships among traits, nonrandom mating (selective breeding to only the best mates), and level of competition within and between groups. Since only "**Registered Limousin**" cattle have EPDs provided on their "Performance Records" and other NALF documents, cattlemen are encouraged to always insist that animals be registered, and ownership be transferred, such that updated genetic information may be provided.

Before thinking about EPDs for individual traits, the basic concept of EPDs is that they serve to rank animals according to additive genetic merit for a given trait. The accompanying tables provide the average EPDs for current Limousin sires and percentile breakdown information, both of which give benchmarks to determine where animals rank, genetically, in the population.

Gestation Length (GL) EPDs

Gestation length EPDs predict genetic differences in gestation length, and are calculated from breeding and calving date information on A.I. sired calves. Different from other traits, gestation length EPDs are expressed in **days**. Low gestation EPDs are desired, and indicate genetics for shorter average gestation lengths of offspring.

The advantages of shorter gestation length include: a small increase in post-partum interval and thus slightly improved re-breeding performance; slightly decreased birth weight and an associated subtle improvement in calving ease, primarily for first calf heifers; a slight increase in actual weaning weight because increased age at weaning for shorter gestation length cattle.

As an example of how to use gestation length EPDs, consider the following two bulls:

	GL EPD
Bull A	-3.0 days
Bull B	+2.0 days
Difference	**= 5.0 days**

For this example, if bulls A and B were bred to comparable groups of cows, calves from bull A would be expected to be born 5 days earlier (on average) than calves from bull B due to differences in the genes for gestation length from these two sires. If follows that cows bred to bull A would have 5 days longer to recover from calving before the start of the next breeding season. Generally, because of the small but favorable genetic relationships between gestation length and birth weight, bull A's calves would be expected to be born with less calving difficulty as compared to calves from bull B. **Because calf birth weight is more closely related to calving ease than gestation length, birth weight EPDs should continue to receive primary emphasis,** while at the same time sires with high, positive gestation length EPDs should be avoided for use on heifers.

Birth Weight (BW) EPDs

Birth weight has been identified as the single most influential factor contributing to calving difficulty. **In studies of birth weight data, birth weight EPDs of sires has been shown to be the single most accurate genetic predictor of differences in calf birth weight.** Generally, lower birth weight EPDs are desired, and indicate genetics for smaller calves at birth and less associated calving difficulty.

Here's how birth weight EPDs work. Consider the following two bulls for use on first-calf heifers, and the difference between their birth weight EPDs:

	BW EPD
Sire A	–2.5 lbs.
Sire B	+2.5 lbs.
Difference	**= 5 lbs.**

If bulls A and B were each bred to similar groups of heifers, based on their birth weight EPDs we would expect calves from bull A to have birth weights that average 5 lbs. less than calves from bull B. Lower birth weight EPDs indicate lighter progeny birth weights, which generally should translate into less potential for calving difficulty for calves from sire A as compared to those from sire B.

Weaning (WW) and Yearling (YW) Weight EPDs

Whether you market your calves at weaning, after a growing or backgrounding program, or as fed cattle; weaning and yearling weight EPDs are useful because they help predict genetic differences in sale weight. Weaning and yearling weight EPDs are expressed in pounds, with higher EPDs indicating genetics passed on to offspring for added growth to weaning and yearling ages.

Consider the weaning (WW) and yearling (YW) EPDs on the following two bulls:

	WW EPD	YW EPD
Bull A	15 lbs.	30 lbs.
Bull B	5 lbs.	10 lbs.
Difference	**10 lbs.**	**20 lbs.**

Because of his advantage in growth EPDs, bull A would be expected to pass on genes to his calves which result in 10 more pounds at weaning and 20 more pounds at yearling as compared to calves from bull B, when bred to comparable cows. This weight difference is due to genes for growth the calves inherited from their sires.

Milk (MA) EPDs

Since milk is a trait only expressed in daughters, and because milk is not directly measured, milk EPDs are expressed as differences in pounds of weaning weight of calves from daughters, due to genes for milk passed from sires to daughters. An example helps make milk EPDs easier to understand. Let's look at the following two bulls:

	Milk EPD
Bull A	+5 lbs.
Bull B	–5 lbs.
Difference	**= 10 lbs.**

The difference in milk EPD of bulls A and B is 10 pounds. Daughters of bull A would be expected to wean calves that are 10 pounds heavier than the calves from daughters of bull B, due to genes for milking ability the daughters inherited from their respective sires.

It is important to remember that the level of milk EPD which is "best" depends upon a number of factors, including; whether or not daughters are retained for breeding, the length of time calves are fed following weaning before they are marketed, the cost and availability of feed, and the milking ability of the cows to which the bulls are mated. A high level of milk will result in heavy calves at weaning from daughters, but is also likely to cause an increase in maintenance requirements and potentially lower expressed reproductive performance if sufficient feed is not available to help heavy milking cows cycle back and rebreed quickly. On the other hand, cows with low genetic potential for milk are not likely to produce sufficient calf weaning weight to offset their cost of production.

