Using Genomic Information to Select Replacements

GE-EPDs can help find the most profitable replacements for your program.

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GENETICS

When it comes to making genetic progress in a herd, major decisions are made twice a year — selecting sires and selecting replacement heifers. The importance of genomic information and expected progeny differences (EPDs) when it comes to selecting bulls that will sire more than 20 calves a year is often discussed, but have you ever thought about the impact a female has on your operation? Not only is she likely your most expensive input cost, but she is also responsible for half of the genetics that contribute to your replacement heifers each year, as well as to the bull prospects developed by seedstock producers. Furthermore, depending on how many replacement heifers you keep out of her, she may have a genetic impact on your herd for years to come.

What is your current protocol for selecting replacements? Age, weight, phenotype, pelvic measurements and genetics are all important data points to consider. While EPDs cannot replace these things, they can help you better understand each female's strengths and weaknesses and allow you to better place potential replacement females into their most profitable production scenario. Genomically elite females may become donor dams for seedstock producers, while others may be better suited for someone else's breeding program.

Likewise, commercial producers harness the power of genomics when they select bulls with genomic-enhanced expected progeny differences (GE-EPDs) and selection indexes. When doing so, it is recommended to also use commercial genomic profiles to help identify genetically superior replacement heifers who inherit the superior DNA from the bulls purchased.

Table 1: Comparison of EPDs for four half-sibling females, including two AHA selection indexes

Animal ID	CE	WW	SCF	CW	REA	MARB	BMI$	CHB$
Calf A	-0.6	63	17.6	79	0.52	0.23	387	133
Calf B	4.5	52	23.5	66	0.36	0.27	464	127
Calf C	1.4	59	19.6	73	0.47	0.15	404	120
Calf D	5.9	50	23.2	71	0.37	0.33	463	133
Breed Avg.	3	55	15.9	69	0.42	0.13	347	118
Calves' Sire	1.1	67	22.4	91	0.66	0.33	473	152

Data reported are real GE-EPDs from AHA, June 16, 2023.

Evaluating replacements

Let's create a scenario where you have a set of four half-sibling replacement heifers to choose from. All are from the same influential AI sire that you selected for that year. Phenotypically, these females all match your selection criteria, and all were born on the same day. Their biggest differences can then be found in the DNA they inherited from their sire and dam. This could apply to a registered breeder or a commercial operation interpreting a commercial genetic test.

Now, even though they all have the same sire, that doesn't mean they inherited the same pieces of DNA from him. Even within a sperm cell there are more than 1 billion different combinations of chromosomal inheritance. To show how this occurs in

a real-life example, Table 1 includes American Hereford Association (AHA) GE-EPDs on four half-sibling females, all sired by the same bull. Comparing each heifer's genetic values can help to differentiate otherwise similar females.

While there are some maternal and terminal traits of interest listed, the table also includes their overall Baldy Maternal Index (BMI$) and Certified Hereford Beef (CHB$) economic index values. These are a representation of their maternal and terminal attributes, respectively. Here is a summary of how each female "measures up" to her siblings.

- Calf A: The highest-ranking sibling for CHB$, supported by superior EPD values for carcass weight (CW) and ribeye area (REA). While above average, she is the lowest in the group for BMI$. Given her lower predictions for calving ease (CE) and sustained cow fertility (SCF), it is likely this female would be more profitable in a terminal focused herd.
- Calf B: The highest-ranking sibling for BMI$, with increased EPD values for CE and SCF. Her lower weaning weight (WW) EPDs correlated to lower terminal traits of interest and a lower CHB$ index value. Although, given her superior EPD for marbling (MARB), if bred to a more terminal bull, this heifer could prove valuable as a replacement.
- Calf C: This heifer just kind of falls "middle of the pack" for both indexes and most of the traits listed above. Her BMI$ value of 404 is above breed average, and she is also above average for CE, WW and SCF. Overall, given the information provided, there is nothing keeping her from being a replacement female.
- Calf D: Compared to her siblings, this heifer won the "genetic lottery." She has the highest BMI$ and CHB$ values of the group. With her increased EPD values for CE, SCF and MARB she checks all the boxes. Not only would she make a good replacement candidate, but if phenotype and all other criteria aligned, she may even be donor dam material.

It is worth mentioning that this comparison is only meant for example purposes to show how EPDs can be used to make selection decisions. There is a multitude of other traits that are included in the AHA genetic evaluation that may be of large economic importance to an operation. There are also many other breeding programs and ideologies that could take the information provided and make different decisions than the ones discussed above.

If you're reading this and wanting to know how to specifically apply the concepts to your operation, the staff at AHA are more than happy to assist. **BA**

Editor's note: Jamie T. Courter, Ph.D., is a bovine technical services manager for NEOGEN.