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The potential of genomic selection for improving ewe longevity

In a previous article, we highlighted the need for genetically improving the length of ewe productive life in U.S. sheep based on our studies in Katahdin sheep. Ewe longevity is an example of a trait that will benefit from genomic selection because it is sex limited (only females have records) and measured late in the life of the animals. Therefore, the Sheep GEMS team has conducted genomic studies to support the implementation of genomic selection to improve ewe longevity in U.S. sheep.

Using records collected in the National Sheep Improvement Program (NSIP), we found that, on average, Katahdin ewes were 3 years of age at their last lambing. Over their lifetime, ewes produced 2.7 litters, gave birth to 4.6 lambs that weighed in total 40 lb., and weaned 4.3 lambs that weighed in total 154 lb. All these traits, which are indicative of ewe productive longevity, are heritable, with heritability estimates ranging from 6 to 15%. That means we can improve them through genetic selection. We also found that all these indicator traits for ewe longevity were highly correlated genetically. That means improvement in one trait will lead to improvement in the other traits. Therefore, we only need to use one indicator of ewe longevity in our selection programs. Among the options, the total number of lambs weaned over a ewe's lifetime seems the best trait to use. Nonetheless, we found no evidence of genetic improvement in ewe longevity over time in Katahdins, stressing the need to consider it directly in our breeding decisions.

We also identified multiple genes associated with ewe longevity traits that were located across eighty-six genomic regions in Katahdin ewes. These regions include genes that affect prolificacy, the number of immature follicles in the ovaries, synthesis and release of reproductive hormones, and early pregnancy events. Moreover, we also identified genes related to response to stress or pathological conditions, growth performance, and carcass traits. That list coincides with the most common reasons we cull sheep: infertility, low prolificacy, and other reproductive issues; illness; low growth performance; and poor body condition. Importantly, these traits or conditions are biologically complex and controlled by many genes. However, as a next step, we need to study these genomic regions in greater depth for genetic markers that may assist us in identifying ewes with higher merit for longevity.

Overall, in our studies of ewe longevity, we found producers cull most ewes early in their life. However, it is not clear if this was voluntary or involuntary culling. We therefore need more complete records on culling reasons and dates. When we cull ewes at earlier ages, they wean fewer lambs over their lifetime. We also need to retain more ewe lambs, reducing how choosy we can be. No genetic progress in ewe longevity was evident over the past years, indicating that we need to include it in our selection decisions. By doing so, we can improve the profitability of the U.S. sheep industry.

For further information contact Drs. Luis Pinto (lbatista@purdue.edu) or Luiz Brito (britol@purdue.edu).

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