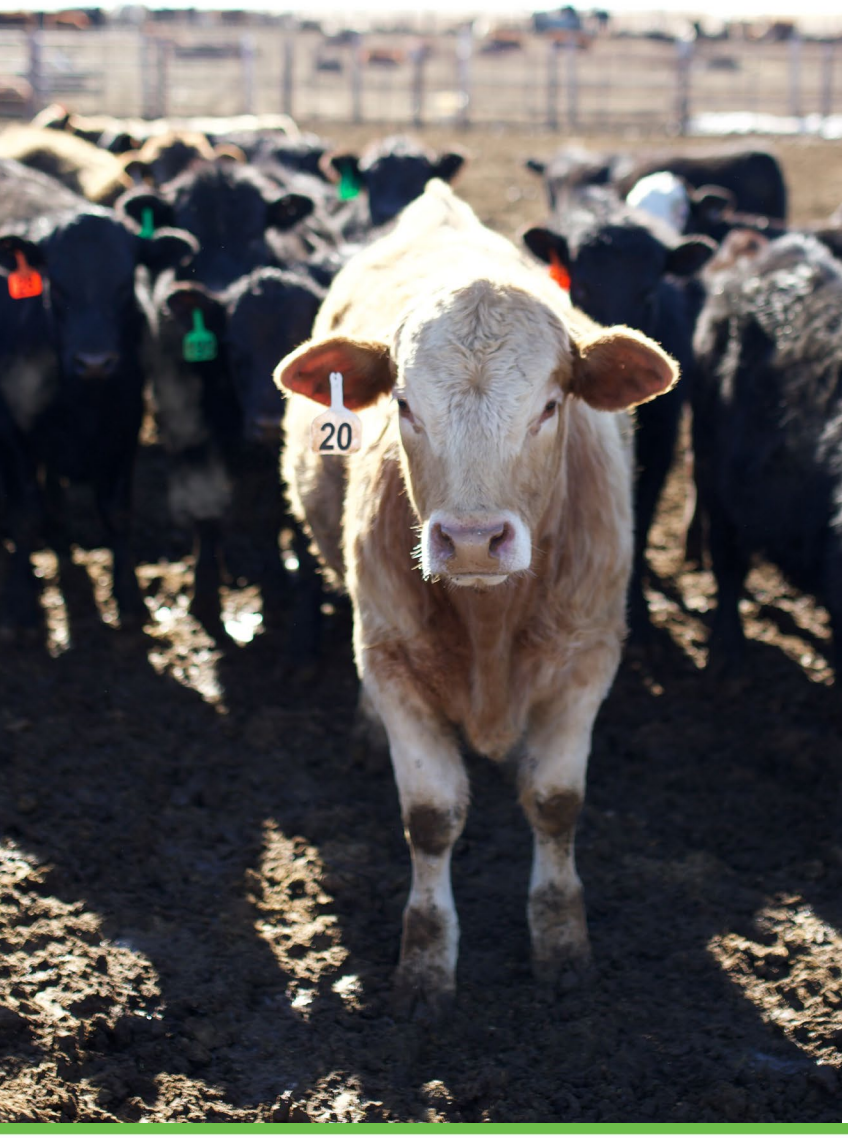
SP 1043

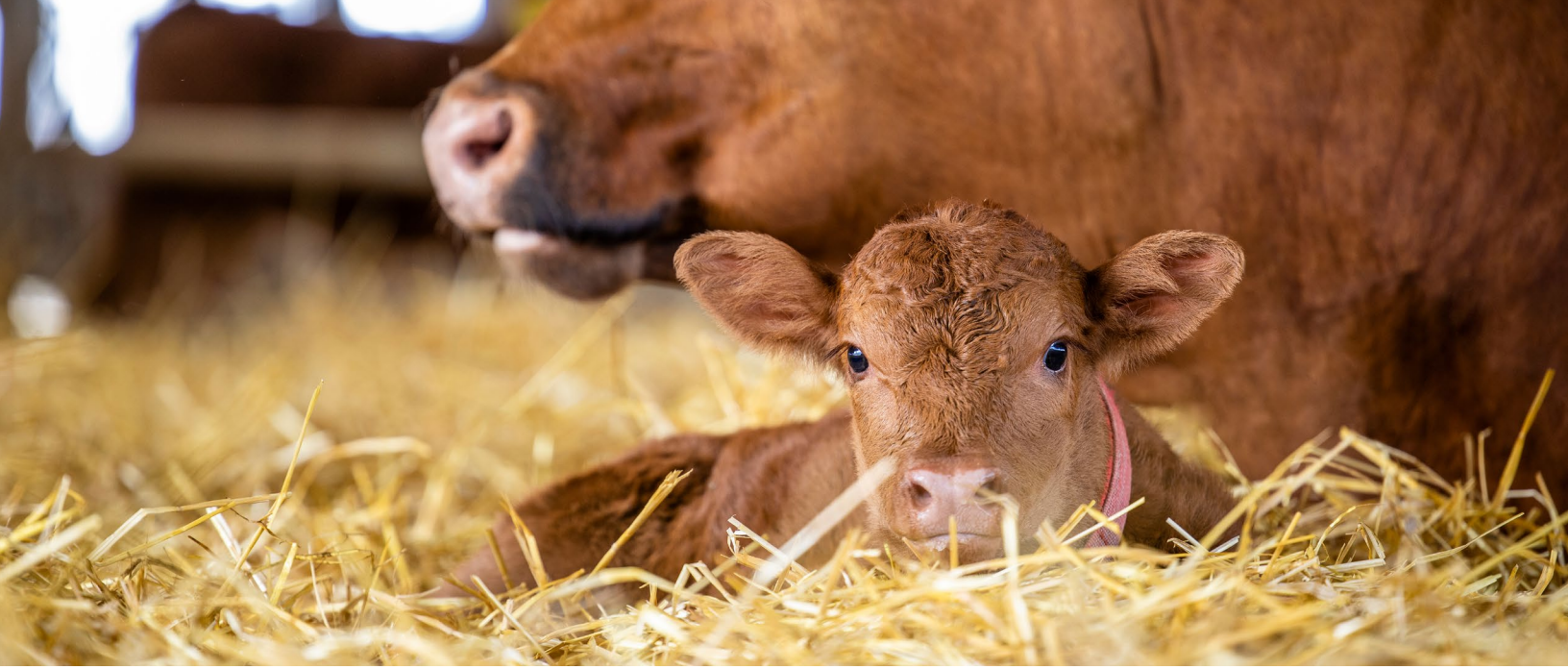
# Genetic Selection with Feedlot and Carcass Traits in Mind

**Troy Rowan**, Assistant Professor and Extension Beef Cattle Specialist, Department of Animal Science




The performance of a calf pre-weaning, in the feedlot and on the grid is determined by a combination of the animal's environment, management and genetic potential. Genetic improvement has been one of the major drivers of the increased share of carcasses grading choice or prime (68 percent in 2010 to 85 percent in 2024, USDA). Cattle buyers have long paid premiums for calves from management programs that reduce the health risk of calves (i.e., vaccinations, castration, etc.). The benefits of these practices are easy to verify and have noticeable effects on the calf's feedlot performance. Categorizing genetic differences between