



# Cattle Producer's Handbook

Miscellaneous Section

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## Beef Performance Glossary

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**Accuracy (of selection)**—Correlation between an animal's unknown actual breeding value and a calculated estimated breeding value.

**Average daily gain (ADG)**—Measurement of daily body weight change in animal on a feed test. Most bull tests are 140 days in length.

**Adjusted weaning weight (WW)**—An unshrunk, off-the-cow weight adjusted to 205 days of age and to a mature dam age equivalence.

**Adjusted yearling weight (YW)**—An unshrunk weight adjusted to either 365, 452, or 550 days of age.

**Alleles**—Alternate forms of genes. Because genes occur in pairs in body cells, one gene of a pair may have one effect and another gene of that same pair (allele) may have a different effect on the same trait.

**Artificial insemination (A.I.)**—The technique of placing semen from the male into the reproductive tract of the female by means other than natural service.

**Backcross**—The mating of a two-breed crossbred offspring back to one of its parental breeds. Example: A Hereford-Angus cross cow bred back to an Angus bull.

**Beef carcass data service**—A program whereby producers, for a fee, can receive carcass evaluation data on their cattle by using a special "carcass data" eartag for their slaughter animals. See county extension educator, breed representative, Beef Cattle Improvement Association representative, or area office of USDA meat grading service for information.

**Beef Improvement Federation (BIF)**—A federation of organizations, businesses, and individuals interested or involved in performance evaluation of beef cattle. The purposes of BIF are to bring about uniformity of procedures, development of programs, cooperation

among interested entities, education of its members and the ultimate of user performance evaluation methods, and to build confidence of the beef industry in the principles and potentials of performance testing.

**Birth weight (BW)**—The weight of a calf taken within 24 hours after birth. Heavy birth weights tend to be correlated with calving problems, but the conformation of the calf and the cow are contributing factors.

**Body condition score**—A score on a scale of 1 to 9, reflecting the amount of fat reserves in a cow's body, where 1 = very thin and 9 = extremely fat.

**Bos indicus**—These are the Zebu (humped) cattle including the Brahman breed in the United States.

**Bos taurus**—Includes most cattle found in the United States, including their European ancestors.

**Breed**—Animals that have a common origin and common characteristics, which distinguish them from other groups of animals within that same species.

**Breeding program goals**—The objective or "direction" of breeder's selection programs. Goals are basic decisions breeders must make to give "direction" to their breeding program. Goals should vary among breeders due to relative genetic merit of their cattle, their resources, and their markets.

**Breeding soundness examination**—Inspection of a bull involving evaluation of physical conformation and soundness through genital palpation, scrotal circumference, and testing semen for motility and morphology.

**Breeding value**—Value of an animal as a parent. The working definition is twice the difference between a very large number of progeny and the population average when individuals are mated at random within the population and all progeny are managed alike.

