Facial Eczema Tolerance

SIL Technical Note

Subject:	**Breeding for facial eczema tolerance**
Relates to:	Production, health and welfare
Date:	Updated September 2023

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 ™ 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 more animal friendly test.
- 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 flock history, previous testing rate, to be tested are used to determine the required dose rate to ideally give a response where 50% of the animals have levels greater than 55 international units per litre of blood 21 days after challenge. The liveweight of the animals 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 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. As there is less control over consistent exposure to the toxin it is recommended to test a much larger group of animals so these differences can average out.

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 birth flock, birth year, sex and dosed at the same rate and time.
- If different dose rates are to be used, then it is recommended that at least 4 animals are tested at each dose rate and 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 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, or sexes, 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.

<u>Genetic Evaluation</u>

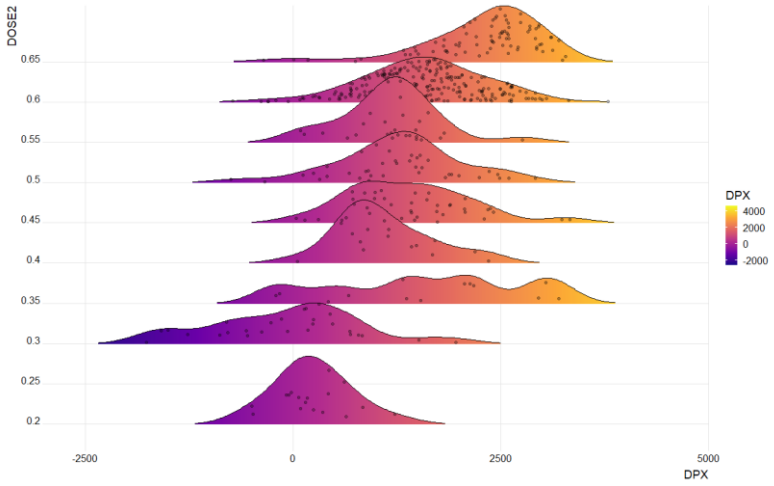
To be used in the evaluation requires a minimum of 4 GGT21 results per contemporary group, which can be 4 per flock at the same dose, or more if there are different mobs, ages etc. 4 is required to calculate a flock/mob average for comparison purposes.

Data recorded for tested individuals

- GGT levels pre dosing (Base level)
- Liveweight at dosing
- Dose rate
- GGT levels 21 days after dosing
- Mob code for different contemporary groups
- Values for natural challenge are recorded as GGTNAT
- Recording date.
- ***Bureaus****- use dosing year (not birth year) for recording year when loading.*

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.

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 enhance breeding values if there is a history of genotyping within the flock that is doing the RamGuard testing or genetically related flocks.

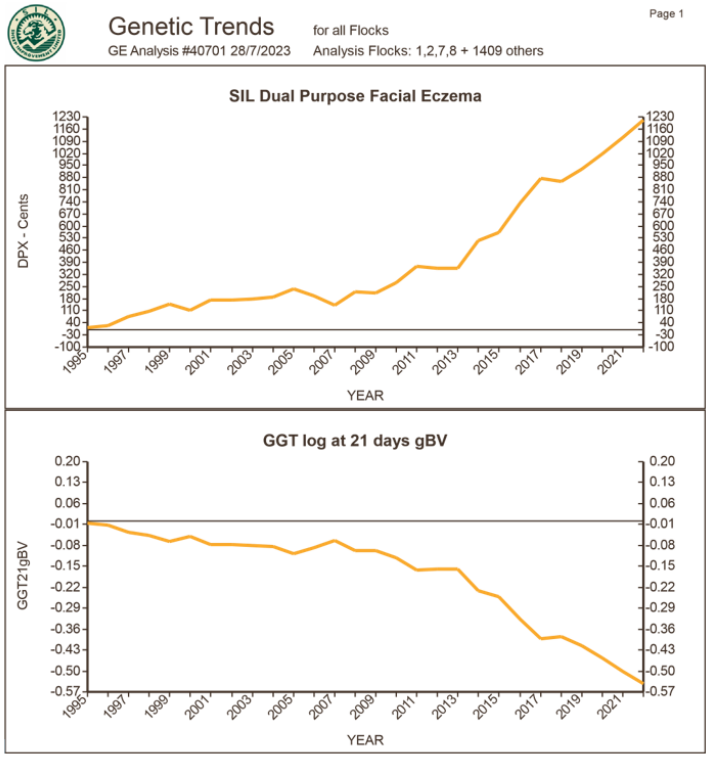
The Dual Purpose FE index (DPX) is multiplied by a weight economic value reflecting the value of an improved unit of tolerance meaning a higher index indicates higher merit for FE tolerance. The economic weight is based on the effects facial eczema has on survival and performance of breeding ewes and 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 (OPTIONAL not usually in tech note but demonstrates considerable gain possible)

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



Index – a higher value indicated greater FE tolerance

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

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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