Total Maternal (TM) EPDs

Total maternal EPDs combine predictions for milk and weaning weight to predict the total weaning weight difference of calves from daughters. Similar to milk EPDs, total maternal EPDs express differences in pounds of calf weaning weight from daughters. However, as the name implies, total maternal EPDs predict the total pounds of calf weaning weight difference from daughters, due to both the genes for milk the daughter inherited and genes for weaning growth passed from the sire, to the daughter and on to the daughter's calf. **Total maternal EPDs are calculated by adding an animal's milk EPD to one-half of the animal's weaning weight EPD.**

An example helps to make total maternal EPDs easier to understand:

	WW EPD	MA EPD	TM EPD
Bull A	20 lbs.	10 lbs.	20 lbs.
Bull B	10 lbs.	0 lbs.	5 lbs.
Difference	**= 10 lbs.**	**10 lbs.**	**15 lbs.**

The difference in total maternal EPDs between sires A and B is 15 lbs. Calves out of daughters of sire A would be expected to weigh 15 lbs. more at weaning as compared to calves from daughters of sire B, due to both genes for milk the sire passed on the his daughters and genes for weaning growth that the daughters' calves inherited from their maternal grandsire. Total maternal EPDs are useful because neither the weaning or milk EPD entirely predicts the weaning performance differences of calves from daughters.

Scrotal Circumference (SC) EPDs

Scrotal circumference EPDs are expressed in cm, with higher values indicating genetics for larger yearling scrotal circumference of sons and earlier age of puberty in daughters. Larger scrotal circumference and earlier age at puberty are linked to higher semen quantity and quality in bulls, and potentially higher conception rates and earlier calving in replacement heifers.

Here's an example of how to interpret EPDs for scrotal circumference:

	SC EPD
Bull A	–.5 cm
Bull B	+.5 cm
Difference	**= 1.0 cm**

If bulls A and B were each bred to similar sets of cows, bull calves from sire B would be expected to have yearling adjusted scrotal measurements which average 1.0 cm larger than yearling sons of sire A. Since yearling scrotal size in bulls and age at first cycling (puberty) in heifers are similar traits, daughters of bull B would also be expected to have inherited genes for earlier puberty than daughters of bull A. Scrotal circumference EPDs warrant consideration when selecting bulls from which daughters are going to be retained for replacements.

Stayability (ST) EPDs

Stayability EPDs are calculated from calving and pedigree data, and predict genetic differences in the probability that daughters will remain in production until six years of age or beyond, given that daughters had at least one calf reported prior to six years of age. Since the primary reason cows are culled is because of reproductive failure, EPDs for stayability mainly indicate genetic differences in sustained reproduction. To a lesser extent, stayability EPDs may also represent genetic differences in other factors which contribute to reasons why daughters of certain sires are "preferred" by breeders, and as a result remain in the herd until at least six years of age.

Higher stayability EPDs are desired, and generally indicate genetics for greater longevity. The two sires listed below help illustrate how to interpret EPDs for stayability:

	Stayability EPD
Sire A	+15%
Sire B	+5%
Difference	**= 10%**

If sires A and B were bred to comparable cows, 10% more of sire A's daughters would be expected to remain in production until at least six years of age as compared to daughters of sire B. Stated another way, due to genetics for stayability EPD from their sires, each daughter of sire A would be expected to have a 10% greater likelihood of staying in production to age six or beyond, as compared to daughters of sire B.

Docility (DOC) EPDs

Thanks to the efforts of Limousin breeders, well over 100,000 (as of 1/2000) Limousin animals have had docility scores submitted to the NALF office. NALF sponsored research has determined that docility scores are moderately heritable (.40), and that behavior problems can be effectively avoided through the use of EPDs for docility.

Docility EPDs predict genetic differences in the probability that offspring exhibit calm behavior. **Higher docility EPDs are preferred, and represent genetics for calmer behavior.** Here is how to interpret docility EPDs:

	Docility EPD
Sire A	+20%
Sire B	+ 5%
Difference	**= 15%**

If sire A has a docility EPD of +20% and sire B is +5%, we would expect 15% more of sire A's offspring to be scored as "calm", as compared to the percentage of offspring of sire B. Said another way, each offspring of sire A would have a 15% greater likelihood of inheriting genetics for "calm" behavior as compared to each offspring of sire B. Docility EPDs can thus be used to minimize the proportion of animals produced with unacceptable behavior.

EPDs for Carcass Traits

Analogous to EPDs for growth traits, EPDs for carcass traits predict genetic differences in carcass merit. However, the optimum genetic profile for carcass EPDs depends upon the targeted market for which cattle are being produced. Remember, as with other traits the observed carcass performance of an animal (phenotype) is determined by both genetics and environment, and EPDs only predict differences due to genes passed from parents to offspring.

