

## How to Read a DNA Test for Horse Coat Color and Breeding

Genetic testing is a powerful tool for understanding your horse's coat color and planning for its breeding future. DNA test results can look intimidating at first, but they are surprisingly straightforward to read once you understand the basic terminology. This guide will walk you through the key genetic markers and what they mean for your horse.

### Understanding the Core Genes: E, A, and Rn

Most coat color tests focus on a few key genes that determine a horse's base color and pattern. You'll see these represented by letters in the test results. Remember, horses inherit two copies of each gene—one from their dam and one from their sire.

- **Extension (E) Gene:** This gene determines if your horse can produce black pigment.
  - **E/E:** Your horse has two dominant "E" genes. It will always pass on the ability for black pigment to its foals.
  - **E/e:** Your horse has one dominant "E" and one recessive "e" gene. It produces black pigment, but can pass on the "e" gene, which results in chestnut base colors.
  - **e/e:** Your horse has two recessive "e" genes. It cannot produce black pigment and will have a chestnut base color. It will always pass on the "e" gene.
- **Agouti (A) Gene:** This gene determines where black pigment is located on the body. It only works if the horse has at least one dominant "E" gene (E/E or E/e).
  - **A/A:** Your horse has two dominant "A" genes. It will restrict black pigment to the points (mane, tail, and legs). This results in a bay coat.
  - **A/a:** Your horse has one dominant "A" and one recessive "a" gene. It will also be bay, but it can pass on the "a" gene, which allows for black pigment to cover the entire body.
  - **a/a:** Your horse has two recessive "a" genes. The black pigment is not restricted, resulting in a black base coat.
- **Roan (Rn) Gene:** This is the gene responsible for the roan pattern, mixing white hairs with the base coat.
  - **Rn/rn:** Your horse has one dominant "Rn" gene. This is what makes a horse a roan. It can pass the gene to its foals.
  - **rn/rn:** Your horse has two recessive "rn" genes. It does not have the roan gene.
  - **Rn/Rn:** This is a rare, homozygous dominant genotype. In roan horses, this is often associated with developmental challenges and is why breeders use genetic testing to avoid this combination.

### Putting It All Together: Reading the Results

A DNA test result will typically list the horse's genotype for each gene. Here's what some common results mean:

- **Test Result: E/E, a/a, Rn/rn**
  - **E/E:** Can produce black pigment.
  - **a/a:** Black pigment is not restricted to the points.

- **Rn/rn:** The horse has the roan gene.
- **Conclusion:** This is a **Blue Roan** (black base with the roan gene).
- **Test Result: e/e, A/a, Rn/rn**
  - **e/e:** Cannot produce black pigment; the base is chestnut.
  - **A/a:** The agouti gene is irrelevant since there is no black pigment to restrict.
  - **Rn/rn:** The horse has the roan gene.
  - **Conclusion:** This is a **Red Roan** (chestnut base with the roan gene).
- **Test Result: E/e, A/a, Rn/rn**
  - **E/e:** Can produce black pigment.
  - **A/a:** Restricts black pigment to the points.
  - **Rn/rn:** The horse has the roan gene.
  - **Conclusion:** This is a **Bay Roan** (bay base with the roan gene).

### **Breeding Implications: Preventing Homozygous Roans**

The most important reason to test a roan horse's DNA is to ensure you do not breed a foal that is homozygous for the roan gene (Rn/Rn). As you saw in the study by Ludwig et al., this can lead to serious health and developmental issues.

- **If your horse is Rn/rn:** It carries one copy of the roan gene. To avoid the Rn/Rn outcome, you must breed it with a horse that does not have the roan gene (rn/rn). This combination will give you a 50% chance of a roan foal (Rn/rn) and a 50% chance of a non-roan foal (rn/rn), with no risk of a homozygous roan.

Genetic testing is a simple and crucial step for any responsible breeder. It gives you the information you need to make informed decisions, ensure the health of your foals, and safely breed for the stunning coat colors you desire.