Facial Eczema Tolerance

Technical Note

Subject: Breeding for facial eczema tolerance
Relates to: Production, health and welfare
Date: Updated May 2025

Summary

- Facial eczema (FE) is a disease that can cause severe losses of production and death in sheep, caused by ingestion of the fungal toxin sporidesmin. It is possible to select for sheep that are more tolerant without adverse effects on other production traits.
- Breeders wishing to select for FE tolerance use the RamGuard TM service by AgResearch. Animals are challenged with the toxin and tolerance measured in terms of the level of a liver enzyme (GGT21) in a blood sample. Data from natural challenge can also be used. Research is underway to develop an alternative test that is more animal friendly.
- The use of FE tolerant rams and retention of more tolerant females can result in significant levels of tolerance over time, reducing both clinical and sub-clinical impacts of FE.

Background

FE is a significant disease for sheep, historically it was mainly observed in the Northern North Island. The fungus proliferates under warm and humid conditions, releasing spores containing a toxin – sporidesmin. With climate change, it has already become more widespread, and breeders are experiencing higher levels of challenge.

Fig 1: Areas in New Zealand liable to facial eczema outbreaks in 2009 (left) and areas predicted to be liable to facial eczema under 3 degrees climate warming (right).

Currently, the distribution of FE is intermediate between the two maps.

The severity of disease outbreaks can vary between and within years and is related to environmental condition (temperature, humidity, pasture conditions). Subclinical disease can result in reduced lifetime production or death later when stressed.

Genetics of FE tolerance

- FE is strongly inherited (about 40% heritability) and is genetically independent of important production traits.
- Selection to improve FE tolerance will not impact negatively on production traits but it is one more trait to select on.

Selecting for FE tolerance

Currently the RamGuard programme developed by AgResearch is used to assess animal's tolerance to an FE challenge, until an alternative test is available.

Animals are challenged with a known dose of the fungal toxin and the resulting level of an enzyme – gamma glutamyl transferase (GGT) produced by the liver is measured 21 days post-challenge. The history of the flock being tested and previous testing rate, are used to determine the required dose rate to ideally give a response where 50% of animals have levels greater than 55 international units per litre of blood 21 days after challenge. The animal's liveweight is used to calculate the final volume of the dose. If there is suspicion of a natural challenge, at least a sub-set if not all animals are to be bleed and levels of GGT measured at least seven days prior to the planned dosing date. If no natural challenge is suspected, animals are blood tested prior to challenging to provide a baseline and knowledge if there has been a natural challenge or some other event that has caused elevated GGT levels.

The toxin is expensive to produce, and the final dose volume is liveweight dependent – so testing larger animals is more expensive. In non-FE areas, with no background levels of FE, hoggets may be tested in Autumn. In areas where FE is present, testing usually occurs in Spring as rising 2-tooths when there is no challenge.

Natural challenge – if sheep are exposed to a natural FE challenge, blood samples can be taken and GGT levels measured. It is recommended to test a much larger group of animals under natural challenge as there is less control over consistent exposure to the toxin so more animals are needed to average out differences.

Recording FE data

RamGuard works with the ram breeder and a veterinarian experienced with FE testing.

Who to test?

- It is recommended that 4 -5 progeny per sire are tested.
- A minimum of 4 tested animals per contemporary group is required to be used in the genetic evaluation. Three tests are insufficient to form a flock statistical average for accuracy.
    - A contemporary group is animals that have grazed together prior to the challenge (mob) and are the same age group, sex, same dose rate and same time of testing.
    - Different dose groups must be coded as separate mobs and consist of 4 or more animals to be used in the evaluation.