Carcass Weight (CW) EPDs

EPDs for carcass weight predict genetic differences in the average hot carcass weight of progeny, at an age constant endpoint. **Consequently, carcass weight EPDs predict genetic differences in the growth of muscle, fat and bone which contribute to hot carcass weight.** While more carcass weight equates to more total dollars worth of product produced, carcasses which are too heavy may be discounted. To avoid discounts, carcass weight EPDs may also be used to help avoid producing carcasses which fall outside the targeted industry range. Based on the National Beef Quality Audit, an industry "ideal" carcass weight of around 750 pounds was identified, with weights between 650 and 900 pounds cited as acceptable.

As a means of demonstrating carcass weight EPDs, consider the following two bulls:

	CW EPD
Bull A	10 lbs.
Bull B	40 lbs.
Difference	**= 30 lbs.**

If bulls A and B were each bred to comparable groups of cows, the average carcass weights of offspring of each sire would differ by 30

pounds due to genes inherited from their sires. Remember, EPDs predict differences in performance, not actual weights. Knowing which of the above two bulls is most appropriate may not be as simple as it seems. On one hand, bull B is expected to produce more total pounds of carcass weight. However, if bull B produces some carcasses which are too heavy, overweight discounts may work to bull B's disadvantage.

Optimum carcass weight EPDs for sires will vary according to a number of factors, such as characteristics of the cows to which the sires are mated and the calf growing/finishing management regime. Gaining a feel for optimum carcass weight EPDs will require some trial and error, and are likely to depend upon the targeted market. Avoiding extremes in carcass weight EPD should help to minimize the risk of discounts in traditional markets.

Ribeye Area (REA) EPDs

Ribeye area EPDs offer an objective measurement of genetic differences in muscularity. **EPDs for ribeye area are expressed in units of square inches, with larger values indicating larger ribeyes and increased expected overall carcass muscularity and red meat yield.** As an example of how to interpret ribeye area EPDs, consider the following two sires:

	REA EPD
Bull A	–.40 sq.in.
Bull B	.60 sq.in.
Difference	**= 1.00 sq.in.**

By definition, if sires A and B are mated to similar groups of cows, the average ribeye area of calves from sire B are expected to be 1.00 square inch larger than the average of calves from sire A, at an age constant end point, due to genes passed on for ribeye area. While larger ribeye area is generally desired, some marketing programs may discriminate against carcasses with ribeyes which are too large.

Recognizing that ribeye area EPDs may not be available for some young sire prospects, differences in muscularity can be observed visually, and these differences are at least moderately heritable. Fed cattle with high red meat yield can successfully be produced by selecting thick, muscular appearing sires.

Fat Thickness (FAT) EPDs

The National Beef Quality Audit identified excess external fat and excess seam fat as two of the largest contributors to economic lost opportunity in the beef industry. **By industry standards, most Limousin cattle represent genetics for high levels of carcass leanness.** However, some variation exists within the Limousin population.

Consider the fat thickness EPDs for the following two bulls:

	FAT EPD
Bull A	.00 in.
Bull B	.05 in.
Difference	**= .05 in.**

When bred to similar sets of cows, managed alike and processed at a constant age, offspring of sire A are expected to produce carcasses which have .05 inches less outside fat measured at the 12th/13th rib interface as compared to the average for carcasses from offspring of sire B.

As with other carcass traits, depending upon the targeted market, there is likely danger in selecting for extreme levels of either low or high outside fat. It follows that intermediate levels are likely more optimum in most traditional situations. While cattle that are too fat represent excessive levels of trim loss, extremely lean cattle can represent potential for cold induced shortening (causing toughness), fleshing ability problems in the cowherd, and potentially "harder doing" cattle.

Marbling Score (MARB) EPDs

Marbling scores are subjective evaluations of intramuscular fat in the ribeye. At present, marbling scores are the only easily measured indicator of palatability of beef carcasses. The three components of palatability include tenderness, juiciness, and flavor. It appears that the chief benefit of marbling is that it serves as an insurance policy against overcooking. As well, marbling is the primary determinant of USDA quality grades, which contribute to determination of the value of beef carcasses in many traditional fed cattle marketing transactions.

Marbling EPDs are expressed in units of numeric marbling score, with higher values indicating genes for greater deposition of intramuscular fat, or higher expected marbling score and higher USDA quality grade at a constant age.

Consider the marbling score EPDs of sires A and B:

	MARB EPD
Bull A	–.15
Bull B	+.15
Difference	**= .30**

If bred to comparable groups of cows and processed at a constant age, the average marbling score of carcasses from offspring of sire A is expected to be .30 score units higher than the average of carcasses of offspring produced by sire

B, due to genes passed on from the sires for marbling score. The difference of .30 score units is equivalent to about one-third of a USDA quality grade.

