Rate of Genetic Improvement

By James Morgan, PhD

Rate of flock improvement is based on several factors. A few of these include accuracy of identifying superior animals, generation time, number of traits selected for and consistency of selection from year to year. To be candidates, traits need to be both heritable and variable with in your flock or breed.

My father raised registered Shorthorn cattle for 30 years before transitioning to a commercial herd in the 70's. He had attended college taking two years of pre-engineering courses prior to being drafted for WWII. After the war, he made the decision to return to the family farm. Dad was hungry for knowledge and in particular he wanted more information about beef genetics. After being badgered for many months, the county extension agent finally loaned Dad a genetics text and said a farmer won't get much from a college book. Dad took a couple of things to heart out of the book. The one thing that he cited the most from that book was, "Select three traits that you want your cattle herd to improve on. No matter what bulls you buy or replacement heifers you keep, never go backward on those three traits. At the end of thirty to forty years, you may be able to add a fourth trait".

Dad told the story more as a lesson for life and not as much for the genetics. His goal was that my siblings and I would understand the importance of selecting a few key goals and to be consistent and patient. Little did Dad know that this piece of wisdom would become important in my second career as a shepherd. "Select three traits for your cattle herd and never use a bull or a replacement heifer that takes you backwards on any of those three traits. At the end of 30 years, you can add a fourth trait."

Dr Charles Parker, retired US Sheep Experiment Station Director and Chairperson of the Ohio State University Animal Science Department, relates a similar lesson about selecting superior sheep. When Charles was a Texas Aggie and graduate student he met with a group of sheep producers. One proud shepherd told Charles that their flock management plan included selecting for 32 different traits. Similar to my father's story, Dr Parker's lesson is that genetic progress is greatly diminished by selecting for too many traits.

How does the advice from the 1940's beef genetic textbook apply to genetic selection for sheep performance in the early 21st century? The basic principles from my Father's advice still apply. A few differences should be mentioned. In terms of biology, sheep have a shorter generation time than cattle and most breeds twin (more replacement animals to choose from). With the development of EPDs (expected progeny differences), livestock producers have access to greatly increased accuracy of selection. At the beginning of the 21st century, a shepherd can make significantly faster progress than my Father could with his cattle, especially if they take advantage of across flock EPDs and the shorter generation interval.

But wait, meat production requires many traits. Inferior quality in any of the following can cause production train wrecks: structural soundness, growth, reproductive soundness, milking ability, prolificacy, lamb survival, parasite resistance and the list goes on. They are all important. If a

shepherd only selects for three to four traits, what happens to the rest? Eventually, the traits not selected for become unacceptable. They can not be ignored.

One approach is to select a few key traits with significant impact on financial return and production and then set minimum standards/cull levels for the important, but second tier traits. This will keep the second tier traits acceptable but still allow the flock to greatly improve production. Note that the more rigorous the cull levels are for the second tier, the slower the progress on the primary traits. A second approach is to use an index that selects for several traits and ranks each according to its importance. My preference is to use an index for improved meat production (pounds lamb weaned/ewe lambing), cull animals that are not structurally or reproductively sound and set minimum standards for conformation and muscling. Note the primary selection index is rewarded at the market and that culling traits are poorly rewarded.

Recently, the National Sheep Improvement Program (NSIP) released two new indexed EPDs (expected progeny differences) that reward performance and financial return. These were developed by Drs Dave Notter, Larry Kuehn, Bindu Vanimisetti and Randy Borg at Virginia Tech and Dr Rodney Kott at Montana State University. One index is "pounds lamb weaned/ewe lambing". This EPD identifies sires with large numbers of daughters and relatives that rarely lose or reject lambs and also have good growth and milk production. At the sale barn, shepherds are paid for pounds of live lamb. So this is a "money trait" for production and rewards genetics for growth, prolificacy, milk and survival. Over time, selecting on this trait will increase the number of ewes that triple in the flock. By combining the Number Born EPD with the Pounds Weaned EPD index, the shepherd can identify genetics that wean high pounds of lamb but predominantly twin.

The second indexed EPD factors in the management system (range or farm flock) and cost of feed and forage to rank genetics for profit potential. The index includes individual EPDs for prolificacy, growth, milk, wool and yearling weight. Currently, this trait is being used by Targhee breeders in NSIP. The index rewards ewes that are more prolific and have lambs that grow well. The research indicated that ewes with heavier yearling weights are more expensive to feed and thus decrease profit. The main point to make on these indexed EPDs is that they allow a shepherd to select multiple traits based on their importance for production and/or financial return. Both of these NSIP EPD indexes also have significant potential to optimize genetics and not just maximize growth or prolificacy.

In summary, keep your important selection traits to a minimum, be consistent from year to year and use the best tools available. For the important traits that do not make the primary list, set minimum levels for culling breeding stock that do not meet acceptable production standards.

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