A SIL Web Note

SIL Meat Yield revisited

Differences between pre-2010 and post-2010 eBVs

Mark Young, B+LNZ & SIL

19-aug-2013

<u>Why did SIL change the Meat eBVs in 2010?</u>

SIL changed these eBVs to clearly separate the effects of size from the effects of carcass merit at any given carcass size. In other words, the effects of size are now solely accounted for using the growth eBVs while the new meat yield eBVs tell us something about the carcass over and above its size.

<u>"Meat" *versus* "Meat Yield"</u>

It is worth revisiting the differences between the "old" eBVs and the "new" eBVs that replaced them in SIL indexes. Some flocks still use the old eBVs but current SIL indexes are based on the new eBVs. Because the old eBVs tell us something different to the new eBVs, there is not a good relationship between the old Meat eBVs and the new Meat Yield index.

Old eBVs were all "sizes" whereas new eBVs are "relative sizes". Bigger sheep by and large had bigger values for the old eBVs for lean weight (LEAN), fat weight (FAT) and eye muscle area (EMA). The new eBVs are all adjusted to a constant carcass size (using autumn LW data) so that positive values mean animals have higher values than you would expect <u>for their size</u>. Typically average animals have eBVs near zero for these new traits. That is because selection up till now has led to increases in animal size more than in increases in "yield".

<u>Table</u>: Old vs new eBVs

Old eBV	New eBV	
"size"	"relative size"	
EMA	EMAc	Note the subscript "c" indicating it is adjusted to a set carcass weight of 19kg
FAT	FATY	
LEAN	LEANY*	*introduced more recently
SHLEAN	SHLY	
LNLEAN	LNLY	
HQLEAN	HQLY	

This distinction between "size" and "relative size" is very important. Previously animals could have high values simply because they were big, even though they had low values for animals of that size. New eBVs tell us whether they are high or low for the trait at any given body size.

<u>Why does SIL use three regional yield eBVs for lean?</u>

New commercial systems for estimating carcass value consider where an animal has lean. Having lean in the hind leg is worth more than it is in the shoulder, and the loin more than the leg, on a value per unit weight basis. SIL has implemented a system to reflect this.

By contrast, fat decreases value of the three regions more uniformly so we produce just one fat yield eBV (FATY).

When estimates of lean tissue yield are based on just LW and ultrasound scanning data, it is not possible to discriminate animals with more lean in one region than average. Rather, the lean yield eBVs really only tell us whether an animal is better or worse than average for overall lean yield. At the request of users, SIL has produced an overall lean yield eBV (LEANY) that can be used on reports to reflect this overall yield. However, SIL indexes for Meat Yield still use the three regional lean yield eBVs (SHLY, LNLY & HQLY) to account for the value of lean in the different regions AND so that we do not have an apparently different Meat Yield index using just one LEANY eBV.

SIL has introduced the LEANY eBV so you can put one eBV on a SIL report to summarise lean yield merit across the three regional eBVs (SHLY, LNLY & HQLY). LEANY eBV is not used in standard SIL indexes.

More about Yield

Yield is not exactly the same as the percentage of a tissue but they are closely related. Animals with a higher than average yield will have a higher than average tissue % for that tissue. A yield eBV tells us the weight of tissue an animal has compared to other animals at the same carcass size, where SIL adjusts all animals to the same carcass size (19kg). So animals with a higher yield at the same carcass weight have more of that tissue by weight than other animals of the same carcass weight, which is the same as having a higher percentage of that tissue. This holds for lean or fat. Meat Yield eBV units are kilograms of a tissue relative to the average for animals of the standard carcass weight of 19kg in 1995 (the current SIL base year). So values can be outside the range of +1.0 to -1.0.

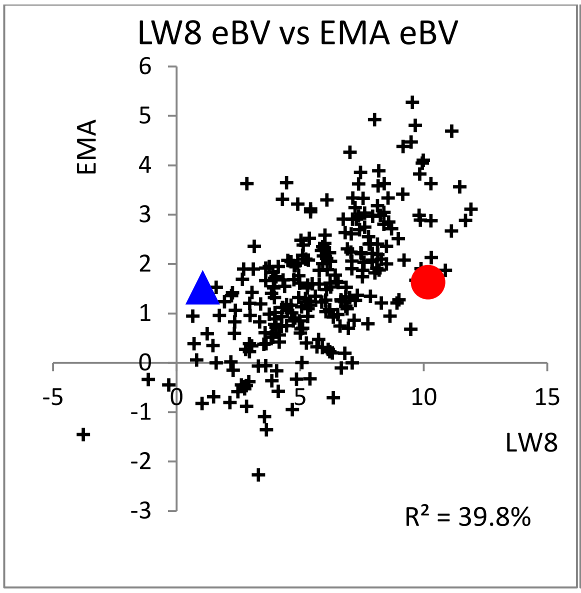
The only way an animal can have a higher yield at the SIL adjusted carcass weight of 19kg, is for it to have a higher than average yield for its actual carcass weight. But we reward carcass weight separately in the growth eBVs. So SIL splits carcass value between carcass weight and the yields of lean and fat. Big sheep are rewarded in the Growth indexes. Having high yield for their size is rewarded (lean) or penalized (fat, in TS sheep) in the Meat Yield indexes.