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- The difference is doubled because only one gene of each pair is transmitted from a parent to each progeny.
- British breeds**—Breeds of cattle such as Angus, Hereford, and Shorthorn originating in Great Britain.
- Caesarean section**—A process where the calf is removed from the cow during parturition by making a large incision in the right side of the cow just above the flank.
- Calving difficulty (Dystocia)**—Abnormal or difficult labor, causing difficulty in delivering the fetus and/or placenta.
- Calving season**—The season(s) of the year when the calves are born. Limiting calving seasons is the first step to performance testing the whole herd, accurate records, and consolidated management practices.
- Carcass evaluation**—Techniques of measuring components of quality and quantity in carcasses.
- Carcass merit**—Desirability of a carcass relative to quantity of components (muscle, fat, and bone), USDA quality grade, plus potential eating qualities.
- Carcass quality grade**—An estimate of palatability based primarily on marbling and maturity and generally to a lesser extent on color, texture, and firmness of lean.
- Carrier**—A heterozygous individual having one recessive gene and one dominant gene for a given pair of genes (alleles). For example, an animal with one gene for polledness and one gene for horns will be polled but can produce horned offspring when mated to another animal carrying the gene for horns.
- Central test**—A location where animals are assembled from several herds to evaluate differences in certain performance traits under uniform management conditions.
- Chromosome**—Chromosomes are long DNA molecules on which genes (the basic genetic codes) are located. Domestic cattle have 30 pairs of chromosomes.
- Closed herd**—A herd in which no outside breeding stock (cattle) are introduced.
- Collateral relatives**—Relatives of an individual that are not its ancestors or descendants. Brothers and sisters are an example of collateral relatives.
- Compensatory gain**—Gain from cattle that have been nutritionally deprived for part or all of their life. Once fed feedlot rations they compensate for the earlier restriction of feed by gaining very rapidly.
- Conformation**—The shape and arrangement of the different body parts of an animal.
- Congenital**—Acquired during prenatal life. Condition exists at or dates from birth. Often used in the context of congenital (birth) defects.
- Contemporary group**—A group of cattle that are of the same breed and sex 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.
- Correlation**—A measure of how two traits vary together. A correlation of +1.00 means that as one trait increases the other also increases (a perfect positive relationship). A correlation of -1.00 means that as one trait increases the other decreases (a perfect negative, or inverse, relationship). A correlation of 0.00 means that as one trait increases, the other may increase or decrease (no consistent relationship). Correlation coefficients may vary between +1.00 and -1.00.
- Crossbreeding**—The mating of animals of different breeds (or species). Crossbreeding usually results in heterosis (hybrid vigor).
- Culling**—The process of eliminating less productive or less desirable cattle from a herd.
- Cutability**—An estimate of the percentage of salable meat (muscle) from a carcass vs. percentage of waste fat. Percentage of retail yield of carcass weight can be estimated by a USDA prediction equation that includes hot carcass weight, rib eye area, fat thickness, and estimated percent of kidney, pelvic, and heart fat.
- Deviation**—A difference between an individual record and the average for that trait for that contemporary group. These differences sum to zero when the correct average is used. A ratio deviation is the ratio less the average ratio or 100.
- Dominance**—Dominant genes affect the phenotype when present in either homozygous or heterozygous condition. A dominant gene need only be obtained from one parent to achieve expression.
- Double muscling**—A simple recessive trait evidenced by an enlargement of the muscles with large grooves between the muscle systems especially noticeable in the hind leg.
- Dressing percent**— $(\text{Chilled carcass weight} \div \text{live-weight}) \times 100$ .
- Dwarfism**—A recessive trait in which the skeleton is quite small and the forehead has a slight bulge.
- Dystocia (calving difficulty)**—Abnormal or difficult labor causing difficulty in delivering the fetus and/or placenta.
- Economic value**—The net return within a herd for making a pound or percentage change of the trait in question.
- Effective progeny number (EPN)**—An indication of the amount of information available for estimation of expected progeny differences in cattle evaluation. It is a function of number of progeny but is adjusted for their distribution among herds and contemporary groups and for the number of contemporaries by other sires. EPN is less than the actual number because the distribution of progeny is never ideal.
- Embryo transfer**—Removing fertilized ova (embryos) from one cow (donor dam) and placing these embryos

into other cows (recipient cows), usually accompanied by hormone-induced superovulation of the donor dam. More calves can be obtained from cows of superior breeding value by this technique. Only the proven producers should become donor dams.

**Environment**—All external (non-genetic) conditions that influence the reproduction, production, and carcass merit of cattle.

**Estimated breeding value (EBV)**—An estimate of an individual's true breeding value for a trait based on the performance of the individual and close relatives for the trait. EBV is a systematic way of combining available performance information on the individual and sibs and the progeny of the individual. Expected progeny differences have replaced EBV's in most breed associations.

**Expected progeny difference (EPD)**—The difference in performance to be expected from future progeny of an individual, compared with that expected from future progeny of another individual. EPD is an estimate based on progeny testing and is equal to one-half the estimate of breeding value obtainable from the progeny test records.

**F<sub>1</sub>**—Offspring resulting from the mating of a purebred (straight-bred) bull to purebred (straight-bred) females of another breed.

**Fat thickness**—Depth of fat in tenths of inches over the rib eye muscle at the 12th rib. It consists of a single measurement at a point three-fourths of the lateral length of the rib eye muscle from the split chine bone.

**Feed conversion (feed efficiency)**—Units of feed consumed per unit of weight gained. Also the production (meat, milk) per unit of feed consumed.

**Fertilization**—The union of the male and female gametes to form a new individual. This union combines two haploid cells to restore the diploid number of chromosomes in the new individual.

**Frame score**—A score based on subjective evaluation of height or actual measurement of hip height. This score is related to slaughter weights at which cattle should grade choice or have comparable amounts of fat.