Generally, depending upon the marketing system, higher marbling score EPDs are favored over lower values, because "Choice" grade carcasses are typically more valuable than carcasses which grade Select or lower, if other carcass characteristics are equal. However, marketing programs exist (i.e. Laura's Lean Beef) which do not reward marbling, and may in fact desire less marbling in order to minimize the fat and caloric content of branded beef products. Research has also shown that there is generally only a relatively weak relationship between level of marbling and tenderness, which is the most important factor contributing to palatability.

Table 1. Limousin Possible Change Values for Various Levels of Accuracy.

	Possible Change (+ or –)				
BIF Accuracy	Birth Wt EPD	Weaning Wt EPD	Yearling Wt EPD	Milk EPD	Scrotal EPD
.1	2.9	15.9	23.6	15.6	.62
.2	2.6	14.1	21.0	13.8	.56
.3	2.2	12.3	18.4	12.1	.49
.4	1.9	10.6	15.8	10.4	.42
.5	1.6	8.8	13.1	8.7	.35
.6	1.3	7.0	10.5	6.9	.28
.7	1.0	5.3	7.9	5.2	.21
.8	.7	3.5	5.3	3.5	.15
.9	.4	1.8	2.8	1.7	.08

Accuracy

Accuracy is a measure of the reliability associated with an EPD. **For Limousin cattle, accuracy is designated by either a "P", "P+" or a numeric value which ranges from 0 to 1.** Accuray indicates the type and amount of information which was used to calculate the EPD.

EPDs with "P" accuracy have the lowest level of reliability because only pedigree information was available for calculating the EPD. Since an animal inherits a sample half of its genes from each parent, EPDs with "P" accuracy are calculated by simply averaging the EPDs of the parents. Breeders are strongly recommended to also consider the adjusted weights and ratios for animals which only have "P" accuracy.

Accuracy defined as "P+", or a low numeric accuracy (<.30), indicates that both pedigree data and an animal's own weight and contemporary group information have been incorporated into the animal's EPDs. For example, a "P+" accuracy associated with an animal's weaning weight EPD means that the animals own adjusted weaning weight, and that of other animals in its weaning group, along with pedigree information for all animals in the group has contributed to the calculation of the EPD. An animals "P+" accuracy is updated to a numeric accuracy during each National Cattle Evaluation (NCE).

For "P", "P+" and low levels of accuracy, commercial and seedstock producers should find comfort in the fact that the accuracy associated with the average EPD of a group of young, non-parent sires can be fairly high. For example, if you were to average the yearling weight EPDs of three unproven, young sire prospects, generally the accuracy associated with the average EPD would be somewhere around .60. What's more, even a "P" or "P+" accuracy EPD has been shown to be a more reliable genetic indicator than the animals own adjusted weight or ratio.

Generally, animals with numeric accuracy above about .30 have had their own weights and group information, and/or that of progeny processed through the NCE. Higher accuracy values, those closer to one, indicate more reliability because more information has been incorporated. Accuracy increases as more information from progeny accumulates, which in turn reduces the amount of potential error associated with the EPD. (See Table 1: Possible Change Values.) Consequently, accuracy allows us to evaluate the amount of risk associated with a selection decision. Risk can be minimized through use of genetically superior, high accuracy sires, typically facilitated through an A.I. program.

Possible Change

First of all, keeping in mind everything you just read about accuracy, keep in mind possible change is nothing more than the potential error associated with an EPD.

Put another way, the accuracy estimates the possible error associated with an EPD at a given accuracy level.

Look at Table 1 above. This is similar to the Table of Possible Change you will find in every Limousin genetic evaluation manual.

Now, let's look at a bull you are considering that has a +5.0 lbs. milk EPD with a .5 accuracy. Reading across you will see that at that accuracy level, you're really saying the bull is +5.0 lbs. for milk, plus or minus 8.7 lbs. In fact, given statistical rules, what you're saying is that there is 66.6 percent chance the bull's true value for milking ability lies somewhere between -3.7 lbs. and

+13.7 lbs. Conversely, statistics say there is a 33.3 percent chance the true value will fall above or below that range.

If you expect EPDs to be a static, one-time, all-time measurement of an animal, it will frustrate you. If you accept the fact that EPDs change, that they're expected to change, you'll be less frustrated.

Other Accuracy Measures—In order to offer breeders perspective on the breadth of information contributing to specific EPDs, you will also find in the Genetic Evaluation Manual the number of herds from which birth weight has been reported, the number of daughters contributing to total maternal, the number of sons contributing to scrotal, and the number of carcasses used in deriving the carcass EPDs.

The bottom line is that as more data is collected on the progeny of a sire or dam, the higher their EPD accuracy becomes; or the less the error becomes associated with the true progeny difference for that animal.

More About Where EPDs Come From

EPDs come from performance information submitted to a breed organization. What's more, when calculating EPDs, only performance information submitted on animals evaluated in contemporary groups can be utilized.

Contemporary groups and the fact that all animals within a breed population share common ancestors are the reasons calves out of Sire A in Georgia can be compared to other calves out of Sire A in Nevada. It doesn't matter that individual calves by sire A do better or worse in one environment or another, what matters is how calves out of Sire A compare to calves out of other sires in the same environment, in the same contemporary group.

