

# Beef Production 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 tests for bulls are 140 or 160 days long.

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

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

**Ad lib feeding** — No limit placed on amount of feed intake. Self-feeding or allowing cattle to consume feed on a free-choice basis.

**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 (AI)** — The technique of placing semen from the male in 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 your local University Extension director, 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 consumers of 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.

**Breeder** — In most beef breed associations, the owner of the dam of a calf at the time she was mated or bred to produce that calf.

**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 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. The difference is doubled because only a sample half (one gene of each pair) is transmitted from a parent to each progeny. Breeding value exists for each trait and is dependent on the population in which the animal is evaluated. For a given trait, an individual can be an above average producer in one herd and a below average producer in another herd.

**British breeds** — Breeds of cattle such as Angus, Hereford and Shorthorn that originated in Great Britain.

**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.

**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. Days on feed and fat thickness (of 0.25 inches or more) are comparable to quality grade in estimating eating quality.

**Carcass quantity** — Amount of salable meat (muscle) the carcass will yield. Cutability is an estimate of this. (See cutability.)

**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.

**Conception** — The fertilization of the ovum, or egg. The act of becoming pregnant.

**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 (in the same location on the same feed and pasture). Contemporary groups should include as many cattle as can be accurately compared.

**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, or 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 versus percentage of waste fat. Percentage of retail yield of carcass weight can be estimated by a USDA prediction evaluation that includes hot carcass weight, ribeye area, fat thickness and estimated percent of kidney, pelvic and heart fat.

**Dam** — The female parent.

**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.

**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 in the trait in question.

**Effective progeny number (EPN)** — An indication of the amount of information available for estimation of expected progeny differences in sire 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.

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

**Embryo** — A fertilized ovum, or egg, in the earlier stages of prenatal development, usually prior to development of body parts.

**Embryo transfer** — Removing fertilized ova, or embryos, from one cow (donor dam) and placing these embryos into other cows (host 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 proven producers should become donor dams.

**Estimate** — The process of calculating a particular value from data (verb). The value itself obtained from data (noun). The idea is that the true value is being obtained from the calculated value within limits of sampling variation.

**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 brothers and sisters and the progeny of the individual.

**Estrus (heat)** — The recurrent, restricted period of sexual receptivity in cows and heifers. Non-pregnant cows and heifers usually come into heat 18 to 21 days following their previous estrus.

**Expected progeny difference (EPD)** — The difference in performance to be expected from future progeny of a sire compared with that expected from future progeny of the average bull in the same test. 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 (straightbred) bull to purebred females of another breed.

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

**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 will grade choice or have comparable amounts of fat cover over the loin eye at the 12th to 13th rib.

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

**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, or constitution, of an individual determined by its genes or germplasm. For example, there are two genotypes for the polled phenotype [PP (homozygous dominant) and Pp (heterozygous)].

**Genotype-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.

**Gonad** — The organ that produces the reproductive cells, the testicle in the male and the ovaries in the female.

**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.

**Heifer** — A female of the cattle species less than three years of age that has not borne a calf.

**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.

**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.

**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).

**Involution** — The return of an organ to its normal size or condition after enlargement, as of the uterus after parturition. A decline in size or activity of other tissues; the mammary gland tissues normally involute with advancing lactation.

**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 ribeye between the 12th and 13th rib.

**Metabolic body size** — The weight of the animal raised to the  $3/4$  power ( $W^{0.75}$ ); 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 sire evaluation** — Programs of sire evaluation conducted by breed associations

to compare sires on a progeny test basis. Carefully conducted national reference sire evaluation programs give unbiased estimates of expected progeny differences. Sire evaluations based on field data rely on large numbers of progeny per sire to compensate for possible favoritism or bias for sires within herds.

**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.

**Open** — A term commonly used to indicate a nonpregnant female.

**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.

**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, or egg, by the ovary. Cows usually ovulate several hours (up to 15 hours) after the end of estrus or standing heat.

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

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

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

**Performance pedigree** — A pedigree that includes performance records of ancestors, half- and full-sibs and progeny in addition to the usual pedigree information. Also, the performance information is systematically combined to list estimated breeding values on the pedigrees 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, postweaning 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.

**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.

**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 herdbook 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 a 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 and environmental influences are involved.

**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.

**Reach** — See selection differential.

**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, ribeye 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.

**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 in rotation systems than in 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 of 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 national sire evaluation programs.

**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.

**Terminal sire** — Sires used in a crossbreeding system where all their progeny, both male and female, are marketed. For example, F1 crossbred dams could be bred to sires of a third breed and all calves marketed. Although this system allows maximum heterosis and complementary 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:

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

The exception to this is birth weight ratio. It is calculated as:

$$200 - \frac{\text{Adjusted birth weight of individual}}{\text{Average adjusted birth weight of contemporary group}} \times 100$$

**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.

*Adapted from a Beef Improvement Federation Fact Sheet prepared by David Notter, Virginia Polytechnic Institute and State University. Reviewed by Al Smith, Virginia commercial producer; Darrell Wilkes, National Cattlemen's Association; Roger McCraw, North Carolina State University; Kenneth W. Ellis, University of California; Dixon D.*

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