Heritability
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Heritability

When we are talking about breeding matters, the term “heritability” often comes up. This is a brief explanation of what heritability is and some examples.

Background
The performance of an animal for most characteristics depends on two factors: the genetic makeup of the animal and the environment that animal performs in. For example, a very well bred cow farmed in a poorly fed herd will perform at a much lower level than if she was farmed in a herd with better nutrition. Expanding this example a little; even though she is well bred, this cow may perform at a lower level in the poorly fed system than a poorly bred animal in a well-fed herd. However, when groups of well-bred and poorly-bred cows are farmed together, the well-bred group will invariably outperform the poorly-bred group.

The key point is that environment and genetics combine to determine how an animal performs.

Heritability
Having made the point that expression of a characteristic depends on a combination of genetics and environment, it now starts to get a little trickier. This is because the contribution to expression of genetics vs environment tends to differ from one characteristic to another.

Let us take two important traits in dairy cows:
1. Fertility is a trait in which environmental influences play a major role in accounting for variability in the national herd. In other words the variation in fertility is due to a wide range of environmental influences. On the other hand genetic influences have only a minor role in accounting for variation in fertility.
2. Protein yield is a trait whose variability is determined to a moderate degree by environment and to a moderate degree by genetic makeup. Compared to fertility, the expression of protein yield in a cow is more closely controlled by genetics and less by environment.

In general terms, characteristics whose variation is controlled to a greater degree by genetic makeup are said to have higher heritability than traits whose variability is dominated by environmental influences. Fertility has only a very low heritability while protein yield has moderate heritability.

Genetic progress for traits of high vs low heritability
Genes are passed from generation to generation, not performance. Therefore, generally, genetic gain is more rapid for a trait whose expression is more attributable to genetic makeup (ie has a higher heritability) than for a trait whose expression is less attributable to genetic makeup (ie a low heritability). We expect to make more rapid gains in protein than fertility.

Heritability of traits
Traits of high or moderate heritability include: milk volume, protein yield, fat yield, condition score, type traits, shed traits, liveweight.
Traits of low heritability include: fertility, somatic cell score.

Heritability and Breeding Values
For any trait, an animal’s breeding value tells us the relative superiority of that animal compared to the population average (or any other animal) for genetic makeup. Breeding values indicate how well the offspring are expected to perform compared to offspring from other animals. Implicitly breeding values take into account heritability: therefore, even for a trait of low heritability, an animal with a very good breeding value can make a considerable difference to the population for that trait.