

Making Progress with Important Lowly Heritable Traits

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What does lowly heritable mean? Lowly heritable means that little of the measured difference between two animals is attributed to genetics. Most of the difference is due to management/environment. Table 1 shows examples of heritability of several traits. Is a ewe that twins at three years of age compared to a ewe that singled at three years of age genetically more prolific? Possibly.

Before I discuss the lowly heritable traits, I believe the most important things a sheep seedstock producer can do is to set realistic and objective flock genetic goals, limit the number of goals and be consistent in their application from year to year. Too many objectives and changing objectives will result in slow progress.

Introduction. Many of the traits that significantly affect both the management and financial return of a sheep flock are lowly heritable. Some of these lowly heritable traits include lambing difficulties (dystocia), vaginal prolapse, 60 day weights and number born/ewe (prolificacy). Prolificacy and weight gain impact profitability. Occurrence of dystocia and prolapse greatly increase labor and if losses occur, also decrease profit. As seedstock producers, we would like to improve our flock genetics for these lowly heritable traits, but we do not want to make selection and culling decisions that have little to no effect. Inaccurate culling can remove animals of great value.

Let's take 60 day weights. Even if they are the same breed, born in the same season, and raised together, only 10% of the difference in 60 day weights between two lambs is attributed to genetics. Consider two lambs born on the same day and at 60 days, one of which is 60 pounds and another which is 50 lbs. If a shepherd selects the heavier lamb, will they be selecting for faster growing genetics? Maybe. Ten percent of 10 pounds is only one pound. One pound difference is not significant. If there are 70 lb and 35 pound lambs, then selecting the 60-70 pound lambs and culling the 35-40 pound lambs are more likely to be improving flock genetics for growth.

Traits	Percentage
Number Born	10
% Weaned	12
60 day wt	10
120 day wt	20
240 day wt	40
Carcass Wt	35
Weight of trimmed retail cuts	45

(Taken from Sheep Production Handbook, 2002 Edition, Volume 7; Percent (%) Weaned taken from NSIP Notebook, 2005)

There are seedstock producers that make claims that their flocks are superior for lowly heritable traits. But are they? For example, a seedstock producer may say they cull all ewes with dystocia and all of their lambs. So, is their flock superior? Are they making progress? Maybe. Since this is lowly heritable, the shepherd is culling 5-10 ewes to eliminate the one ewe that has genetics significantly more likely of passing on dystocia. It is like owning 5 dogs and one of them is killing your sheep, so you get rid of all 5 to get the one culprit. This is expensive. For the flock that does not keep good records, it does decrease chances that the flock will require more shepherd intervention and not be easy care.

Better progress occurs when a seedstock producer can cull the genetically inferior sheep at bottom end of their flock and select the superior animals at the top end.

Selection for genetic improvement, including lowly heritable traits, is most effective when there are larger differences between the top and bottom of the flock so that a producer can cull the bottom and select for the top. Traits can be one of three types, continuous, multiple steps and "yes/no" (2 state) traits (Table 2). Let's look

at an example of each type of trait and what it might mean for selection choices in your flock.

A) 60 Day Weights. Weight gain is an example of a trait that can have large differences between the top and bottom and allows selecting at the top and culling at the bottom. Directly compare only animals raised under the same conditions. It

is also not accurate to compare lambs between seasons or between flocks. You need to adjust weights for number born, number raised, age of ewe, age of lamb at weighing and sex of lamb. In your own flock, selecting in the top 10-20% and culling the bottom 20% is effective, especially if there is a wide range in weights. If the range is 35-70 pounds at 60 days, the lambs at the top are much more likely to have superior genetics for gain than if the range of 60 day weights is smaller (e.g. 45-55 lbs). Selecting sheep by using expected breed values (EBVs) from the National Sheep Improvement Program greatly increases accuracy of selecting for weight gain.

B) Number Born, Number Weaned. These traits have multiple steps and in most Katahdin flocks range from 1-3 in born or weaned. These traits are typically harder to make progress since the difference between single born and twin born is only one. A small change in nutrition can tip a ewe to singling rather than twinning. Selecting mature ewes that

CONTINUED ON PAGE 14

Type of Trait Variable	Examples	Numerical Example
Continuous	Weight traits Fecal Egg Count	e.g. 60 day wt can vary continuously from 25-70 lbs. FEC can vary from 0 to >25,000
Step	Number Born, Number Weaned	Number born typically varies from 1-4
Step (2 state; present or not present)	Bottle Jaw, Prolapse Dystocia	Yes/No or Present/Absent

repeatedly triple, and culling mature ewes that repeatedly single, will result in faster progress, since the breeder can select at the top and cull at the bottom. But many producers are not interested in triplets. So, selecting triplet bearing ewes is often not an option.