animals is more challenging. Still, opportunities are emerging that allow producers to verify the quality and genetic potential of their cattle to capture further premiums in the market.

This publication briefly reviews the genetics and available selection tools of traits important in feedlot and carcass performance to accelerate genetic progress. Adjusting bull selection decisions to include these traits will be an essential shift for producers interested in marketing direct-to-consumer beef or enrolling their cattle in genetic-verified programs.

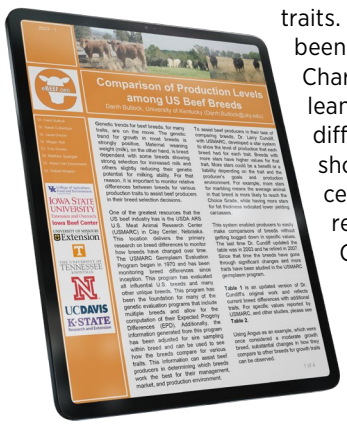


## GENETICS OF FEEDLOT AND CARCASS TRAITS

| Trait | Heritability |
|---|---|
| Calving Ease | 0.19 |
| Weaning Wt. | 0.28 |
| Yearling Wt. | 0.42 |
| Dry Matter Intake | 0.33 |
| Carcass Wt. | 0.44 |
| Ribeye Area | 0.32 |
| Marbling | 0.48 |
| Estimates from Utrera and Van Vleck (2004) | |