- If different dose rates are to be used in the same flock, then it is recommended that there is one group of animals (progeny of one sire) that are split and tested at both dose rates for genetic benchmarking (i.e. 4 at one dose rate and another four at the other dose rate). This does increase the number of animals to test, but if there are animals with unknown or lower tolerance then lower dose rates are required. Generally, the animals being dosed at both rates will be those with greater tolerance to avoid welfare issues.
- If animals become too unwell prior to collection of the 21day blood sample, a blood sample should be taken before the animal is euthanised.
- Natural challenge – sample as many animals as practical/affordable, if they are in different mobs grazing different areas, different ages, different sexes or different dose rates, they should be coded as separate mobs. It is useful for a natural challenge to do spore counts in each paddock/mob to understand the level of challenge. Recommend using double digit mob codes for natural challenge e.g Ramguard test mob1 at 0.3 dose, Ramguard test mob2 at 0.4 dose and mob 11, 12 etc for natural challenge animal mobs

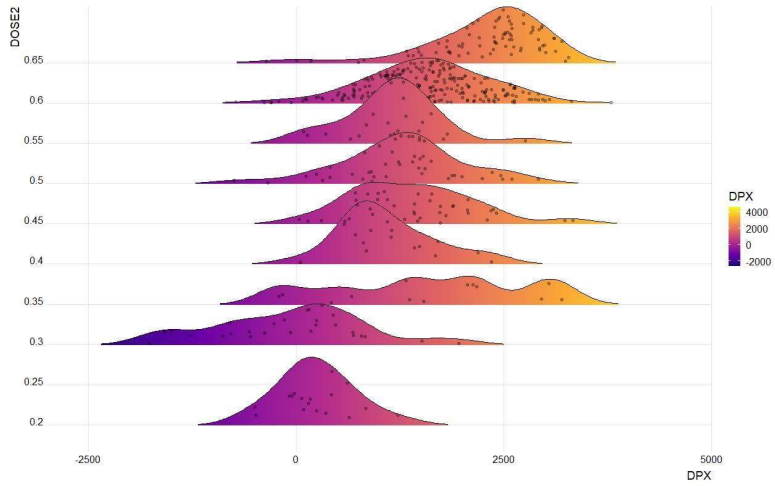
Genetic Evaluation

A minimum of 4 GGT21 results per contemporary group are required to be used in the evaluation, which can be 4 per flock at the same dose, or more if there are different mobs, ages etc. 4 is required to calculate a flock/mob average for comparison purposes.

Data recorded for tested individuals

- GGT levels pre-dosing (Base level)
- Liveweight at dosing
- Dose rate
- GGT 21 days after dosing
- Mob code for different contemporary groups)sex, dose, group etc
- Values for natural challenge are recorded as GGTNAT – to be used in the evaluation these should also be reloaded as GGT21 with a double digit mob code e.g 11, no dose rate is recorded.

The genetic evaluation does not fit dose rate, but it is used as part of the contemporary group fit and animals with higher dose rates are generally rewarded with better values, Fig 2. Generally, as dose rate increase from 0.2 to 0.65 DPX values increase (N Jopson AbacusBio)



As dose increases, generally DPX increases (the peaks for doses move right as dose increases).

Flocks testing at multiple dose rates is helpful for benchmarking.

Reporting FE tolerance

The evaluation produces a GGT21gBV, where a lower level of GGT indicating less liver damage is desirable – so a lower or more negative BV is best. The evaluation is part of the single-step genomic evaluation and so animals who have been genotyped may benefit from genomically enhanced breeding values if there is a history of genotyping within the flock doing RamGuard testing or genetically related flocks.

