Canadian Simmental Association Performance Program Handbook

January 15, 2010

Introduction

This handbook is designed to serve a variety of purposes. It is set out in sections to serve as a guideline for the Canadian Simmental Association's (CSA) performance programs, and to answer specific breeder questions on a variety of topics pertaining to the CSA programs. It has further been developed to serve as a more in depth source of information for those breeders that are interested in further pursuing their knowledge and understanding of performance testing in general, specifically in the context of the CSA.

As such an attempt is made throughout to explain by example. The subject material has been approached with an industry perspective, explaining not only what we do, but hopefully why we do it in terms of the Canadian and global beef industry.

We hope that the material is of some use and can be applied in an integrated way across operations.

While comprehensive breeding programs require many skills and activities to be successful, including financial management and marketing, the scope of this handbook is intended to deal strictly with selection and breeding decisions. It does attempt to provide a framework for applying breed improvement programs into an operation in an integrated manner. This is by no means the be all, end all of performance program information, as there is no end to what we may be interested in, and future developments are arriving on the scene every day in a dynamic industry.

If there are any questions, concerns, or ideas regarding this publication, please do not hesitate to contact the Canadian Simmental Association.

At the end, there is a comprehensive listing of other resources that are available.

Definitions: definitions are presented in blue text

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Protein Industries

Introduction

All protein is made of building blocks called amino acids. The combination of amino acids and the way they connect to each other determines the type of protein produced and its' functions.

Beef is a protein industry. What we ultimately sell to the end consumer is a nutrient rich, protein dense food source. This means that we are in competition with other protein products including poultry, pork, plant and manufactured proteins. With this in mind it is good to have at least an idea of what these industries look like and how they function.

Pork

The pork industry has changed remarkably over the last 20 to 30 years. Barns have increased in size and production has become much more intensified. Traditional purebred operations have basically disappeared and genetics and selection decisions are nearly all operated by large multinational corporations.

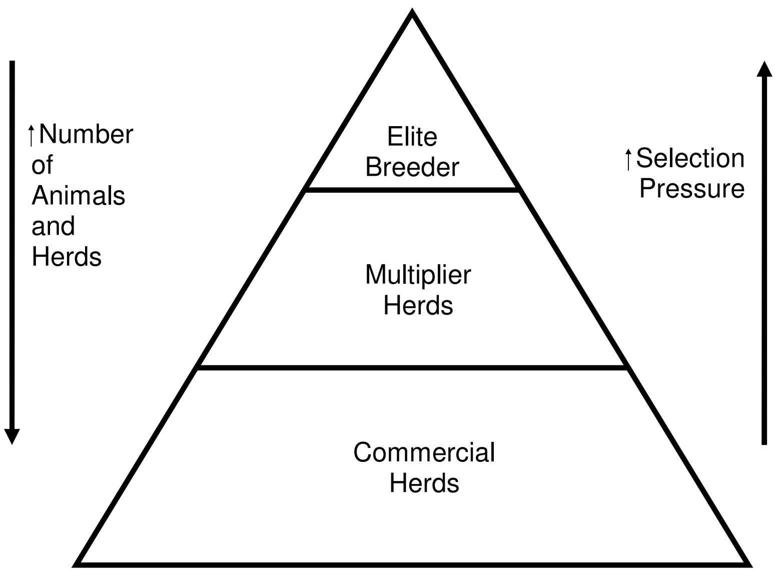


Figure: A traditional breeding pyramid. Relatively few animals representing highly selected genetics from elite breeders (breeding company) are used in multiplier herds. The multiplier herds in turn produce enough animals for use in the commercial production industry. As you proceed to the top of the pyramid selection pressure increases, and selection tools such as EPD, ultrasound, and gene markers may be more likely to be in use. As you proceed down the pyramid, the number of animals increases, and selection pressure declines. Often data from commercial herds is fed back up the pyramid to assist in the genetic selection decisions of the elite breeders.

Pork production is now matching management with carefully selected lines. Every piece of pork produced is a combination of genetics from specific lines designed to optimize hybrid vigour and predictability of the end product. Most pork in Canada is sold on a carcass basis, and much is raised using a “contract farming” method.

This results in a sharply defined breeding pyramid, with nucleus herds producing intensively selected genetics, multiplier herds expanding the numbers of these selected individuals and then commercial production ultimately producing the end product.

Because pigs have larger litters than cattle and a shorter generation interval, the response to these selection programs can be observed in a relatively short period of time.

Poultry

Admittedly, chicken and beef are raised in quite different environments with quite different management but, there are a few facts that are interesting and we can definitely learn from the poultry industry. 25% of the worlds meat comes from poultry (this does not include eggs). Market share has increased 19% since 1990, and last year about 30% of Canadian production was further processed. In 1950 an 1800g bird (4lb) took 12 weeks to grow and had an average feed conversion of 3.5:1. By 1990, the same bird was taking 6 weeks to produce and converting feed at the amazing rate of 1.8:1.

Genetics have been the single greatest factor in increasing product quality and productivity. Every commercial bird produced is a crossbred of highly specialised and carefully selected genetic lines. The poultry industry is highly integrated from start to finish.

In contrast, the beef industry typically sees production taking about 14 months for an animal to reach slaughter. Animals are not raised in a closed and controlled environment, and feed conversions typically range in the area of 6.5 to 8:1. Generation intervals are much longer than in the poultry industry and many commercial producers have no planned crossbreeding system at all. Integration and co-ordination between industry players is almost non existent. The result is that since 1990 our market share has continually fallen as real prices continue to decline.

Here's a comparison of some of the differences between beef and poultry:

	Beef	Chicken
Digestive System	Ruminant	Monogastric
Feed Efficiency (Feed/Gain)	7:1	1.8:1
Cost / lb gain ($2.50 Barley)	36.5 cents	9.4 cents
Birth to slaughter	60 weeks	6 weeks

If the beef industry achieved improvement on the same scale as the poultry industry, here's where we would be today:

	1950	2000	Savings
Feed Efficiency (Feed/Gain)	7:1	3.6:1	3.4 lb Feed/lb Gain
Cost / lb gain ($2.50 Barley)	36.5 cents	18.8 cents	17.7 cents/lb
Birth to slaughter	60 weeks	30 weeks	30 weeks
Cost of gain 600-1200 pounds	$219.00	$112.80	$106.20

To put this into perspective, let's assume that Canadian feedlots are operating at 2008 fed cattle levels of 3,298,400 head (Canfax) and are taking these calves from 600 to 1200 pounds. There would be net savings of $350,290,080 due to improved feed efficiency. As well, if you take into account the time saved, overall production could be doubled.

Poultry has an even more defined breeding structure than the pork industry. Because of the need for automation in processing plants, birds must be nearly identical when finished. Vertical integration is more pronounced than pork and many value added products are produced.

A typical breeding scheme in broiler production may look like the following…

Elite Breeder (breeding company): selects 4 lines:
A, B, C, D and crosses
♂A x ♀B and ♂C x ♀D to produce
♂AB and ♀CD

Multiplier Herd crosses: ♂AB x ♀CD to produce
ABCD chicks

Commercial Producer: grows ABCD offspring

Some classic errors have occurred with poultry breeding that we can learn from. For example, in the Turkey industry, so much emphasis has been placed on breast meat, that turkeys can no longer breed naturally. All commercial turkey production is a product of artificial insemination. As well, perceptions of animal welfare concerns (largely layer chickens in cages) have done some damage to the industry.

Poultry has done a tremendous job in terms of value added, further processed products and product consistency. As well, production efficiency and genetic selection methodology have been applied extremely successfully. Poultry has an advantage over beef in that generation interval is quite short and superior animals can produce many offspring in a short time period.

Plant Protein

While we may dismiss vegetarians out of hand, it is important to realize that much of our protein requirements are derived from plant sources.

Plant protein is produced in Canada under a variety of structures. More and more, production is becoming integrated, and control over genetics is becoming consolidated. Much of the commercial grain produced is the result of highly selected genetic lines.

One tremendous advantage of plants is that it is possible to grow new plants without seeds, and they are easily cloned and also relatively easy to add new genes to. For example, you can grow a new houseplant with a clipping from another plant. You do not require seed. This new plant will have exactly the same genetic makeup as the original plant.

Because of the ability to introduce new genes fairly easily it is also possible to produce variants such as Roundup Ready ™ canola and soybeans. While much of this technology is still in debate, it is still important to realize the fact that new genes can be introduced rapidly and easily into plant protein.

Plant protein has a relatively low cost of production, in fact even less than that of poultry. The reason for this is that there are energy losses when animals break down and reassemble the protein in their feed.

Fish

Historically fish have been simply captured in nature, and as such the cost of production was insignificant. In recent years we have started to realise that this source of protein is not inexhaustible. This has produced a movement to create fish farms, or commercial fish production. This industry is in its' infancy in many ways and faces some tremendous hurdles in its' development.

Fish have a low cost of production in terms of feed conversion. This is largely due to the fact that their body mass is supported by the water they live in. It takes a lot of energy for a pig, chicken or cow just to stand up. As well, fish have a tremendous social acceptability and are viewed as being high in essential fatty acids.

Concerns with fish farming involve disease, farming techniques and potential escape of animals into the wild.

Manufactured Protein

When speaking of manufactured proteins, we are referring to those produced through synthetic or bacterial methods. Bacterial protein is low cost and easily manipulated. With the ability to genetically engineer bacteria it is possible to produce a single amino acid (specific part of a protein) or a detailed complex protein molecule for a specific function.

These are worth mention, as they are a growing source of much of the specialised proteins and molecules we use in everyday life, including many of the drugs we use. While it can be quite expensive to develop the technology, the actual cost of production is extremely low as there are no organs or life systems to support.

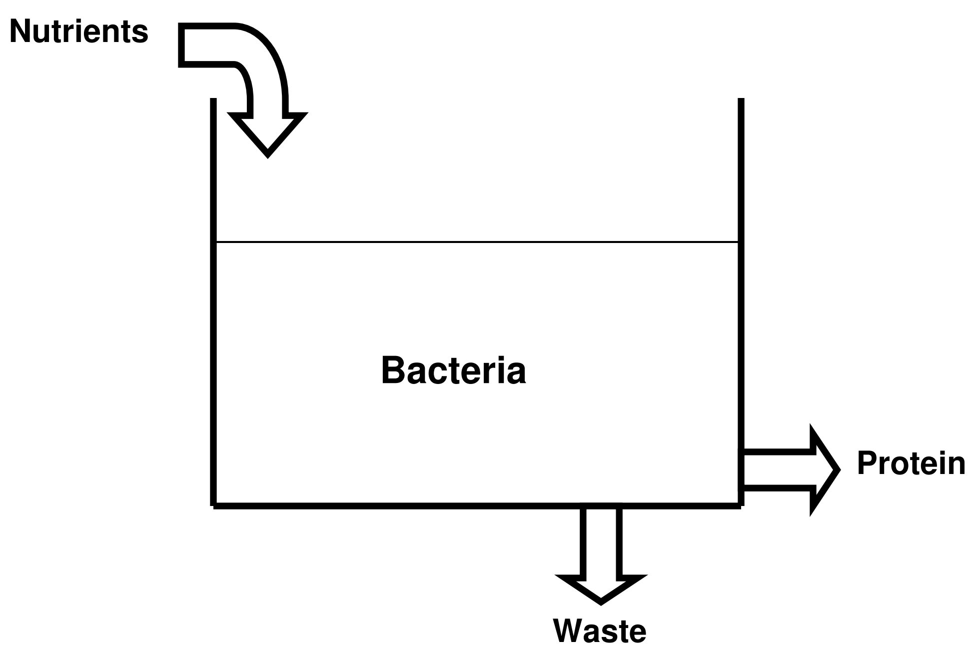


Figure: A diagrammatic representation of a bacterial protein production system. Nutrients are added to the system, the desired protein is extracted and wastes are removed so that the bacteria can continue to grow and produce the desired product.

Summary

One of the main advantages all of these industries have over beef is in the predictability of their product. This is largely the result of intensive genetic selection.

Table: A comparison of various characteristics of different protein industries

	Beef	Pork	Poultry	Plant	Manufactured
Vertical Integration	Low	Moderate	High	Moderate	High
Genetic Selection	Low/Mod	High	High	High	High
Generation Interval	Long	Moderate	Short	Short	Short
Predictability	Low	High	High	High	High
Organised Mating	Low	High	High	High	N/A
Ease of Incorporating New Genes	Hard	Hard	Hard	Moderate	Easy

Most purebred are controlled by breeding companies and all commercial animals are produced from a designed crossbreeding system. As such, the number of breeds and strains involved has been significantly reduced over time, in each of the pork and poultry industries.

These industries provide both a challenge for us, but also a tremendous learning opportunity to avoid some of the mistakes they have made pursuing genetic progress.

It is important to recognise both the strengths and weaknesses of our competitors in the protein business. We can learn a lot from the successes and failures in other industries, and also gain some foresight into potential tradeoffs that may occur as the industry evolves.

The beef industry has less vertical integration than many other protein industries, and beef is generally raised in more varied environments. Many of the challenges facing the beef industry are also being faced by other protein industries, including environmental concerns, animal welfare issues and others.

Many of the tools used by other protein industries are available to the beef industry and are being used today, including such things as EPDs, gene markers, and ultrasound. Beef generally has a longer generation interval, and lower fecundity (number of offspring) than these other protein sources but also has the advantage of being able to convert lower quality feedstuffs into high quality protein.

The Canadian Beef Industry

It is extremely important that we understand where we fit as an industry, since genetics have such a large impact on the final product, food.

Canada's total cattle population is somewhere around 13.2 million head (Dairy and Beef). While that is a lot of cows, it is only 1.3% of the world's cattle inventory of just over 1 billion head. Many of these 1 billion cattle are not used for beef production and when we factor them out, Canada produces roughly 2.4% of the world's beef. In terms of world beef production, that leaves us in 11th spot, well behind countries such as the US, Brazil or China. Our national cowherd is somewhere around 4.5 to 5 million head.

If we shift our thinking to exports, then Canada moves up significantly in the world rankings, even post BSE. Canadian beef comprised 12% of world exports, and Canada ranked 3rd overall in terms of export tonnage. Canada also appears 9th on the list of beef importers.

Most cattle in Canada are located on the prairies (82% in the 3 prairie provinces) with Ontario coming in at roughly 7% of the Canadian cattle population. Alberta feeds 65% of the cattle in feedlots in the country (roughly 3.3 million head), with Ontario coming second at 22%. Average cow herd size is 61.

Canadian beef production has several natural advantages over other countries. These advantages focus in two main areas: health of animals/food safety and product quality.

While it is extremely important to realise that controlling cost of production is vital to the success of any agri-business, it is also important to realise that when we look at beef production globally, we cannot compete with the cost of production from countries like Brazil and Argentina. Some information obtained form Brazil puts their cost of production at less than $200 US per head, from conception to slaughter (pers. comm. 2002). This does not mean that we do not have to pay attention to our cost of production, but rather we do need to keep it in a world context and optimize our cost of production to produce a superior, safer product.

In terms of domestic protein production (within Canada) we do have an advantage, in that ruminants can convert otherwise unusable forages into a highly edible and valued protein product. Also, ruminants can harvest areas that cannot be harvested by mechanical means due to terrain, etc.

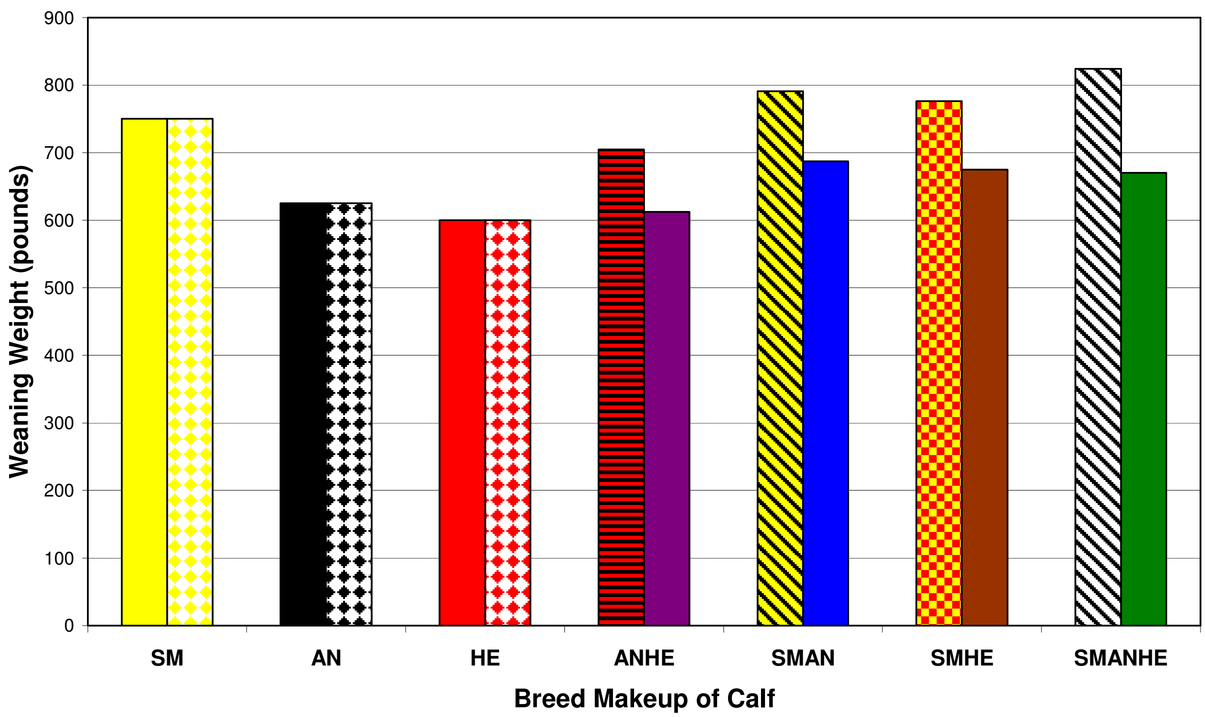
The Canadian industry is very fragmented, with many cow/calf producers selling calves at weaning and having no feedback from beyond the farm gate. This means that in many cases there is little or no financial reward for superior carcass characteristics, or feedlot performance. If this is so, then why are we concerned about it at a genetic selection level? Ultimately the beef chain is driven by consumers purchasing beef. The money entering the chain is derived from these people. The better our performance throughout the chain, however fragmented, the more potential profit is built into the chain.

The BSE issue in the Canadian industry has also led to increased efforts to trace and reward quality products. This makes ensuring genetics work across the entire production chain increasingly important.

Hybrid Vigour

Heterosis, or hybrid vigour is exploited in all commercial protein production industries. It is sometimes referred to as "the only thing you'll ever get for free in the beef industry".

Heterosis (hybrid vigour): Amount by which the average performance for a trait in crossbred calves exceeds the average performance of two or more purebreds that were mated in a particular cross. (BIF Guidelines, 8th Edition)



	SM	AN	HE	ANHE	SMAN	SMHE	SMANHE
Actual Performance	750	625	600	704	791	776	824
Average Performance of Parents	750	625	600	613	688	675	670
% Heterosis	0	0	0	15	15	15	23

The graph and table show the actual weaning weight of a calf (first bar) and the average performance of its parents (second bar). In the case of cross bred animals, the calf's actual performance is greater than the average of its parents. This difference is heterosis.

The 3 way cross (SMANHE) expresses the greatest performance (23% in this case) as he receives hybrid vigour (offspring heterosis) from his own genetic makeup, but also benefits from the hybrid vigour being expressed by his ANHE mother (maternal heterosis) (eg: greater milk production by the dam).

The largest impact of heterosis is on traits of low heritability. This includes traits like fertility, longevity and disease resistance.

