Selecting for profit

GENE TALK

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At a recent conference I attended in Australia there was an elegant presentation on what happens when you select on a composite trait like weight of lamb weaned per ewe rather than its component parts.

This measure can be a useful rule of thumb when comparing performance of flocks or herds but there are significant downsides to using this trait for genetic improvement.

Let's look at this for sheep. The issues for beef cattle are the same but simpler, without the complication of multiple births.

The things affecting weight of lamb weaned per ewe are:

- Number of lambs born per ewe (NLB BV)
- Vigour of the lamb (SUR BV, ability of the lamb to survive)
- Mothering ability of ewe (SURM BV, ability of ewe to rear lambs)
- Weaning weight direct (WWT BV, ability of the lamb to grow)
- Weaning weight maternal (WWTM BV, ability of ewe to grow lambs)

There are other non-genetic things we correct for when estimating these Breeding Values (BVs) such as litter size and permanent environment effects. In its simplest form total weight of lamb weaned per ewe is equivalent to the number of lambs times lamb survival times the average weaning weight of lambs. This is a combination of traits based on multiplication whereas the selection index approach used by SIL or Breedplan uses a combination of traits that are added together. Animal breeding theory can show the latter approach is basically the same as the first.

While it sounds like it can achieve the same outcome, selection on just the composite variable – weight of lamb weaned per ewe – will give slower overall gains and we lose sight of which components are changing.

Weight of lamb weaned per ewe can show that some ewes are more efficient than others. However, good ewes can differ in the way they are superior because of larger litter size, better survival or faster growth in their lambs. As well as that, we can't tell whether the superiority is because of the ewe expressing maternal traits (NLB, mothering ability, milking ability) or traits that the lamb expresses (lamb vigour, lamb growth rate) or whether the genetic superiority is coming down the sire or dam lines.

Selecting for weight of lamb weaned per ewe means the effective heritability is pulled down by the lower heritability traits.

If we simply select for weight of lamb weaned per ewe the greater part of variation in that trait is number of lambs weaned, which in turn comes mostly from number of lambs born. This is such a strong effect that we effectively downplay the importance of lamb growth, which has higher heritability and lose sight of lamb survival, a less heritable trait. Not to mention that we can't partition genetic merit between the lamb (direct effect) and the ewe (maternal effect) for lamb survival and lamb growth (weaning weight).

Analysis presented by the conference's Australian researchers clearly showed that when selection was for weight of lamb weaned per ewe, the highest values were dominated by triplet litters and that for ewes rearing one lamb we cannot discriminate between those born as singles, twins or triplets.

More detailed work showed that selection based on weight of lamb weaned per ewe meant the effective heritability was reduced, leading to slower progress in improving weight of lamb weaned per ewe.

As well, this approach does not indicate where change occurred, such as in number of lambs born, lamb survival or faster lamb growth. Selecting for weight of lamb weaned per ewe means the effective heritability is pulled down by the lower heritability traits. So we have lower accuracy in selecting for genetic merit overall, leading to slower genetic gain.

In some ways selection for weight of lamb weaned per ewe might appear to be like selecting on an index and not looking at the component traits. In fact, it is worse than that. At least the index puts the appropriate weighting on each trait based on its heritability (a function of accuracy of assessment).

When we can estimate component BVs with acceptable accuracy there is no good argument to bundle all the traits together into one number and select on that basis. Modern evaluation systems break genetic merit into key component traits of production and production costs for the evaluation of BVs. They then recombine these traits in an economic selection index that accounts for differences in heritability and economic value. This is the most efficient way to select for improvement in farm profit, provided all major components of profit are in the index.

If you have any questions about this topic send an email to silhelp@sil.co.nz or leave a message on 0800-silhelp (0800 745 435).

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