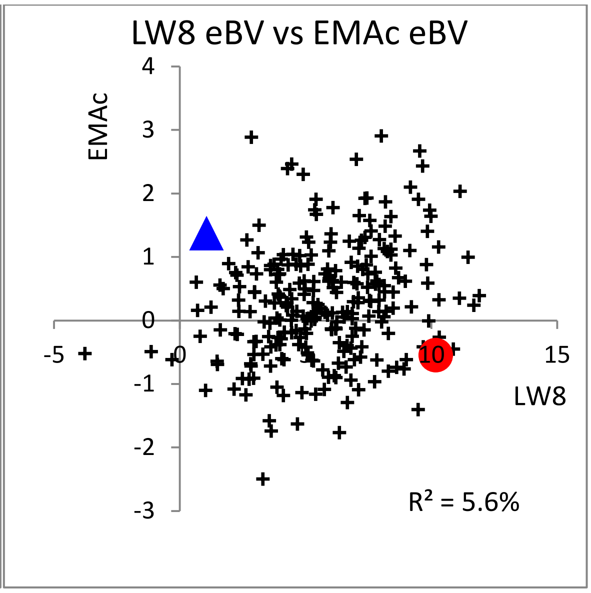
Some people ask why SIL puts the weighting for overall size on (carcass weight) CW eBV and not LW8 eBV. We put the weighting on CW rather than LW8 because that is what farmers are paid for. In actual fact these eBVs are perfectly related in most sheep because we predict the CW eBV from LW8 information. SIL does not use actual carcass weight data from meat processor information to estimate its growth eBVs..

So new Meat Yield eBVs tell us whether animals are high or low for the trait at any given body size. The figures below depict this visually for a group of sires when we plot size (e.g. LW8 eBV) against either EMA (a size) or EMAc (a relative size). We would see the same effect if we plotted LW8 against LEAN (weight) and LW8 against LEANY (lean yield or one of the 3 regional lean yields).

In the first figure, the animal represented by the **red circle** has an EMA eBV of just above 1.5 which looks good. But he has a very high LW8 eBV so when we adjust for body size, he has a negative EMAc eBV of about -0.5. In other words, he has low EMA for his size. In contrast, the animal represented by the **blue triangle** has a roughly similar eBV for EMA but a much lower LW8 value. So when we adjust for body size this animal has a very good EMAc value indicating it is well muscled for its size.

Figures. A: LW8 versus EMA. B: LW8 versus EMAc.





These same principles hold for each size trait in the left column of the table above compared to the relative size trait on the same row but in the next column.

If you are unsure what eBVs are on your SIL reports, check out the front page, where their definitions will be listed, or ask your bureau.

For those readers who are concerned about the weak relationship for LW8 with EMAc (R^2 = 5.6%) compared to LW8 with EMA (R^2= 39.8%), this is actually good. It shows us that the adjusted EMAc eBV is telling us something over and above what the LW8 eBV does i.e. LW8 eBV tells us about genetic merit for overall size while EMAc tells us about whether the animal has high genetic merit for EMA for that size. This also holds for the relationships between the different yield eBVs and the LW8 or CW (both characterize "size") eBVs.

An animal can have a high LEAN or EMA eBV but a low lean yield or EMAc eBV if it is big but less well muscled than average for its size.

Why does FATY have larger values than the lean yield eBVs?

For animals with extreme values for tissue yield, you will see that FATY has larger sized values (+ or -) than the lean yield eBVs (SHLY, LNLY, HQLY or LEANY). This occurs for several reasons.

Firstly, because when we split lean yield into three regions, we are looking at the extent to which an animal differs from average for lean yield, with that total lean yield difference split into three parts and attributed to each region. However, this still doesn't explain it all.

Secondly, there is a strong "part-whole relationship" between lean tissue weight and total carcass weight. Since the lean tissue is the major part of the carcass for the animals we breed for meat production, to have less lean means an animal is smaller. But when we then adjust for carcass size so it is not possible for lean yield to vary much if it is the largest tissue in the carcass. By contrast fat can vary a lot more, because it is the smallest tissue in the carcass in many sheep, without having the same impact on overall carcass weight. In other words, since an animal has a high % of lean and a lot lower % of fat in the carcass, you can't vary lean% much since most of the carcass is lean.

A third reason is that as animals develop, we see a decrease in bone% and in increase in fat% but relatively smaller changes in lean%. And since saleable lean yield includes some, but not all, carcass bone, if we have less fat% we are likely to have more lean yield other things being equal. That they don't perfectly offset each other reflects both the accuracy of our predictions and the fact that our predictions don't consider all bone.

A consequence of these relationships is that generally if an animal has positive values for lean yield, it has negative values for fat yield, AND if it has negative values for lean yield, it has positive values for fat yield.

Variation in FATY eBVs is greater than in lean yield eBVs (SHLY, LNLY, HQLY or LEANY) due to lean comprising most of the carcass. Lean yield cannot vary as much as fat yield due to lean tissue comprising the majority of the carcass and because we don't account for variation in bone.

Generally, animals with positive lean yield eBVs have negative fat yield eBVs and *vice versa*.