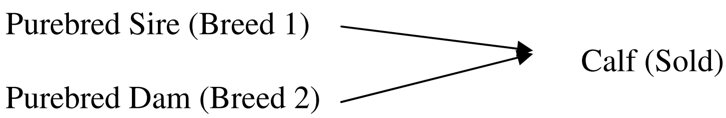
Crossbreeding Systems

There are a variety of crossbreeding systems in use in the industry, and each attempts to capture heterosis and produce combinations that successfully match management and environment. Additionally, each system has both strengths and weaknesses associated with it.

Crossbreeding: the mating of animals of different breeds or subspecies, frequently resulting in heterosis (hybrid vigour) for many economically important traits. (BIF Guidelines, 8th Edition)

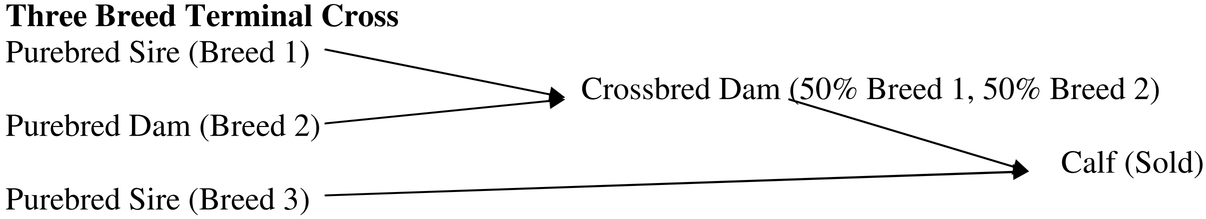
F1: offspring resulting from the mating of a purebred (straight-bred) bull to purebred (straight-bred) females of another breed. (BIF Guidelines, 8th Edition)

Two Breed Terminal Cross



The calf will have maximum heterosis, but will not benefit from heterosis expressed by the mother. Additionally, this system requires the maintenance of a herd to produce replacement females, or another source of replacement females.

Three Breed Terminal Cross



In this scenario the F1 dam will express maximum heterosis, as she is a combination of two unlike gene pools. In addition the calf will also express maximum heterosis. This system also requires an additional source for replacement females.

Two Breed Criss Cross

This system involves maintaining cow herds of two different breeds and using a sire of the opposite breed on each cow herd. Daughters of each breed of sire are crossed back on each subsequent generation with the opposite breed. This system maintains roughly 2/3 of hybrid vigour and is a good option for production of replacement females. This system may result in wide fluctuations in breed composition within the cow herd. A two breed rotation will maintain much of the hybrid vigour in the cow herd.

Three or Four breed rotational

This is similar to a two breed rotation, except that 3 or more breeds of sire are used in rotation and females are mated to the breed of sire to which they are least related.

Criss-cross Terminal

Many options of the above systems are in use throughout the commercial industry. Examples, include maintaining a portion of the herd to produce replacement females and then mating the remaining portion of the herd to a terminal sire.

Rotate Sire breed
Another option often used is the simple rotation of sire breeds every few years. While easy to manage, this system can result in large variation in the cow herd.

Example of 4 breeding cycles retaining heifers using rotational crossing of Angus and Simmental Sires

Cycle 1	**Angus Bull**
	½ Angus ½ Simmental Cows
Offspring	¾ Angus ¼ Simmental
Cycle 2	**Simmental Bull**
	½ Angus ½ Simmental Cows ¾ Angus ¼ Simmental Cows
Offspring	¼ Angus ¾ Simmental 3/8 Angus 5/8 Simmental
Cycle 3	**Angus Bull**
	½ Angus ½ Simmental Cows ¾ Angus ¼ Simmental Cows 3/8 Angus 5/8 Simmental Cows
Offspring	¾ Angus ¼ Simmental 7/8 Angus 1/8 Simmental 11/16 Angus 5/16 Simmental
Cycle 4	**Simmental Bull**
	½ Angus ½ Simmental Cows ¾ Angus ¼ Simmental Cows 3/8 Angus 5/8 Simmental Cows 7/8 Angus 1/8 Simmental Cows 11/16 Angus 5/16 Simmental Cows
Offspring	¼ Angus ¾ Simmental 3/8 Angus 5/8 Simmental 5/16 Angus 11/16 Simmental 7/16 Angus 9/16 Simmental 11/32 Angus 21/32 Simmental

Specific four breed
F1 cows are mated to F1 bulls of differentbreed composition. For example, a Hereford x Angus cow mated to a Charolais x Simmental sire. Continuation of this system (retaining of heifers) results in a composite breed situation.

Composite
Composite breeding schemes utilize mating of crossbred animals that are designed to meet the environment and maintain hybrid vigour. These systems are relatively easy to manage and do not require maintaining separate cow herds.

There is some good information available on crossbreeding on these sites, and several others…
http://www.extension.umn.edu/distribution/livestocksystems/DI3926.html
http://www.dpi.qld.gov.au/beef/2243.html
http://stephenville.tamu.edu/~shammack/L5207.pdf

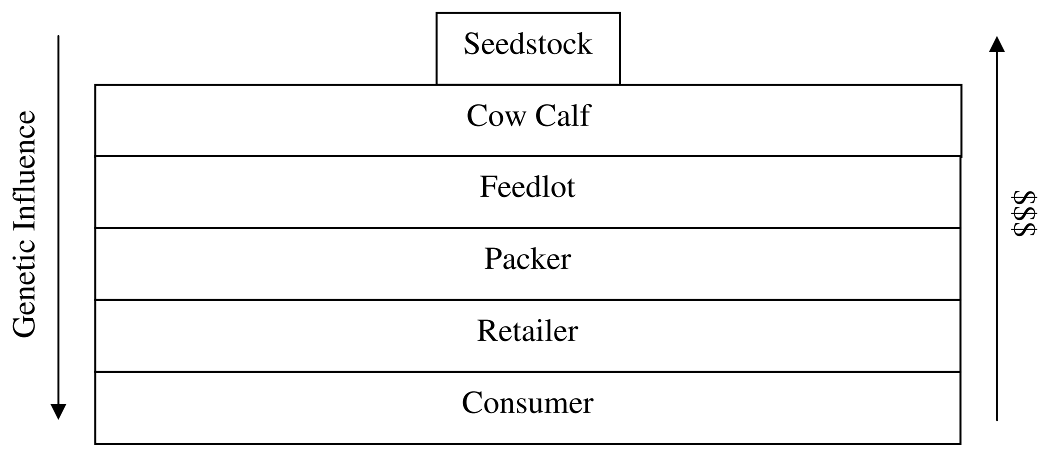
Setting Goals and Defining Your Program

This is the most important task of any purebred breeder, and unfortunately is one thing that is often forgotten. Making change in a breeding program is easy. Creating improvement is more difficult. The basis for any type of genetic improvement lies within the breeding objectives of the seed stock producer and their belief that they are in the business of providing genetics to the commercial beef industry.

Breeding Objective: The goal of a breeder's selection program, for example to produce high quality, lean meat at lowest cost. It may also include a listing of the traits to be used as selection criteria to achieve the overall goal. Objectives may vary among breeders due to their genetic and physical resources and their markets. (BIF Guidelines, 8^{th} Edition)

If we reflect back to our breeding pyramid we may intuitively see that defined goals are important. As successes or failures are made, they tend to be amplified through the pyramid, affecting more animals as they come down through the chain.

Hopefully, the direction of most seed stock programs is based on what the customer demands. When establishing any type of a long term breeding objective it may be useful to talk to your current or potential commercial customers. It is also important to assess the beef industry as a whole and to get some idea of where the industry is heading. It is also important to realise that the genetics you produce will influence many thousands of pounds of beef that will be eaten by consumers from around the world. This ultimately is where your income as a seed stock producer is derived from and it is important to remember this when creating or modifying a breeding program.



It is also extremely important to consider the impact your decisions may have on the beef industry. The majority of the influence of seedstock in the commercial beef industry comes from the sale of bulls into commercial cowherds. This means that relatively few animals from the seedstock sector will have a major impact on the finished product and the consumer. Let's look at the following example.

Your Purebred Herd Size	20 Cows	200 Cows
Number of Bull Calves in Your Herd	10	100
Number of Bulls Sold from Your Herd	8	80
Number of Cows Bred by Each Bull You Sold	25	25
Total Number of Cows Bred by Your bulls	200	2000
Average Carcass Weight (Canfax Statistical Briefer – June 2002)	796 lbs	796 lbs
Total Carcass Weight	159,200 lbs	1,592,000 lbs

Let's look at the number of people influenced by your breeding decisions…

You and your family are affected by the success of your enterprise	1+
Your commercial customers who bought bulls from you	1+
Their calves went to a feedlot or to several feedlots	1+
Those calves went to at least one packing plant	1+
And to at least one grocery store	1+

In 2008 average beef consumption in Canada was approximately 30.45 lbs per person (Canfax). On a carcass weight basis this works out to 51 lbs. This means that the beef produced from your sires affected over 3121 people and 31,215 people respectively, not counting your family or anyone else in the production chain. It is also important to note that this is only one year worth of production. There may be more of your genetics out there as many commercial producers will keep bulls for several years. This puts a tremendous responsibility on your genetic selection program.

Some recent work conducted by the Beef Information Centre shows only an 80% satisfaction rating with our product (Beef Consumer Satisfaction Benchmark Study, 2002). 1 out of every 5 beef experiences is not satisfactory to our end customer. If we view genetics as a limiting factor, we not only have a lot of work to do, but we also have tremendous opportunity to make progress.

There are several important questions that must be asked in order to set a breeding objective. Although the questions are the same the answers may vary for each operation.

1. What do my customers want to buy?
2. What do I want to produce?
3. Where am I at now? How do I know?
4. Where do I want to be in 5 years? 10 years? 20 years?
5. What do I need to do to achieve my targets?
6. How do I measure my progress towards my target?

These questions and the answers will determine how you approach your performance programs and the type of information that you use in your operation. It is a very good idea to write down your goals and objectives for your program. This may seem like a useless or even a difficult exercise, but in many cases it helps to clarify in your mind what you are trying to accomplish and it provides the basis of a concrete plan to help you achieve your goals.

The process of defining a breeding objective and determining if you are achieving your goals is dynamic.

1. Goals

We must set our goals so that we know if we are heading in the right direction, or holding the fort if we are at the place we want to be for certain traits. A sample breeding objective may be:

To produce seedstock that produce superior females, with high fertility, low maintenance and desirable carcass characteristics. These characteristics should be defined so that selection decisions can target progress.

2. Objective Phenotypic Data
Once we have defined our goals, it should be relatively easy to determine what information we need to collect on our cattle. If we are concerned about fertility, we should collect breeding data, if we are interested in carcass traits we need to look at carcass testing and ultrasound as options, etc.

3. Genotype Data
Once we have phenotype information, we need to obtain genotype data. This is where pooling data and working with a breed association, come in. By amalgamating large quantities of data from a variety of sources we can determine the genetic merit of animals.

4. Breeding Decision (Genetic Selection)
Once you have genotype information, you need to apply it to your goals to select parents and make decisions.

5. Assessment of Results
This takes us back to step 2. We need to measure progeny, in order to determine if our goals are being met. Also, as part of this step, we need to consider customer satisfaction levels, and we may also need to reassess our goals.

Selection: Choosing some individuals and rejecting others as parents of the next generation of offspring. Choosing as parents those individuals of superior estimated genetic merit for traits of interest. (BIF Guidelines, 8th Edition)

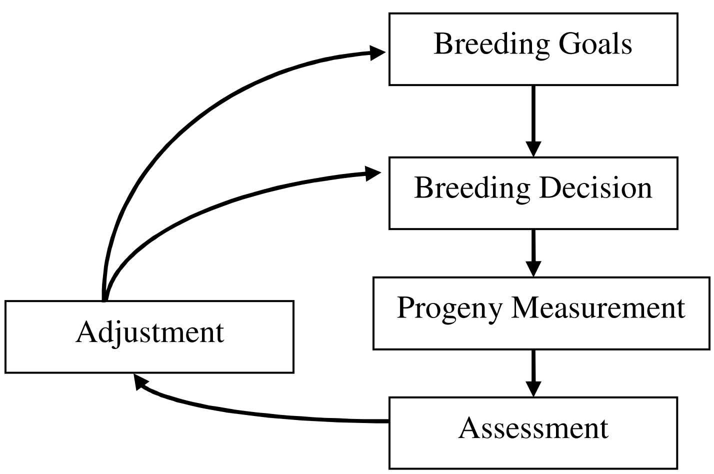


Figure: A representation of the circular nature of the selection process. Defined breeding goals assist in assessment and determining adjustments to the breeding program.

Rate of Progress (RoP)
Rate of Progress in a breeding program is dependent upon 2 factors: selection intensity and generation interval.

Selection differential (reach): The difference between the average for a trait in selected cattle and the average for that same trait of the group from which they came. The expected response to selection for a trait is equal to the selection differential times the heritability of the trait. (BIF Guidelines, 8th Edition)

Selection Intensity: The selection differential measured in phenotypic standard deviation units of the selected trait. It is inversely proportional to the proportion of available replacements actually selected to be parents of the next generation. For example, with AI compared to natural service, only a small proportion of the bulls needs to be selected, and the selection intensity, selection differential, and selection response will be high. (BIF Guidelines, 8th Edition)

A higher selection intensity or a shorter generation interval both result in more rapid genetic improvement. Selection intensity refers to the culling rate of potential sires and dams. **If more animals are culled or fewer animals are selected as parents, then fewer genes are left in the population to pass on to the next generation and thus progress is more rapid.**

If generation interval is shortened, parent stock can be turned over more rapidly, incorporating selected genes into the population sooner and more often.

RoP = Selection Intensity / Generation Interval
RoP increases as Selection Intensity increases and/or Generation Interval decreases

Full Service Genetic Provider

The concept of being a full service provider of genetics is discussed here as a separate topic, although it strongly relates to operational goals. Consider becoming a Full Service provider as working towards becoming the one stop shopping centre for you r customer's genetic needs.

As discussed previously, it is important for the commercial industry to be able to take advantage of hybrid vigour. This implies that the full service provider provides more than one breed to their customer, and fulfills more than one selection objective with their products. It is possible to become a full service provider through cooperation with like-minded individuals who deal in other breeds.

The following questions serve as food for thought in considering becoming a full service provider of genetics.

1. How many breeds or composites do you maintain?
2. What are the selection objectives of each breed?
3. How many females do you maintain in each breed?
4. How many bulls do you use per year per breed?
5. What is the average age of your females? Of your bulls?
6. What percentage of females are bred to produce purebreds and what percentage are bred to produce crossbred/commercial replacement animals?
7. What percentage of bull and heifer calves are performance tested to 1 year of age?
8. What traits do you routinely measure on animals up to 18 months of age?
9. What traits do you routinely record on producing females?
10. What percentage of your selection emphasis is placed on visual traits and what percentage on EPDs?
11. What percentage of heifers do you retain for breeding each year?
12. What percentage of bulls do you retain each year for breeding?
13. How many herd sires are used form outside your herd annually?
14. What is the average EPD profile and range on breeding females and bulls?
15. What has been your herd genetic trend for each trait over the last 5 years?
16. Do you collect data from your commercial customers? If so what type of data do you collect?
17. How many times have you visited or talked with your direct customers in the last 12 months?
18. How many times have you talked with your customer's customer (feedlots, packers, retail) in the last 12 months?

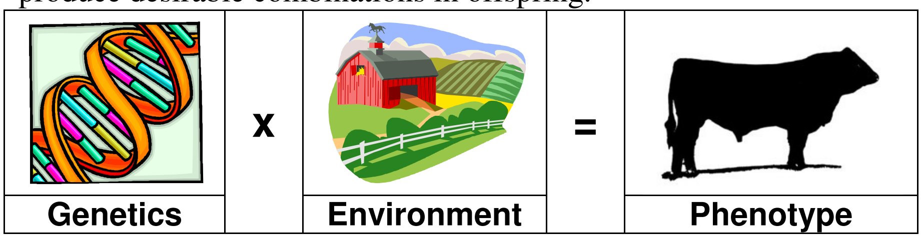
Conceptually, being a full service provider of genetics, means nothing more than meeting all of the varied needs of your customers, including provision of target specific genetics for crossbreeding, warranty, and service. This important concept in genetics is nothing more than in depth customer service, but it is worth considering in terms of an individual seedstock operation.

Performance Recording

In order to improve our breeding stock, we have to measure what they are doing and select those that are superior. This is the basis behind all genetic improvement.

Phenotype and Genotype

All animals are a combination of their genetics interacting with the environment. Once the sperm and egg are joined, the genetic makeup of the animal is fixed for its' lifetime. It is impossible to change an animal's genetics once it is conceived. This is the reason we plan matings. We hope to use our knowledge of the genetics of the potential parents in order to produce desirable combinations in offspring.



Phenotype: The visible or measurable expression of a character; weaning weight, post weaning gain, or reproduction for example. For most traits phenotype is influenced by both genotype and environment. The relative degree to which phenotypic variation among individuals is caused by transmissible genetic effects is the heritability of a trait. (BIF Guidelines, 8th Edition)

Genotype: The two alleles present at a locus in an individual. Far a locus with only two alleles, three genotypes are possible. For example, at the polled/horned locus in cattle, two common alleles are P (the dominant allele preventing growth of horns) and p (the recessive allele allowing horn growth). The three possible genotypes are PP (homozygous dominant), Pp (heterozygous or carrier), and pp (homozygous recessive). (BIF Guidelines, 8th Edition)

As breeders we attempt to enhance the genetic combinations or potential of our cattle. To do this we must select genotypes. Unfortunately we cannot see genotype, only how it is expressed. For this reason we measure phenotype, and pool data to determine genotype by pedigree relationships and contemporary groupings.

It is important to note that the genotype must fit the environment in order to result profitable production. This is called genotype x environment interaction. For example, in areas of higher rainfall, cows with a larger mature size and greater milk production may be most profitable, however in drier areas, smaller females with only moderate milk production may be optimal.

Genes – genes are particles of DNA that code for different characteristics. Genes are the blueprint for animal growth. Genes are composed of deoxyribonucleic acid or DNA and are found on chromosomes which are contained in the nucleus of the animal's cells.

