Real world genetic improvement (Newman, S).

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Genetic improvement of livestock is a straightforward process. Basically, you measure an animal for some indicator of performance, choose the males and females with the highest performance, make matings between those selected candidates, and all things being equal, the progeny of those matings should (on average) be better than the previous generation. Then repeat. This process works well only in the most ideal of circumstances. For example, there is no single biological trait accounting for total profitability in a breeding program. After all, seedstock producers, whether beef, pigs, or fish, are in business primarily to make a profit, as are their breeding stock customers, who produce food products. Producer's profits are influenced by consumer demand for their products. Purchase of breeding stock involves a cost but can provide a positive influence on the functioning of the system by reducing other expenses or increasing income from output, or both. The producer will be motivated to pay more for breeding stock if given assurance that profit will increase because of these increased costs. Efforts to improve the value of this product (and thus the income earned) are likely to add expenses. The breeder will be motivated if given assurance that greater income will adequately cover these increased expenses. Therefore, a systematic approach to the design and implementation of a genetic improvement program is essential. A breeding goal must be defined, balancing all traits of economic importance associated with reproduction, growth, survival, and product quantity and quality. These traits must be measured and along with pedigree and other non-genetic information, incorporated into a genetic evaluation scheme to arrive at estimates of breeding value (EBV) of animals in the population. Selecting candidates based on an index composed of EBV weighted by marginal economic values allows the breeder to select parents for future generations based on their contribution to profitability of their commercial customers. Other aspects of breeding program design that can affect economic returns include mate selection (balancing genetic variability and selection response), genetic lag (time delay in dissemination of genetic improvement), incorporation of commercial crossbred data, and use of genomic information. Examples of "Real World" breeding programs incorporating many of these approaches will be presented.