For instance, it could be the calves of Sire A weaned at 625 lbs. on some lush pasture in Georgia, but only weaned at 500 lbs. on the Nevada desert. In the same environment, perhaps calves out of Sire B weaned 600 lbs. in Georgia and at 475 lbs. in Nevada. By themselves, the actual weights don't mean anything when it comes to calculating EPDs, what matters is that in a contemporary group, in both environments, the difference between Sire A and Sire B is 25 lbs.

Given the genetic connectedness of the breed, performance evaluation in contemporary groups allows for the genetic comparison of sires between herds all across the nation.

So, EPDs come from breeders submitting performance data on calves in contemporary groups. With that in mind, the validity of EPDs can only be as good as the accuracy with which performance information is submitted. Moreover, the more data that is submitted, the more accurate EPDs become.

So, What's A Contemporary Group?

In basic terms, a contemporary group is a group of cattle of the same sex and percentage blood, born within 90 days of each other that are managed the same way.

For the Limousin breed, if you're submitting performance data, all you need to do is designate the management code for each animal you report. As long as calves are designated by management code, and whether or not they have been creep-fed, the NALF computer assigns them to correct contemporary groups.

EPDs Are Breed Specific

As a commercial cattlemen purchasing genetics, or as a seedstock producer building genetics for the commercial industry, you must understand that you cannot directly compare EPDs between breeds.

There are lots of complicated reasons for this fact but basically it boils down to the fact that each breed's EPDs are calculated using a different historic time-frame from which to calculate EPDs. Consequently, tempting as it may be to look at a Limousin EPD and compare it to Angus, you can't; it's like comparing apples to oranges.

Yes, there has been a lot of talk about statistical equations which allow you to do this. The jury is still out, and so far there is not an inter-breed system that the North American Limousin Foundation feels confident enough in to endorse.

What goes into figuring EPDs?

While it may be difficult to fully understand the mathematics which are used to calculate EPDs, it is not too difficult to gain a conceptual "cowboy feel" for what goes into calculating EPDs at the University of Georgia (UG).

Producers can think of the genetic evaluation program as a giant, ongoing investigation which is conducted to zero-in on the true genetic differences between animals for various traits. As additional information accumulates daily in the NALF office, and evaluations are conducted at the UG, Limousin breeders are continually honing in on true genetic differences between animals.

Without question, the most important "raw materials" needed to calculate EPDs are the weights, measurements and management/grouping information submitted by Limousin breeders. As already discussed, similar to most

Fig D-15: Heritability estimates for current Limousin genetic evaluations.

Trait	Heritability
Birth Weight	.42
Weaning Weight	.23
Yearling Weight	.20
Milking Ability	.19
Scrotal Circumference	.41

"raw materials", the raw data must be adjusted and weighted before it has maximum predictive value and is in the form of an EPD.

In one sentence, an EPD summarizes all of the performance information reported, which has been adjusted for environmental effects, weighted by the heritability of the trait and relationships to other traits, and attached to the pedigree information for all animals and their mates over time. Accurate and comprehensive inputs including data, adjustments, heritabilities and mathematical formulas, result in accurate and reliable EPDs, which are the most accurate predictors of genetic merit that we have in the beef industry. Keep in mind, EPDs measure genetic differences between animals and do not predict absolute performance.

Preparing the Data

As previously mentioned, depending upon the trait, NALF and the UG adjust performance records for the effects of age and/or the age of an animal's dam and other environmental effects. In addition to other data edits which are performed, this is the first step to calculating EPDs. Once records are adjusted, the degree to which each animal's performance differs from the average performance of all animals in its contemporary group is calculated for each respective EPD trait.

Records Weighted for the Heritability of the Trait

As mentioned previously, when computing EPDs, performance data is weighted according to the heritability of the trait. Actually, an animal's deviation from the average of the contemporary group is weighted by the heritability of the trait. Heritability estimates are values which range from 0 to 1, and quantify the degree to which like begets like for any given trait. The higher the heritability, the higher the resemblance among relatives and the higher the degree to which genes influence expression of the trait. Table D-15 provides the heritability estimates used for birth, weaning and yearling weight, milking ability and scrotal circumference.

Statistical Models

In addition to adjustments and weighting performance for the heritabilities of the traits, different multiple trait statistical models are used for calculation of EPD and accuracy values.

EPDs for weaning, yearling and milk are calculated using a multiple trait model. In simplified terms, this means that weaning information is used to help more accurately estimate EPDs for yearling weight. This is possible because research tells us that some of the same genes which influence weaning weight also influence yearling weight. Milk is included in the model to separate out the maternal effects on weaning weight.

The genetic evaluation for birth weight also utilizes a multiple trait model. Simply stated, this means that both birth and weaning weight information contributes to birth weight EPDs. The primary advantage to this approach is that birth weight EPDs for young, non-parent animals should be more reliable because growth information is contributing to the estimate.