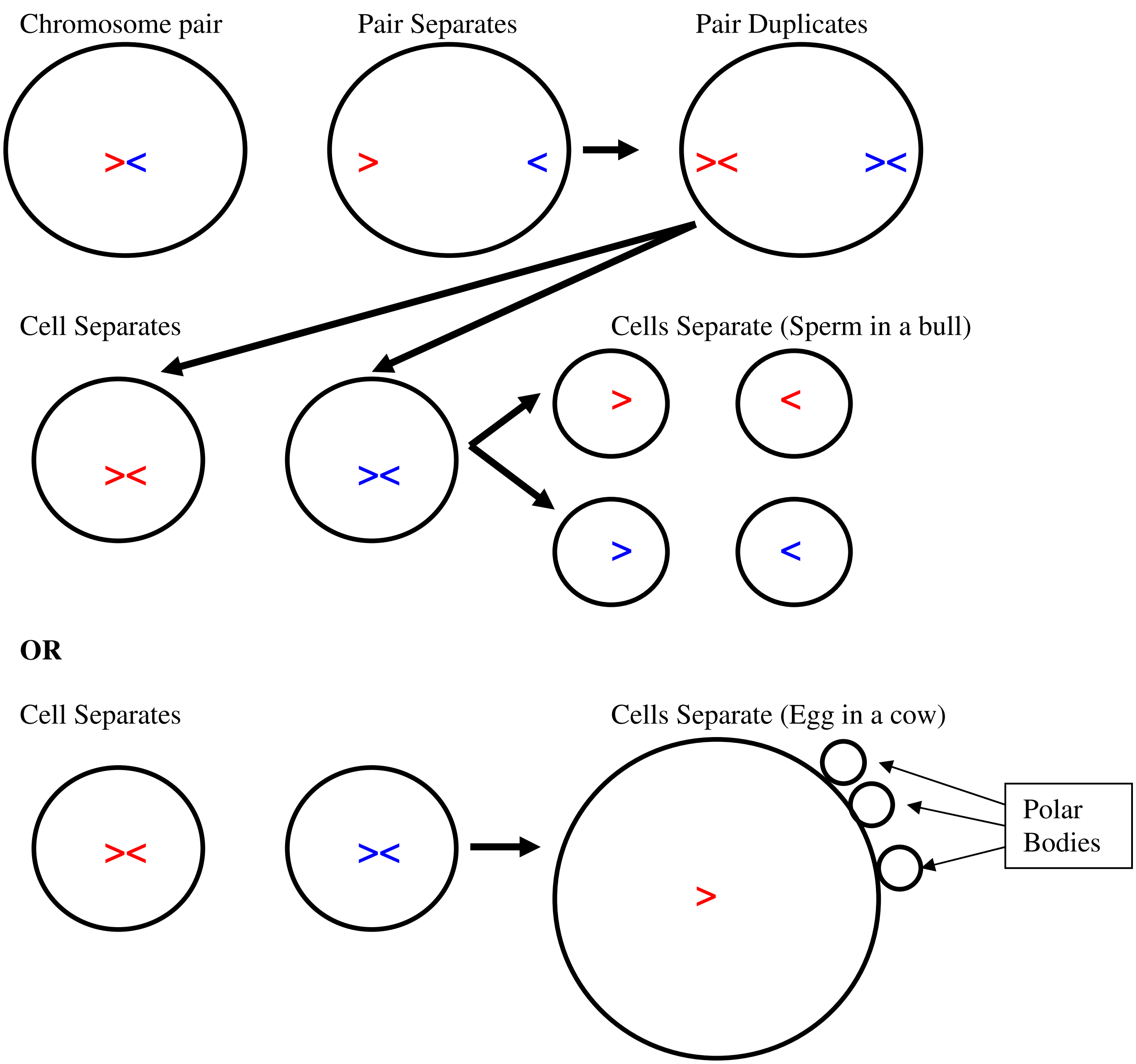
Genetics: the study of genes and inheritance

Meiosis

Meiosis is the process by which bulls produce sperm and cows produce eggs.

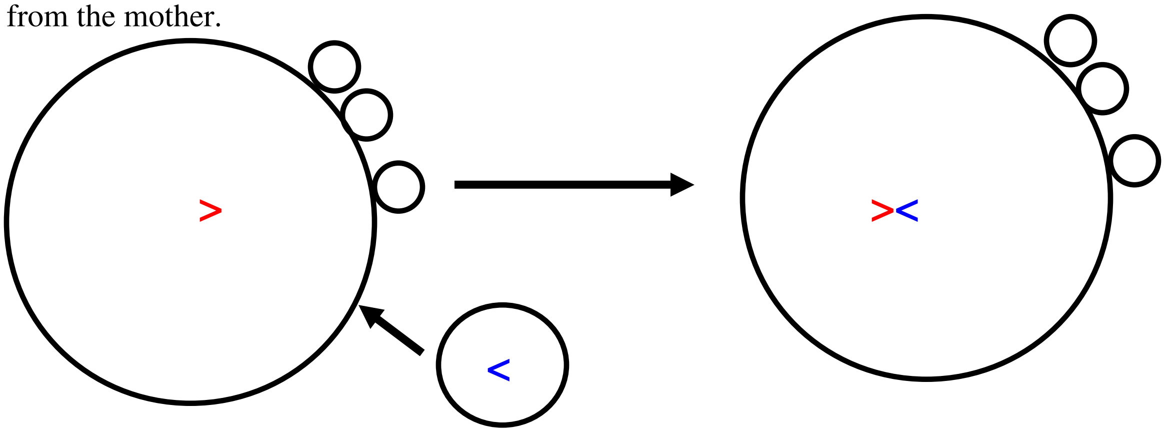
Every cell in a cow contains 60 chromosomes arranged in 30 pairs. Through the process of meiosis this number is halved in eggs and sperm. When fertilisation occurs, the number is again brought back up to 60 chromosomes.

The chromosome pairs separate, duplicate, separate and then separate again to reduce the number to 30.



Once the chromosome number is halved in the egg, the other three cells produced are absorbed into the main cell to provide nourishment. These 3 cells are called polar bodies (eggs are much bigger than sperm).

When a sperm fertilizes an egg the chromosome pairs match up and the animal is again left with 60 chromosomes in 30 pairs. This is how an animal gets ½ of its genes from the father and ½ from the mother.



Egg Sperm Fertilized Egg (Zygote)

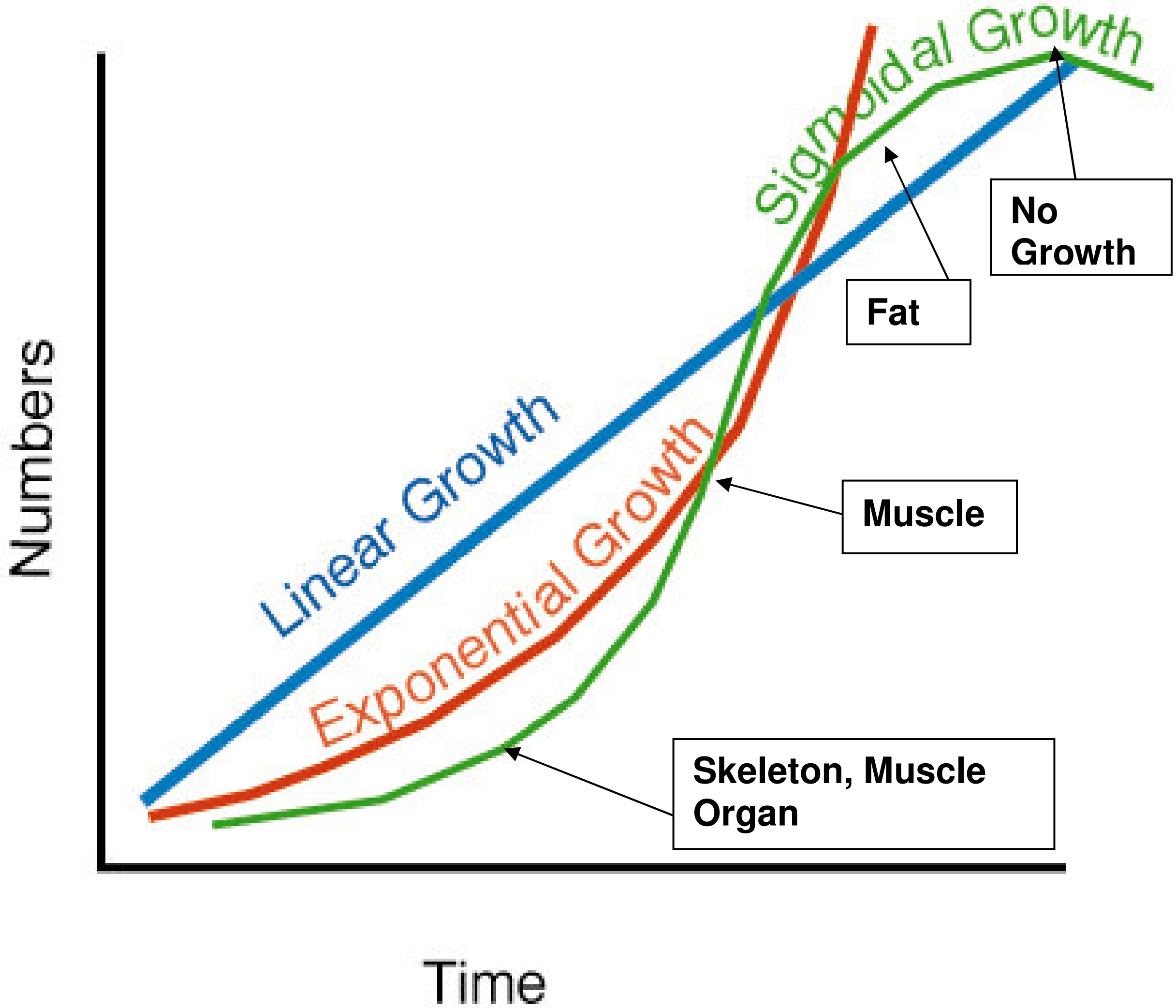
There are several good internet sites that deal with Meiosis. The following are a couple of easily understood ones, with good visuals. You can also do a search using your web browser.
http://www.csuchico.edu/~jbell/Biol207/animations/meiosis.html
http://www.biology.arizona.edu/cell_bio/tutorials/meiosis/main.html

In genetic selection we are concerned with trying to identify superior genes that can be transmitted by eggs or sperm. Identifying these genes is vital to a successful breeding program, because once the egg is fertilised, the genetic makeup of that animal is set for life. In other words, once the sperm fertilises the egg, there is no new DNA added to the animal. Its genetic potential is set.

This is why it is important to performance test and to know our goals as breeders, so that we can optimize our chances of establishing the best genetic combinations.

Growth Curve

Once the egg is fertilised, mitosis or cell division begins. This is the process of growth that we are familiar with. Cells divide, then grow and divide again, increasing the number, size and type of cells. The result of this process is a growth curve.



Every animal has a growth curve. The curve is sigmoidal or S shaped. At various points this line is curvilinear and at other points it is relatively flat. Animals put on tissue in the following order: Central Nervous System, Bone, Muscle (most rapid growth phase), Fat (sub Q, Peritoneal, Marbling).

Different breeds tend to reach different points on the curve at different ages. Breeds which marble, tend to achieve smaller mature size and reach the fat deposition portion of the curve earlier. Breeds with more lean growth, tend to spend slightly more time in the rapid growth phase of the curve. Breeds which reach the fat production stage of the curve sooner (eg: Angus, Hereford) also tend to reach sexual maturity at an earlier age.

Fat takes much more energy to produce than muscle tissue. This accounts for the slower growth rate.

We try to take measurements within the flat parts of the curve so that we can easily adjust the data and compare animals. Contemporary groups attempt to define animals that are along the same area in the growth curve. This is the reason for the age ranges for taking weaning and yearling weights on animals. Contemporary groups and adjustments will be discussed in detail in a later section.

Total Herd Reporting

In order to make good decisions in our breeding program, we require complete information on the performance of our cattle. Incomplete reporting could be compared to accounting for Enron or WorldCom. It may look nice at first, but it is misleading and counterproductive in the long run.

The implementation of total herd reporting represents a fundamental shift in the way we have traditionally thought about performance testing. The THE program shows that we are concerned about completeness of data and also that identifying the low end is as important as improving the top end of our product. For example, if we only report the top ½ of our calves, the group that is from the 50 to 75% range in our herd actually appears to be the bottom end. This can be referred to as data bias, or a bias shift.

Let's look at an algebraic analogy:
A+B = C
If A = 1 and B = 2 we can figure out that the total production of C = 3
1 + 2 = 3
If we don't report A, because it is too small and in the bottom half of the herd. A + B = C is now:
? + 2 = C
If we try to determine the average production in this herd we know that (1+2) / 2 = 1.5
Without reporting A, we can only guess.
And it is very difficult to accurately determine the genetic merit of either A or B.

This is very similar to the concept of total herd reporting.

Complete reporting does not make your poor cows look bad, but rather incomplete reporting on all calves, discounts your superior females.

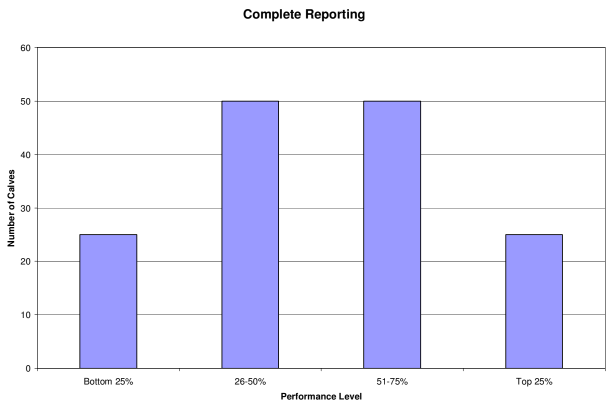
In order to demonstrate the concept of data bias let's look at a weaning group of 7 calves. If a producer reports all of his weights the average 205 Day weight of the group is 646.4 pounds. By cutting the two bottom calves out of the group and not reporting them the producer has reduced the relative performance of his better calves (shown in the New Index column). For example, calf A goes from being slightly above average to below average.

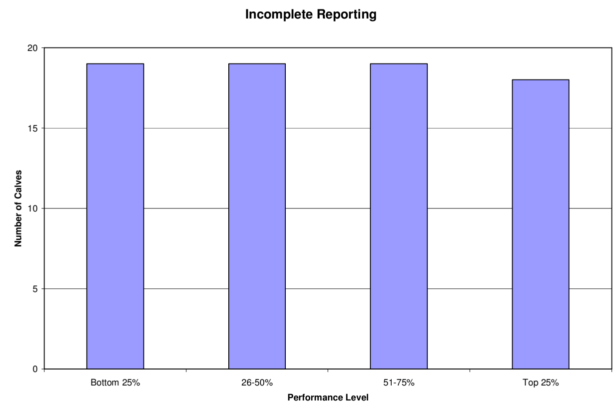
Calf	205 Day Adjusted Wt	Index	New Index	Sire
A	650	100.6	98.2	2
B	675	104.4	102.0	1
C	605	93.6	XXX.X	1
D	635	98.2	95.9	2
E	670	103.6	101.2	2
F	680	105.2	102.7	2
G	610	94.4	XXX.X	1

In this example the calves may also be from 2 different sires. If the two calves that were removed were from the first sire, we have inadvertently brought him closer to the other sire in the performance of his progeny. In the first example Sire 2's progeny have an average index of 101.9 and Sire 1's progeny have an average index of 97.5. By failing to report the bottom two calves in the group the indexes are now 99.5 (Sire 2) and 102.0 (Sire 1). We have effectively reversed the appearance of these two sires by failure to report all the data.

This concept applies to all aspects of data collection, including calving records. Relative birth weights can also be influenced by incomplete reporting in the same way. For example, not reporting your heavy calves makes your light calves relatively heavier, when compared to the remaining calves.

If we look at the following charts, we can see that by only reporting the top ½ of the calves we have moved from comparing 150 calves, to only comparing 75. As well, we have moved half of the top calves into the bottom ½ of the herd, and changed the distribution within the group. We have reduced the variability and lessened our opportunity to make good selection decisions.





BIAS SHIFT

This has negative marketing and selection implications, as indexes are reduced on calves that should appear better.

In profitable beef production, fertility is paramount to success. Without the collection of complete breeding and production and fertility information it is impossible for us to identify those animals that carry optimal genetics. Even a trait as simple as pounds weaned per cow exposed requires knowledge of breeding and production data across the entire herd. If we look at the above charts as an example, we see that incomplete reporting washes out, or hides our superior animals. A good example, if the cow that is 5 years old and has only had 1 calf reported to the dataset. While the odds are good that her other calves may not have been of a quality to register, by failing to report them, we do not know if the dam was open for the first 3 years of her productive life, or simply failed to produce quality calves.

As well, collection of disposal information on females and calves may provide the potential to identify genetics for disease resistance, longevity, and other traits of growing importance to profit.

If we believe that beef production is a combination of genetic factors interacting with the environment, then it is vital that we collect as much information from all environments as possible.

Successful breed improvement programs revolve around the concept of measuring traits that are important, comparing those traits between animals and then selecting the superior animal. Total herd reporting allows us to do this objectively.

Data Collection

Breeding Information

Breeding information is collected on every female. It is important to know what cows were exposed to which sires. The reason for this is that in order to enhance fertility we need to know which cows were bred, and of those which ones successfully calved.

Calving Information

Calving information is collected, as this is the primary time for calf losses in the commercial industry. As commercial herds get larger, and more small producers work off farm, the need for unassisted, live calves continues to rise.

Weaning Information

Weaning information is collected because most commercial producers still market calves at weaning, based on live weight.

Weaning is also the point in time at which the direct impact of the cow on her calf's performance is ended. This means it is a very good time to take measurements on cows and calves in order to determine female productivity.

Yearling Information

Yearling data is collected as most commercial cattle go into feedlots and are typically marketed at around a year of age. Gains and weight at a year of age are therefore important to the profitability of cattle feeders. As well, measures such as pelvic size and scrotal are often collected at a year of age. These values are useful indicators of maternal and fertility traits in potential replacement females.

Ultrasound Information

Beef cattle ultimately end up as beef. In recognizing the importance of this, ultrasound data collected at around a year of age, allows us to get an idea of carcass characteristics without slaughtering the potential seedstock animal. Many animals are sold off feed on their carcass merit or a "grid" pricing system. For this reason ultrasound information is important to collect.

Carcass Information

Carcass information is collected for much the same reason as ultrasound data. While carcass information is not collected on those animals retained for breeding purposes, it is insightful to collect carcass data on cull animals, and progeny groups from organised breeding scenarios.

Forms

This section deals strictly with filling out the forms to collect performance information.

THE Female Enrollment Instructions

As in previous years, breeders simply need to review their inventory and identify those animals that have been disposed. The remaining females on inventory will automatically be enrolled if a disposal code is not included. This change is designed to reduce the paperwork required of THE herds and enhance the level of complete reporting.

Work is ongoing to capture heifer pregnancy data. All non-disposed yearling heifers now appear at the end of the enrollment listing, and breeders wishing to participate in heifer pregnancy work can enter either a disposal code, or a breeding code and resulting pregnancy test result. Heifers kept as replacement females can be enrolled as per the enclosed fee schedule.

As before THE breeders can submit all data and register and transfer offspring born to THE cows during the enrollment year. **Complete** herd data submitted through the THE program will continue to be sent to the genetic evaluation and will be the driving force behind EPDs for the Canadian Simmental breed.

Example:

DAM			BREEDING								
TATTOO NAME	REGNUM		SIRE REG	SIRE TATTOO	AI/ NAT	FROM	TO	FALL SPR F/S	PREG Y/N	BREEDING CODE	DISP CODE
									DISPOSAL DATE		
ABC 123P	123456	1)	654321	EFG 456S	A	15/06		S	Y	100	1
SM COW 123P		2)	789101	JKL 789T	N	15/07	15/09				
1			2	3	4	5	6	7	8	9	10
									11		

Dam

1. Tattoo, Name, Regnum

This section is pre-printed with the tattoo, name and CSA registration number of the dam. Females are printed in tattoo order by year of birth.

If the dam does not appear on the page, simply add her to the end of the listing.

All active yearling females will print at the end of the listing. This is for the collection of heifer pregnancy data. If you wish to participate, please indicate a breeding code and a resulting pregnancy test result for all heifers that were exposed to breeding in 2009. For females that were not exposed, please indicate an appropriate disposal code.

Breeding

Breeding information is used to provide an objective reporting measure for production, and to establish fertility trait measurement. All active yearling heifers appear on the listing. Please indicate a breeding code and resulting pregnancy test information for those heifers that were exposed over the past year if you wish to participate in the heifer pregnancy analysis.

2. Sire Reg – enter the CSA registration number of the sire used to breed the cow.

3. Sire Tattoo – enter the tattoo of the sire used to breed the cow.

4. AI/Nat – complete the box with an A if the breeding was done using artificial insemination, N for natural service

5. From – enter the AI or observed breeding date, or the date the sire was turned out with the female in day/month/year format. (E.g.: 15/06/2009 is June 15, 2009)
6. To – enter the date the sire was pulled, in the case of natural service in day/month/year format.
7. Fall Spr F/S – enter 'F' if the animal is a fall calver. If the animal is a spring calver enter 'S' or leave the space blank.
8. Preg Y/N – if the dam was pregnancy tested and confirmed pregnant enter Y (Yes). If the dam was tested and confirmed open enter N (No). If the dam was not preg-tested leave this space blank.
9. Breeding Code – enter the three digit breeding code to describe how the cow was bred. (see following page)
10. Disp Code – enter the three digit disposal code, if the dam was removed from the herd. (see following page)
11. Disposal Date – enter the date the female was removed from the herd in day/month/year format.