**Freemartin**—Female born twin to a bull calf (approximately 9 out of 10 will not be fertile).

**Generation interval**—Average age of the parents when the offspring destined to replace them are born. A generation represents the average rate of turnover of a herd.

**Genes**—The basic units of heredity that occur in pairs and have their effect in pairs in the individual, but which are transmitted singly (one or the other gene at random of each pair) from each parent to offspring.

**Genetic correlations**—Correlations between two traits that arise because some of the same genes affect both traits. When two traits (i.e., weaning and yearling weight) are positively and highly correlated to one

another, successful selection for one trait will result in an increase in the other trait. When two traits are negatively and highly correlated (i.e., birth weight and calving ease) to one another, successful selection for one trait will result in a decrease in the other trait.

**Genotype**—Actual genetic makeup (constitution) of an individual determined by its genes or germ plasm. For example, there are two genotypes for the polled phenotype [PP (homozygous dominant) and Pp (heterozygote)].

**Genotype x Environment Interaction**—Variation in the relative performance of different genotypes from one environment to another. For example, the "best" cattle (genotypes) for one environment may not be the "best" for another environment.

**Gestation**—The period of pregnancy, or the period of time from conception until young is born.

**Half-sibs**—Individuals having the same sire or dam. Half-brothers and/or half-sisters.

**Heat synchronization**—Causing a group of cows or heifers to exhibit heat together at one time by artificial manipulation of the estrous cycle.

**Heredity**—The transmission of genetic or physical traits of parents to their offspring.

**Heritability**—The proportion of the differences among cattle, measured or observed, that is transmitted to the offspring. Heritability varies from zero to one. The higher the heritability of a trait, the more accurately does the individual performance predict breeding value and the more rapid should be the response due to selection for that trait.

**Heritability estimate**—An estimate of the proportion of the total phenotypic variation between individuals for a certain trait that is due to heredity. More specifically, hereditary variation due to additive gene action.

**Heterosis (hybrid vigor)**—Amount by which measured traits of the crossbreds exceed the average of the two or more purebreds that are mated to produce the crossbreds.

**Heterozygous**—Genes of a specific pair (alleles) are different in an individual.

**Homozygous**—Genes of a specific pair (alleles) are alike in an individual.

**Hot carcass weight**—Weight of carcass just before chilling.

**Inbreeding**—Production of offspring from parents more closely related than the average of a population. Inbreeding increases the proportion of homozygous gene pairs and decreases the proportion of heterozygous gene pairs. Also, inbreeding increases prepotency and facilitates expression of undesirable recessive genes.

**Incomplete dominance**—A situation in which neither gene with a gene pair is dominant to the other, with

the result that both are expressed in the phenotype which is intermediate between the two traits.

**Independent culling levels**—Selection of culling based on cattle meeting specific levels of performance for each trait included in the breeder's selection program. For example, a breeder could cull all heifers with weaning weights below 400 pounds (or those in the bottom 20 percent on weaning weight) and yearling weights below 650 pounds (or those in the bottom 40 percent).

**Kidney, pelvic, and heart fat (KPH)**—The internal carcass fat associated with the kidney, pelvic cavity, and heart expressed as a percentage of chilled carcass weight. The kidney is included in the estimate of kidney fat.

**Lactation**—The period after calving during that milk is formed in the udder.

**Lethal gene**—A gene, or genes, that cause the death of an individual that expresses them.

**Libido**—Sexual desire or sex drive.

**Linebreeding**—A form of inbreeding in which an attempt is made to concentrate the inheritance of some one ancestor, or line of ancestors, in a herd. The average relationship of the individuals in the herd to this ancestor (outstanding individual or individuals) is increased by linebreeding.

**Linecross**—Offspring produced by crossing two or more inbred lines.

**Marbling**—The specks of fat (intramuscular fat) distributed in muscular tissue. Marbling is usually evaluated in the rib eye between the 12th and 13th rib.

**Maturity**—An estimation of the chronological age of the animal or carcass, which is accomplished by assessing the physiological stages of maturity of bone and muscle characteristics.

**Metabolic body size**—The weight of the animal raised to the 3/4 power ( $W^{.75}$ ); a figure indicative of metabolic needs and of the feed required to maintain a certain body weight.

**Metabolism**—The transformation by which energy is made available for body uses.

**Most probable producing ability (MPPA)**—An estimate of a cow's future productivity for a trait (such as progeny weaning weight ratio) based on her past productivity. For example, a cow's MPPA for weaning ratio is calculated from the cow's average progeny weaning ratio, the number of her progeny with weaning records, and the repeatability of weaning weight.

