STRATEGIES FOR IMPROVING FLOCK GENETICS

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Introduction

Most commercial sheep producers associate improvement in genetics with the use of top quality rams, and rightly so, since most genetic improvement in the flock can be attributed to ram selection. Ultimately, the quality of a ram’s genetics is determined by the economic impact of his lamb crop on the operation’s bottom line. After all, the lamb crop is generating most of the income, whether through market lamb sales, or retained use as breeding ewes within the flock. With improved genetics comes “better” performance from the sheep which influences expenses for things like feed, labor or capital investments (facilities, land, purchase of breeding stock, etc.). Studying the economic value of genetic improvement is important to provide commercial breeders with useful information to achieve meaningful genetic change. Our research has focused on using available tools such as expected progeny differences (EPD) to make economically efficient genetic improvement. To do this, the added value (or expense) associated with genetic change is evaluated. With this type of evaluation commercial breeders can assess the economic value of a ram based on his estimated genetic contribution to the future lamb crop.

The most important criteria for choosing breeding sheep is that they are reproductively sound (i.e. rams that can breed and ewes that maintain pregnancies and wean lambs). After assessing fertility, measures of genetic value for characteristics such as pre- and post-weaning lamb growth, number of lambs born and fleece traits are typically available either through comparisons within the flock (pedigrees, growth ratios, ADG, etc.), or from EPD which are a more reliable measure of an animal’s genetics. Appraising the value of such traits is relatively straightforward; obviously, increases in lamb growth, number of lambs born and wool quality or quantity all increase income for the system but at the same time each is also associated with added expenses to the production system.

Research

Methods: Data from Targhee sheep (a dual purpose meat and wool breed) participating in National Sheep Improvement Program’s Across-flock National Genetic Evaluation were available for this study. EPD were obtained for production traits, including:
- WW = Weaning Weight (Weight at weaning, 120 days)
- MM = Maternal Milk (Genetic measure of milk production for lamb growth)
- YW = Yearling Weight (Weight at one year of age)
- FW = Fleece Weight (Weight of fleece at one year of age)
- FD = Fiber Diameter (Fiber diameter of yearling fleece)
- SL = Staple Length (Length of staple of yearling fleece)
- PLC = Percent Lamb Crop (number of lambs born per 100 ewes lambing)
The economic value of each trait was calculated based on the change in profit from a one-unit change in each trait, independent of all other traits. An example would be the profit or loss given by a one-pound increase in WW, with all other traits held constant. Profit was estimated by subtracting expenses from income. For example, the income from a one-pound increase in WW minus the cost of the additional feed required to support the added growth. Each trait was evaluated under different production scenarios that represented a range of feed costs and lamb markets that were common for producers. The resulting economic values for each trait represented the dollar value associated with genetic change in the trait.

**Results:** Figure 1 represents the relative value of each trait for a marketing system where market lambs are not discounted for heavy weights (i.e. heavy and light weight lambs have the same value per pound) and where differing feed costs were assumed for high feed costs (higher cost of purchased hay) and lower feed costs (lower cost of grazed forage). Values for each trait indicate the percentage change in profit from selection on the trait for high and low feed cost scenarios. A relative value greater than one hundred indicates positive change in income while a value less than one hundred represents a negative change in profit. For example in a grazing system the value of improving WW by one-unit is nearly a 5% increase in profit, compared to no change in the trait, as opposed to a one-unit increase in YW which yields a reduction in profit of nearly 2% due primarily to the added feed requirements of a larger breeding ewes.

**Figure 1. Returns over feed costs as a percentage of average performance**

Lamb growth was of major economic importance, reflecting the added value of larger market lambs. Similarly, the economic importance of PLC was also high. More lambs born per ewe had an obvious advantage for increasing profit by producing more lambs for market. Although increasing PLC reduces the number of single born lambs and increases the number of multiple litters, it also influences lamb survival and ADG of these lambs, because twin and triplet born lambs typically have lower survival and ADG than single born lambs.

Selection for MM also increases lamb weight, however, the lamb gain associated with milk production is less efficient that gain from a lamb’s direct feed intake and therefore the economic value is about one half the value of WW. Ewes that produce more milk...
have higher energy requirements and thus consume more feed (supplement or hay) than those producing less milk which results in somewhat higher feed costs from selection for MM.

Although rams contribute the most genetic improvement to the flock and the lamb crop generates the most income, it is the breeding ewe that accrues the most expense within the flock. Selection for increased YW with no change in WW results in increased post-weaning gain and a larger mature body size of the breeding ewe. Heavier ewes have a higher feed requirement and therefore a higher feed cost, with little change in income. Therefore, selection for added ewe weight has a negative relative influence on the profitability of the system.

The preceding research has resulted in the development of an economic breeding objective for the Targhee breed. Economic values for each trait have been implemented in multiple trait selection indexes to provide breeders with a single dollar value used to rank rams on their cumulative economic value based on predicted genetic values for each trait. Furthermore, this research helps put into perspective the relative economic importance of different traits and demonstrates the value of reproduction over growth and wool traits for sheep.

*Ongoing research:* Currently our research is focusing on characterizing the relationships between genetic improvements of reproduction and lamb growth with survival of the lambs and breeding ewes. Knowledge of the genetic influence on lamb and ewe survival can help make optimal changes in genetic improvements for the flock by increasing the length of time a ewe is reproductively functional, thereby reducing the number of lambs retained for breeding each year and allowing more lambs to be marketed.

Preliminary results indicate heritability associated with the length of time a ewe stays productive in the flock is low, ranging from 0.01 to 0.14. This indicates only a small genetic influence on the length of time a ewe remains productive. Although the genetic component of ewe survival is small, it is important because it provides a means of improving flock productivity through selection. Yet to be addressed is the genetic relationship between a ewe’s length of productive life and other production traits, such as reproduction and lamb growth.