Breeding Codes

100	Cow exposed
101	Cow calved
102	Dry (cow calved but did not wean a calf)
103	Cow lost calf but raised foster calf
104	Open (did not conceive)
105	Cow used as embryo donor cow
106	Cow used as recipient
107	Cow not exposed
108	Aborted or otherwise lost calf before due date
109	Bred Commercial

Cow Disposal

202	sold for breeding purposes, certificate not transferred
203	died, sickness or disease
204	died, injury
205	died, calving difficulty
206	died, old age
207	died, other
208	culled, calf performance / productivity
209	culled, feet & legs
210	culled, disposition
211	culled, teat & udder soundness problems
212	culled, calving difficulty
213	culled, age
214	culled, open or aborted calf
215	culled, injury
216	culled, sickness or disease
217	culled, prolapsed
218	culled, cow lost calf (not due to calving difficulty)
219	culled, cancer eye
220	culled, colour
221	culled, other reasons

Important Note: Complete performance information is encouraged on all producing females, as it greatly improves the quality of the data, and the ensuing genetic evaluation.

Calving Data Instructions

1. Breeding Data

If breeding information was reported at enrolment, then the list will preprint with the applicable information. Please complete the record for the calf, next to the appropriate service information.

BREEDING DATA					
DAM	SIRE	BREEDING			
REGNUM	REGNUM	AI/NAT A/N	AI DATE D/M/Y	FLUSH DATE D/M/Y	RECIP ID
TATTOO	TATTOO	EMBRYO E		TRANSPLANT DATE D/M/Y	RECIP BTH YR RECIP BREED
123456	654321	A	15/06/2009		
ABC 123P 2000123456	EFG 456S				

Sire

Regnum – enter the official CSA registration number of the sire of the calf
Tattoo – enter the tattoo of the sire of the calf

Breeding Code – enter the appropriate breeding code for the dam
AI / Nat (A/N) – enter A if the calf is the result of an AI service, enter N if the calf is the result of natural service
AI Date (D/M/Y) – enter the AI date for the breeding that resulted in the calf (if applicable) in day/month/year format (eg: 15/06/2009 would be June 15, 2009).

Additional Embryo Information

BREEDING DATA					
DAM	SIRE	BREEDING			
REGNUM	REGNUM	AI/NAT A/N	AI DATE D/M/Y	FLUSH DATE D/M/Y	RECIP ID
TATTOO	TATTOO	EMBRYO E		TRANSPLANT DATE D/M/Y	RECIP BTH YR RECIP BREED
123456	654321	A	15/06/2009	15/06/2009	789J
ABC 123P 2000123456	EFG 456S	E		22/06/2009	1999 SMSMANHE

Embryo (E) – enter an E if the calf is the result of an embryo transplant.
Flush Date (D/M/Y) – enter the date the embryo was flushed in day/month/year format (eg: 15/06/2008 would be June 15, 2009).
Transplant Date (D/M/Y) – enter the date the embryo was transplanted in day/month/year format (eg: 22/06/2009 would be June 22, 2009)
Recip ID – enter the identification of the recipient dam.
Recip Bth Yr – enter the year of birth of the recipient dam.
Recip Breed – enter the breed makeup of the recipient dam using a combination of 4 – 2 letter breed codes. In this example the dam is ½ Simmental, ¼ Angus, ¼ Hereford

Applications to register Embryo Calves require Transplant/Flush documents to be provided!!!

2. Birth Information

Complete the birth information for the calf, next to the applicable breeding information.

There have been some new additions to this part of the form, in order to facilitate data collection to better understand the genetics of the Simmental female. For those who wish to participate, supporting documentation for these sections can be found at the end of this document.

BIRTH INFORMATION										
TATTOO	LOC L/R/B	BIRTHDATE D/M/Y	SEX M/F	TWIN #	EASE	H/P/S	BLACK Y/N	BIRTH WT/LBS	GRP	VIG
JKL 789X	L	15/01/2010	M	1	U	P	N	105	1	1

ANIMAL NAME (25 CHARACTERS MAX)																								
S	I	M	B	U	L	L		C	A	L	F		7	8	9	X								

Tattoo – enter the tattoo of the calf
Loc (L/R/B) – enter the tattoo location (L – left ear, R – right ear, B – both ears)
Birthdate (D/M/Y) – enter the birthdate of the calf in day/month/year format. In this example the calf was born on 15/01/2010 or January 15, 2010.
Sex (M/F) – enter the sex of the calf (M – Male, F – Female)
Twin # - if the calf is a twin enter a 2, if a triplet enter 3. For single calves enter 1 or leave blank.
Ease – enter the ease with which the calf was born.
H/P/S – enter the horn status of the calf (H – calf is horned, P – calf is polled, S – calf has scurs/loose horns)
Black (Y/N) – enter Y if the calf is black, otherwise leave blank
Birth WT/Lbs – enter the actual measured birth weight of the calf in pounds (do not record guessed weights)
Grp – enter the birth group of the calf. For example if you keep your first calf heifers separate, enter these as group 1 and your mature cows as group 2.
Vig – enter the calf's vigour score
Twin Code – enter the code that is applicable to how the twin was raised.
Calf Disp – if the calf died or has been disposed of, enter the appropriate code
Disp Date – enter the date in day/month/year format on which the calf was disposed from the herd.
Animal Name (25 Characters Max) – if you wish to register the animal or record a name with the CSA enter the name in the appropriate spaces.

BIRTH INFORMATION		
MISC CODES/DATES		
TWIN CODE	CALF DISP	CALF DISP DATE

STEERED DATE

Twin Code – if the calf is a twin (or multiple birth) enter the code for how the calf was raised (eg: 3 = raised on foster dam)
Calf Disp – if the calf was disposed of or died, indicate the appropriate disposal code
Calf Disp Date – if the calf was disposed of or died, enter the date in day/month/year format.
Steered Date (D/M/Y) – enter the date the calf was castrated in day/month/year format (if applicable).

3. Dam Data

BREEDING CODE	101	DAM WT LBS	1450	DAM WT DATE	15/01/2010	DAM DOCIL	1	DAM BCS	3	DAM MA	1	DAM UDDER SCORE	44	DAM DISP		DAM DISP DATE	

Breeding Code – enter the appropriate breeding code for the dam at the time of calving.
Dam Wt / Lbs – if you choose to weigh your cows on, or near calving, such as during their final Scour Guard shot, please provide the weight in pounds
Dam Wt Date – enter the date in day/month/year format when the female was weighed and/or body condition scored. In this example the female weighed 1450 pounds and was weighed on January 15th, 2010.
Dam Docil – enter the female's docility score when she calved.
Dam BCS – if you body condition score your cows at calving, please enter the information here on a scale of 1 to 5.
Dam MA – enter the dam's mothering ability score
Dam Udder Score – enter the udder score of the dam. Udders must be scored within 24 to 48 hours of calving. Enter teat size, then suspension, scoring from 0 to 5 for each.
Dam Disp – if the female was culled or disposed of, please enter the appropriate disposal code.
Dam Disp Date – enter the date the female was disposed of in day/month/year format.

4. Register/Lab

REGISTER / LAB		
DNA	CERT	APPLICANT #
COMMENTS		
PCB	Y	99999

Cert –enter a Y (for Yes) if you wish to register the calf upon submission of your calving data. Please ensure all relevant information is completed to ensure the registration process proceeds as rapidly as possible.
DNA – if you wish to request a DNA test for the calf enter the appropriate code in the box.
Applicant # - enter the CSA member number of the person/membership that is applying for registration on the calf.
Comments – enter any relevant comments pertaining to the calf.

5. Signatures

Please ensure that any required signatures are completed at the bottom of each applicable page.

Nat. Service Sire – the signature of the owner of any natural service sires used that are not owned by the applicant are required in order to complete the registration of a calf.
Applicant – the signature of all owners who may be applying for registration of a calf are required.

Return completed forms to the CSA office at:
Canadian Simmental Association
#13, 4101 – 19th St NE
Calgary, Alberta T2E 7C4

IMPORTANT NOTES:

Herds with multiple ownership, or herds which are operated as a single unit, should submit calving information on all animals together under a single or master herd number. This does NOT affect ownership or registration requirements, however it does ensure that calves are handled correctly in the genetic evaluation and that proper credit is given to the animal's genetic merit.

To ensure accuracy of data entry and enhance the ability of staff to investigate breeder concerns, all forms will remain on file in the CSA office. Forms will not be returned. It is therefore strongly advised that you make photocopies of the completed forms for your records.

Applications for registration must be accompanied by appropriate signatures and documentation. Transplant/Flush documents must be provided to register ET calves.

In order for data to be included in CSA genetic EPD evaluations, it must be received by the CSA office no later than JUNE 1st for the Fall Evaluation and NOVEMBER 1st for the Spring Evaluation!!!

Weaning Data Collection Instructions

1. Breeding Data

Submission of calving data to the CSA prompts the weaning data forms to print with applicable information pre-printed. Please complete the record for the calf.

BREEDING DATA / INFORMATION DE SERVICE			
CALF	DAM	SIRE	
REGNUM	REGNUM	REGNUM	BIRTHDATE
TATTOO	TATTOO	TATTOO	D/M/Y
2003123456			
987654	123456	654321	15/02/2010
JKL 789X	ABC 123P	EFG 456S	Sex M

Calf - Regnum – the official CSA registration number of the calf prints if the calf has been registered
Tattoo – the tattoo of the calf

Dam - Regnum –the official CSA registration number of the dam of the calf
Tattoo –the tattoo of the dam of the calf

Sire - Regnum –the official CSA registration number of the sire of the calf
Tattoo –the tattoo of the sire of the calf

Birthdate (D/M/Y) – the reported birthdate of the calf in day/month/year format

Sex – the sex of the calf

2. Weaning Information

Complete the weaning information for the calf, next to the applicable breeding information.

Complete the weaning/dam section if you collect this information on your cow herd at weaning.

WEANING/CALF								WEANING/DAM		
WEANING								WT/Lbs		
DATE D/M/Y	WT/Lbs	CREEP WKS	Grp	DOCIL	Hip HT IN	H/P/S	CALF DISP	DATE D/M/Y	BCS	Hip HT IN
								1450		
15/9/2010	750	3	1	2	50	P		20/9/2010	4	54
S I M B U L L C A L F 7 8 9 X										

Weaning/Calf
Date (D/M/Y) – enter the weaning weigh date in day/month/year format. In this example the calf was weighed on 15/09/2010 or September 15, 2010.
WT/Lbs – enter the weaning weight of the calf in pounds (do not record guessed weights or weights from a girth tape)

CREEP WKS – if the calf was creep fed while on the dam, enter the number of weeks. In this case the calf was creep fed for 3 weeks prior to weaning.
Grp – enter the management group of the calf. Calves that are managed together and have had equal opportunity to perform should be grouped together.
DOCIL – enter the calf docility score from 1 to 5
Hip HT (IN) – enter the calf hip height in inches
H/P/S – enter the horn status of the calf (H – calf is horned, P – calf is polled, S – calf has scurs/loose horns). If the horn status was reported at calving it will preprint in the form.
Calf Disp – if the calf died or has been disposed of, enter the appropriate code
Animal Name (25 Characters Max) – if you wish to register the animal or record a name with the CSA enter the name in the appropriate spaces. If the calf is already registered or had a name recorded at calving, it will appear in this space.

Weaning/Dam
WT/Lbs – enter the weight of the dam in pounds (do not record guessed weights or weights from a girth tape)
Date (D/M/Y) – enter the weigh date in day/month/year format. In this example the dam was weighed on 20/09/2109 or September 20, 2010. Dams should be weighed as close to the weaning date as possible.
BCS – if you body condition score your cows at weaning, please enter the information here on a scale of 1 to 5.
Hip HT (IN) – enter the dam's hip height in inches

3. Register/Transfer

REGISTER / TRANSFER					
STEERED DATE D/M/Y	**Disposal Date**	**BLACK Y/N**	**CERT**	**DNA**	
Transfer					
		Y		PCB	

Sold to/
Vendu a ____________________ Member No.
No. de Membre ______________
Address
Addresse ____________________
Postal Code
Code Postal ____________________ Sale Date
D/M/Y ____________________

Steered Date (D/M/Y) – enter the date the calf was castrated in day/month/year format (if applicable).
Disposal Date - – if the calf has been disposed of, enter the appropriate code
Black (Y/N) – enter a Y (for Yes) if the calf is black in colour
Cert –enter a Y (for Yes) if you wish to register the calf upon submission of your weaning data. Please ensure all relevant information is completed to ensure the registration process proceeds as rapidly as possible.
DNA – if you wish to request a DNA test for the calf enter the appropriate code in the box.

Transfer
Sold to – enter the name of the person who purchased the calf (if applicable)
Member No. – enter the CSA member number of the purchaser
Address – enter the complete and correct mailing address of the purchaser of the calf
Postal Code – enter the purchaser's postal or zip code
Sale Date (D/M/Y) – enter the date of sale of the calf in day/month/year format

4. Signatures

Please ensure that any required signatures are completed at the bottom of each applicable page.

Nat. Service Sire – the signature of the owner of any natural service sires used that are not owned by the applicant are required in order to complete the registration of a calf.
Applicant – the signature of all owners who may be applying for registration of a calf are required.

Return completed forms to the CSA office at:
Canadian Simmental Association
#13, 4101 – 19th St NE
Calgary, Alberta T2E 7C4

IMPORTANT NOTES:

OPTIONAL DATA – All data is optional. In order to register an animal it is required to submit information such as name, colour, and horn status as required by the CSA by-laws and the Animal Pedigree Act. If you choose to submit information such as weaning weight, then it should be submitted on ALL animals. In order to be included in the weaning weight evaluation all animals must have weigh date, weight, creep weeks (if creep fed) and management group completed. Guessed weights are not appropriate.

To ensure accuracy of data entry and enhance the ability of staff to investigate breeder concerns, all forms will remain on file in the CSA office. Forms will not be returned. It is therefore strongly advised that you make photocopies of the completed forms for your records. Please review pre-printed information for accuracy and make any required corrections.

In order for data to be included in CSA genetic EPD evaluations, it must be received by the CSA office no later than JUNE 1st for the Fall Evaluation and NOVEMBER 1st for the Spring Evaluation!!!

Yearling Data Collection Instructions

1. Breeding Data

Submission of weaning data to the CSA prompts the yearling data forms to print with applicable information pre-printed. Please complete the record for the calf.

BREEDING DATA / INFORMATION DE SERVICE			
CALF	DAM	SIRE	
REGNUM	REGNUM	REGNUM	BIRTHDATE D/M/Y
TATTOO	TATTOO	TATTOO	
2003123456			
987654	123456	654321	15/02/2009
JKL 789W	ABC 123P	EFG 456S	

Calf - **Regnum** – the official CSA registration number of the calf prints if the calf has been registered
Tattoo – the tattoo of the calf

Dam - **Regnum** –the official CSA registration number of the dam of the calf
Tattoo –the tattoo of the dam of the calf

Sire - **Regnum** –the official CSA registration number of the sire of the calf
Tattoo –the tattoo of the sire of the calf

Birthdate (D/M/Y) – the reported birthdate of the calf in day/month/year format

2. Yearling Information

Complete the yearling information for the calf, next to the applicable breeding information.

YEARLING									
Sex	DATE D/M/Y	WT/Lbs	Grp	Hip HT IN	Scrotal	Scrotal DATE D/M/Y	H/P/S	CALF DISP	
ANIMAL NAME (25 CHARACTERS MAX)									
M	15/3/2010	1500	1	52	38	20/3/2009	P	1	
S I M _ B U L L _ C A L F _ 7 8 9 W									

Sex – the sex of the calf will pre-print in this space if it was reported
Date (D/M/Y) – enter the yearling weigh date in day/month/year format. In this example the calf was weighed on 15/3/2010 or March 15, 2010.
WT/Lbs – enter the yearling weight of the calf in pounds (do not record guessed weights or weights from a girth tape)

Grp – enter the management group of the calf. Calves that are managed together and have had equal opportunity to perform should be grouped together.
Hip HT (IN) – enter the calf hip height in inches
Scrotal – enter the scrotal measurement on bull calves in centimetres. It is important that the same technician record scrotal measurements on all bulls, to avoid inconsistencies in the way the tape is pulled.
Scrotal DATE (D/M/Y) – enter the scrotal measurement date in day/month/year format. In this example the calf was taped on 20/3/2010 or March 20, 2010.
H/P/S – enter the horn status of the calf (H – calf is horned, P – calf is polled, S – calf has scurs/loose horns). If the horn status was reported at calving it will preprint in the form.
Calf Disp – if the calf died or has been disposed of, enter the appropriate code
Animal Name (25 Characters Max) – if you wish to register the animal or record a name with the CSA enter the name in the appropriate spaces. If the calf is already registered or had a name recorded at calving, it will appear in this space.

3. Register/Transfer

<table>
<tr><th colspan="6">REGISTER / TRANSFER</th></tr>
<tr><th>STEERED DATE
D/M/Y</th><th>DISP DATE
D/M/Y</th><th>BLACK
Y/N</th><th>CERT</th><th>DNA</th><th></th></tr>
<tr><th colspan="6">Transfer</th></tr>
<tr><td></td><td></td><td>N</td><td>Y</td><td>PCB</td><td>99999</td></tr>
<tr><td colspan="6">Sold to/
Vendu a ____________________ Member No.
No. de Membre ____________
Address
Addresse ____________________
Postal Code
Code Postal ____________ Sale Date
D/M/Y ____________</td></tr>
</table>

Steered Date (D/M/Y) – enter the date the calf was castrated in day/month/year format (if applicable).
Disp Date (D/M/Y) – enter the date the calf was disposed of in day/month/year format (if applicable).
Black (Y/N) – enter a Y (for Yes) if the calf is black in colour
Cert –enter a Y (for Yes) if you wish to register the calf upon submission of your yearling data. Please ensure all relevant information is completed to ensure the registration process proceeds as rapidly as possible.
DNA – if you wish to request a DNA test for the calf enter the appropriate code in the box.
Sold to – enter the name of the person who purchased the calf (if applicable)
Member No. – enter the CSA member number of the purchaser
Address – enter the complete and correct mailing address of the purchaser of the calf
Postal Code – enter the purchaser's postal or zip code
Sale Date (D/M/Y) – enter the date of sale of the calf in day/month/year format

4. Signatures

Please ensure that any required signatures are completed at the bottom of each applicable page.

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Applicant – the signature of all owners who may be applying for registration of a calf are required.

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IMPORTANT NOTES:

OPTIONAL DATA – All data is optional. In order to register an animal it is required to submit information such as name, colour, and horn status as required by the CSA by-laws and the Animal Pedigree Act. If you choose to submit information such as yearling weight, then it should be submitted on ALL animals. In order to be included in the genetic evaluation all animals must have weigh date, weight and management group completed. Guessed weights or other performance figures are not appropriate.

To ensure accuracy of data entry and enhance the ability of staff to investigate breeder concerns, all forms will remain on file in the CSA office. Forms will not be returned. It is therefore strongly advised that you make photocopies of the completed forms for your records. Please review pre-printed information for accuracy and make any required corrections.

In order for data to be included in CSA genetic EPD evaluations, it must be received by the CSA office no later than JUNE 1st for the Fall Evaluation and NOVEMBER 1st for the Spring Evaluation!!!

Ultrasound

See the Canadian Simmental Association Carcass Data Collection Guidelines.

Carcass Data

See the Canadian Simmental Association Carcass Data Collection Guidelines.

