IMPACT OF USING ONE OR 200 BULLS ON YOUR DAIRY HERD

Roger D. Shanks

TAKE HOME MESSAGES

♦ For genetic advancement, AI bulls are superior to natural service bulls.

♦ Choosing one bull maximizes your potential return, but increases your risk.

♦ Using five to fifteen proven AI bulls is recommended for a 200-cow herd.

♦ Progeny testing young bulls is essential for maintaining US genetic advantage.

♦ Using eight to twenty young bulls is recommended for a 200-cow herd.

First, criteria needs to be established for evaluating how many bulls should be used in a 200-cow dairy herd. As a geneticist, I believe that the focus should be on the response to selection. Four components comprise response to selection and are 1) accuracy of evaluation, 2) intensity of selection, 3) genetic variability, and 4) generation interval. A breeder should want to increase the first three and reduce the generation interval to maximize the response to selection. A dairy producer will also want to focus on costs of the genetic improvement, but I will not address the costs in detail.

ACCURACY OF EVALUATION

Bulls with higher reliabilities have more accurate genetic evaluations, primarily as a result of having more daughters spread out in a large number of herds. In the short run, using only proven bulls would maximize accuracy of evaluation. However, if everyone followed this policy, no proven bulls would be available for the next generation. Each producer needs to assist with the testing of the next generation of bulls. The recommendation to maximize genetic progress is for at least 20% of a herd to be bred to young bulls. These young bulls should not be just any young bulls, but should be the sons of outstanding parents. My preference is to use an index to evaluate the young bulls based on the performance of their parents and close relatives. Several indexes are available to the industry including net merit and TPI. More than one young bull should be used because the accuracy of the parental information in predicting the genetic merit of the young bull is not as accurate as the information of progeny used to predict the genetic merit of proven AI bulls. My recommendation would be to use at least eight to twenty young bulls annually in a herd of 200 cows.
INTENSITY OF SELECTION

Semen is available on close to 500 US Holstein dairy bulls. If you choose to use 200 bulls in your herd, one per cow, you are selecting bulls at a very low intensity of selection. Selecting the top 40% of bulls (best 200) corresponds to an intensity of selection of .97. Selecting the best 20 bulls (top 4%) increases the intensity of selection to 2.15. The response to selection from selecting the best 20 bulls versus selecting 200 bulls more than doubles the response to selection. If the best 5 bulls are chosen (top 1%), the intensity of selection increases to 2.67. The intensity of selection is greatest if you choose one bull for the entire herd and that bull could be selected on the characteristics that you deem important. Unfortunately, if many other people have the same goals of sire selection as you or if the bull does not produce much sperm, the semen may be relatively high priced. Choosing 200 bulls will have the opposite problem in that the average of the 200 bulls will be near average for most traits. If you wish to use selection to improve your herd, the use of 200 bulls will not be very efficient (that is the intensity of selection would be low). Some of you may justifiably indicate that among the 200 bulls will be bulls unique for many different characteristics. This is true, but the average of all 200 bulls will not have the opportunity to be near the extreme for any characteristic. Neither one nor 200 is a good answer to the number of bulls that should be used to mate 200 cows. My recommendation is to use five to fifteen proven AI bulls annually for genetic advancement in a 200-cow herd.

GENETIC VARIABILITY

Generally, the producer has little control over the genetic variability that is in the population. Inbreeding has the potential to increase variability by increasing the amount of homozygosity and decreasing the amount of heterozygosity in the herd. However, a combination of inbreeding and selection may reduce variability. The potential of inbreeding could be different whether one or 200 bulls were used on the herd. With 200 bulls, a wise choice of mates could work to minimize inbreeding. If only one bull is used for all 200 cows, the producer would be relying on the industry to have bulls available that are unrelated to what has been used in previous years. The average relationship between animals within a breed has been increasing over the years. To state another way, more and more animals are related to each other. Finding an outcross sire is becoming a greater challenge. A bull is an outcross if the bull is less related to his potential mate than the mate is related to the population. A bull may be inbred, but an outcross, if the bull or his ancestors are less closely related to the general population than the ancestors are to each other. In general, avoidance of inbreeding leads to a recommendation to use several bulls in a 200-cow herd.

GENERATION INTERVAL

We all like the majestic old cows that have had long productive lives, yet maintain their youthfulness. However, for genetic advancement, I would more appreciate outstanding daughters. A breeder can revel in the merits of a majestic old cow, but the genetics are not getting any better as the cow ages. (The genetics of an animal does not change with age.) What does change is the merit of contemporaries. If a producer is making good breeding decisions the young cows entering the herd should be better than the older cows. Having a young herd corresponds to having a short generation interval that facilitates genetic advancement. A producer needs to be more careful with selection decisions when minimizing the generation interval because progress will be fast in the direction of selection (either good or bad). Choosing the bulls and cows with the desired outstanding characteristics is critical. Minimizing the
generation interval does not mean that all of the cows will be first-calf heifers, although the young cows could be a significant portion (half or more) of the herd.

OTHER CONSIDERATIONS

Using only one bull annually should increase uniformity in your herd but not as much as you might imagine because a 200-cow dairy has cows of various ages and the cows of different ages would be sired by different bulls. If a mistake is made in choosing the one sire, close to a hundred unwanted daughters may be in the herd. Is the risk worth it? Using one bull annually is wonderful if you have been choosing all of the correct sires. Otherwise, you may have groups of cows that need culling.

Physically, it may not be possible to breed the entire herd to one AI bull because you cannot get enough semen on any one bull. This is not an argument to maintain a bull on the farm. One bull allowed to mate naturally will not be able to service 200 cows. You could collect semen on your one bull and then mate him artificially to the entire herd. If you are going to all of that trouble I hope the bull is different and better (at least in your eyes) than any of the bulls that are available in AI.

Misidentification of a straw of semen at the farm is not an issue if semen is in the nitrogen tank for only one bull. The first straw out of the tank could be used for insemination and the hazard of thawing unwanted straws would be eliminated. With semen from 200 bulls in the nitrogen tank, finding the desired straw for a particular cow could lead to problems of misidentification or of thawing undesired straws. Again, a compromise having semen from fewer than 200 bulls in the semen should minimize potential problems. A semen location inventory would be highly desirable and I hope that location of semen from 20 to 40 bulls could be handled accurately.