**National Cattle Evaluation**—Programs of cattle evaluation conducted by breed associations to genetically compare animals. Carefully conducted national cattle evaluation programs give unbiased estimates of expected progeny differences (EPD's). Cattle evaluations are based on field data and rely on information

from the individual animal, relatives, and progeny to calculate EPD's.

**Nonadditive gene effects**—Favorable effects or actions produced by specific gene pairs or combinations. Nonadditive gene action is the primary cause of heterosis. Nonadditive gene action occurs when the heterozygous genotype is not intermediate in phenotypic value to the two homozygous genotypes.

**Number of contemporaries**—The number of animals of similar breed, sex, and age, against which an animal was compared in performance tests. The greater the number of contemporaries, the greater the accuracy of comparisons.

**Optimum level of performance**—The most profitable or favorable ranges in levels of performance for the economically important traits in a given environment and management system. For example, although many cows produce too little milk, in every management system there is a point beyond which higher levels of milk production may reduce fertility and decrease profit.

**Outbreeding**—Mating of animals less closely related than the average of the population.

**Outcrossing**—Mating of individuals that are less closely related than the average of the breed. Commercial breeders and some purebred breeders should be outcrossing by periodically adding new sires that are unrelated to their cow herd. This outcrossing should reduce the possibility of loss of vigor due to inbreeding.

**Ovulation**—Release of the female germ cell (egg) by the ovary. Cows usually ovulate several hours (up to 15 hours) after the end of estrus or standing heat.

**Palatability**—Acceptable to the taste or sufficiently agreeable in flavor to be eaten.

**Parturition**—The act of giving birth; calving.

**Pedigree**—A tabulation of names of ancestors, usually only those of the three to five closest generations.

**Percent calf crop**—The number or percentage of calves produced within a herd in a given year relative to the number of cows and heifers exposed to breeding.

**Performance data**—The record of the individual animal for reproduction, production, and possibly carcass merit. Traits include birth, weaning and yearling weights, calving ease, calving interval, milk production, etc.

**Performance pedigree**—A pedigree that includes performance records of the individual, ancestors, relatives, and progeny in addition to the usual pedigree information. Also, expected progeny differences are included by some breed associations.

**Performance testing**—The systematic collection of comparative production information for use in decision making to improve efficiency and profitability of beef production. Differences in performance among

cattle must be utilized in decision making for performance testing to be beneficial. The most useful performance records for management, selection, and promotion decisions will vary among purebred breeders and for purebred breeders compared with commercial cattle producers.

**Phenotype**—The visible or measurable expression of a character; for example, weaning weight, post-weaning gain, reproduction, etc. Phenotype is influenced by genotype and environment.

**Phenotypic correlations**—Correlations between two traits caused by both genetic and environmental factors influencing both traits.

**Polled**—Naturally hornless cattle. Having no horns or scurs.

**Pounds of retail cuts per day of age**—A measure of cutability and growth combined, it is calculated as follows: cutability times carcass weight divided by age in days. Also, it is reported as lean weight per day of age (LWDA) by some associations.

**Possible change**—The variation (either plus or minus) that is possible for each expected progeny difference (EPD). This measurement of error in prediction or estimation of EPD decreases as the number of offspring per sire increases.

**Postpartum**—After the birth of an individual.

**Prepotent**—The ability of a parent to transmit its characteristics on its offspring so that they resemble that parent, or each other, more than usual. Homozygous dominant individuals are prepotent. Also, inbred cattle tend to be more prepotent than outbred cattle.

**Prewaning gain**—Weight gained between birth and weaning.

**Progeny**—The young, or offspring, of the parents.

**Progeny records**—The average, comparative performance of the progeny of sires and dams.

**Progeny testing**—Evaluating the genotype of an individual by a study of its progeny records.

**Puberty**—The age at which the reproductive organs become functionally operative and secondary sex characteristics begin to develop.

**Purebred**—An animal of known ancestry within a recognized breed that is eligible for registry in the official herd book of that breed.

**Qualitative traits**—Those traits in which there is a sharp distinction between phenotypes, such as black and white or polled and horned. Usually, only one or few pairs of genes are involved in the expression of qualitative traits.

**Quantitative traits**—Those traits in which there is no sharp distinction between phenotypes, with a gradual variation from one phenotype to another, such as weaning weight. Usually, many gene pairs are involved, as well as environmental influences.