Performance Codes

The following codes are for use in completing CSA performance data collection forms

Twin #
1 or blank - Single
2 - Twin
3 - Triplet

Twin Code
1 - Raised on own dam multiple
2 - Raised on dam single
3 - Raised on foster dam

Calving Ease
U - Unassisted
E - Easy assist
H - Hard pull
S - Caesarean section
M - Malpresentation

Breeding Codes
100 - Cow exposed / AI
101 - Cow calved
102 - Dry (cow calved but did not wean a calf)
103 - Cow lost calf but raised foster calf
104 - Open (did not conceive)
105 - Cow used as embryo donor cow
106 - Cow used as recipient
107 - Cow not exposed
108 - Aborted or otherwise lost calf before due date
109 - Bred Commercial

Cow Disposal
202 - Sold for breeding purposes, certificate not transferred
203 - Died, sickness or disease
204 - Died, injury
205 - Died, calving difficulty
206 - Died, old age
207 - Died, other
208 - Culled, calf performance / productivity
209 - Culled, feet & legs
210 - Culled, disposition
211 - Culled, teat & udder soundness problems
212 - Culled, calving difficulty
213 - Culled, age
214 - Culled, open or aborted calf
215 - Culled, injury
216 - Culled, sickness or disease
217 - Culled, prolapsed
218 - Culled, cow lost calf (not due to calving difficulty)
219 - Culled, cancer eye
220 - Culled, colour
221 - Culled, other reasons

Calf Disposal Codes
301 - Aborted premature
302 - Stillborn / full term
303 - Died at birth / defect
304 - Died at birth / other
305 - Died before weaning / disease
306 - Died before weaning / other
307 - Died before yearling / disease
308 - Died before yearling / other
309 – Culled / castrated-birth weight
310 – Culled / castrated-performance
311 – Culled / castrated-physical defect
312 – Culled / castrated-disposition
313 – Culled / castrated-injury
314 – Culled / castrated-poor market opportunities
315 – Culled / castrated-colour
316 – Culled / castrated-small & inadequate testicles
317 – Culled / castrated-other reasons

Other Disposal Codes
401 – Herd bull
402 – Sale bull

DNA
BTF - Type on file (minimum requirement for natural service sire)
PCS - Parentage confirm to sire
PCD - Parentage confirm to Dam
PCB - Parentage confirm to both sire and dam (minimum requirement for AI sires)

Common Breed Codes
AN - Angus
AR - Red Angus
BD - Blonde D’Aquitaine
CH - Charolais
GV - Gelbvieh
HH - Horned Hereford
HP - Polled Hereford
HO - Holstein
LM - Limousin
MA - Maine Anjou
RP - Red Poll
SA - Salers
SS - Shorthorn
SM - Simmental
TA - Tarentaise

Body Condition Scores (BCS)
Thin
1 - Severely emaciated; starving and weak; no palpable fat detectable over back, hips or ribs; tailhead and individual ribs prominently visible; all skeletal structures are visible and sharp to the touch; animals are usually disease stricken. Under normal production systems, cattle in this condition score are rare.
1.5 - Emaciated; similar to BCS 1, but not weakened; little visible muscle tissue; tailhead and ribs less prominent.
2 - Very thin; no fat over ribs or in brisket; backbone easily visible, slight increase in muscling over BCS 2.
Borderline
2.5 - Borderline; individual ribs noticeable but overall fat cover is lacking; increased musculature through shoulders and hindquarters; hips and backbone slightly rounded versus sharp appearance of BCS 3.
Optimum
3 - Moderate; increased fat cover over ribs, generally only the 12th and 13th ribs are individually distinguishable; tailhead full but not rounded
3.5 - Good; back, ribs, and tailhead slightly rounded and spongy when palpated; slight fat deposition in brisket.
Fat
4 - Fat; cow appears fleshy and carries fat over back, tailhead and brisket; ribs are not visible; area of vulva and external rectum contain moderate fat deposits; may have slight fat in udder
4.5 - Very fat; squared appearance due to excess fat over back, tailhead and hindquarters; extreme fat deposition in brisket and throughout ribs; excessive fat around vulva and rectum and within udder; mobility may be restricted.
5 - Obese; similar to BCS 8 but to a greater degree; majority of fat deposited in udder limits effective lactation. Under normal production systems cattle in this condition score are rare.

Calf Vigour Scores
As part of a research project to look at calf vigour/mothering ability, reporting of calf vigour scores is now an option available to interested breeders. Vigour scores are assigned within calving ease groups.

0 - unobserved
1 - extremely aggressive standing and sucking behaviour
2 – somewhat aggressive standing and sucking behaviour (normal)
3 – clearly not aggressive, delayed standing and sucking behaviour
4 - required assistance to nurse
5 - was hand-fed (tube, bottle, etc.)

Thus a potential calving ease / calf vigour score would look like.
U 2 – calf was unassisted, but exhibited normal, somewhat aggressive behaviour for standing and suckling when compared to other unassisted calves.
H 1 – calf required a hard pull, but exhibited extremely aggressive behaviour for standing and sucking.

Calf vigour scores should be recorded within 1 hour of birth where possible and can be reported with the calving ease score on your forms.

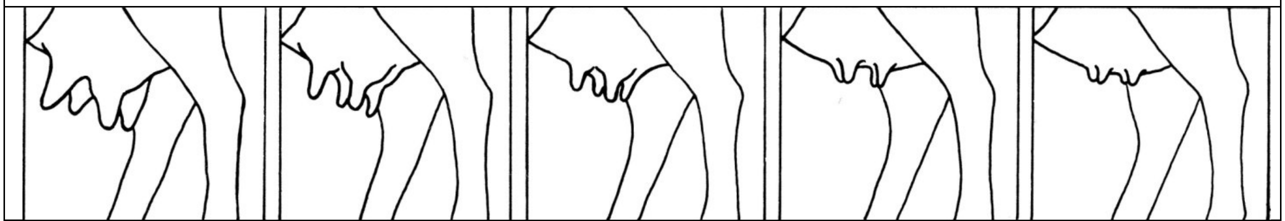
Mothering Ability Scores
As part of the research project into calf vigour and mothering ability, reporting of mothering ability scores is now an option available to interested breeders. Mothering scores should be assigned shortly after birth.

0 – unobserved behaviour
1 – strong interest in calf
2 – normal interest in calf
3 – limited interest in calf
4 – no interest in calf (required intervention)

Mothering ability scores can be recorded next to the Dam Udder Score on the forms, and should be scored with calf vigour.

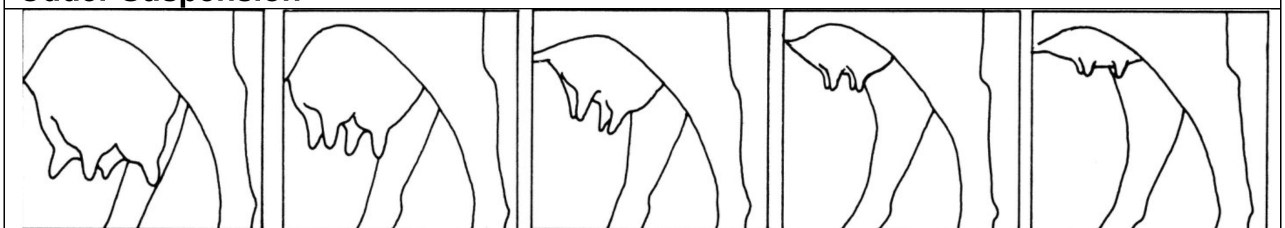
Udder Scoring

Teat Size



1 – very large, balloon shaped	**2** – large	**3** – intermediate, moderate	**4** – small	**5** – extremely small

Udder Suspension



1 – very pendulous	**2** – large	**3** – intermediate, moderate	**4** – tight	**5** – very tight

The udder score is thus a 2 digit code, with the first digit representing the teat size and the second digit representing the udder suspension. Udders should be scored within 24 hours of calving (at the same time birth weights are taken). Although the scoring system is subjective, it does serve to objectively describe differences in udder quality and thus can be useful in genetic evaluation. Any combination of scores is possible. Udders should be scored on the weakest quarter.

Scoring is relatively simple. Just remember the scale is from 0 to 5, with 3 being in the middle. This scoring system was derived from the Holstein scoring system.

Docility Scores

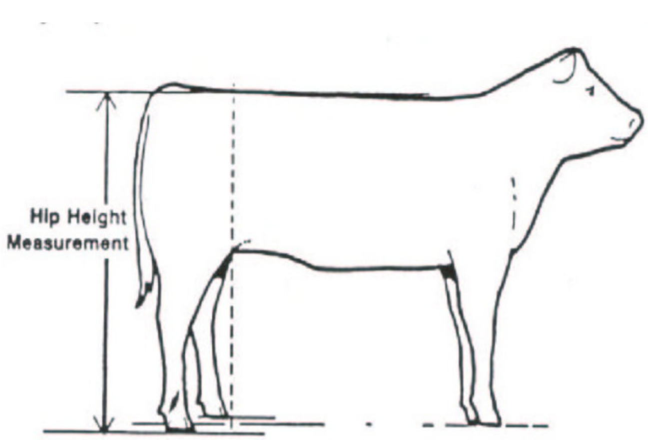
1 - Docile - Mild disposition, gentle and easily handled, stands and moves slowly during processing, undisturbed, settled, somewhat dull, does not pull on headgate when in chute, exits chute calmly

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 (how close animal will allow you to come to them before moving away) and exits chute wildly

5 – Aggressive/Very Aggressive - Similar to score 4 but with added aggressive behaviour, fearful, extreme agitation, continuous movement which may include jumping and bellowing while in chute, exits chute frantically and may exhibit attack behaviour when handled alone.



Hip Height Measurement

Hint: To easily record hip height measurements, simply tack a piece of measuring tape to the inside wall of the working chute. Hip heights can then be read as the animals are processed.

BIF Guidelines for Uniform Beef Improvement Programs (Eighth Edition – 2002)

Reports

This section deals strictly with reports sent back from the CSA. The calculations used to arrive at the reported results are discussed in a later section.

Performance Report

After the reporting of weaning and yearling information, a performance report is sent out. This report contains summary information on each animal that has had a performance record submitted.

1. Pedigree Information

PEDIGREE INFORMATION / PEDIGREE		
SIRE / PERE	DAM / MERE	CALF / VEAU
Tattoo/Reg	Tattoo/Reg	Tattoo/Reg
EFG 456S 654321	ABC 123P 123456	JKL 789X 987654

Sire Tattoo/Reg – the tattoo and registration number of the sire of the calf
Dam Tattoo/Reg – the tattoo and registration number of the dam of the calf
Calf Tattoo/Reg – the tattoo and registration number (if registered) of the calf

2. Birth Information

BIRTH INFORMATION/NAISSANCE						
GRP	SEX	EASE	HPS	BIRTHDATE D/M/Y	WT PDS LBS	BWTADJ INDEX RANK
1	F	U	P	15/01/2010	100	100 96 12/20

3. Weaning Information

WEANING INFORMATION/SEVRAGE					
GRP Mgmt/ Con	WT PDS LBS	DATE WEIGH PESEE	205 ADJ INDEX/ RANK	ADJ INDEX/ RANK	WPDA INDEX/ RANK
1 3	725	05/08/2010 203	732 110 1/8	3.06 113 1/8	3.55 112 1/8

GRP – the weaning contemporary group of the calf. More information on contemporary groups is contained in the next section.
WT LBS – the actual weaning weight of the calf in pounds
DATE WEIGH D/M/Y – the date the weaning weight was taken in day/month/year format. The number located below is the age of the calf in days when it was weighed. In this case the calf was weighed on August 5th, 2010 and was 203 days old.
205 ADJ WT – the 205 day adjusted weight of the calf
INDEX/RANK – the index of the 205 day adjusted weight within the contemporary group. The number underneath is the rank of the calf within the contemporary group and the group size. In

this example we can see that the calf's 205 day adjusted weight was 732 pounds, indexed 110 and was the heaviest calf in the contemporary group of 8 calves.
ADG – the gain of the calf from birth to weaning in pounds per day
WPDA – the weight per day of age of the calf in pounds gained per day.

4. Yearling Information

YEARLING INFORMATION/AN					
GRP Mgmt/ Con	WT PDS LBS	DATE WEIGH PESEE D/M/Y	365ADJ INDEX/ RANK	ADJ INDEX/ RANK	WPDA INDEX/ RANK
1	1195	10/04/2011 390	1143 107 1/7	2.57 102 3/7	3.09 108 2/7

GRP – the yearling contemporary group of the calf. More information on contemporary groups is contained in the next section of this manual.
WT LBS – the actual yearling weight of the calf in pounds
DATE WEIGH D/M/Y – the date the yearling weight was taken in day/month/year format. The number located below is the age of the calf in days when it was weighed. In this case the calf was weighed on April 10th, 2011 and was 390 days old.
365 ADJ WT – the 365 day adjusted weight of the calf
INDEX/RANK – the index of the 365 day adjusted weight within the contemporary group. The number underneath is the rank of the calf within the contemporary group and the group size. In this example we can see that the calf's 365 day adjusted weight was 1143 pounds, indexed 107 and was the heaviest calf in the contemporary group of 7 calves.
ADG (AVERAGE DAILY GAIN) – the gain of the calf from weaning to yearling in pounds per day
WPDA (WEIGHT PER DAY OF AGE) – the weight per day of the calf in pounds gained per day.

5. EPDs

EPDs							
CE EPD/ ACC	BWT EPD/ ACC	WWT EPD/ ACC	YWT EPD/ ACC	MCE EPD/ ACC	MWWT EPD/ ACC	MILK EPD/ ACC	SCRO EDP/ ACC
4.4 0.29	4.9 0.47	44.8 0.26	73.1 0.18	5.0 0.11	36.4 0.17	14.0 0.12	N/A

The calf's EPDs. More information on EPDs is contained later in this manual.
CE EPD/ACC – the calving ease EPD and accuracy
BWT EPD/ACC – the birth weight EPD and accuracy
WWT EPD/ACC – the weaning weight EPD and accuracy
YWT EPD/ACC – the yearling weight EPD and accuracy
MCE EPD/ACC – the maternal calving ease EPD and accuracy
MWWT EPD/ACC – the maternal weaning weight EPD and accuracy (1/2 WWT + Milk)
MILK EPD/ACC – the milk EPD and accuracy
SCRO EPD/ ACC – the scrotal EPD and accuracy

Sire Summary

1. Sire

SIRE	
REG No. **NAME**	**TATTOO**
654321 SIMMENTAL BULL 456H	EFG 456H
	Females> Males >

This section contains the registration number, tattoo and name of the sire for which progeny information is being summarised. Results are sorted by sire and sex of the offspring.

2. Birth

BIRTH											
#	**#**	**HORN STS**			**CALVING EASE**					**AVG**	**AVG**
Born	**WTs**	**H**	**P**	**S**	**U**	**E**	**H**	**S**	**M**	**BWT**	**INDEX**
5	5	2	3		5					98	102
5	5	1	4		4	1				102	99

This section summarizes the birth information reported on the sire's progeny.
 # Born – the number of calves reported to the sire. In this case 5 females, and 5 males.
 # WTs – the number of birth weights reported on the sire's calves.
HORN STS

H – the number of horned calves reported from the sire
P – the number of polled calves reported from the sire
S – the number of scurred/loose horn calves reported form the sire.

In this example the sire had 2 horned heifers, 3 polled heifers, 1 horned bull and 4 polled bulls reported.
CALVING EASE

U – the number of calves born unassisted to the sire
E – the number of calves requiring easy or slight assistance
H – the number of calves requiring heavy assistance at birth
S – the number of calves born via C-section
M – the number of calves reported as being malpresentations

In this example the sire had 5 unassisted heifer calves, 4 unassisted male calves and 1 male calf that required slight assistance at birth.
AVG BWT – the average birth weight of the sire's calves
AVG INDEX – the average birth weight index of the sire's calves within their contemporary groupings.

3. Weaning

WEANING				
#	ADJ 205D WT		DAILY GAIN	
	AVG WT	AVG INDEX	AVG WT	AVG INDEX
5	695	105	2.75	103
5	750	102	3.00	103

This section summarizes the progeny of the sire's weaning performance.
- the number of calves with weaning weights reported.

ADJ 205D WT

AVG WT – the average 205 day adjusted weight of the sire's calves
AVG INDEX – the average 205 day adjusted weight index of the sire's calves within their respective contemporary groups.

DAILY GAIN

AVG WT – the average daily gain of the sire's calves to weaning
AVG INDEX – the average gain index of the sire's calves relative to their contemporaries.

4. Yearling

YEARLING				
#	ADJ 365D WT		DAILY GAIN	
	AVG WT	AVG INDEX	AVG WT	AVG INDEX
5	1125	102	2.75	101
5	1250	105	3.25	105

This section summarizes the post-weaning performance of the sire's progeny.
- the number of calves with yearling weights reported.

ADJ 365D WT

AVG WT – the average 365 day adjusted weight of the sire's calves
AVG INDEX – the average 365 day adjusted weight index of the sire's calves within their respective contemporary groups.

DAILY GAIN

AVG WT – the average daily gain of the sire's calves from weaning to yearling
AVG INDEX – the average gain index of the sire's calves relative to their contemporaries.

5. EPDs

EPDs										
CE EPD/ ACC	BWT EPD/ ACC	WWT EPD/ ACC	YWT EPD/ ACC	MILK EPD/ ACC	Tot Mat EPD/ ACC	MCE EPD/ ACC	CW EPD/ ACC	REA EPD/ ACC	FAT EPD/ ACC	MARB EPD/ ACC
3.6 0.40	3.1 0.60	35.3 0.60	58.3 0.55	7.3 0.40	25.0 0.47	1.2 0.35	-0.9 0.40	-0.02 0.40	0.00 0.40	0.05 0.40

The sire's EPDs and accuracies. More information on EPDs is contained later in this manual.
CE EPD/ACC – the calving ease EPD and accuracy
BWT EPD/ACC – the birth weight EPD and accuracy

WWT EPD/ACC – the weaning weight EPD and accuracy
YWT EPD/ACC – the yearling weight EPD and accuracy
MILK EPD/ACC – the milk EPD and accuracy
Tot Mat EPD/ACC – the maternal weaning weight EPD and accuracy (1/2 WWT + MILK)
MCE EPD/ACC – the maternal calving ease EPD and accuracy
CW EPD/ACC – the carcass weight EPD and accuracy
REA EPD/ACC – the rib-eye area EPD and accuracy
FAT EPD/ACC – the backfat EPD and accuracy
MARB EPD/ACC – the marbling ability EPD and accuracy

Management and Contemporary Groups

Perhaps the most important and least understood concepts in performance testing are that of Management and Contemporary Grouping. The way animals are grouped affects how they are evaluated against their peers.

A Management Group is just that, a group of calves that are managed in the same way. This could mean calves that are born about the same time and raised in the same pasture until weaning are a management group. A Contemporary Group is a group of comparable calves that are raised in the same way. For example, let's take our management group of calves that were raised in the same pasture. These calves would be split by sex to form 2 contemporary groups, one of bull calves and one of heifer calves. This is because bull calves and heifer calves can not be directly compared with each other.

Management Group: a group of calves that are managed together under the same conditions (same location on the same feed and pasture). This group is split by sex, and age to form contemporary groups.

Contemporary Group: A group of cattle that are of the same breed and sex, are similar in age, and have been raised in the same management group (same location on the same feed and pasture). Contemporary groups should include as many cattle as can be accurately compared.

Think of this example:

The Canadian Olympic weightlifting team goes to the Olympic Games on the same plane and stays in the same hotel, eating the same meals. They have trained together for years prior to the games. The weightlifters are a management group. However, not all of these weightlifters will compete against each other. These athletes are split even further into male and female weight classes, so that valid comparisons can be made between athletes. These classes are a contemporary group.

Cattle are the same way. In order to make valid comparisons between calves, they must have the same management or in Olympic terms the same training. This is how management groups are defined. They also have to be similar in age, and sex. This is a contemporary group definition.

