

FACTSHEET

Using genetics to improve the health of a sheep flock

Breeders have made great genetic progress in productive traits such as growth, meat and reproduction over time - but it is also possible to improve animal health by measuring and selecting for disease resistance/tolerance.

More resilient sheep are desirable in the face of increasing challenges to productivity, increasing disease risk and cost of interventions.

To make progress a trait needs to be both heritable (the degree of genetic influence) and variable in the population. By testing or measuring for a trait, correcting for any environmental influences,

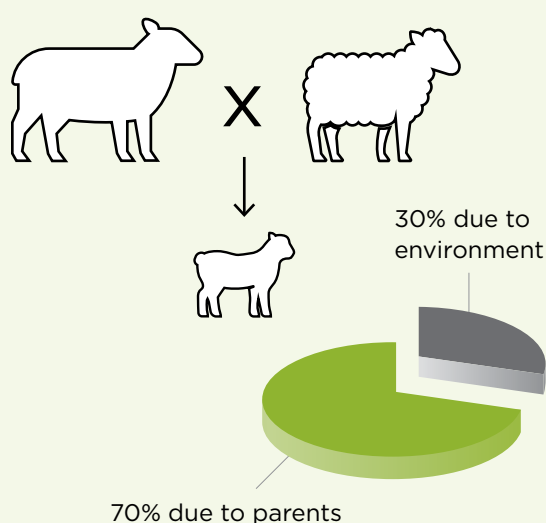
individuals that are superior for the trait can be identified and then used to breed the next generation.

It is quicker to make progress in traits with moderate (20% to 30%) to high (>40%) heritability but still possible even at lower heritabilities (for example reproduction at 10%), it just takes longer.

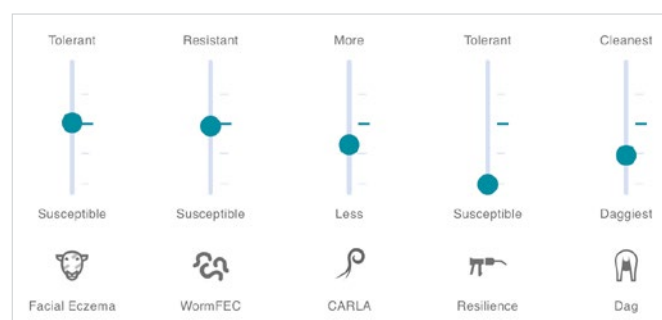
Fortunately, most disease traits are of moderate to high heritability.

By choosing rams and replacement females that have greater tolerance or resistance to disease, flock health can improve over time. The rate of improvement will depend on the amount of heritability and variation for that trait.

Heritability of tail length



On the flipside of this page you can see a summary of some health traits. There is genetic information available for these traits for some NZ flocks. These can be found on the nProve website (<https://nprove.nz>) which is searchable for the traits of interest.



Resistance to internal parasites

Heritability = about 25%



All sheep are born with no immunity to internal parasites but develop resistance as they mature if the challenge is not overwhelming. To identify individuals with early and higher levels of immunity lambs must be exposed to a parasite burden, then faecal samples obtained and assessed for parasite eggs measured in eggs/gram. Animals with greater immunity will have a lower number of eggs per gram than the mob average. Lambs may be sampled soon after weaning or in the Autumn – these are referred to as Faecal egg count 1 & 2 (FEC1 & FEC2). A reasonable challenge is required to differentiate the more immune animals – usually a minimum mob average of 800 eggs per gram. Breeding values for FEC1, FEC2 and adult AFEC are produced, correcting for known non-genetic effects. Low or negative BVs indicate a lower parasite burden indicated by lower egg production and are best.

There is a weak negative relationship of internal parasite resistance with productivity. Energy devoted to the immune system can be at the expense of other traits. If selecting for productive traits only, then over time there will be an associated slow reduction/decline in parasite resistance.

Index selection allows for animals with high productivity and parasite resistance.

The core index for maternal sheep is the NZ Maternal Worth (NZMW) consisting of reproduction, survival, lamb growth and adult size. The sub-index for parasite resistance is Dual Purpose WormFEC (DPF) and should be used in conjunction with the NZMW to select productive and resistant replacements. Indexes consist of a number of BVs multiplied by an economic weighting and are in cents. With indexes and sub-indexes a higher value indicates higher merit.

Dag Score

Heritability = about 30%



Dags are a significant cost to sheep farmers due to the work of crutching and dagging, increased risk of flystrike and reduced value of contaminated wool. Dagginess has a moderate heritability. Some sheep are more sensitive to changes in feed and increased parasite challenge leading to scouring and the accumulation of dags.

Dags are measured using a 0 to 5 scale with 5 being extensive dags around the breech and down the legs. Lambs should be measured when there is good variation in dagginess so the better animals can be identified and the worst eliminated. Lamb scoring is usually at around 3 months or 6-8 months.

nProve produces two dag BVs, lamb dag score (LDAG) and adult dag score (ADAG). Adult dag is usually predicted from lambs scores, but adult ewes can also be measured.

