

Making the cut

Selection is choosing which sheep/goats get to be parents and which ones are removed from the flock/herd. Selection is one of two ways to make genetic improvement in flocks/herds. The other is crossbreeding. Some traits respond more rapidly to selection, e.g., fleece, carcass, and conformation traits, while other traits benefit more from crossbreeding e.g., reproduction and fitness. At the same time, you can still make genetic progress with traits that have low heritabilities. In fact, most flocks/herds should be selecting for prolificacy despite its low heritability (only about 10%).

There are two types of selection: natural and artificial. Some breeds developed under natural selection, e.g., Gulf Coast Native, Hog Island, Spanish, and San Clemente. Artificial selection is when people choose which animals get to mate. There are pros and cons to each type of selection.

Selection has three primary goals: 1) increase the frequency of desirable alleles; 2) decrease the frequency of undesirable alleles; and 3) eliminate any deleterious alleles. Single trait selection is not usually recommended, as it can have unintended consequences, since traits are often genetically linked. It's better to select for multiple traits or to use selection indexes to make breeding decisions.

Response (R) to selection:

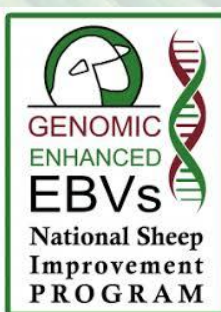
- 1) Heritability (h^2) - how much of a trait's differences are genetic
- 2) Repeatability - how accurate the data is
- 3) Genetic variation - how much variability there is in the population.
- 4) Selection differential (S) - average genetic superiority of the parents
- 5) Generation interval (GI) - average age of the parents when the offspring are born

$$R = (h^2 \times S) \div GI$$

Simple example using fecal egg count (EPG)

$$R = [0.4 \times (1500-500)] \div 4$$

minus 100 eggs per year



Tools of selection

- Visual appraisal +
- Production benchmarks
- On-farm performance records
- Central performance test data
- Estimated breeding values (EBVs)
- Genomics (GEBVs)

What makes selection difficult (slow)?

- Most traits of economic importance are quantitative (polygenic) meaning they are affected by many genes.
- Sometimes it's difficult to separate genetics from environmental influences.
- Some traits cannot be easily or directly selected for/against, e.g., embryo survival and ovulation rate.
- Some traits have low heritabilities.