Rules for forming Contemporary Groups are as follows:

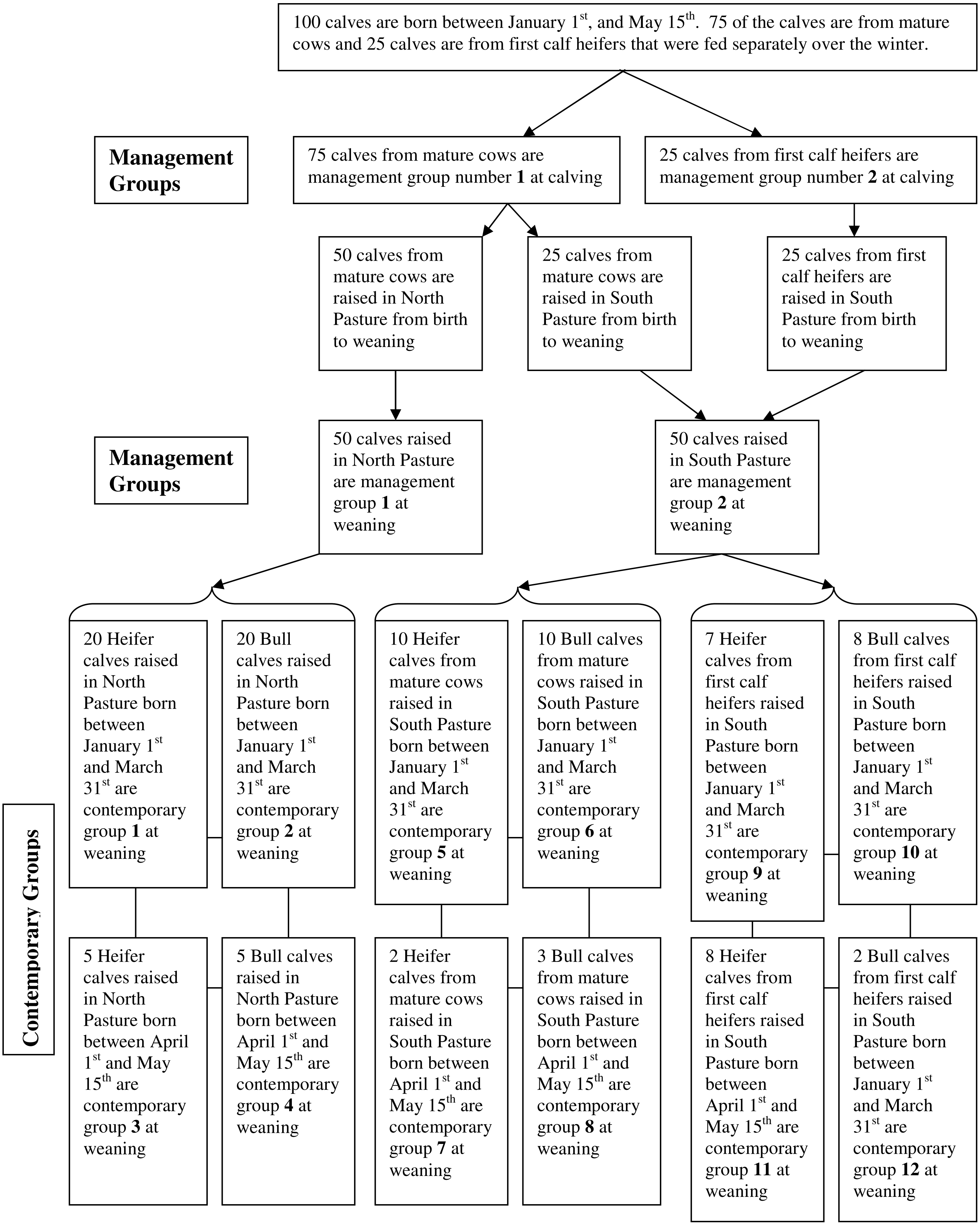
1. Calves must belong to the same management group from birth on (same birth, weaning and yearling management groups)
2. Calves must be of the same sex
3. Calves must be born within a 90 day time frame (first calf and last calf in the group are less than 90 days apart in age)

Contemporary groupings attempt to compare calves that are at the same stage in the growth curve. Age restrictions are placed on the groupings in order to enable adjustments while calves are along the linear parts of the growth curve.

In order for calves to receive a rank or an index, there must be enough calves in their contemporary group to allow for a reasonable comparison. The number of calves needed is a minimum of 5. This means 5 calves of the same age, and sex that have been managed in the same way are required in order to calculate ranks and indexes for any trait we are interested in such as average daily gain or adjusted weaning weight.

A contemporary group requires only 2 calves to be included in the EPD analyses. This is because of the extra pedigree information and advanced adjustments that can be applied during the EPD evaluation.

An example of management and contemporary groupings can be found on the next page.


100 calves are born between January 1st, and May 15th. 75 of the calves are from mature cows and 25 calves are from first calf heifers that were fed separately over the winter.
Management Groups
75 calves from mature cows are management group number 1 at calving
25 calves from first calf heifers are management group number 2 at calving
50 calves from mature cows are raised in North Pasture from birth to weaning
25 calves from mature cows are raised in South Pasture from birth to weaning
25 calves from first calf heifers are raised in South Pasture from birth to weaning
Management Groups
50 calves raised in North Pasture are management group 1 at weaning
50 calves raised in South Pasture are management group 2 at weaning
Contemporary Groups
20 Heifer calves raised in North Pasture born between January 1st and March 31st are contemporary group 1 at weaning
20 Bull calves raised in North Pasture born between January 1st and March 31st are contemporary group 2 at weaning
10 Heifer calves from mature cows raised in South Pasture born between January 1st and March 31st are contemporary group 5 at weaning
10 Bull calves from mature cows raised in South Pasture born between January 1st and March 31st are contemporary group 6 at weaning
7 Heifer calves from first calf heifers raised in South Pasture born between January 1st and March 31st are contemporary group 9 at weaning
8 Bull calves from first calf heifers raised in South Pasture born between January 1st and March 31st are contemporary group 10 at weaning
5 Heifer calves raised in North Pasture born between April 1st and May 15th are contemporary group 3 at weaning
5 Bull calves raised in North Pasture born between April 1st and May 15th are contemporary group 4 at weaning
2 Heifer calves from mature cows raised in South Pasture born between April 1st and May 15th are contemporary group 7 at weaning
3 Bull calves from mature cows raised in South Pasture born between April 1st and May 15th are contemporary group 8 at weaning
8 Heifer calves from first calf heifers raised in South Pasture born between April 1st and May 15th are contemporary group 11 at weaning
2 Bull calves from first calf heifers raised in South Pasture born between January 1st and March 31st are contemporary group 12 at weaning

In this example there are 2 groups of cows at calving. Mature cows and first calf heifers. These cow groups are assigned a management group number at birth, when calving is reported. In this case the mature cows were given management group number 1, and the first calf heifers were given management group number 2.

The producer then put 50 of his mature cows into the North Pasture for the summer. He put 25 of his mature cows and all 25 of his first calf heifers in the South Pasture over the summer. The cows in the North Pasture are shown as management group number 1 at weaning and the cows in the South Pasture are shown as management group number 2. This means that calves in the North Pasture were managed the same from calving to weaning and calves in the South pasture were managed together from calving until weaning.

It begins to get more confusing at the contemporary group stage. The calves in the North Pasture are split into 4 contemporary groups. The heifers and bulls are split apart into 2 groups. This is because we cannot directly compare bull calves and heifer calves. These 2 groups are then split because of the age of the calves. Heifer calves born in the first 90 days are grouped together, and later born heifers are grouped separately. The same is done with the bull calves. This is because it is difficult to compare calves that are over 3 months different in age at weaning. Since each of the contemporary groups have at least 5 calves in them, all of the calves in contemporary groups 1, 2, 3, and 4 will receive ranks and indexes.

The 50 calves in the South Pasture are also split by sex into bull calves and heifer calves. These groups are split by age as well, with calves born in the first 90 days of the calving season being split out from later born calves. The calves in the South Pasture must also be split based on their management at calving time. Because of the different management at calving between the mature cows and the first calf heifers, the calves have not had equal opportunities to perform. It would be like comparing the amount a weightlifter that weighs 100 pounds can lift versus a weightlifter that is 320 pounds. Therefore the calves from mature cows are split out from the calves from the first calf heifers.

Contemporary groups 7, 8, and 12 would not receive ranks and indexes on the reports since they consist of less than 5 calves. They will however be included in the EPD evaluation since each group has at least 2 calves.

If the heifers and cows were all managed the same at calving then there would only be contemporary groups based on sex, age and pasture, since all the calves in each pasture would have had equal opportunity to perform.

If the producer reduced his calving season to 60 days, then all of the calves of the same sex and raised in the same pasture would have been included in the contemporary group. This is because there would no longer be a large age difference between the calves.

If the producer now fed all of his bulls together over the winter and all of his heifer calves together in another pen, he would still have 12 contemporary groups at yearling, since the calves would not be equal due to how they were managed prior to weaning.

Contemporary Groupings

Following are several examples of how the contemporary groupings from the above example may change if management of the cowherd changes.

First calf heifers and cows managed separately at calving, North Pasture and South Pasture, 60 day calving period

1. Heifer calves from mature cows raised in the North Pasture
2. Bull calves from mature cows and raised in the North Pasture
3. Heifer calves from mature cows and raised in the South Pasture
4. Bull Calves from mature cows and raised in the South Pasture
5. Heifer calves from first calf heifers and raised in the South Pasture
6. Bull Calves from first calf heifers and raised in the South Pasture

All cows managed together at calving, 120 day calving period, North Pasture and South Pasture

1. Heifer calves born during the first 90 days and raised in the North Pasture
2. Bull calves born during the first 90 days and raised in the North Pasture
3. Heifer calves born between 90 and 120 days and raised in the North Pasture
4. Bull calves born 90 and 120 days and raised in the North Pasture
5. Heifer calves born during the first 90 days and raised in the South Pasture
6. Bull calves born during the first 90 days and raised in the South Pasture
7. Heifer calves born between 90 and 120 days and raised in the South Pasture
8. Bull calves born 90 and 120 days and raised in the South Pasture

All cows managed together at calving, 120 day calving period (first 60 days = management group 1, 60 to 120 days = management group 2), North Pasture and South Pasture

1. Heifer calves born during the first 60 days and raised in the North Pasture
2. Bull calves born during the first 60 days and raised in the North Pasture
3. Heifer calves born between 60 and 120 days and raised in the North Pasture
4. Bull calves born 60 and 120 days and raised in the North Pasture
5. Heifer calves born during the first 60 days and raised in the South Pasture
6. Bull calves born during the first 60 days and raised in the South Pasture
7. Heifer calves born between 60 and 120 days and raised in the South Pasture
8. Bull calves born 60 and 120 days and raised in the South Pasture

All cows managed together at calving, 60 day calving period, North Pasture and South Pasture

1. Heifer calves raised in the North Pasture
2. Bull calves raised in the North Pasture
3. Heifer calves raised in the South Pasture
4. Bull calves raised in the South Pasture

Cows and first calf heifers managed separately at calving, all in one pasture, 120 day calving period

1. Heifer calves from first calf heifers, born in the first 90 days
2. Bull calves from first calf heifers, born in the first 90 days
3. Heifer calves from mature cows, born in the first 90 days
4. Bull calves from mature cows, born in the first 90 days
5. Heifer calves from first calf heifers, born between 90 and 120 days

6. Bull calves from first calf heifers, born between 90 and 120 days
7. Heifer calves from mature cows, born between 90 and 120 days
8. Bull calves from mature cows, born between 90 and 120 days

Cows and first calf heifers managed together at calving, all in one pasture, 60 day calving period

1. Heifer calves
2. Bull calves

Cows and first calf heifers managed together at calving, all in one pasture, 120 day calving period (first 60 days = management group 1, 60 to 120 days = management group 2)

1. Heifer calves born in the first 60 days
2. Bull calves born in the first 60 days
3. Heifer calves born between 60 and 120 days
4. Bull calves born between 60 and 120 days

Hopefully the above examples help to show how the breakdown of management groups into contemporary groups occurs.

A basic rule of thumb is that all animals that are managed together and that you as a breeder feel had equal opportunity should be grouped together as a management group. For some people this means that they will group calves at birth. For Example calves born in the first 45 days, and then calves in the next 45 days may be grouped separately.

Management groups describe cattle that are treated in the same way. Contemporary groups break down these management groups into cattle that can be directly compared.

Calculations

Several calculations are performed on the performance information that is submitted to the Canadian Simmental Association office. These calculations are used to help account for the differences between animals, such as the age of their mother, to allow for more accurate comparison of the animals within their contemporary groupings.

205 Day Adjusted Weight (205D WT)

The 205 day adjusted weight is used to compare calves weaning weights on an age constant basis. The calculation is as follows…

205 day adjusted weight =

$$\frac{\text{actual weaning weight} - \text{actual birth weight}}{\text{weaning date} - \text{birthdate}} * 205 + \text{Age of Dam Adjustment} + \text{Birth weight}$$

This basically means that the calculation takes the animal's daily gain from birth to weaning and multiplies it by 205 to achieve an age constant value. The birth weight is then added back in as well as an age of dam adjustment.

The age of dam adjustment is used to account for the fact that younger cows will tend to have lighter calves at weaning than cows aged 5 to 10. The age of dam adjustments are recalculated each year.

Due to the growth curve of the animal, calves must be between 160 and 250 days of age when they are weighed at weaning in order to receive a 205 Day Adjusted Weight.

Let's look at an example of a bull calf from a 4 year old cow that was 95 pounds at birth, was weaned at 200 days of age and weighed 730 pounds. We will use 50 pounds as the age of dam adjustment for 4 year old cows.

$$\text{205 Day Weight} = \frac{(730 - 95)}{200} * 205 + 50 + 95$$

$$\text{205 Day Weight} = 3.175 * 205 + 50 + 95$$

$$\text{205 Day Weight} = 651 + 50 + 95$$

205 Day Weight = 796 pounds

Age of Dam Adjustment (AOD)

The age of dam adjustment used by the Canadian Simmental Association is calculated each year using a five year rolling average of the entire Simmental female population. The average 205 day weaning weight is calculated for bull calves and heifer calves based on the age of the dam. It is also calculated separately for creep and non creep-fed calves. No age of dam adjustment is used at this stage.

These results are then subtracted from the average of the cows aged 5 to 10 years of age to find the appropriate weaning weight adjustment factor.

For example let's look at a hypothetical case of all non creep-fed bull calves.

Age of Dam	Avg. Weaning Weight	Adjustment Calculation	Age of Dam Adjustment
2	650	= 750 - 650	100
3	675	= 750 – 675	75
4	700	= 750 – 700	50
5 to 10	750	None	0
10+	725	= 750 – 725	25

This means that non creep-fed bull calves from 2 year old cows would have 100 pounds added onto their 205 day weaning weight. Bull calves from 3 year old cows would have 75 pounds added and 4 year old females would have 50 pounds added onto their bull calves adjusted weaning weights. Cows over 10 years old with non creep-fed bull calves would have 25 pounds added onto their calves respective adjusted weaning weights.

The reason that there is no adjustment for cows aged 5 through 10 years is that the adjusted weaning weights are virtually identical between these age groups. This is however checked each year to ensure that this is still the case.

205 Day Index

The 205 Day Index is a way to compare 205 day adjusted weights between calves from the same contemporary groups. In order to receive an index, the calf has to have a 205 Day Adjusted Weaning Weight and be part of a contemporary group with at least 3 calves in it.

In order to calculate an index all of the adjusted weaning weights for the group are averaged. This produces a group average weaning weight, which is then set equal to 100. Each calf's adjusted weaning weight is then divided by the group average weaning weight and multiplied by 100 to put it on a 100 point scale. Calves with a 205 Day index of more than 100 are above the group average and calves with an index of less than 100 are below the group average for weaning weight.

Example:

5 non creep-fed bull calves (A, B, C, D, E)

Bull Calf	205 Day Adjusted Weaning Weight
A	700
B	725
C	750
D	775
E	675

Group average = (A + B + C + D + E) / 5
= (700 + 725 + 750 + 775 + 675) / 5
= (3625) / 5
= 725

725 pounds is the group average adjusted weaning weight.

The indexes are calculated as follows.

Index A = (Adjusted Weaning Weight Bull A / Group Average Adjusted Weaning Weight) * 100
= (700 / 725) * 100
= (0.966) * 100
= 96.6

Index B = (Adjusted Weaning Weight Bull B / Group Average Adjusted Weaning Weight) * 100
= (725/725) * 100
= (1.000) * 100
= 100.0

Index C = (Adjusted Weaning Weight Bull C / Group Average Adjusted Weaning Weight) * 100
= (750/725) * 100
= (1.034) * 100
= 103.4

The results are shown in the next table.

Bull Calf	205 Day Adjusted Weaning Weight	205 Day Index
A	700	96.6
B	725	100.0
C	750	103.4
D	775	106.9
E	675	93.1

Bull calves A and E had 205 Day adjusted weaning weights below the average of their contemporary group, while bulls C and D performed better than the average of their contemporary group. Bull Calf B performed right at the group average as is shown by his index of 100.0.

205 Day Rank

The 205 Day Rank describes where each calf fits within its' contemporary grouping for Adjusted weaning weight. Ranks are expressed as fractions. The first number shows the position of the calf in its' group and the second number shows the size of the group.

Let's look again at our 5 bull calves.

Bull Calf	205 Day Adjusted Weaning Weight	205 Day Index	205 Day Rank
A	700	96.6	4 / 5
B	725	100.0	3 / 5
C	750	103.4	2 / 5
D	775	106.9	1 / 5
E	675	93.1	5 / 5

Bull Calf A ranks 4/5. This means that he had the fourth highest adjusted weaning weight in his contemporary group of five calves. The heaviest bull was bull D. His rank was 1/5.

Weight Per Day of Age (WPDA)

Weight per Day of Age is calculated by taking the animal's weight on the date it was weighed and dividing by the number of days old it is when it is weighed.

Let's look at a calf that is weighed at weaning and then again at yearling. This calf weighed 750 pounds when he was 210 days old and when weighed at 355 days old he was 1250 pounds.

WPDA weaning = weight / age in days
= 750/210
= 3.57

WPDA yearling = weight / age in days
= 1250 / 355
= 3.52

It is very important to remember when looking at WPDA, that higher birth weights may result in slightly higher WPDA. For example take a calf that is born at 120 pounds versus one that weighs 80 pounds at birth. If they both gain 50 pounds in 30 days, their weight per day of age will be as follows.

WPDA = (120 + 50)/30 = 170/30 = 5.7
WPDA = (80 + 50)/30 = 130/30 = 4.3

Hopefully you can see that the difference in weight per day f age is due to the birth weight differences. This effect of birth weight will be reduced as the calf ages, however it is an important factor to keep in the back of your mind when considering weight per day of age.

Weight Per Day of Age Index

The WPDA Index is calculated in exactly the same manner as the 205 Day Index. It is used to help compare weight per day of age between calves within a contemporary group.

Let's look at an example of 5 bull calves again.

Bull Calf	Weight Per Day of Age
A	3.25
B	3.50
C	3.65
D	3.75
E	3.00

The average of the group is calculated as:

Group Average = (A + B + C + D + E) / 5
= (3.25 + 3.50 + 3.65 + 3.75 + 3.00) / 5
= (17.15) / 5
= 3.43

To calculate the index each calf's WPDA is divided by the group average and then multiplied by100 to place on a 100 point scale where 100 equals the average of the group.

Index A = (WPDA Bull A / Group Average WPDA) * 100
= (3.25/3.43) * 100
= (0.948) * 100
= 94.8

Index B = (WPDA Bull B / Group Average WPDA) * 100
= (3.50/3.43) * 100
= (1.020) * 100
= 102.0

Index C = (WPDA Bull C / Group Average WPDA) * 100
= (3.65/3.43) * 100
= (1.064) * 100
= 106.4

The results are shown in the next table.

Bull Calf	Weight Per Day of Age	WDPA Index
A	3.25	94.8
B	3.50	102.0
C	3.65	106.4
D	3.75	109.3
E	3.00	87.5

Bulls A and E had WPDAs below the average of the group, while B, C, and D had WPDAs higher than the average of the contemporary group.