A separate multiple trait model is used to calculate scrotal circumference EPDs. The model includes scrotal circumference as well as direct and maternal weaning weight. Weaning weight was included in the model to help account for selection which occurs at weaning and provide information on a correlated trait to increase the accuracy of scrotal circumference EPDs.

Multiple trait models utilize the genetic correlations between traits. Table D-16 lists the correlations used to calculate EPDs for Limousin cattle. Genetic correlations range from –1 to +1, and quantify the degree to which genes influencing one trait also affect another trait. Generally, the genetic correlations used in the Limousin EPD analysis indicate that some of the genes which positively influence growth, also cause higher birth weights and larger scrotal circumferences.

Direct/Maternal Relationship Set to Zero

Milk EPDs are calculated using a zero relationship between weaning weight and milking ability. This means that NALF is assuming that different sets of genes independently control weaning growth and milk production. Using a zero relationship in the calculation procedures means that milk EPDs will be based strictly on pedigree information until weaning weights of calves from daughters pass through the evaluation at the University of Georgia.

Fig D-16: Genetic correlation estimates used in Limousin EPD calculations.

Trait	Genetic Correlation
Birth Weight and Preweaning Gain	.34
Birth Weight and Postweaning Gain	.22
Preweaning Gain and Postweaning Gain	.28
Preweaning Gain and Scrotal Circumference	.15

Incorporation of Performance Records on ET Calves

The UG utilizes performance records from calves produced through ET if the following information is reported:

1 Recipient cow ID
2 Recipient cow breed code
3 Recipient cow birth year
4 Recipient cow registration number (if recipient is a registered Limousin)

In addition to these requirements, ET calves must be produced from fairly common breeds/crossbred types of recipients in order for their performance to contribute to their EPDs. As well, the same contemporary group concepts apply to ET calves as are used for natural calves. If all conditions are met, records from ET calves contribute to EPDs for the ET calves, donor cows (direct traits only, not milk) and sires. Please see the Blood Typing section on recording ET calves for information about how to correctly complete the ET forms.

Linking Contemporary Groups Together

In order to make EPDs comparable for all animals across all contemporary groups, the calculation procedures take into account the degree to which animals are related through common ancestors in their pedigrees. Because of the widespread use of AI, contemporary groups are linked together through the use of these pedigree ties. This also functions to account for differences in the level of genetic competition among animals across groups. It follows that accurate pedigree information is an important contributor to accurate and reliable EPDs.

Why do EPDs Change? Understanding Interim EPDs and Accuracy

EPDs change because additional performance information is continually accumulating for animals and their relatives over time. As animals and their offspring are represented in various additional groups throughout different environments, EPDs are recalculated to incorporate added information. It should be understood that only during the evaluation at the UG, do the performance records of offspring contribute to the EPDs of their parents. In the meantime, NALF computes interim EPDs.

Interim EPDs

EPDs are assigned one of three types of accuracy values, either a "P", "P+" or numeric value which ranges from zero to one. Accuracy was discussed in more detail on page D-26. If EPDs have a "P" or "P+" accuracy, the EPD was calculated by NALF and is considered an interim EPD. The word "interim" is used because these values are calculated and updated by NALF in-between evaluations at the UG. Interim values are updated and assigned numeric accuracy for a given trait if performance information on the individual or its offspring are added to the NALF herdbook prior to the next UG evaluation.

In order to understand why two types of interim EPDs ("P" and "P+") are calculated, it is necessary to talk about how quantitative traits are inherited.

Traits that are continuously distributed, like weight traits and numeric measurements, are controlled by a large number of genes, each of which have relatively small effects. Because of the large number of randomly inherited genes involved, a single cow mated to a single bull can produce an estimated 1.073 billion different genetic combinations.

If no performance information is available for an animal or its offspring, EPDs with "P" accuracy are calculated by figuring the average of the EPDs of the parents (see page D-26). This calculation assumes the individual inherited an average sample of genes from each parent, but tells us nothing about the sample it actually inherited. Clearly, some animals inherit an average sample, but many others inherit a sample which is either above or below average.

For timely and accurate representation of the EPD, as soon as performance information is reported for an animal and its mates in the same group, the EPD is adjusted to reflect how well the animal performed in its group. A "P+" accuracy is then assigned and the EPD indicates whether or not it received a good, average or poor sample of genes from its parents. The "P+" accuracy tells you that the animal's pedigree information, plus its own performance has been incorporated into the EPD, but that the performance has not yet contributed back to its parent's values. The "P+" accuracies are updated to numeric values during the UG evaluation.

In order for an animal to have an EPD with "P" or "P+" accuracy computed, its parents (sire and dam) or its sire and maternal grandsire must have EPDs with numeric accuracy. In the case of an animal whose sire and maternal grandsire have EPDs with numeric accuracy, but whose dam does not have EPDs, EPDs are calculated by adding one-half of the sire's EPD to one-fourth of the maternal grandsire's EPD for each respective trait. If the sire has EPDs with "P" accuracy, no "P" or "P+" EPDs are calculated for their offspring.