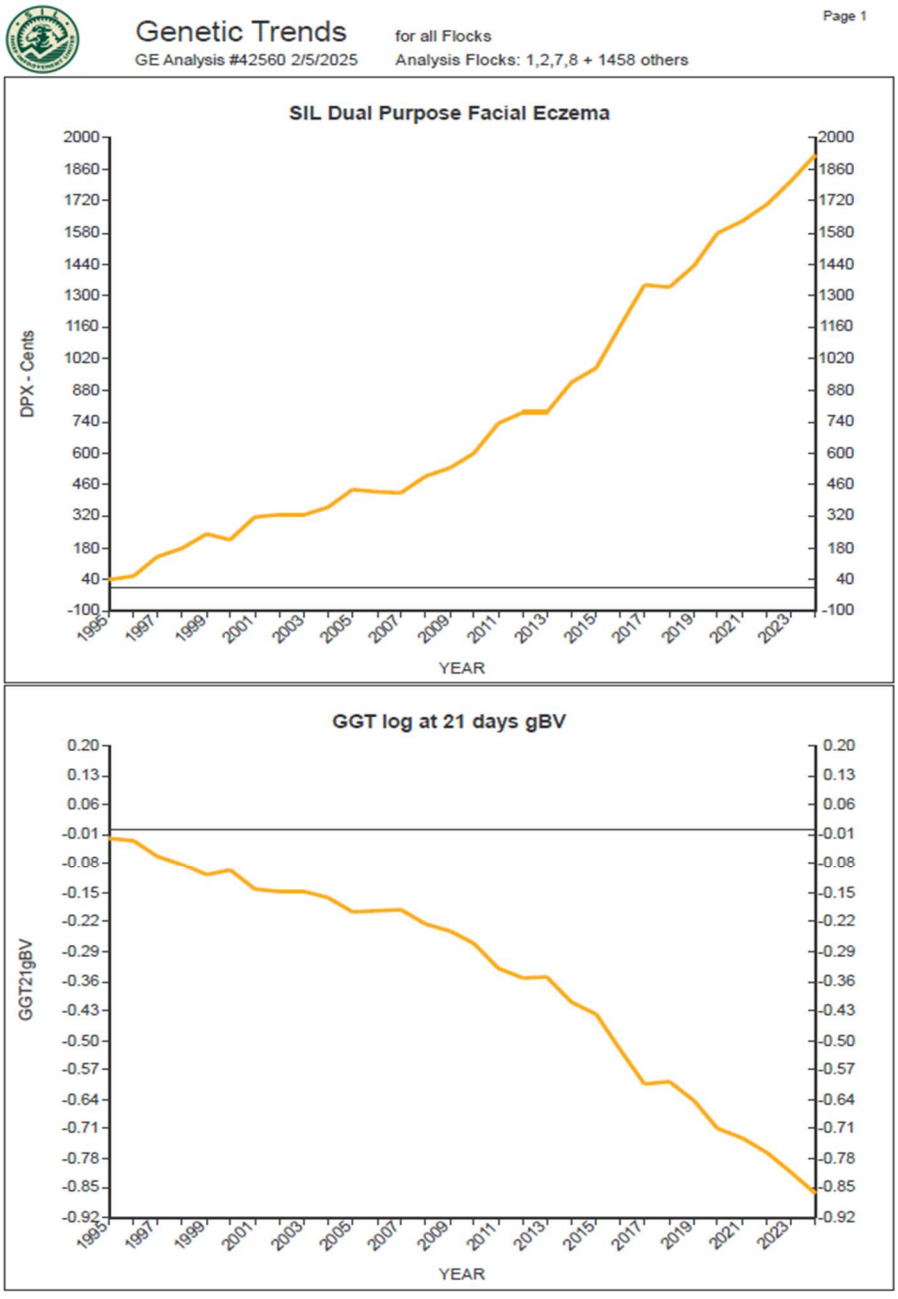
The Dual Purpose FE index (DPX) is multiplied by an economic value reflecting the value of an improved unit of tolerance meaning a higher index indicates higher merit for FE tolerance. The economic weight is based on the effects facial eczema has on survival and performance of breeding ewes and young ewe replacements over a 10 year cycle containing 2 severe and 3 moderate outbreaks. For the DPX index, higher values are best.

Dual purpose indexes are expressed in cents per ewe lambing. It is recommended to report the sub-index rather than BVs on reports.

GGT21gBV and Indexes can be generated and reported for terminal sires.

Progress to date

Fig 3. Genetic trend graphs for connected flocks recording and selecting for FE tolerance.



What is best?

For the Index DPX– a higher value indicated greater FE tolerance (cents per ewe mated)

For the breeding value GGT21 BV – a more negative number indicates less liver damage in response to the fungal toxin challenge.

Contacts

RamGuard™ AgResearch

Russell Croy based at AgResearch Lincoln
russell.croy@agresearch.co.nz
+6433218753

References:

A history of facial eczema (pithomycotoxicsis) research. New Zealand Journal of Agricultural Research, 52:4 345-376.
Communications with Dr Tricia Johnson, AgResearch, Invermay 2023