NSIP Factsheet

Using the NSIP Maternal Wool Breeds Index to Improve Ewe Productivity

The NSIP "Maternal Wool Breeds Index" predicts EBVs for Ewe Productivity, defined as the weight of lamb weaned per ewe lambing. The Index was originally designed for the Polypay breed, but can also be used in other breeds of wool sheep. The Index does not consider EBVs for postweaning lamb growth, ultrasound scanning traits, and wool measurements, but, given the primary role of the Polypay and related breeds as maternal breeds, improving ewe productivity is considered to be a major production goal.

The Maternal Wool Index is defined as a function of EBVs for weaning weight (WW), maternal weaning weight (MWW), number of lambs born (NLB), and number of lambs weaned (NLW) as:

Index = 0.583 x WW + 2.639 x MWWT + 0.406 x NLW – 0.035 NLB.

Positive index weightings for WW, MWW, and NLW are obvious, as these are all clearly positively related to the total weight of lamb weaned. The negative weighting for NLB is less intuitive, but allows ewes that weaned large litters without lamb losses to have a slightly superior index compared to a ewe that weaned a litter of the same size, but lost one or more lambs. Thus a ewe that weaned two lambs from a twin litter would have a slightly higher index than a ewe that had triplets but weaned only two lambs. Proper interpretation of index weighting involves viewing them as the effect of a 1-unit change in each EBV holding all other EBVs constant. Thus at the same NLW EBV, a ewe with a higher NLB EBV would require birth of more lambs in order to wean a comparable number, which is undesirable.

Genetic correlations among traits in the Index are all assumed to be zero except for a positive genetic correlation of 0.5 between NLB and NLW, so effects of weaning growth, maternal weaning weight, and prolificacy (NLB and NLW) are essentially independent. Genetic correlations between the Index and each of its components are shown below:

Component trait	Genetic correlation with the Index
Weaning weight	0.07
Maternal weaning weight	0.31
Number of lambs weaned	0.94
Number of lambs born	0.40

The table shows that the Index is dominated by NLW, which is not unexpected, because the most efficient way to increase the weight of lamb weaned is to wean more lambs. Despite its negative weight in the index, NLB still has a positive genetic correlation with the Index, by virtue of its positive relationship with NLW. Thus, we want to avoid increases in NLB that do not yield corresponding increases in NLW. However, increasing NLB still, on average, results in increases in NLW and, therefore, in the Index. The Maternal Weaning Weight has a modest positive impact on the index, but its effect is much smaller than that for NLW, and the direct effect of the Weaning Weight EBV on the Index is small.

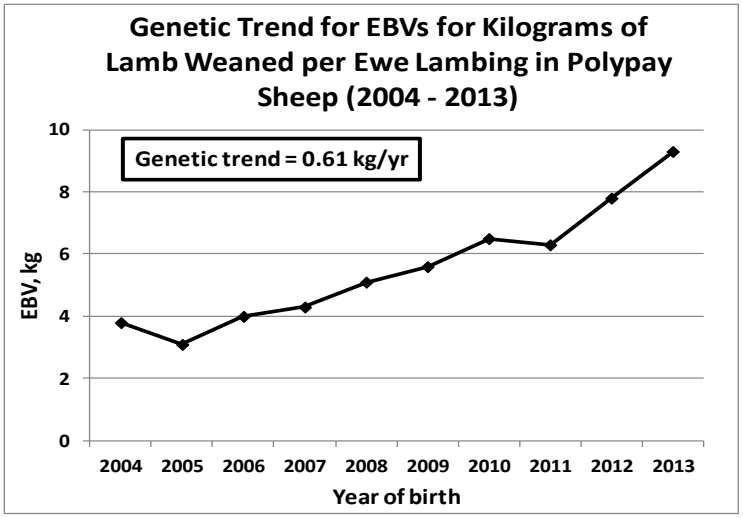
Index values are reported by LAMBPLAN as "ratios" to the mean index value, but, in fact, are derived by simply adding 100 to the Index shown above. The 50th percentile for the USA Maternal Wool Index from the June 2013 Percentile Report at www.nsip.org was 107.6, which corresponds to an average value for the Index shown above of 7.6 kg. Index values can thus be derived simply from the component EBVs.

Changes in EBVs for component traits associated with selection on the Index are shown below as the expected change associated with a 5-unit change in the Index, which approximately corresponds to the expected average difference in each trait between animals in the upper 10th percentile or the 50th percentile for the Index. The table confirms that selection on the Index will mainly emphasize NLW and will improve NLW more rapidly than NLB.

Component trait	Expected change in breeding value associated with a 5-unit change in the Index[a]
Weight of lamb weaned per ewe lambing	5.0 kg = 11.0 pounds
Weaning weight	0.05 kg = 0.11 lb
Maternal weaning weight	0.19 kg = 0.42 lb
Number of lambs weaned	11.5%
Number of lambs born	5.5%

[a]Based on the June 2013 Percentile Report, this difference approximately corresponds to selecting animals in the 10th versus 50th percentile for the Index.

Genetic trends in EBVs for the Maternal Wool Index between 2004 and 2013 are shown below for NSIP Polypay flocks. The average rate of genetic improvement was 0.61 kg/yr (1.34 lb/yr), corresponding to an increase of 1.5%/yr. This value is below the predicted maximum, but still substantial, corresponding to a total increase of 5.5 kg (12.1 lb) in ewe productivity over this 10-yr period. While the observed genetic trend is below the predicted maximum, that outcome is not unusual. As a comparison, the genetic trend in milk production in Holstein cattle is commonly held up as the gold standard for genetic improvement of a maternally influenced trait but generally does not exceed 1%/year. Also, over the past 10 years, the U.S. average lamb crop (number of lambs marketed per breeding ewe) has averaged only 110% and has shown no positive trend. By contrast, the rate of genetic improvement in ewe productivity in Polypay sheep has accelerated, equaling 0.87 kg/yr (2.2%/yr) for the 5 yr since the NSIP-LAMBPLAN merger in 2009. NSIP producers are thus in the enviable position of making substantial and documentable genetic improvement in a key economic trait, with additional opportunities for even more rapid genetic improvement.



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