Lower LDAG and ADAG BVs indicate a lower propensity to form dags.

Productive sheep with less dags are desired.

The core index for maternal sheep is the NZ Maternal Worth (NZMW) consisting of reproduction, survival, lamb growth and adult size. The sub-index for dags is DPD and should be used in conjunction with the NZMW to select productive and lower dag replacements. Indexes consist of a number of BVs multiplied by an economic weighting and are in cents. With indexes and sub-indexes a higher value indicates higher merit.

Facial eczema

Heritability = about 40%



Facial eczema (FE) is a significant disease in parts of New Zealand and is expected with climate change to become more widespread. It is caused by ingestion of a fungal toxin -sporesdesmin. It causes damage to the liver and bile ducts and can cause skin photosensitivity. Death may occur at the time of FE challenge or later when combined with stress such as pregnancy or birth/lactation or result in lower lifetime productivity due to liver damage. Sheep vary in their tolerance of the toxin and sheep with better genetic tolerance can be selected improving the resilience of the flock to FE challenges over time.

Sheep are blood sampled 21 days after a measured challenge, or may be sampled after a natural FE challenge and levels of an enzyme indicating the extent of liver damage measured. The measured challenge is expensive and relatively few animals are measured- the recommendation is 5 progeny per sire.

nProve uses the measurements and pedigree to predict the GGT21 BV (enzyme at 21 days post challenge) for measured animals and their relatives. A lower or negative BV indicates less liver damage than average.

Productive sheep with greater FE tolerance are desired.

The core index for maternal sheep is the NZ Maternal Worth (NZMW) consisting of reproduction, survival, lamb growth and adult size. The sub-index for facial eczema tolerance is Dual Purpose Facial eczema (DPX) and should be used in conjunction with the NZMW to select productive and FE tolerant replacements. Indexes consist of a number of BVs multiplied by an economic weighting and are in cents. With indexes and sub-indexes a higher value indicates higher merit.

Resilience to internal parasites

Heritability = about 15%



An alternative to breeding sheep for resistance to internal parasites (lower faecal egg counts) is to select for sheep that continue to perform better when challenged with parasites.

To assess tolerance requires a group of control animals that are regularly drenched animals and undrenched animals. Both groups are weighed regularly and when the performance of the undrenched animals falls below 80% of the growth rate of the drenched animals they are drenched and the days to drenching and the liveweight recorded. Animals are then weighed again 7-10 days later and again those that fall below 80% of the liveweight gain of the control mob are recorded for days to drench and liveweight recorded. A reasonable parasite challenge is required to differentiate the animals tolerance.

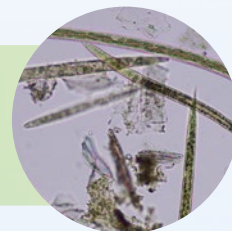
nProve produces two breeding values, age when drenched (DRAGE) and liveweight gain to first drenching (RGAIN). Higher values indicate a later age when drenched and higher liveweight gain at 1st drench respectively. These indicate greater tolerance to internal parasites.

The core index for maternal sheep is the NZ Maternal Worth (NZMW) consisting of reproduction, survival, lamb growth and adult size. The sub -Index for parasite tolerance is Dual Purpose Resilience (DPZ) and should be used in conjunction with the NZMW to select productive and more parasite tolerant animals. Indexes consist of a number of BVs multiplied by an economic weighting and are in cents. With indexes and sub-indexes a higher value indicates higher merit.

Note: animals with higher parasite tolerance may still be larger shedders of parasite eggs.

Parasite resistance – CARLA

Heritability = about 22%



One immune mechanism that develops as animals are exposed to internal parasites is the production of an antibody in the saliva which reduces the establishment of the infective L3 larval stage.

This antibody response, measured using the CARLA® Saliva test, limits the ability of L3s to establish in the gastro-intestinal tract. Fewer larvae establishing means fewer adult worms and therefore reduced FEC and reduced pasture contamination. Fewer L3s establishing also means less energy is required to fight the adult worm population, so as a result animals with high levels of CARLA® antibody tend to be more productive.

CARLA is measured by swabbing the sheep's mouth, the level of antibody is then measured by the AgResearch laboratory.

Higher CARLA levels indicate a greater saliva immune response. An advantage of CARLA is it is produced in response to ingestion of parasites, the animals can still be drenched as well.

nProve produces a CARLA BV, with higher values indicating a greater immune response.

Productive sheep with greater parasite resistance is desired.

The core index for maternal sheep is the NZ Maternal Worth (NZMW) consisting of reproduction, survival, lamb growth and adult size. The sub -Index for CARLA is Dual Purpose CARLA (DPC) and should be used in conjunction with the NZMW to select productive and more parasite tolerant animals. Indexes consist of a number of BVs multiplied by an economic weighting and are in cents. With indexes and sub-indexes a higher value indicates higher merit.



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