“Repeatability” increases accuracy of selection. For this example, look at Table 3, where comparison of both prolificacy and number weaned are demonstrated. This table is an example of a “dam production” record. Picking a twin born lamb out of ewes

gain, using EBVs from the National Sheep Improvement greatly increases accuracy in selecting for number born and number weaned and allows accurate selection even before the ewe lambs.

C) Dystocia, Vaginal Prolapse. These are “yes/no” traits and in most Katahdins flocks are low in frequency. It is hard to make significant progress since dystocia and vaginal prolapse typically are rare (less than 10%) and often are affected by management (overfeeding during late gestation). Strict culling of relatives will have a

Table 3. Dam Production Record (number born/number weaned)

Age of Ewe	Ewe 1	Ewe 2	Ewe 3	Ewe 4	Ewe 5
1	1/1	2/2	1/1	2/1	2/2
2	2/2	1/1	2/2	3/2	3/3
3	1/1	2/2	2/2	3/1	3/2
4	1/1	2/2	2/2	3/1	3/3

2 and 3 is much more likely to provide twinning genetics. It is important to also look at the dam production records of the dam of a sire when selecting or purchasing sires. Ewe # 1 has mostly singling genetics while ewes 2 & 3 have twinning genetics and ewes 4 & 5 have mostly tripletting genetics. Your accuracy of selection increases if evaluation of repeated years is done.

One year’s record is only 10% heritable, but looking at 3-4 years records, heritability is 30-40%. Repeatability is important.

It should also be pointed out that using repeated occurrence is important for selecting for number weaned (lamb survival). Similar to number born, number weaned is also 10-12% heritable. By selecting ewes 2, 3 and 5, the shepherd is also selecting repeatable weaning genetics at approximately 30% heritability. The dam production record is arguably one of the most important selection traits for profit and meat production in the sheep industry. Lambs have to be born and have to live before they can be sold. If the fastest growing lamb was out of ewe #1 or ewe # 4, profit would be marginal because most of the time, only 1 lamb would be sold. Sires for your ewe flock should come from ewes with good dam production records. As with selecting for weight

minimal impact on removing animals with genetics predisposed to these traits, while greatly decreasing ability to make progress on other traits. A few guidelines will help.

Vaginal prolapse tends to repeat and a ewe who prolapses as a yearling or two year old, will typically prolapse again the next year or in a couple years. Culling an occasional ewe (less than 10% of your first time lambing ewes) will have no significant effect on your flocks genetic predisposition to prolapse, but culling needs to occur.

Dystocia in Katahdins is less repeatable. If few ewes (10% or less) in the flock have dystocia, culling a ewe that requires help with lambing once in her career will have little impact on flock genetics for dystocia.

It tends not to repeat. Many of the ewes that have dystocia may need help once in 7-8 lambings.

Since vaginal prolapse and dystocia are not highly heritable, aggressive culling of a ewe and all of her relatives is probably more than what a shepherd needs to do. As well as being lowly heritable, her offspring’s genetics are diluted in half by a ram.

But there are times in which “aggressive” culling of a ewe and her close relatives are warranted. It takes good record keeping. Every ewe who prolapses or has lambing difficulties

needs to be flagged and each year’s lambing records need to be evaluated with regards to previous years. When should breeders aggressively cull for dystocia and vaginal prolapse? Here are a few suggestions.

- *If a ewe requires assistance lambing 2-3x in her career:* Culling of the ewe is warranted. Repeatability greatly increases the likelihood of this being genetic. If the breeder is part of the National Sheep Improvement Program and EBVs (estimated breeding values) for birth weight, a high birth weight EBV could be part of the decision process.
- *If several of a ewe’s close relatives or a ram’s daughters prolapse or have dystocia:* Suggest culling the daughters of that ewe and ram and look closely at older relatives or her half sibs.
- *If 20-30% or more of the flock has dystocia:* This indicates significant genetic issues in the flock (need to distinguish between the management issues of over feeding and whole flock genetic problems). At 20-30%, genetics that predispose ewes to these difficulties is present and genetic progress can be made by rigorous culling. It will take a few years to fix.
- *Operations that have their greatest financial losses associated with cases of dystocia or prolapse.* This would tend to be shepherds that work off farm 50 or more hours a week or travel extensively during lambing season. Profit in these operations is not as strongly affected by growth or other common genetic goals, but by easy care. In this case, aggressive culling of a ewe and relatives for dystocia or prolapse can occur to minimize any chance of a management issue. These operations can decide that it is worth culling 5-10 ewes to prevent one occurrence of lambing issues. Some breeders may also decide to not keep ram lambs or buy rams out of ewes that have ever had a case of dystocia. It has value, but will limit progress on other traits.
- *Culling does not mean passing these problems on to another Katahdin breeder.* Those culled sheep need to move into slaughter channels.