

DNA Scrapie Resistance Testing

A specific gene in the sheep's DNA determines if the sheep will be resistant or susceptible to scrapie. The location of this gene has been labeled codon 171. There are two different genes or sequences that can be found at codon 171. These have been labeled Q and R. Each sheep has two codon 171's, one from its dam and one from its sire. Therefore the only possible genotypes are QQ, QR or RR. (QR and RQ are considered the same). A sheep will pass one of the codon 171's to its offspring. Which one that it passes is a totally random event. On average it will pass on one of the codons 50% of the time and the other 50% of the time.

The presence of at least one copy of the R gene will result in a sheep that is resistant to scrapie. The presence of QQ means that the sheep is susceptible to becoming infected with scrapie if it is exposed. Remember this is a test for genetic susceptibility to scrapie not presence of infection. There are many QQ sheep that do not have scrapie. They are susceptible but have not been exposed to the scrapie agent.

Let us run through the possible breeding scenarios.

1. Both of the parents are QQ: All offspring will be QQ. Each offspring will get one copy of the Q from its dam and one from its sire.
2. Both of the parents are RR: All offspring are RR. Each offspring will get one copy of the R from its dam and one from its sire.
3. One of the parents is QQ and the other is RR: All offspring will be QR. Each offspring will get one copy of the Q and one copy of the R.
4. One of the parents is QR and the other is QQ: One half of the offspring will be QR and one half will be QQ. All of the offspring will get one copy of Q from the QQ parent and one half will get an R and one half will get a Q from the QR parent.
5. One of the parents is QR and the other is RR: One half of the offspring will be QR and one half will be RR. All of the offspring will get one copy of the R from the RR parent and one half will get a Q and one half will get an R from the QR parent.
6. Both parents are QR: One fourth of the offspring will be RR, one fourth will be QQ and one half will be QR.

As you can see sheep that are RR have great value because all of their offspring will be resistant to scrapie. Many seedstock producers have been testing a portion of their flock to determine their genotype. Herd rams are the most important sheep to test as they have the most impact on next year's lamb crop. If all of the herd rams are RR all of the offspring will have at least one copy of the R gene regardless of the genotype of the ewe flock. In blackface sheep the evidence is clear that codon 171 is responsible for scrapie resistance or susceptibility. In white-face breed there may be other codons that may be important as well. The cost of the test is about \$17 per sample.