by Bennet Cassell

Can genetics improve health traits?

THOSE of you who are interested in the most recent research on this topic will want to read two recent articles by Nate Zwald and colleagues in the Journal of Dairy Science: JDS 87:4287-4294 and 4295-4302. Those papers address several questions, two of which I will borrow for this article:

First, do producers record health data of sufficient quality and quantity to be able to tell which bulls are genetically superior for health traits?

Second, given that the data exist, do genetic differences between bulls of sufficient consequence exist to justify attention through selection?

Dairy cows express a great deal of health trait information depending on how veterinarians and producers define each trait. To narrow down the question to a workable situation, Zwald and his coworkers studied displaced abomasum (DAs), ketosis, mastitis, lameness, cystic ovaries, and metritis. The sources of data were on-farm computer programs PCDART, Dairy Comp 305, and DHI-Plus.

Quality counts . . .

Quantity was not an issue, as lots of farms enter health data into these three programs. However, the collection of health data is optional, and the focus is solution of problems on the farm. Health data are not routinely processed (though some are stored) at a central computing facility as are milk production records or reproductive events. Reproductive events impact estimation of milk yield or they probably wouldn't be centrally processed either.

Health traits present another problem . . . there is no standard coding method. Producers who record health events use abbreviations that suit their own needs. One farmer might enter "ketosis" to describe a cow with said disease (pretty straightforward), while the dairyman down the road entered "ketos" or "ketotic". One producer may carefully enter "ketotic" for every suspect in the herd, while another may only record events where the veterinarian treats a cow. Research with data like this is not for the timid, as Zwald would tell you. He actually dealt with 21 different codes or acronyms to describe mastitis.

A whole list of questions . . .

Health traits bring a Pandora's Box of problems for genetic analysis. The six health traits considered here don't occur with equal frequency.

- About 3 percent of the cows in the study had displaced abomasums.
- 21 percent were recorded as displaying metritis.
- About 10 percent of cows displayed ketosis.
- 10 percent had lameness.
- 20 percent had at least one case of mastitis during each lactation.
- 8 percent had cystic ovaries.

DAs, ketosis, and metritis occur almost exclusively in early lactation. Mastitis and lameness can happen just about anytime. Producers won't likely find (or even look for) cystic ovaries in the first 30 days of lactation. Cystic ovaries typically occur from Day 30 to 150. Some events like mastitis and lameness can occur several times during lactation.

It is essential to simplify the definition of health traits. For instance, code "clinical" cows as having expressed the trait, regardless of how many clinical events occurred. There is no perfect way to standardize the degree of severity before the health event is coded as "clinical." DAs tend to be pretty easy to code. Ketosis is less objective.

What they found . . .

Genetic control of all the traits was high enough to attract interest. Heritabilities in first lactation were:

- 0.18 for DAs
- 0.11 for ketosis
- 0.07 for mastitis
- 0.08 for lameness, cystic ovaries, and metritis

For reference, h^2 for somatic cell score and productive life are 0.12 and 0.08. The authors went a little further than individual health traits and looked at a trait defined as "any disease in the first 50 days of lactation." Heritability for this health composite was 0.12 in first lactations and 0.10 for all lactations. There is sufficient genetic variation to change some of these health traits, but is it worth the effort?

The authors estimated genetic correlations between the 15 possible pairs of health events. I'll cover a selected few that are pretty interesting. **DAs and ketosis** have a positive genetic correlation of 0.45. **Ketosis and cystic** ovaries have a positive genetic correlation of 0.42 while that for **ketosis and lameness** was positive 0.19.

That ketosis character seems to contribute to several problems. The authors stated, "Positive genetic relationships between these traits seem to indicate that daughters of certain sires tend to be susceptible to all health disorders, perhaps because they lack adequate general immune response or because they experience extreme negative energy balance in early lactation."

The authors concluded that breeding companies could make significant genetic progress in these six health traits if they concentrated progeny testing in herds that recorded the health disorders, standardized trait definitions and diagnoses, and implemented systems to transfer and store the data.

There are problems enough in that conclusion, but the kicker is that progeny group sizes need to increase! That caveat has hit a stone wall for years in the U.S. I am less than optimistic that demand for genetic evaluations for health traits will tip the balance in favor of larger progeny groups.

Improving health traits through selection is not on everyone's radar screen. We already have a problem with information glut. Genetic evaluations are calculated routinely on at least 26 different traits in Holsteins, not counting the various genetic markers. Adding six new health traits would not be a move welcomed with open arms by those in semen marketing or perhaps those in the sire department either. This business of breeding better dairy cattle is pretty complex already, but would we be wise to "dumb down" the system?

Look at the total package . . .

Our overriding goal should be to breed cows with higher lifetime economic merit. Poor cow health is expensive, and treatments increase risk of drug violations. There are quality of life issues for the cow, too.

In some countries, if technology exists to breed healthier cows, the public expects that technology to be used, regardless of return on investment to the cow's owner. I'll leave it to others to speculate on whether such attitudes will dominate breeding decisions in the U.S., but here is one attitude that I sincerely hope takes hold of producers.

We have largely ignored the health of dairy cows through selection programs, and we have paid a price for that decision. Options exist, but cooperation and leadership by key movers and shakers will be required to act on them.

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