

Color Inheritance in North American Yaks by Lawrence G. Richards August 15, 2013

Three colors are recognized in North American yaks: Native Black, Imperial and Golden. Native Blacks are black hided animals with a grey or brown muzzle. Some individuals will show a grey or grizzly dorsal stripe. Native Blacks vary from a near dark black to brownish.

Frequently coal black at birth, Imperials are black with a shiny black nose. As they develop, this color often takes on a reddish cast from sun exposure, however most persist with a coal black color into adulthood. These latter Imperials tend to have a glossy coat. The reddish cast may be due to modifying or casting genes that act in the presence of the primary black gene and interaction with sunlight to create the reddish cast. This can also be seen in Black Angus cattle.

Goldens are a reddish brown color that varies from light red to a more brownish red.

There are no solid white yaks in North America, however white yaks are common in Asia.

There are three yak color patterns in North America; Royal, Trim and Solid. Royals exhibit a piebald pattern with a pink muzzle and tongue. They are black and white or gold and white. They usually have a full white tail and piebald pattern throughout the torso with white usually continuous under the belly. The face usually has a broad white stripe. The amount of body white varies significantly from about 10% to less than 90%. On occasion we will see some very small spots, but never what I would call a true roan. Some people have referred to this pattern as a Holstein type pattern, but this is frankly erroneous. There is no similarity in the pattern or the inheritance.

Trims display some white facially as a star or stripe. Rear legs, and sometimes all four legs, have white socks and 1/3 to 1/2 of the tail will be white. We have seen full white tails in Trims. The amount of white does not determine if the animal is a Trim; even a small expression of white qualifies the animal as a Trim. There are three Trim colors: Native Black Trim, Imperial Trim and Golden Trim.

Solids are completely solid with no white. They are Native Black, Imperial and Golden.

Pattern and Color Inheritance

Pattern inheritance is very simple. Royals are homozygous for the Royal color pattern. Trims are heterozygous for their color pattern and Solids are homozygous for the solid pattern. The mode of Royal inheritance is incomplete dominance where the heterozygous genotype results in a partial expression that we designate as the Trim phenotype. I will designate the Royal genotype as RR, the Trim genotype as Rs and the Solid genotype as ss.

Then:

Royals (RR) bred to Royals (RR) produce 100% Royals (RR).

Royals (RR) bred to Solids (ss) produce 100% Trims (Rs).

Royals (RR) bred to Trims (Rs) produce 50% Royals (RR) and 50% Trims (Rs).

Trims (Rs) bred to Trims (Rs) produce 25% Royals (RR), 50% Trims (Rs) and 25% Solids (ss).

Color Inheritance

Imperials are either homozygous Imperial or heterozygous Imperial.

Only one copy of the Imperial gene is required for the Imperial gene to dominate over the Native Black or Gold colors and produce Imperials. A homozygous Imperial bull will always produce Imperial offspring when bred to Native Black females. When bred to Royal females he will always produce Imperial Trims. A heterozygous Imperial bull will produce a mixture of Imperial and Native Black offspring when bred in the same manner.

The Golden yak color is inherited as a recessive trait that requires the homozygous genotype for phenotypic expression. The heterozygous genotype is not expressed, but is a recessive carrier. The inheritance is identical to the red gene in Red and Black Angus cattle.