The degree to which genetics govern the expression of a trait is referred to as heritability. For example, as seen in the table at right, the heritability of weaning weight is approximately 0.28, meaning that 28 percent of an animal's phenotypic variation comes from its inherited genetic potential, and 72 percent is determined by management and environment. It is important to note that these heritability estimates will differ based on the population and breed in which they are measured. The more heritable a trait, the more rapidly it will respond to genetic selection over time. Growth and carcass traits have a higher heritability than pre-weaning growth, calving ease or maternal traits.Knowledge of an animal's genetic merit for highly heritable traits, such as carcass and feedlot traits, aligns quite well with actual performance. Feeders could take advantage the post-weaning growth (i.e., yearling weight) which is significantly more heritable than pre-weaning growth and calving ease.

Historical selection has generated substantial differences within and between breeds related to carcass and feedlot traits. For example, Angus has long been known to add marbling, whereas Charolais are known for their favorable lean growth and low fat. The breed differences table in this fact sheet shows the relative strengths of certain breeds based on the most recent US Meat Animal Research Center (USMARC) Germplasm Evaluation Program, which can be found on this website: (https://ebeef.ucdavis.edu/sites/g/files/dgvnsk7331/files/inline-files/Factsheet1_2023_0.pdf).

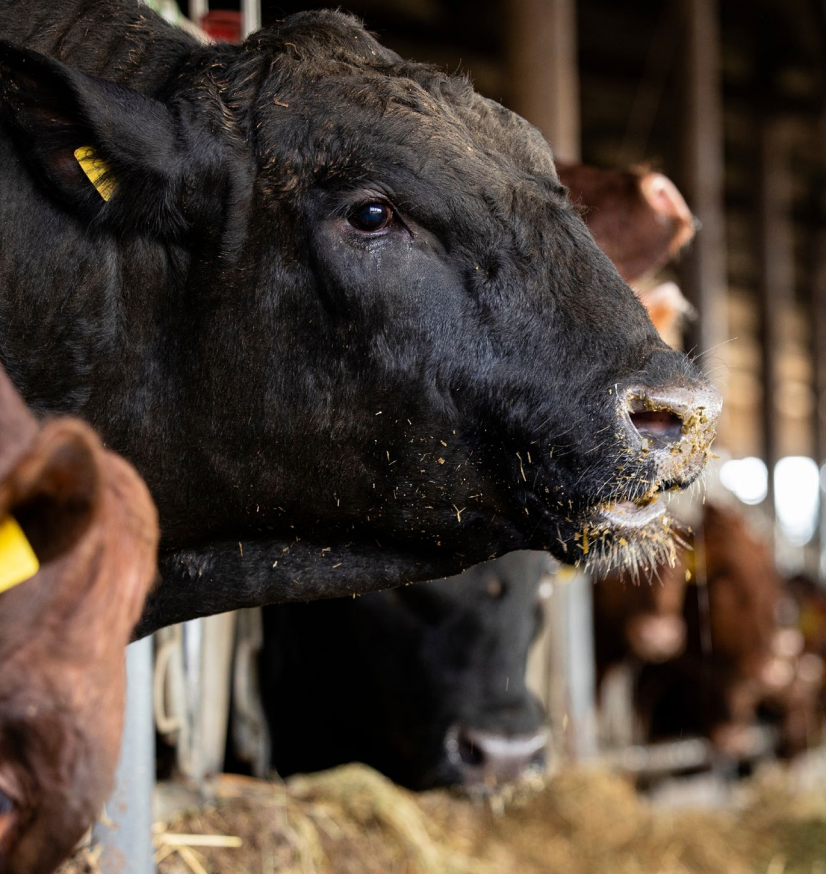



These breed differences represent opportunities for matching complimentary breeds in terminal crossbreeding programs. It is also important to remember that huge amounts of variation exist within breeds regarding genetic merit for any trait.

