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from 1991 to 1993

Contractor: AgResearch



Breeding for reduced worm drench requirements in sheep

- Some lambs have the ability to maintain good growth rates and have minimal dags when exposed to roundworm challenge, despite reduced use of drenches.
- Is it feasible to select for this trait and how heritable is it?

Tough sheep

The battle is on against drench resistance in New Zealand sheep.

Breeding sheep that can **resist nematode infection** is one way that sheep farmers may be able limit their use of drenches. Such sheep develop a high level of immunity to nematode infection and therefore have low faecal worm egg counts [FEC's] when tested. This is known as **resistance**.

Another breeding strategy may be to select for sheep that maintain adequate productivity under worm challenge, despite reduced drenching frequency. This trait is called **resilience**. Some resilient lambs are also resistant to infection with worms, but not all are. Those that are resilient but have high FEC's are said to be **tolerant** of worm infection.

Breeding for nematode resistance and resilience in lambs is a very **complex** job. Research has indicated that lambs with low FEC's do not always perform better than the lambs with high FEC's and lambs which perform well when left undrenched do not always have low FEC's.

Breeding for resilience

This project, funded by Meat New Zealand from 1991 to 1993, looked at the feasibility and implications of breeding for resilience in lambs.

In short, it showed that while resilience is only **moderately heritable**, there may be long term benefits for breeders if they select for both resilience and resistance. (*note: heritability is the chance of a trait passing from one generation to the next. It is measured from 0 to 1, with 1 indicating that all the variation is genetic*).

Testing for resilience in commercial flocks

The project, carried out by AgResearch, tested rams and their progeny for resilience using a 'drench on demand' procedure.

The project aimed to -

- see whether the 'drench on demand' procedure is a good way to test for resilience
- examine the relationship between resilience and resistance to worm infection
- estimate the heritability of resilience

Altogether **progeny from 213 different commercial rams** from the Eastern Romney and Wairarapa Romney Improvement Groups were tested for resilience.

In Year One there were 3395 ewe lambs and 4138 ram lambs in the trial. All were grazed on the farmers properties.

Mustered in four to five times

Between weaning and autumn, the ram lambs were mustered four to five times and assessed on their -

- * condition score
- * dag score

Those lambs whose body condition and amount of dags were of a concern to their owners, were drenched (i.e. 'drench on demand'). The number of times the lamb was drenched was recorded. The goal was to identify the rams whose progeny required, on average, the lowest number of drench treatments to **maintain acceptable condition**.

Ewe lambs tested

Growth rates, FEC's and dags were also assessed in the female half siblings (who also went for an extended period without drenching). This enabled genetic correlation between **resilience** (the **ram lambs**) and **resistance** (the **ewe lambs**) to be calculated.

In Year Two the study was restricted to 4000 lambs. This time, the decision whether to drench was based on individual liveweight gain data as this was considered to be less subjective.

In Year Three, progeny from selected commercial rams were tested alongside progeny from **resilient** rams (identified from the Wallaceville Animal Research Centre's **experimental flocks**).

Through **genetic linkages**, commercial lamb performance was also compared to that of progeny of resistant, resilient and susceptible rams from Wallaceville's breeding lines (using flock records from 1988 -1993).

Resilient ram lambs performed better under limited drenching

Progeny of those rams selected for resilience **needed fewer drench** treatments than their non-resilient counterparts (1.87 vs 2.29 drenches over the test period).

The lambs from resilient rams had significantly less dags and higher weight gains under challenge compared with the lambs from the resistant or susceptible rams. However, they had intermediate FEC levels.



Heritability of resilience low

Results showed that overall, heritability for resilience **measured in this way** is **low** from one generation to the next (0.05 to 0.14). Yearling liveweight or fleece weight, for example, have heritabilities that are double this. Heritability also appeared to depend on how severe the worm challenge was. The more severe, the higher the heritability.

Date of **birth**, **age** of dam and **birth rank** all significantly affected resilience, largely because of their influence on weaning weight (which in turn tended to influence the lamb's later performance).

Simply, selecting for individual lambs which do well when left undrenched (i.e. **phenotypic selection**) could cause a **bias** towards lambs that are simply well grown at weaning. (*Note: phenotype selection is when you chose an animal on its own performance, not the performance of its family members*).

This in turn would **work against twins** and late born lambs which tend to be lighter at weaning, regardless of their genetic merit.



Breeders need to use a **progeny testing** approach instead, (where ewes are single-sire mated and the performance of other family members are used to assess the true genetic merit). This can achieve up to 1.9 times faster genetic progress.

Select for both resilience and resistance.

In the study, ram lambs that received fewer drench treatments (i.e. were more resilient) also tended to have sisters with higher than average growth rates and lower than average dags while under challenge.

On the other hand, there was **no genetic correlation** (relationship) **between resilience** in male progeny and **FEC** in their sisters. This means that FEC levels, and the resulting pasture contamination levels, won't necessarily decrease in a flock when it is selected for **resilience**.

On the flipside, if lambs are selected purely for **resistance** (i.e. low FEC), some will be poor performers in terms of productivity but this might be counteracted to some extent by a reduction in pasture contamination.

The results suggest that farmers grazing Romney based sheep under New Zealand conditions should **breed for both resistance and resilience**.

What does this mean for farmers?

Calculations suggest that a reduction of up to one drench per lamb per 4-5 sheep generations could be achieved through breeding for resilience using **traditional methods**.

What is really needed is a genetic marker for these traits so carrier rams can be identified by a blood test.

Because of the inevitable production losses when you try and identify the most resilient animals through **progeny testing**, there is currently **no general recommendations** for farmers to select for resilience in its own right.

The strategy used most widely involves selecting lambs for high productivity and low FEC when left undrenched for limited periods. This service is currently being provided by **Worm FEC™**.

Points to remember

- Breeding for resilience is not enough to manage the drench resistance problem in the short term. Genetic markers for both resilience and resistance would greatly speed-up flock improvement.
- Resistance and resilience traits are considered as "traits under development".
- Research continues on combating drench resistance.

Contacts for more information

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