**Random mating**—A system of mating where every female (cow and/or heifer) has an equal or random chance of being assigned to any bull used for breeding in a particular breeding season. Random mating is required for accurate progeny tests.

**Rate of genetic improvement**—Rate of improvement per unit of time (year). The rate of improvement is dependent on: (1) heritability of traits considered, (2) selection differentials, (3) genetic correlations among traits considered, (4) generation interval in the herd, and (5) the number of traits for which selections are made.

**Recessive gene**—Recessive genes affect the phenotype only when present in a homozygous condition. Recessive genes must be received from both parents before the phenotype caused by the recessive genes can be observed.

**Reference sire**—A bull designated to be used as a benchmark in progeny testing other bulls (young sires). Progeny by reference sires in several herds enable comparisons to be made between bulls not producing progeny in the same herd(s).

**Regression (regressed)**—A measure of the relationship between two variables. The value of one trait can be predicted by knowing the value of the other variable. For example, easily obtained carcass traits (hot carcass weight, fat thickness, rib eye area, and percent of internal fat) are used to predict percent cutability. Likewise, breeding value estimates based on limited data are regressed back toward the population average to account for the imperfection of this relationship.

**Rib eye area**—Area of the longissimus muscle measured in square inches at the 12th rib interface on the beef forequarter.

**Rotational crossbreeding**—Systems of crossing two or more breeds where the crossbred females are bred to bulls of the breed contributing the least genes to that female's genotype. Rotation systems maintain relatively high levels of heterosis and produce replacement heifers from within the system. Opportunity to select replacement heifers is greater for rotation systems than for other crossbreeding systems.

**Scrotal circumference**—A measure of testes size obtained by measuring the distance around the testicles in the scrotum with a circular tape. Related to semen producing capacity and age at puberty of female sibs and progeny.

**Scurs**—Horny tissue or rudimentary horns that are attached to the skin rather than the bony parts of the head.

**Seedstock breeders**—Producers of breeding stock for purebred and commercial breeders. Progressive seedstock breeders have comprehensive programs designed to produce an optimum or desirable combination of economical traits (genetic package) that will ultimately increase the profitability of commercial beef production.

**Selection**—Causing or allowing certain individuals in a population to produce offspring in the next generation.

**Selection differential (reach)**—The difference between the average for a trait in selected cattle and the average of the group from which they came. The expected response from selection for a trait is equal to selection differential times the heritability of the trait.

**Selection index**—A formula that combines performance records from several traits or different measurements of the same trait into a single value for each animal. Selection indexes weigh the traits for their relative net economic importance and their heritabilities plus the genetic associations among the traits.

**Sibs**—Brothers and sisters of an individual.

**Sire summary**—Published results of sires from national cattle evaluation programs.

**Sperm**—A mature male germ cell.

**Super ovulation**—Process by which a cow produces more eggs than normal. Done in embryo transfer techniques.

**Systems approach**—An approach to evaluating alternative individuals, breeding programs, and selection schemes that involves assessment of these alternatives in terms of their net impact on all inputs and output in the production system. This approach specifically recognizes that intermediate optimum levels of performance in several traits may be more economically advantageous than maximum performance for any single trait.

**Tandem selection**—Selection for one trait at a time. When the desired level is reached in one trait, then selection is practiced for the second trait.

**Terminal sires**—Sires used in a crossbreeding system where all their progeny, both male and female, are marketed. For example F, crossbred dams could be bred to sires of a third breed and all calves marketed. Although this system allows maximum heterosis and complementary of breeds, replacement females must come from other herds.

**Trait ratio**—An expression of an animal's performance for a particular trait relative to the herd or contemporary group average. It is usually calculated for most traits as:

$$\frac{\text{Individual record}}{\text{Average of animals in group}} \times 100$$

**Ultrasonic measurements**—Used to estimate carcass and reproductive characteristics. Operates off the principle that sound waves echo differently with different densities of tissue.

**USDA yield grade**—Measurements of carcass cutability categorized into numerical categories with 1 being the leanest and 5 being the fattest. Yield grade and cutability are based on the same four carcass traits.

**Variance**—Variance is a statistic that describes the variation we see in a trait. Without variation, no genetic progress is possible, since genetically superior animals would not be distinguishable from genetically inferior ones.

**Weight per day of age (WDA)**—Weight of an individual divided by days of age.



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