## SELECTION TOOLS

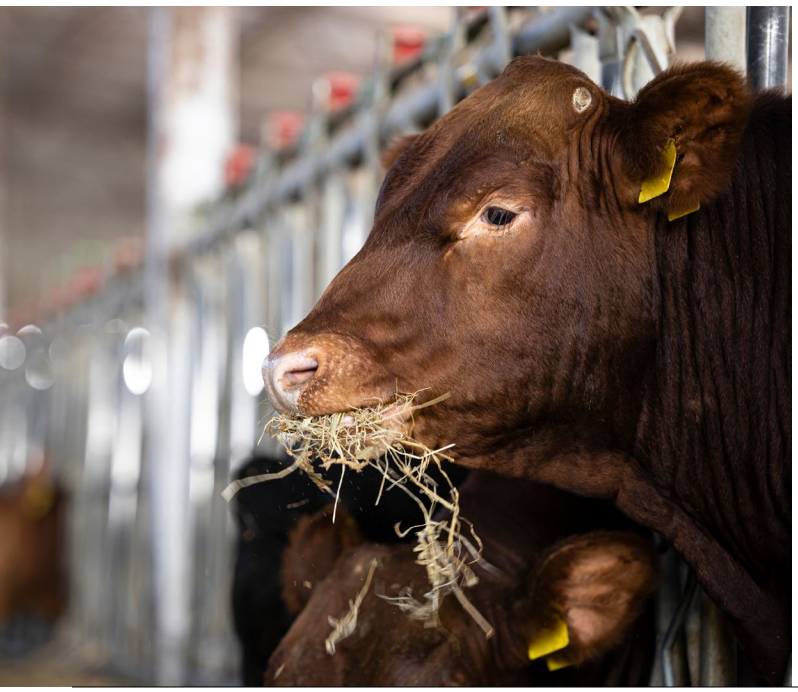
Genetic improvement of carcass and feedlot traits requires selecting the correct sires. High heritabilities for these traits also mean that including them in an operation's breeding objective can improve genetic potential rapidly. Multiple breeds report expected progeny differences (EPDs) for feedlot and carcass traits. These are described in detail in the table below. It is important to remember that EPDs cannot be directly compared across breeds.

| Trait (Abbreviation) | Breeds | Definition |
|---|---|---|
| Dry Matter Intake (DMI) | AN, HF | Pounds of feed intake per day on a dry matter basis |
| Yearling Weight (YW) | CH, HF, SM, RAN, LM | Adjusted 365-day weight in pounds. |
| Fat Thickness (FAT) | AN, CH, HF, RAN, LM, GV | External fat thickness at 12th rib |
| Marbling (MARB) | AN, CH, HF, SM, RAN, LM, GV | USDA marbling score |
| Ribeye Area (REA) | AN, CH, HF, SM, RAN, LM, GV | Square inches of ribeye |
| Carcass Weight (CW) | AN, CH, HF, SM, RAN, LM, GV | Pounds of hot carcass weight |
| Yield Grade (YG) | SM, RAN, LM, GV | USDA yield grade |
| AN = Angus, CH = Charolais, HF = Hereford, SM = Simmental, RAN = Red Angus, LM = Limousin, GV = Gelbvieh | | |



## MULTI-TRAIT SELECTION

Attempting to use all these economically important trait predictions when making selection decisions is a challenging task. All these traits play a role in the ultimate profitability of a herd, though to different degrees. This problem becomes even more complicated when we attempt to generate replacement females while increasing terminal merit. Economic selection indexes combine multiple traits by their economic importance to a breeding objective. The result is a single value representing the profitability difference between sires in a generalized breeding scenario.



Most breeds report a terminal and/or all-purpose economic selection index. Terminal indexes combine all relevant traits related to feedlot gain and grid-based carcass performance into a single value, typically reported in dollars (i.e., profit difference per calf of a sire). All-purpose indexes operate like terminal indexes but have substantial economic influence on replacement female traits. Operations that plan to keep replacement females should not solely use a terminal index for their bull selection decisions. Doing so could quickly erode the herd's genetic potential for producing efficient and long-lived replacements. Understanding the breeding goal assumptions of an index and the traits that are modeled within are essential before an operation uses them for selection decisions.

Indexes reduce the complexity of balancing multiple traits simultaneously and place appropriate economic influence on each trait based on real-world market signals. Producers interested in improving end-product merit should use these terminal or all-purpose indexes when selecting bulls. A bull's impact on a herd immediately (directly sired calf crops) and over the long term (replacement females) makes it the primary driver of genetic progress. As herds shift their focus towards terminal traits, making targeted bull purchases is the most direct and immediate way to create positive genetic change. EPDs and indexes allow us to make these decisions much more confidently. In a follow-up publication, we will review strategies for using sire information and genomic tests to add value to feeder cattle.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