At least 5 calves are required in a contemporary group in order to calculate indexes.

Weight Per Day of Age Rank

The WPDA Day Rank describes where each calf fits within its' contemporary grouping for Weight per Day of Age. Ranks are expressed as fractions. The first number shows the position of the calf in its' group and the second number shows the size of the group.

Let's look again at our 5 bull calves.

Bull Calf	Weight Per Day of Age	WDPA Index	WDPA Rank
A	3.25	94.8	4/5
B	3.50	102.0	3/5
C	3.65	106.4	2/5
D	3.75	109.3	1/5
E	3.00	87.5	5/5

Bull Calf A ranks 4/5. This means that he had the fourth highest weight per day of age in his contemporary group of five calves. The bull with the highest weight per day of age was bull D. His rank was 1/5.

365 Day Adjusted Weight (365D WT)

The 365 Day Adjusted Weight is calculated in order to allow comparison of weights on an age constant basis. In order for a calf to receive a 365 day adjusted weight it must be weighed at yearling time between 320 and 410 days of age, and it must also have a 205 Day Adjusted

Weaning Weight. This is because the actual and adjusted weaning weights are used in the calculation of the 365 Day Adjusted Weight.

365 Day weight is calculated using the gain from weaning to yearling and then adding it to the gain from birth to weaning.

The calculation is as follows:

365 Day Weight =

$$\frac{\text{actual yearling weight} - \text{actual weaning weight}}{\text{yearling date} - \text{weaning date}} * 160 + \text{205 Day Adjusted Weight}$$

This calculates the average daily gain from weaning to yearling and multiplies by an age constant factor of 160. By adding the gain over 160 days to the 205 Day Weight we reach the adjusted weight at the end of 365 days (205 + 160). As well, by using the 205 Day Adjusted Weight we account for age of dam effects.

365 Day Weight =

Average Daily Gain from Weaning to Yearling * 160 + 205 Day Adjusted Weight

Let's look at our bull from the 205 Day adjusted Weight calculation.

Our bull calf from a 4 year old cow was 95 pounds at birth, was weaned at 200 days of age and weighed 730 pounds. We used 50 pounds as the age of dam adjustment for 4 year old cows.

His 205 Day Weight was calculated as 796 pounds. Let's say he was weighed at yearling 170 days after he was weaned and he weighed 1250 pounds.

The 365 Day Weight Calculation would appear as follows:

$$\text{365 Day Weight} = \frac{(1250 - 730)}{170} *160 + \text{205 Day Weight}$$

365 Day Adjusted Weight = 520 / 170 * 160 + 796
365 Day Adjusted Weight = 3.06 * 160 + 796
365 Day Adjusted Weight = 489 + 796

365 Day Adjusted Weight = 1285 pounds

365 Day Index

The 365 Day Index is calculated in the same way as the previously described indexes and is used to compare the 365 Day Adjusted Weights of calves within the same contemporary group. As before, at least 3 calves are required in a contemporary group before indexes can be calculated.

Let's look at an example of 5 bull calves again.

Bull Calf	365 Day Adjusted Weight
A	1200
B	1250
C	1175
D	1285
E	1225

The average of the group is calculated as:

Group Average = (A + B + C + D + E) / 5
= (1200 + 1250 + 1175 + 1285 + 1225) / 5
= (6135) / 5
= 1227

To calculate the index each calf's 365 Day Adjusted Weight is divided by the group average and then multiplied by100 to place on a 100 point scale where 100 equals the average of the group.

Index A = (365 Day Weight Bull A / Group Average 365 Day Weight) * 100
= (1200/1227) * 100
= (0.978) * 100
= 97.8

Index B = (365 Day Weight Bull B / Group Average 365 Day Weight) * 100
= (1250/1227) * 100
= (1.019) * 100
= 101.9

Index C = (WPDA Bull C / Group Average WPDA) * 100
= (1175/1227) * 100
= (0.958) * 100
= 95.8

The results are shown in the next table.

Bull Calf	365 Day Adjusted Weight	365 Day Index
A	1200	97.8
B	1250	101.9
C	1175	95.8
D	1285	104.7
E	1225	99.8

Bulls A, C, and E had 365 Day Adjusted Weights below the average of the group, while B, and D had 365 Day Adjusted Weights higher than the average of the contemporary group.

365 Day Rank

The 365 Day Rank describes the calf's 365 Day Adjusted Weight and Index in comparison to the other calves in the contemporary group. The rank is expressed as a fraction with the first number showing where the calf fits in the group and the second number showing the size of the group. At least 5 calves are required in a contemporary group in order to provide ranks.

Let's look at our 5 bull calves again.

Bull Calf	365 Day Adjusted Weight	365 Day Index	365 Day Rank
A	1200	97.8	4/5
B	1250	101.9	2/5
C	1175	95.8	5/5
D	1285	104.7	1/5
E	1225	99.8	3/5

In this case Bull C had the lowest 365 Day Adjusted Weight and Index. He was ranked fifth in his contemporary group of 5 calves (5/5). Bull A had the second lightest 365 Day Adjusted Weight and so is shown as 4/5. The heaviest 365 Day Weight was Bull D, and he is shown as 1/5, meaning that he was the heaviest calf in his contemporary group.

Average Daily Gain (ADG)

Average Daily Gain is calculated on calves from the period between weaning and yearling. The calculation is as follows:

$$\text{Average Daily Gain} = \frac{(\text{yearling weight} - \text{weaning weight})}{(\text{yearling date} - \text{weaning date})}$$

This number basically helps to show how a calf grows on feed, once it has been removed from it's mother.

If we look at our bull calf we have been using as an example:

Our bull calf from a 4 year old cow was 95 pounds at birth, was weaned at 200 days of age and weighed 730 pounds. We used 50 pounds as the age of dam adjustment for 4 year old cows.

His 205 Day Weight was calculated as 796 pounds. Let's say he was weighed at yearling 170 days after he was weaned and he weighed 1250 pounds.

His Average Daily Gain is as follows:

Average Daily Gain = (1250 – 730) / 170
Average Daily Gain = 520 / 170
Average Daily Gain = 3.06

Average Daily Gain Index

An index is also calculated on Average Daily Gain to help in comparing the gain of calves within a contemporary group. The ADG Index is calculated in exactly the same manner as the other Indexes we have discussed, and requires a minimum of 3 calves in each contemporary group.

Let's look at an example of 5 bull calves again.

Bull Calf	Average Daily Gain
A	2.75
B	3.25
C	3.50
D	3.75
E	3.00

The average of the group is calculated as:

Group Average = (A + B + C + D + E) / 5
= (2.75 + 3.25 + 3.50 + 3.75 + 3.00) / 5
= (16.25) / 5
= 3.25

To calculate the index each calf's ADG is divided by the group average and then multiplied by100 to place on a 100 point scale where 100 equals the average of the group.

Index A = (ADG Bull A / Group Average ADG) * 100
= (2.75/3.25) * 100
= (0.846) * 100
= 84.6

Index B = (ADG Bull B / Group Average ADG) * 100
= (3.25/3.25) * 100
= (1.000) * 100
= 100.0

Index C = (ADG Bull C / Group Average ADG) * 100
= (3.50/3.25) * 100
= (1.076) * 100
= 107.6

The results are shown in the next table.

Bull Calf	Average Daily Gain	Average Daily Gain Index
A	2.75	84.6
B	3.25	100.0
C	3.50	107.6
D	3.75	115.4
E	3.00	92.3

Bulls A and E had ADGs below the average of the group, while C, and D had ADGs higher than the average of the contemporary group. Bull B performed at the rate of the group average for Average Daily Gain.

Average Daily Gain Rank

As with the other ranks that have been discussed, the Average Daily Gain Rank is a tool to help compare the gains of calves within a contemporary group. The fastest gaining calf in the group will rank first with the slowest gaining calf ranking last. The rank is expressed as a fraction with the first number showing where the calf placed in its' contemporary group and the second number showing the size of the group.

Using our 5 calves again, we see Average Daily Gain Ranks that look like this:

Bull Calf	Average Daily Gain	Average Daily Gain Index	Average Daily Gain Rank
A	2.75	84.6	5/5
B	3.25	100.0	3/5
C	3.50	107.6	2/5
D	3.75	115.4	1/5
E	3.00	92.3	4/5

In this example we can see that Bull A had the slowest daily gains from weaning to yearling within his group of 5 calves. The fastest gaining calf in the group was Bull D as is shown by his rank of 1/5.

Genetic Analysis

Once all of the performance information has been collected at the Canadian Simmental Association office, it is entered and then performance reports are sent out. The data that is collected is also sent to the University of Cornell for the genetic analysis. This is often referred to as the "EPD run", and is where the North American Simmental EPDs are calculated.

Data is sent two times each year, July 1st and October 31st. This is the reason for the weaning information deadline of October 31st.

EPDs are used to describe genetic differences between animals.

Pedigrees, Management Groups and Performance Measurements

The first step in producing accurate EPDs is describing the exact parentage, measuring the performance of the animals involved, and identifying animals that were managed in the same way as groups. This allows the comparison of apples to apples so to speak. The data is combined with the US data, and animals that are in use in both countries are identified.

Contemporary Groups

A contemporary group is simply refinement of a management group. A contemporary group is a set of animals of the same sex, a comparable age range with equal opportunity to perform. For example, a group of bulls and heifers may have been managed together over the summer creating a management group. Because it is not fair to compare bulls and heifers, this group would be split by sex into two contemporary groups: a group of bulls and a group of heifers. This ensures proper comparison in any genetic evaluation.

Contemporary groups are formed using criteria such as age, sex and management of the calves.

Calculations

Once contemporary groups are figured out and because of the criteria used it is now possible to compare apples to apples within that group. Since EPDs describe differences it is important to look at the differences between members of the group. For example consider the trait weaning weight within a contemporary group. Adjusted weaning weights are used to account for age differences between calves. In this example, we will limit the contemporary group to 3 animals to make it easy to compare.

The group has 3 bulls with adjusted weaning weights (205D AWW) of 650, 700 and 750 pounds. The average adjusted weaning weight of the group is 700 pounds.

Bull A	650
Bull B	700
Bull C	750
Average	2100 / 3 = 700 pounds

If we look at the bulls in the group compared to the average of the group we start to see something that is beginning to look like the EPDs we are familiar with. There are however several steps yet to go, to get at the true genetic differences between these animals.

Bull	205D AWW	Difference from average
A	650	- 50
B	700	0
C	750	+ 50

Heritabilities

Heritability is defined as the amount of the trait expressed that can be attributed to genetics. In reference to our example, this means the portion of the differences in weaning weight that are explained by differences in the genetics of the animals.

The heritability for weaning weight is 0.23. This means that 23% of the difference seen in weaning weight is due to genetic differences between bulls A, B and C.

If we multiply the differences by the heritability we get something even closer to an EPD.

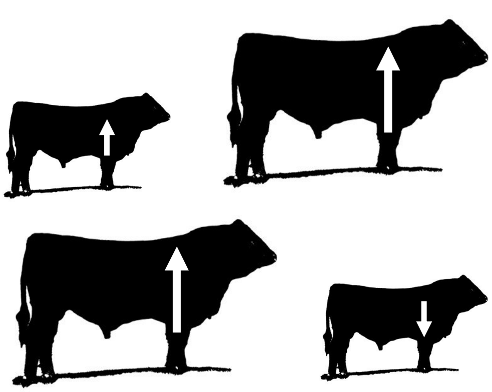
Bull	Difference from average	Difference * h^2
A	- 50	- 11.5
B	0	0
C	+ 50	11.5

If the analysis was done on a single trait this would be a nearly complete EPD. Since several traits are evaluated together correlations now become important.

Correlations

Correlations are a way of describing relationships between things. A correlation of 0 means that there is no relationship between the two things that are being described. A correlation of 1 is called a perfect correlation and means that as one thing increases the other increase to the same degree. A correlation of –1 is also a perfect correlation but it means that as one thing increases the other decreases to the same degree.

Correlation: A numerical measure, ranging between -1.00 and +1.00, describing how two traits are related. A high positive correlation means that as one trait increases, the other one usually does as well. For example, cattle with higher than average yearling weight generally will have a larger mature size as well. When traits are negatively correlated, if one is above average, the other is likely to be below average. For example, as birth weight of a calf increases, calving ease is likely to decrease. A near zero correlation between traits means there is no particular relationship between them. (BIF Guidelines, 8^{th} Edition)



Positive Correlation: as one thing increases, so does the other.

Negative Correlation: as one thing increase the other decreases.

Most correlations are not perfect. For example the correlation between birth weight and weaning weight is +0.50. This means that as weaning weight increases, birth weight will also **tend** to increase. If the correlation was 1, it would be impossible to increase weaning weight without increasing birth weights. Since it is less than 1 it is possible to increase weaning weights without increasing birth weights.

Correlations are used in calculating EPDs. If we assume that genes control an animal's growth, then we can start to see that some of the same genes that make a calf bigger at birth, may also affect the size of that calf at weaning and yearling. Because of the genetic relationship between birthweight and weaning weight the weaning weight EPD may be increased slightly because of the birth weight record.

Let's look again at our 3 bulls.

Bull	Birth Weight	Difference from average	Difference * h^2
A	100	5	2.1
B	95	0	0
C	90	-5	-2.1

If we apply this to our weaning weight figures using the correlation of +0.40, we would get an increase in Bull A and a decrease in Bull C. Including the heritabilities and correlation results in an equation that looks something like the following:

Weaning Weight EPD = (0.2196 * Weaning Weight Difference) + (0.6082 * Birth Weight Difference)

This equation uses the actual differences in weaning weight and birth weight in the contemporary group.

	Weaning	Birth	205D AWW	BWT	Weaning WT EPD
Bull	Diff * h^2	Diff * h^2	Diff	Diff	0.2196*ΔWWT + 0.6082*ΔBWT
A	-11.5	2.1	-50	5	-7.94
B	0	0	0	0	0.00
C	11.5	-2.1	50	-5	7.94

The genetic differences between the bulls are not as large as they first appeared when only weaning weight was looked at. By using what we know about the relationship between birth weight and weaning weight we are able to more accurately figure out the genetic value of the animals within our contemporary group.

	BW	WW	YWT	Milk
Birth Weight (BWT)	**0.40**	0.50	0.21	0.00
Weaning Weight (WWT)		**0.23**	0.51	-0.20
Yearling Weight (YWT)			[illegible]	0.00
Maternal Milk (Milk)				**0.12**

	CWT	REA	ScanWT	BREA	HREA
CWT	0.40	0.46	0.77	0.19	0.17

* - used in AGI Evaluation

	BW	BWM	CE	MCE
BW	**0.47**	-0.30	0.76	0.00
BWM		**0.12**	0.00	0.50
CE			**0.18**	-0.16
MCE				**0.12**
Heritabilities are on the diagonal **(bold)**				

REA		**0.44**	0.12	0.80	0.54
ScanWT			**0.62**	0.21	0.24
BREA				**0.37**	0.85
HREA					**0.50**
Heritabilities are on the diagonal **(bold)**					

	FAT	BFAT	HFAT
FAT	**0.35**	0.79	0.83
BFAT		**0.53**	0.67
HFAT			**0.69**
Heritabilities are on the diagonal **(bold)**			

	MARB	BIMF	HIMF
MARB	**0.53**	0.74	0.69
BIMF		**0.48**	0.79
HIMF			**0.52**
Heritabilities are on the diagonal **(bold)**			

Pedigrees

The types of calculations shown above are done for every contemporary group within the Simmental population. The pedigrees are used throughout this process to tie together all of the various groups in a huge web of genetic information.

If we look back at the process of meiosis, we see that each animal gets ½ of its DNA from each of its parents. This is the relationship that is exploited through the pedigrees. This basic relationship also means that each animal contains ¼ of the DNA from each grandparent, and shares DNA with its cousins, half-sibs, etc. All of these relationships are used to analyse the data.

Base Population

The word base is used to describe what the EPDs are being compared to as a whole. Simmental uses what is called a floating base. Let's look at our 3 bulls again. We will assume that after all of the pedigree analysis that the genetic differences between the bulls stayed relatively the same. Let's also assume that the population average of 0 for weaning weight is –5 in comparison to this contemporary group of bulls, or in other words this group of bulls have genetics for weaning weight that are on average 5 pounds above the base for the breed. Basically, in order to compare the EPDs of our bulls across the breed we need to remove this effect and so we add 5 pounds onto each weaning weight EPD. The EPDs are have now been adjusted to describe the differences relative to the entire Simmental population.

Bull	Weaning Weight EPD	Weaning Weight + Base
A	-7.94	-2.94
B	0.00	5
C	7.94	12.94

If you look closely, the differences between these 3 bulls have not changed only the average of the 3 bulls is different.

EPD

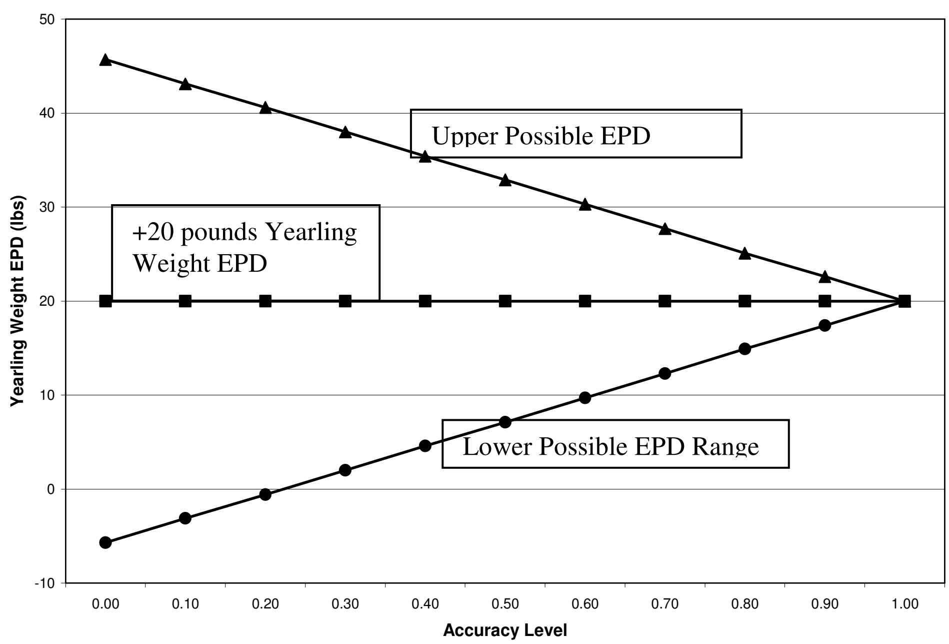
We have arrived at our final EPD destination. All animals are made up of genetics interacting with the environment. By using contemporary groups the genetic differences can be examined because the animals have equal opportunity to perform. The above calculations show the genetic differences between the animals. This means that you can use the pedigrees to compare animals because you have accounted for the environment.

Think about it this way…
Animal = Genetics + Environment
By using contemporary groups, heritabilities and correlations we have eliminated the differences in environment for the animals in the group. The environment now equals 0, therefore…
Animal = Genetics

Now it is possible to compare across herds and countries independent of environments.

Accuracy

Accuracy is the number shown right after the EPD value. It ranges from 0.00 to 1.00. It shows how much information was available for use in calculating the EPD. If the accuracy is close to 1.00, it means we have a lot of information about the genetics of the bull. If it is near 0, it means we have very little information about the bull. In our example we used only 3 bulls. If there are more animals in the contemporary group, complete performance information, accurate pedigrees the accuracy will increase. As well, if an animal has many relatives and progeny in the evaluation accuracy can be increased due to stronger ties with the rest of the Simmental population. This is why bulls in the Sire Summary with a lot of progeny also tend to have very high accuracies.



