To Breed or not to Breed for Parasite Resistance

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Gastrointestinal parasites, or helminths, are a major concern for sheep producers around the world, and can be a major source of production losses[1]. These losses include poor growth rates, reduced milk, meat and wool quality, as well as the cost of treatment. Sheep become infected with helminths when worms are ingested from infected pastures, once inside the sheep, the worms burrow into the gut lining where feed on blood and mature into egg producing adults. These eggs are then shed in the feces where they hatch into larvae that eventually molt into immature worms that travel up grass blades in search of their host to complete the lifecycle.

There are a variety of strategies designed to combat infection including rotational grazing, and regular treatment with anthelmintic drugs. However, the reliance on anthelmintic drugs has also led to the development of anthelmintic drug resistant worms[2], causing scientists to investigate alternate methods of parasite control.

One of the methods under investigation is to selectively breed sheep for helminth resistance. This method is based on the host-parasite co-evolution that has occurred over millions of years, ensuring survival of both species[3]. However, as a result of current selection pressures for enhanced meat, milk and wool production, as well as intensive farming practices, the sheep-helminth interaction has been altered resulting in high parasite loads around the world. There are however, breed differences in susceptibility or resistance to helminth infections, for example in some remote areas off the Scottish coast, a high parasite load may have induced breed-specific selection pressure resulting in breeds that are more resistant than others[4]. Consequently, breeds such as Barbados Blackbelly, U.S. St. Croix, Florida Native and Gulf Coast Native breeds, Indonesian Thin tail, Indian Garole, and African Red Maasai are being used for genetic studies to identify genes that are associated with enhanced helminth resistance[5].

Although, breeding for enhanced helminth resistance may seem simple, it is in fact a complex procedure that starts with being able to effectively identify and measure a desirable phenotype. In sheep, fecal egg counts are generally used to quantify the parasite load, however fecal egg counts can vary depending on season as well as the reproductive status of ewes and so may not accurately depict the parasite load[6]. The scientific community however, has agreed that resistance to helminths is moderately heritable and therefore there is potential to breed for enhanced parasite resistance[5].

Genetic studies have reveled that resistance is a polygenic trait meaning that it is a combination of many genes that contribute to enhance resistance, thus making genomic selection difficult.

However, it may be possible to breed for resistance using phenotypes rather than genotypes, and countries such as Australia, New Zealand, and the UK have pursued this method of improving helminth resistance in their flocks[5]. Semen is now available from these breeding initiatives for producers that want to introduce resistance into their flock. However, introducing resistance genes into North American breeds may not be effective due to different parasite species and rearing conditions. Additionally, it is unclear how breeding for enhanced parasite resistance will affect the ability to fight off other diseases.

Despite the possible drawbacks, there are clear advantages by generating a flock with improved health and production status. This method also adds diversity to helminth control strategies so producers are no longer solely reliant on anthelminthic drugs. Additionally, an overall reduction of egg levels on pasture will also improve health of non-resistant sheep. However, before the implementation of a large-scale breeding program for helminth resistance can occur, further research is necessary to investigate resistance under Canadian pasture and management conditions. Genomic tools should also be used as part of a helminth resistance breeding program to monitor health and production traits to ensure an overall healthy flock.

For more information or to read the full report please visit www.ontariosheep.org it can be found under the parasite tab. **OSN**

References

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