Another NALF policy of interest regarding pedigree EPDs with "P" accuracy involves older animals who have not had performance reported in a group or offspring with performance reported in groups. If none of the above information has been reported in the present year and the four previous years, the animal's "P" accuracy EPDs are no longer printed on any NALF paperwork. This policy is intended to encourage the reporting of performance information and helps save computing time and space in the NALF computer.

Reporting performance information is not mandatory. However, from the time animals are born until evaluated as yearlings, a number of different combinations of performance data on various traits is available on different animals. Figure D-17 on the next page was designed as a reference to help determine what EPDs and accuracies are calculated when common combinations of birth, weaning and yearling data are reported.

As a final note, breeders should recognize that NALF's performance program and the genetic evaluation process is continuously evolving. While implementation of technical advancements may cause the look of EPDs to change over time, incorporation of enhanced procedures is necessary to provide breeders the best possible genetic predictions. Ultimately, a progressive approach helps give Limousin breeders a competitive advantage over other seedstock producers.

Where To From Here?

What you hold in your hands are rudimentary basics when it comes to EPDs. If you take the time to study and understand these basics you will be miles down the road in putting the power of EPDs to work for you.

There are many more advanced principles associated with Expected Progeny Differences and their use. If you would like further information or if you would like to buy a video explaining EPDs, contact the North American Limousin Foundation, Box 4467, Englewood, CO 80155; 303/220-1693.

Fig D-17: Expected Progeny Differences (EPDs) and Accuracy Values (ACCs)

for non-parents calculated by the North American Limousin Foundation (NALF) and the University of Georgia National Cattle Evaluation (UG NCE) for birth weight (BW), weaning weight (WW), yearling weight (YW), milking ability (MA) and scrotal circumference (SC) according to available record(s).

Record(s) Available (at time of UG NCE)	**EPD/ACC**
No Records Reported and only pedigree information available	Interim EPDs and ACCs calculated by NALF Pedigree EPDs with "P" ACC are equal to: 1/2 Sire EPDs + 1/2 Dam EPDs or 1/2 Sire EPDs + 1/4 Maternal Grandsire (MGS) EPDs for each respective trait Note: Sire and Dam or Sire and MGS must have EPDs with numeric accuracy for the respective traits in order for NALF to compute interim EPDs.
Birth Weight (BW) record reported and no weaning or yearling records reported	UG NCE values for birth weight and NALF interim values for other traits BW EPDs from UG NCE with numeric ACC WW EPDs from NALF with "P" ACCs YW EPDs from NALF with "P" ACCs MA EPDs from NALF with "P" ACCs SC EPDs from NALF with "P" ACCs Note: EPDs from NALF with "P" ACCs are calculated for animals whose sire and dam or MGS have EPDs with numeric ACCs. As WW records reported in valid contemporary groups are processed by NALF, EPDs for WW and YW are updated to reflect the addition of weaning weight records, and NALF then assigns a "P+" ACC to updated WW and YW EPDs. "P+" indicates the animal's record has contributed to its EPDs, but has not yet contributed to the EPDs of its parents. "P+" EPDs are updated to EPDs with numeric ACC during the UG NCE.
Birth Weight (BW) and Weaning Weight (WW) Records Reported and no yearling records reported	UG NCE values for BW, WW, YW and MA See special notes SC EPDs and ACCs BW EPDs from UG NCE with numeric ACC WW EPDs from UG NCE with numeric ACC YW EPDs from UG NCE with numeric ACC MA EPDs from NALF with "P" ACC (MA EPD is a pedigree estimate) SC EPD: Calculation of values depend upon sex of animal and available information. Bulls - NALF "P" ACC EPDs if sire and dam or sire and MGS have SC EPDs with numeric ACCs.
Weaning Weight (WW) Record Reported, but no birth weight	BW EPD from NALF with "P" ACC WW EPD from UG NCE with numeric ACC no birth records YW EPD from UG NCE with numeric ACC reported MA EPD from NALF with "P" ACC SC EPD - See Above Notes

While additional combinations of reported performance information exist, the examples cited above explain the most common combinations of performance information available.

Your Commercial Customers — Choosing the Right Sire...

Selecting the "right" sires is the key to making genetic improvement. In your next calf-crop, half of the genes will be from sires used during the last breeding season. If you produce your own replacements, nearly 90% of the genetic makeup of your herd is comprised of genes from sires used during the last three generations.