The more we know about an animal (higher accuracy) the less likely his EPDs are going to change with each new evaluation. As a general rule, a yearling bull with its own performance record will receive an accuracy of about 0.35.

In essence EPDs describe the DNA or genes of the animal. These genes determine the potential performance of the animal. Because we cannot see the DNA directly, we measure the performance of the animal and its relations and use the fact of inheritance to determine what DNA the animal contains. Because we are not looking directly at the DNA, the EPDs are not 100% certain. The more information we can gather, the better job we can do determining the animal's DNA accurately.

Because the EPD describes the DNA or genotype alone, rather than the phenotype (environment and genotype), and because EPDs are calculated in relation to the entire population rather than a contemporary group, they are a much better indicator of genetic merit than a measurement of phenotype, or a rank or index..

Possible Change

Because we do not have 100% certainty about the DNA in the animal, it is possible that as we gather more information, the EPDs of the animal can change. As we get more data, and are able to more accurately determine the DNA the animal carries, it is less likely that the EPDs will change.

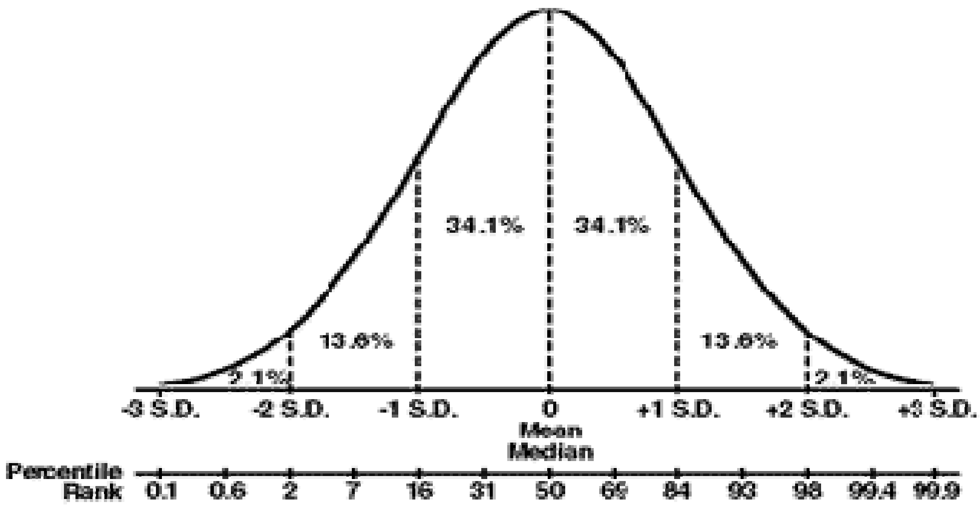
The following table of possible change values represents the expected range that an EPD is likely to change as new information is added into the database. This accounts for roughly 95% of the population. Approximately 5% of the population can have EPD changes outside of this range.

Possible Change Values for EPDs of various accuracy levels.

Acc	CE	BW	WW	YW	MCE	Milk	SC	CWT	REA	Fat	Marb
.05	3.7	2.7	11.9	17.3	4.9	8.5	0.75	23.0	0.41	0.038	0.30
.10	3.5	2.5	11.2	16.4	4.8	8.1	0.71	21.8	0.39	0.036	0.29
.15	3.3	2.4	10.6	15.5	4.8	7.6	0.67	20.6	0.37	0.034	0.27
.20	3.2	2.2	10.0	14.6	4.7	7.2	0.63	19.4	0.35	0.032	0.26
.25	3.0	2.1	9.4	13.7	4.6	6.7	0.59	18.2	0.33	0.030	0.24
.30	2.8	2.0	8.7	12.7	4.5	6.3	0.55	17.0	0.30	0.028	0.22
.35	2.7	1.8	8.1	11.8	4.3	5.8	0.51	15.8	0.28	0.026	0.21
.40	2.5	1.7	7.5	10.9	4.2	5.4	0.48	14.6	0.26	0.024	0.19
.45	2.3	1.5	6.9	10.0	4.0	4.9	0.44	13.3	0.24	0.022	0.18
.50	2.1	1.4	6.2	9.1	3.8	4.5	0.40	12.1	0.22	0.020	0.16
.55	1.9	1.3	5.6	8.2	3.6	4.0	0.36	10.9	0.20	0.018	0.14
.60	1.8	1.1	5.0	7.3	3.3	3.6	0.32	9.7	0.17	0.016	0.13
.65	1.5	1.0	4.4	6.4	2.9	3.1	0.28	8.5	0.15	0.014	0.11
.70	1.4	0.8	3.7	5.5	2.6	2.7	0.24	7.3	0.13	0.012	0.10
.75	1.1	0.7	3.1	4.6	2.2	2.2	0.20	6.1	0.11	0.010	0.08
.80	0.9	0.6	2.5	3.6	1.8	1.8	0.16	4.9	0.09	0.008	0.06
.85	0.7	0.4	1.9	2.7	1.4	1.3	0.12	3.6	0.07	0.006	0.05
.90	0.5	0.3	1.2	1.8	0.9	0.9	0.08	2.4	0.04	0.004	0.03
.95	0.2	0.1	0.6	0.9	0.5	0.4	0.04	1.2	0.02	0.002	0.02
1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.00	0.000	0.00

Populations and Standard Curves

Typically animals within a population are distributed in what is called a "normal" manner. This means that the majority of the population falls somewhere around the average of the breed for any trait, and that fewer animals are distributed at the extreme ends of the breed.


34.1%
34.1%
13.6%
13.6%
2.1%
2.1%
-3 S.D.
-2 S.D.
-1 S.D.
0
Mean
Median
+1 S.D.
+2 S.D.
+3 S.D.
Percentile Rank
0.1
0.6
2
7
16
31
50
69
84
93
98
99.4
99.9

What the EPDs mean

We have described in general how EPDs are calculated. This section examines many EPDs, some not produced by the CSA in terms of what they mean or how to interpret them. Those reported by the CSA are in **Bold**. All EPD values are comparative. This means that they represent bigger/smaller, less/more types of relationships.

We do not know exactly what the resulting progeny will be. For example if we breed a bull that is +50 for weaning weight to a group of cows, we do not know if the calves will weigh 450 or 650 when they are weaned. We do know, that if we also use a bull with a weaning weight EPD of 0 across those same cows the weaning weights would be 400 or 600 respectively. We expect calves from the first bull to be 50 pounds more at weaning than those of the second bull.

Further, if we breed the first bull to a group of inferior cows, and the second bull to a group of superior females, it is conceivable that the calves from the second bull may weigh more at weaning, but remember, we are then comparing apples and oranges. If the first bull was used on the same females as the second, the calves would likely weigh more.

Calving Ease – The ease with which a bull's calves are born to first calf heifers. A first calf heifer is defined as a female calving for the first time at 33 months of age or less. EPDs are reported as deviations in the percent unassisted births. When comparing calving ease EPDs of two sires, the larger EPD indicates a higher percent of unassisted births for calves sired by this bull.

Birth Weight – Calf weight at birth adjusted to a mature dam equivalent. Expected progeny performance is reported in pounds. The EPD value predicts the difference in average birth weight of a bull's calves, compared to calves of all other bulls evaluated. When comparing the birth weight EPDs of two sires, the larger EPD indicates a heavier average birth weight for calves sired by this bull.

Weaning Weight – Calf weight taken between 160 and 250 days of age and adjusted to 205 days of age and a mature dam equivalent. Expected progeny performance is reported in pounds. The EPD value predicts the difference in average 205-day weight of an animal's calves compared to calves of all other animals evaluated. When comparing the weaning weight EPDs of two sires, the larger EPD indicates a heavier average weaning weight for calves sired by this bull.

Maternal Calving Ease – The ease with which a sire's daughters calve as first calf heifers. A first calf heifer is defined as a female calving for the first time at 33 months of age or less. Expected progeny differences are reported as deviations in the percent unassisted births. When comparing the maternal calving ease EPDs of two sires, the larger EPD indicates a higher percentage of unassisted births for calves born to this sire's daughters.

Maternal Milk – The maternal ability of an animal's daughters. Expected progeny performance is reported in pounds of calf weaning weight. The EPD value predicts the difference (due to maternal ability) in average 205-day weight of an animal's daughters calves, compared to calves of daughters of all other evaluated animals. When comparing the maternal milk EPDs of two sires, the larger maternal milk EPD indicates heavier average weaning weights due to the daughters' greater maternal ability.

Maternal Weaning Weight – The weaning weight of an animal's daughters' calves. Expected progeny performance is reported in pounds. The EPD value predicts the difference in average 205-day weight of an animal's daughters' calves compared to calves from daughters of all other animals evaluated. The evaluation reflects both the maternal ability of an animal's daughters and the growth potential of their calves. When comparing maternal weaning weight EPDs of two sires, the larger maternal weaning weight EPD indicates heavier weights due to daughters' ability to produce heavier calves.

Yearling Weight – Weight taken between 330 and 440 days of age and adjusted to 365 days of age and a mature dam equivalent. Expected progeny performance is reported in pounds. The EPD value predicts the difference in average 365-day weight of an animal's progeny, compared to the progeny of all other animals evaluated. When comparing the yearling weight EPDs of two sires, the larger EPD indicates a heavier average yearling weight for calves sired by this bull.

Scrotal Circumference – scrotal size taken between 330 and 440 days of age and adjusted to 365 days. Expected progeny performance is reported in centimeters. The EPD value predicts the difference in average 365 day scrotal circumference of the animal's calves compared to calves of all other animals evaluated. When comparing the scrotal circumference EPDs of two sires, the larger EPD indicates a larger scrotal size for calves sired by this bull.

Carcass Weight – The hot carcass weight of a bull's progeny. Expected progeny performance is reported in pounds and adjusted to a slaughter age of 475 days. The EPD predicts the difference in average carcass weight of a bull's progeny, compared to progeny of all other bulls evaluated. A positive value indicates heavier than average carcass weights, while a negative value (-) indicates lighter than average carcass weights.

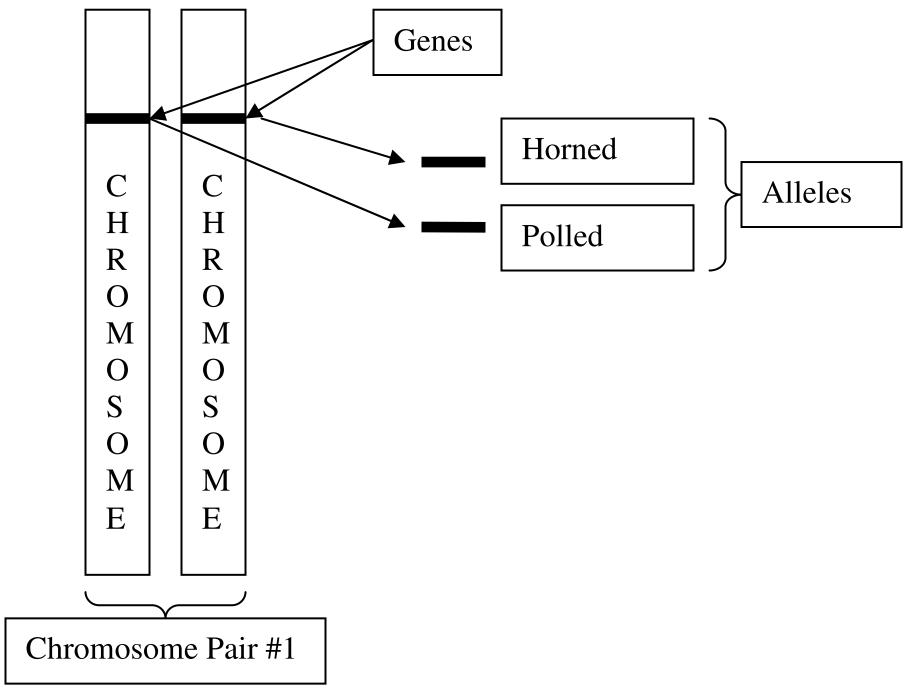
Rib Eye Area – The area of the rib muscle of a bull's progeny. Expected progeny performance is reported in inchess and adjusted to a slaughter age of 475 days. The EPD predicts the difference in average rib eye size of a bull's progeny, compared to progeny of all other bulls evaluated. A positive value indicates bigger than average rib-eye size, while a negative value (-) indicates smaller than average rib-eye size.

Fat Thickness – The external fat thickness of a bull's progeny. Expected progeny performance is reported in inches and is adjusted to a slaughter age of 475 days. The EPD predicts the difference in external fat thickness of a bull's progeny, compared to the progeny of all other bulls evaluated. A positive value indicates thicker than average fat cover compared to the progeny of other bulls evaluated, while a negative (-) value indicates less external fat cover.

Marbling Score – A subjective evaluation of the amount and distribution of intramuscular fat. Degree of marbling is evaluated in the rib-eye muscle between the 12th and 13th rib and is a major factor in determining USDA quality grade. Marbling scores range from 1 (devoid) to 10 (abundant). Expected progeny performance is reported in tenths of a marbling score and adjusted to slaughter age of 475 days. The EPD value predicts the difference in average marbling score of an animal's progeny compared to progeny of all other evaluated bulls. A positive value indicates higher than average marbling scores, while a negative value (-) indicates lower than average scores. Can we change USDA to Canadian term and can we show a table relating the numeric score to Canadian marbling descriptive terms and grades

Gene Markers

A beef animal has 60 chromosomes arranged in 30 pairs. These chromosomes are made up of DNA. 1 chromosome of the pair comes from the father and 1 from the mother. When an animal becomes a parent itself, the pairs split and one chromosome is passed on to the offspring. Along each of these chromosomes, are sequences of DNA that control aspects of the animal's growth. These areas are called genes. Generally a gene is located in a specific region of a specific chromosome. For example, the gene for horned/polled resides near the end of Chromosome #1. Different variations of a gene are called alleles. A different variation of a gene may produce a different result. If the animal carries a horned version of the gene on each copy of Chromosome 1, then the animal has horns. If the animal carries a polled gene, then it will appear polled. Horned/polled variations of the gene are alleles.



DNA is composed of 4 bases (GCAT). G only connects to C and T only connects to A. The gene is the set of instructions defined by the sequence of these DNA bases. If we can identify the exact sequence and where it occurs on the chromosome, then it becomes possible to mark it with a gene marker. Gene markers are a relatively new technology that "flags" the areas of the chromosome that contain specific genes. The reason that alleles produce different results is because they contain slight differences in their DNA sequence. Gene markers identify these areas to tell us which copies of the gene the animal carries. Think of it as a surveyor's flag attached to a specific sequence of bases that will attach to the gene.

With some genes, we don't know the exact location of the gene on the chromosome. Many times we can get close to the area the gene is in by using markers that we know attach to areas of the chromosome where the gene is located. It is bit like being able to narrow an address down to a specific area of town, but not being exactly sure which house on the block we are looking for. The tests to identify these alleles generally require family and pedigree structures, and the testing of several animals to identify the allele with certainty. It could be compared to going door to door on the block and asking who lives in each house, rather than having the exact street address.

Example: Let's assume that the gene for black looks like GCAT, and that by reversing the last two bases the gene now codes for red. If we have a black animal, it may contain a red gene, so we take a DNA sample, and apply a marker. We already know the animal carries at least one copy of the Black Gene as it appears black. When we apply the Red Marker it sticks to the red gene, thus showing that the animal carries a copy of the gene.

Black - GCAT

CGAT**-Red Marker**
Red - GCTA

Because beef cattle are incredibly complex organisms, one gene may not control all aspects of a trait. For example, muscle growth is controlled by a variety of genes spread across a wide number of chromosomes. Marbling is another good example. There are already various commercial tests available to identify different genes that impact marbling, however none of these genes account for all of the variation in the trait. For example, there are bulls with several hundred carcass progeny records that are at the top of there breed for marbling, and yet do not contain a single favourable allele for one of the major marker tests. These sires, may however contain a good combination of other genes that positively impact the marbling of their progeny.

Many new tests are being marketed, and more are coming on stream. For those interested in marker testing, it is often difficult to know where best to invest limited funds. If only for this reason it is important to have breeding goals. By knowing what you are trying to select for, you can more readily determine if the test will impact one or more of your selection criteria. It is also useful to obtain as much information as possible about how much variation the gene can explain. If the gene accounts for a lot of the variation in the trait, then it is likely a better investment than a test for a gene that has limited impact on the trait of interest. Also important is to know whether or not the gene has an impact on more than one trait, and if that impact is positive or negative. For example, is a gene specific to growth rate, or does it also impact mature size. All of these are important factors to consider when investing in marker testing.

When considering a gene marker test, there are a few things to keep in mind.

1. Traits may be controlled by many genes. For example, there may be 5 or 10 different genes that control marbling in an animal. Select tests that explain as much of the variation as possible in the trait.
2. Some genes control more than one trait. Ensure that selecting for a specific gene, does not adversely affect other traits of importance.
3. There are two types of test. Some tests target a specific gene. Others can only target the area of the chromosome where the gene is believed to be. This type of test, generally requires testing of larger family groups and a pedigree structure because it does not specifically identify the exact gene.
4. Does the gene impact traits that are important in my selection program?

Interpreting gene marker results can be difficult, particularly as more markers are added to the possible tests available. Generally speaking these test results should not be used as the sole source for selection. Most experts agree that gene marker information will be combined with traditional performance testing information to produce evaluations that look very similar to the

EPDs we see today. Work is already ongoing into inclusion of gene test results in the existing EPD evaluations. EPDs use performance and pedigree information to determine the relative genetic merit of animals in the population (the animal's genes). The major impact of marker information will be to increase the accuracy of the prediction. Rather than assuming the genes that are present, based on an animal's relative performance, gene markers can be combined with performance data and allow us to assure ourselves that specific genes are present.

The Canadian Simmental Association has adopted a policy of trying to work with various providers of gene tests, to not only facilitate testing but also to confidentially record results and work towards inclusion of marker results in genetic evaluation. It is important to not only report what are perceived as favourable results, but also animals that contain 1 or 0 copies of the "favourable" allele. This is similar to the concept of total herd reporting.

Gene markers are an exciting and rapidly emerging technology that can greatly enhance the power of seedstock producers to create change. There is a lot of good and interesting information available on the internet.

www.marc.usda.gov/genome/genome.html
www.geneticsolutions.com.au
www.igenityl.com
www.frontierbeefsystems.com
www.genomecanada.ca

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Statistical Briefer, Canfax Research, June 2002

Canada's Beef Industry Fast Facts, Beef Information Centre, Fall 2001

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Beef Consumer Satisfaction Benchmark Study, Beef Information Centre, 2002

Beef Carcass Grading Reference, Canadian Beef Grading Agency.

Further Resources

Canadian Pork Council, http://www.cpc-ccp.com/
Chicken Farmers of Canada, http://www.chicken.ca/
Canadian Turkey Marketing Agency, http://www.canadianturkey.ca/
Canadian Egg Marketing Agency, http://www.canadaegg.ca/
Canadian Cattlemen's Association, www.cattle.ca
Beef Information Centre, www.beefinfo.org
Canadian Simmental Association, www.simmental.com
Beef Improvement Federation, www.beefimprovement.org
Genetic Engineering News, http://www.genengnews.com/
Canadian Beef Export Federation, www.cbef.com
Canadian Beef Grading Agency, http://www.telusplanet.net/public/cbga/
Canadian Embryo Transfer Association, www.ceta.ca
CanFax, http://www.cattle.ca/CanFax/default.htm
National Cattlemen's Beef Association, www.beef.org
Beef Consumer Satisfaction Benchmark Study, www.beefinfo.org/retail
Meat and Poultry Online, www.meatandpoultryonline.com
The Meating Place (On-line community for red meat and poultry processors), www.meatingplace.com
Canadian Cattlemen Quality Starts Here Program, www.cattle.ca/qsh/default.htm
Taylor Made Research, www.taylormaderesearch.com
Canadian Food Inspection Agency, http://www.inspection.gc.ca/