MANAGEMENT

Repro Tracks

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Heifer pregnancy EPDs

A research report on the Angus heifer pregnancy (HP) genetic evaluation has been released. A link to the report listing HP EPDs for sires with greater than a 0.30 accuracy is available at www.angussiresearch.com. *Now that the first tool for genetic selection of reproductive performance of females is available, the question becomes: "What does it mean and how should it be used?"*

Breeder's question:

Does the HP expected progeny difference (EPD) predict the "fertility" of a bull's daughters? In particular, can I use it as a selection tool to try to improve the conception rate when I synchronize and artificially inseminate (AI) my heifers?

Response:

Wow, that is a *big* question. The answer cannot be a simple "yes" or "no." HP EPDs are calculated from information indicating whether a heifer becomes pregnant at any time during a breeding season or not. The length of the breeding season, the number of matings and the use of natural service or AI are not factors used in determining the HP EPD. Therefore, HP EPD is an indicator of the likelihood of getting a heifer pregnant at some time in her first breeding season, but not necessarily an indicator of her "fertility" to a specific AI breeding.

It is estimated that the heritability of HP is 13%. That indicates that 13% of the variation in pregnancy success is due to genetics, but it also indicates 87% of the variation is due to environmental and management factors *not* related to genetics. Furthermore, in a preliminary study of the data used in the HP genetic evaluation, researchers noted that the heritability of first-service conception rate was only 3% (Bormann et al., 2006, *J. Anim. Sci.* 84:2022). That indicates that 97% of the variation in conception to a single breeding is due to factors other than genetics.

Bottom line, if "fertility" of a heifer is defined as her ability to conceive and become pregnant to a specific breeding, HP EPDs may not be a very powerful tool for improving "fertility." However, "fertility" is definitely a part of the wide range of effects influencing HP EPDs. Therefore, in the broader context — selection based on HP EPDs will improve overall pregnancy rates of heifers during their first breeding season. However, the rate of improvement will be slow because the heritability of the trait is so low.

Breeder's question:

What is the HP EPD really measuring? I know what EPDs for traits like weaning weight, yearling hip height or %IMF are measuring, but I'm not sure what is being measured by HP EPD or what causes one animal to have a higher HP EPD than another.

Response:

If the first question was a *big* one, this is a Nobel Prize winner! As I implied in the response to the question above, the HP EPD is derived from data on whether a heifer becomes pregnant or fails to become pregnant during her first breeding season. Actually, in some cases it is even broader than that because some records used for calculating HP EPD will be based on whether the birth or weaning of a calf has been reported. Therefore, any genetic effect influencing a heifer's likelihood of becoming pregnant and delivering a calf, from the time she is born until her first calf is born, can play a role in determining HP EPD.

To try and get your arms around this, it may be useful to break a successful pregnancy down into three periods:

Period 1. The time preceding the heifer's first breeding season.

Period 2. The heifer's first breeding season.

Period 3. The maintenance of a pregnancy after the breeding season.

Biological events controlled by genetics occur during each of these periods, and any of those events could have a significant effect on the likelihood of a heifer becoming pregnant.

►**Period 1** should culminate in a heifer reaching puberty prior to the breeding season. There are documented differences in age at puberty among breeds, and it is logical to assume that differences in daughters' ages at puberty among sires within the Angus breed exist. While not as great as differences between breeds, differences between sires within a breed could be significant.

Not reaching puberty before the breeding season obviously reduces a heifer's chance of becoming pregnant during her first breeding season, but the effect of when she reaches puberty, even if it is before the breeding season begins, may also be a factor affecting pregnancy success. Researchers have demonstrated that conception rates of heifers increase during their first three cycles. In other words, a heifer having her third cycle is more likely to conceive than one who has just reached puberty and started cycling.

Other factors related to growth rate and maturity occurring during Period 1 may be important. However, an analysis revealed no relationships between HP EPD and EPDs for any carcass traits or growth traits. This is surprising because genetic differences in growth rate and mature size are often pointed to as the reason for differences in age at puberty among females from different breeds.

►**Period 2** represents the breeding season. It is obvious that differences in pregnancy rate at the end of the breeding season could be due in part to differences in the heifers' abilities to conceive when bred by AI or natural service. However, the research indicating a low heritability for first-service conception rate (3%) argues against the "fertility" of a heifer being the major factor causing differences in HP EPD. Nonetheless, the small cumulative effect of several slightly lower or higher chances of becoming pregnant at each breeding must play a role in determining differences in the likelihood of establishing a pregnancy during the first breeding season.

►**Period 3.** If we can't explain the biology behind genetic effects on

reproduction during Period 1 or 2, Period 3 presents an even greater challenge. Differences in maintenance of pregnancy that are not caused by reproductive diseases or environmental stress (heat or cold) are most often related to differences in dietary and metabolic demands that make it difficult to maintain a pregnancy. Spontaneous abortion in a high-producing dairy cow is the prime example of embryonic loss being caused by a negative energy balance or another nutritional deficiency related to the high genetic potential for milk production.

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Angus heifers have a much lower nutrient requirement than high-producing dairy cows and, in most herds, heifers are usually in better shape prior to their first breeding season than at any other time in their life. Hence, genetic effects on maintenance of pregnancy in Angus heifers may be much different than those described for lactating dairy cows.

I'm sorry to say, "we just don't know" the biological basis for differences in HP EPD. Rather than being influenced heavily by genetic control of one biological process, HP EPD is more likely to be the reflection of the combined genetic effects on many biological events. Given our current understanding of genetic effects that make up HP EPD, perhaps the best thing we can do is use HP EPD as a "general" tool to improve reproduction. The worst thing we could do is to believe HP EPDs define genetic differences controlling just one or two reproductive events.

Editor's Note: *Bill Beal is a beef cattle reproductive physiologist at Virginia Tech. He conducts research involving estrus synchronization, AI, embryo transfer and the use of ultrasound technology. This column is designed to provide answers to questions about reproductive management commonly posed by commercial and purebred breeders. If you have questions or comments related to the reproductive management of cows or bulls, e-mail them to Beal at wbeal@vt.edu or mail them to him at the Dept. of Animal & Poultry Sciences, Virginia Tech, Blacksburg, VA 24061-0306.*