Specifications for the "Right" Sires

Selecting the most appropriate sires depends upon accurately evaluating the given situation. Different sires are needed for different purposes. The following are three different practical examples of types of bulls needed for different circumstances and a list of traits and considerations that are especially important for each type:

Terminal Growth and Carcass Sire

- Will not save replacement heifers
- Rapid growth ("high" weaning and yearling weight EPDs)
- Superior carcass (heavily muscled, lean, high quality)
- Sensible size to maintain acceptable carcass weights
- Acceptable birth weight
- Milk is not important
- Compliment the cows and match the end product market (consumers)

Maternal "All Purpose" Sire

- Will retain replacement heifers
- Optimal birth weight, milk, growth and mature size (moderate frame)
- "Large" scrotal EPD
- Adaptability and convenience traits (fleshing ability, udder quality, etc.)
- Structurally sound, high volume, easy fleshing
- Match the environment, management and mating system
- Muscularity

Calving Ease Sire (Heifer Bull)

- Calving ease ("low" birth weight EPD)
- Sensible actual and adjusted birth weight
- Sensible size
- Same as maternal sire if daughters retained as replacements
- Reasonable muscling

Selecting the "Right" Sire

For example, consider the three sire prospects in Table D-18 on the following page.

Different situations require different bulls. Seldom can one bull be expected to adequately and cost effectively suit the wide variety of needs described in scenarios 1, 2 and 3.

The Growth and Carcass Sire

Because of his superior growth (yearling EPD), Sire A would potentially be the "Growth and Carcass Sire," especially if he has adequate muscularity when evaluated visually. Bull A's birth weight EPD of 2.2 ranked him in about the upper 10% of the population for heavy birth weight in a specified genetic evaulation, i.e. each genetic evaluation at the University of Georgia yields new percentile rankings. Thus he should only be bred to mature cows, in order to avoid calving difficulty. The negative milking ability and lower total maternal EPDs are not of concern since no daughters will be retained for replacement.

The Maternal "All Purpose" Sire

Bull B combines average birth weight with high growth, milk and total maternal EPDs, has a large adjusted scrotal circumference and has a sensible frame score. This performance profile identifies Bull B as an "All Purpose" Maternal Sire prospect. Since daughters of this bull are to be relied upon to perpetuate the cow herd, it becomes especially important to pay close attention to all EPDs. In addition, this bull must be muscular.

The Calving Ease Sire

Most calving difficulty and associated losses occur in first-calf heifers. Calf birth weight has been identified as the most important factor contributing to difficulty, and birth weight EPD has been shown to be the best tool for predicting differences in birth weight. Based on Bull C's birth weight EPD of -1.8, he is a probable calving ease bull that could be mated to yearling first-calf heifers. Bull C also has respectable growth and milk EPDs and would be a possible choice for breeding cows whose mature size is too large.

Fig D-18: Selecting the "Right" Sire

Sire	Birth Weight EPD	Weaning Weight EPD	Yearling Weight EPD	Milking Ability EPD	Total Maternal EPD	Scrotal Circum. EPD	Adj. Yr. Scrotal Circum. (cm)	Frame Score
A	2.2	16	35	–4	4	.2	32	7.0
B	.6	12	25	6	12	1.0	35	6.5
C	–1.8	8	15	3	7	.5	33	6.0

(Remember, new averages are calculated with each new Genetic Evaluation Manual.)

Other Things to Remember

Don't forget, Limousin EPDs cannot be directly compared to EPDs of other breeds. Compared to British breeds (Angus and Hereford), the average Limousin EPDs for birth, weaning, yearling, milk and total maternal are lower because they are based on a different zero EPD point.

On-Line Sire Selector Software

NALF has available an on-line program designed to assist in the selection of sires for use in breeding programs. This program is updated after each National Cattle Evaluation (NCE) to include the latest EPDs. All bulls that qualify for the NCE General Listing and the top 500 young sires for birth, weaning, yearling and milking ability are included.

After the breeder enters selection criteria, bulls that meet the criteria are selected for display and printing. Criteria can include: low/high EPDs, minimum accuracies, birth year range, polled/scurred only, fullblood only and black only.

For more information about this useful tool, contact the NALF office, or log onto NALF's website at **www.nalf.org.**

Troubleshooting

Reasons one or more of your cows doesn't appear on your preprinted cow inventory...

1 The cow is not registered with NALF.
2 The cow is listed with NALF as dead or having sold without papers.
3 The animal is not yet old enough to calve.
4 The animal is 5-years-old or older and has had no offspring reported to NALF in the past three years.
5 The animal was recently purchased and was not listed under the breeder's membership when the inventory was printed.

what to do...

If a cow is not listed on your Cow Inventory Report for any of the above reasons, you can add her on a blank line of the report.

Why doesn't my animal have EPDs?

1 The sire of the animal
   a. does not have EPDs
      or
   b. has EPDs with only a "P" or "P+" accuracy
2 The dam of the animal
   a. does not have EPDs
      or
   b. the maternal grandsire has no EPDs or only "P" or "P+" accuracy EPDs
3 The animal:
   a. was not weighed in a weaning group
      and
   b. has not produced natural (non E.T.) offspring which have been evaluated in a weaning group; or have not produced ET calves evaluated in a contemporary group or have produced ET calves without reporting breed information of the recipient female.

Notes: