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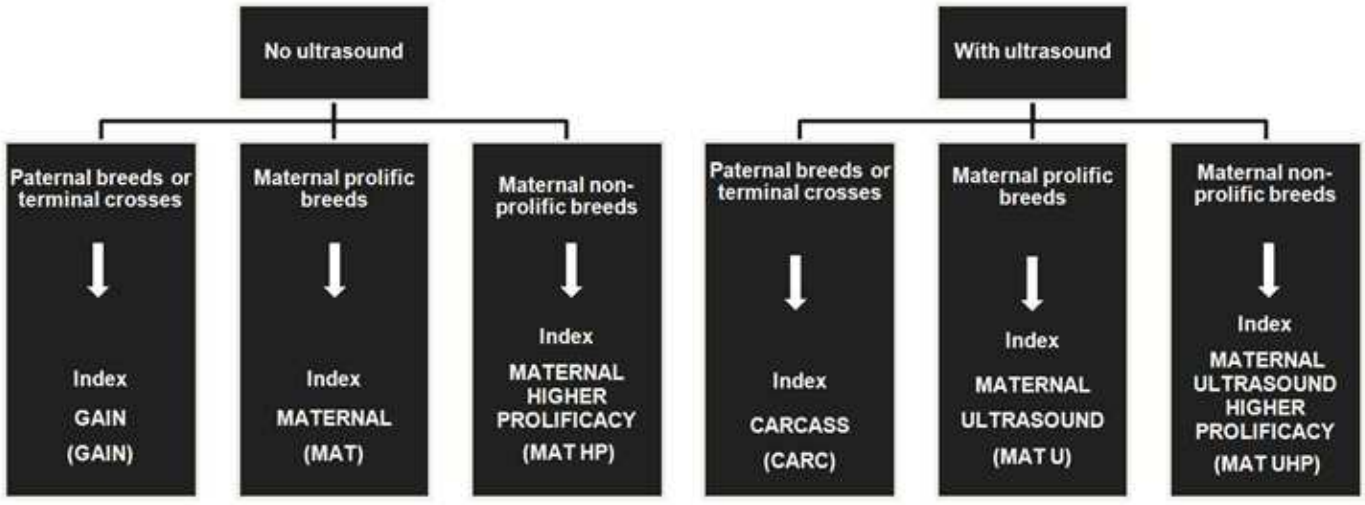
Selection Indexes Best Suited for Breeders!

The needs of the sheep industry have evolved in recent years, so genetic selection guidelines had to be reviewed. Therefore, in November of this year, the genetic evaluation program, GenOvis, will update its selection indexes. The planned adjustments will serve to broaden genetic advancement and will specifically target breeding characteristics that carry an economic impact. These new indexes will also meet the needs recently expressed by purebred and commercial producers. More information on these positive changes is provided below.

Since the implementation of the indexes in the early 2000s, sheep breeds have evolved, and market needs have changed. The best example is the selection of breeding stock in the prolific maternal breeds. These breeds have now reached an optimum level in terms of number of lambs born. Recommendations are now focusing less on the number of lambs born and more on maternal traits (lamb weight at weaning, survival rates, etc.) and terminal traits (better growth and carcass quality). Other indexes are aimed at improving performance in less prolific breeds and in terminal breeds. Thus, the four current selection indexes (Growth (GX), Terminal (Tx), Growth Maternal (GxM) and Terminal Maternal (TxM) will be replaced with six new indexes -- three without ultrasound measurements (GAIN, MAT, MAT-HP) and three with ultrasound measurements (CARC, MAT-U and MAT-UHP).

When it comes time to select breeding animals based on their genetic potential, such as ewe lambs from your own flock or rams from another flock, it is difficult to identify the best animals by looking only at EPD values[1] (EPD = estimated progeny difference). For breeders who try to choose breeding stock by considering every assessed trait, the decision is often difficult, as there are a large number of traits available for genetic selection. In addition to the high number of traits to be considered, the ge-



1 The EPD (estimated progeny difference) is an estimate of the genetic value an animal will pass on to its offspring. The EPDs are calculated using all the performance data of related animals, as well as the performance of the animal itself. Animals with the best EPDs for a given trait are those that have the highest probability of producing exceptional progeny for that trait.

New Indexes Description

	Animals without ultrasound measurements	Animals with ultrasound measurements
Paternal Breeds	**GAIN Index (GAIN)** This index is used to select rams whose descendants will all be sent to a slaughter. It is used for animals that have not had ultrasound measurements, so only growth traits are considered in the calculation. This index replaces the current Growth index (Gx).	**CARCASS Index (CARC)** This index is used to select rams whose descendants will all be sent to a slaughter. It is also an excellent indicator for the selection of breeding stock in terminal breeds. This index is calculated and available only if the producer takes ultrasound measurements in order to improve carcass quality. It replaces the current Terminal index (Tx).
Prolific Maternal Breeds	**MATERNAL Index (MAT)** This index is used to select ewes and rams of prolific maternal breeds (e.g. Rideau Arcott, Romanov) when prolificacy is already near the intended optimal. In this case, our goal is to improve reproductive traits (survival (MAT), birth weight (MAT), weight at 50 days (MAT), etc.) while putting little emphasis on improving the number of lambs born. In addition to reproductive traits, growth traits are included in this index.	**MATERNAL ULTRASOUND Index (MAT U)** This index is similar to the MATERNAL index, except it also includes the carcass traits (loin and fat) measured with ultrasound. Thus, this index makes it possible to select ewes and rams in prolific maternal breeds, where prolificacy is nearly optimal, but a better carcass may be selected. With this index, our goal is to improve reproductive traits (survival (MAT), birth weight (MAT), weight at 50 days (MAT), etc.) while focussing less on improving the number of lambs born. In addition to reproductive traits, growth traits and carcass quality traits are included in this index.
Non-prolific Maternal Breeds	**MATERNAL HIGHER PROLIFICACY Index (MAT HP)** This index is used to select ewes and rams of non-prolific maternal breeds (eg: Dorset), when we want to further improve the number of lambs born. It also helps identify highly prolific animals, where the goal is to improve reproductive traits by focusing on the number of newborn lambs. In addition to reproductive traits, growth traits are included in this index.	**MATERNAL HIGHER PROLIFICACY WITH ULTRASOUND Index (MAT UHP)** This index is similar to the MATERNAL HIGHER PROLIFICACY index, except that it also includes the carcass traits (fat and loin) measured with ultrasound. This index makes it possible to select ewes and rams in non-prolific maternal breeds, where we would like to further improve the number of lambs born, in addition to improving carcass quality characteristics. This index also identifies very prolific animals, where the goal is to improve reproductive traits by focusing on the number of newborn lambs. In addition to reproductive traits, growth traits and carcass quality traits are included in this index.

netic potential of an animal often varies depending on the observed trait (sometimes a positive value for a trait, sometimes a negative value for another trait). Therefore, it is quite common to have animals offering excellent breeding values for certain traits and poor values for other traits (e.g. excellent EPDs for growth traits, but poor EPDs for reproductive traits). This phenomenon is common given the fact that certain traits have negative genetic correlations with one another. For example, weight gain before or after weaning has a negative genetic link with birth weight. Thus, many animals are left with positive EPDs for weight gain before and after weaning and negative EPDs for birth weight (or vice versa). So, how can you find your way among several genetic values for a given animal's EPDs, when some EPDs are positive and others are negative?

To effectively select an animal on multiple traits, producers can rely on one tool: **selection indexes**. A selection index combines the genetic values of the various breeding traits in order to arrive at a single reference value. The single index value helps producers to pre-select a group of breeding animals that stand out from the lot, in order to the select the best animal(s).

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Updated indexes

On previous page are the 6 updated selection indexes that will be available beginning November 4, 2016. These were developed according to different production models in order to facilitate the work of both purebred and commercial producers. In addition, these indexes incorporate other improvements made to GenOvis. For example, new EPDs like survival rate will be included in the indexes.

Index Calculation Method

There are 3 factors used in determining the importance of a trait within an index. The first is the **economic value of the trait**. A bio-economic model makes it possible to calculate the economic value of the various traits of interest in genetic selection. This model was developed by a research group from the University of Guelph, and presented at a global conference on genetics[2]. The greater the impact of the improvement of a trait on the economic return for a producer, the more that trait will matter in the selection index. The second factor is the **heritability of the trait**. Heritability measures the degree of transmission of a trait from parents to offspring. The greater the heritability, the faster the genetic progress will be, and by consequence, the more that trait will matter in determining the index value. Finally, the third factor is the **correlation, or relationship, of one trait to other traits.** This factor takes into account the positive or negative effects of the genetic progress of a trait on other traits.

To give an idea of the relative importance of EPDs in indexes, Figure 1 shows the weighting (in percentage) of sub-indexes according to: growth, carcass quality, and reproduction qualities aimed at greater prolificacy, as well as lambing interval. For example, the CARCASS index consists of 65% of growth traits and 35% of carcass traits. In order of importance, these sub-indexes consist of the following EPDs:

2 Quinton C, Kennedy D, Stachowicz K, Miller S. 2014. Economic breeding objectives for Canadian lamb. Proceedings of 10th World Congress on Genetics Applied to Livestock Production, Vancouver BC, Aug 17-22 2014. 003.

Growth:
Gain from 50 to 100 days EPD;
Weight to 50 days EPD (direct);
Birth weight EPD (direct);
Survival rate EPD (direct);

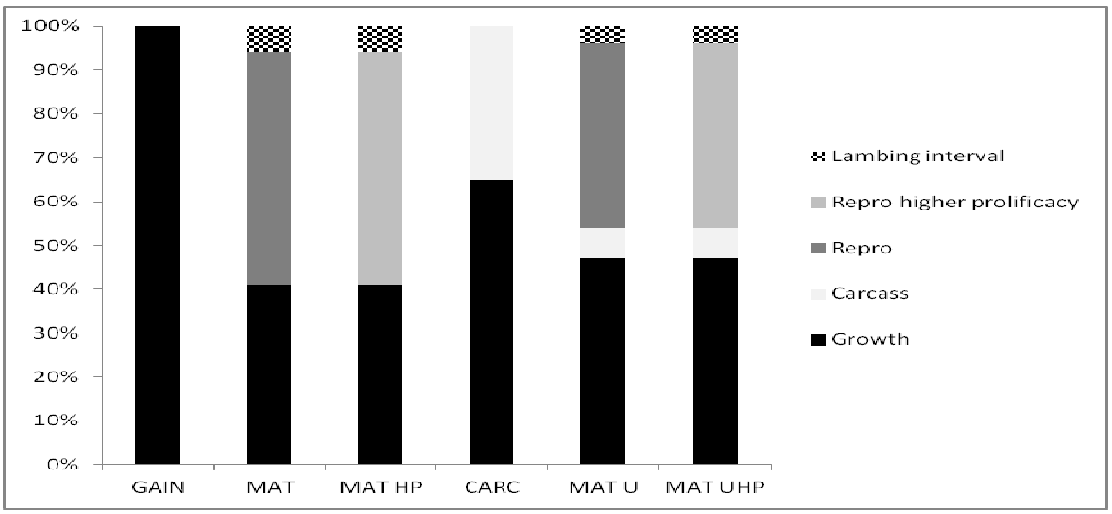
Reproduction:
50 day weight EPD (maternal)
Lamb survival rate EPD (maternal)
Birth weight EPD (maternal)
Number born at later lambing EPD
Number born at first lambing EPD
Total weight at weaning, later lambing EPD
Total weight at weaning at first lambing EPD

Carcass:
Loin depth EPD;
Back fat depth EPD;

Reproduction with higher prolificacy:
Number born at later lambing EPD
50 day weight EPD (maternal)
Number born at first lambing EPD
Lamb survival rate EPD (maternal)
Birth weight EPD (maternal)
Total weight at weaning, later lambing EPD
Total weight at weaning at first lambing EPD

Lambing interval:
Lambing interval EPD

Figure 1: Relative importance of traits in the 6 selection indexes according to growth, carcass, reproduction, higher prolificacy and lambing interval categories.



Finally, the selection indexes combine the genetic value of a given number of traits, as mentioned above. Therefore, it's important to remember to include other parameters, such as conformation, when selecting breeding animals. For example, even if a ram has a very good index, it is is important to make sure that he has the conformation needed to ensure longevity within the flock. It is ideal to use the indexes as a benchmark to make a first round of selection between animals with a higher genetic potential vs. those with a lower potential. These indexes do not constitute an end in themselves.

For more information, a webinar will be presented in late October on indexes and other enhancements to the GenOvis program. Look for your CEPOQ e-newsletter to register!

We would like to thank to the University of Guelph for the development of the economic indexes. A special thanks to Larry Schaeffer, Cheryl Quinton and Delma Kennedy for their great contribution in the development of these indexes.