

Managing Herefords

DNA Testing Procedures



Since 2012 GeneSeek Inc., located in Lincoln, Neb., has been the American Hereford Association's (AHA's) official DNA testing lab.

The DNA testing process is required to get a female donor dam permitted or a sire permitted for

artificial insemination (AI). Also all Hereford sires born after Jan. 1, 2011, must be DNA genotyped at the official AHA DNA laboratory before their progeny can be registered.

Producers can continue to use DNA testing to parentage verify an animal

before registering when the sire of the animal is in question or to test for genetic abnormalities.

Hereford breeders have the option to utilize genomic information to enhance the accuracy of Hereford expected progeny differences (EPDs).

The process: Hereford testing procedures

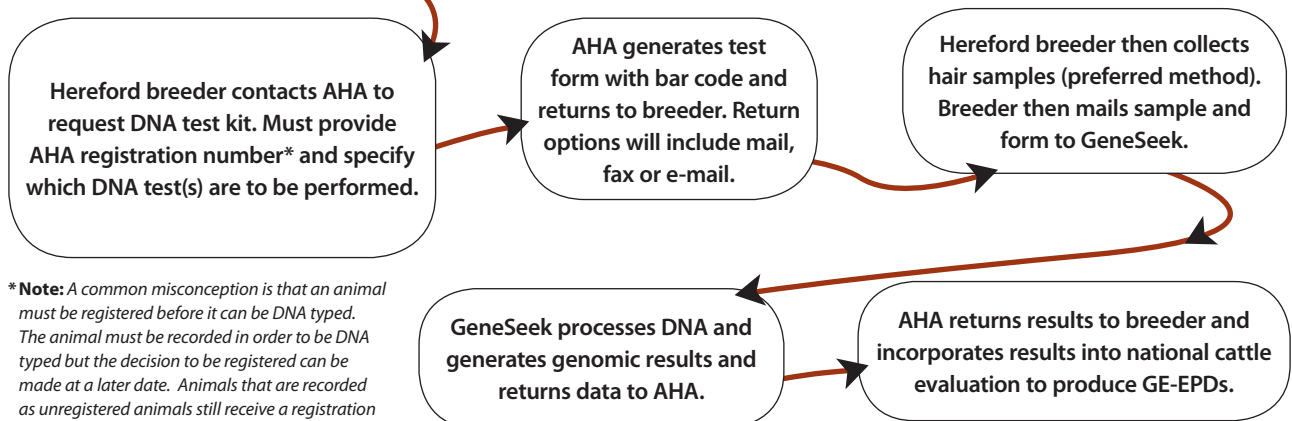
Before contacting AHA to request DNA test kits, Hereford breeders need to have registration numbers ready for the animals they plan to test.* Breeders also need to decide what tests they want to have done. Remember DNA testing is required to get a female donor dam permitted or a sire permitted for AI use. Also all Hereford sires born after Jan. 1, 2011, must be DNA genotyped at the official AHA DNA laboratory before their progeny can be registered.

When a breeder requests a test to get an AI sire permit, AHA staff will determine if the bull's parents have been tested and are on file. If the bull's sire and dam have not been tested, the breeder will need to collect and submit those samples as well. **Note:** *Animals with microsatellite profile results may have to be tested using SNP technology.*

The preferred testing sample collection is hair (see "Instructions for obtaining hair samples"). If hair is not available, producers can submit semen using the same form. Semen does not have to be frozen. Put the semen straw in a ballpoint pen casing, capped and taped on the form where it indicates to put the hair shafts. This procedure prevents the semen straw from breaking while being mailed.

To order kits and for questions about the testing process, contact AHA customer service at 816-842-3757.

Here's the step-by-step process:



***Note:** *A common misconception is that an animal must be registered before it can be DNA typed. The animal must be recorded in order to be DNA typed but the decision to be registered can be made at a later date. Animals that are recorded as unregistered animals still receive a registration number and utilizing that number is necessary so each animal has a unique identity so it can be tracked through the AHA system and at the lab.*

Instructions for obtaining hair samples

- Pull hair samples above the tail switch. Do not cut the hair. The hair root contains the material needed for DNA testing.
- Pull **80 hairs** evenly and directly from the tail so the hair does not break. The switch must be dry and brushed clean of all debris. The lab suggests wrapping the hair around a pencil and then pulling.
- Place the hair in a straight line across the center of the form from the AHA for DNA testing. Keep the hair together with the roots to the left, as noted on the form. Do not curl hair. Attach the center hair shafts to the form with tape.
- Fold the form as you would a business letter. Each sample has an individual envelope for mailing. If you have several to mail, put each sample in its individual envelope and then mail all the envelopes in one big envelope to save on postage. The address is located on the bottom of the form.



Note: *It is important to only include hair from one animal in each kit. The lab cannot detect cross contamination of samples.*

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The GE-EPDs panel testing help AHA continue its work of genome discovery in order to continue to find SNP markers that will enhance the accuracy of EPDs.

Included in this fact sheets are answers to common questions about Hereford DNA testing, testing prices, instructions on how to collect and submit samples and pricing information.

If you have more questions about Hereford DNA testing, contact the AHA at 816-842-3757.

Hereford DNA testing fees

In October 2014, AHA announced an updated pricing structure for DNA testing. The reduction in cost is due to a new 30K LD (low density) product that has been built and produced by GeneSeek. The 30K panel allows AHA to impute to 50K to produce molecular breeding values (MBVs) that are used to produce GE-EPDs. Please note the process to request DNA kits has not changed — Hereford breeders must continue to request a kit from AHA. Also the new LD panel has not shortened the testing time. Please continue to allow enough time to get data back for a production sale if you have a deadline.

Basic test — \$38 (no bulk rate available) includes profile, parentage, abnormalities

GE-EPD test — \$55 (no bulk rate available) includes profile, parentage (needs to be requested), abnormalities and GE-EPD Stand-alone horned/poled

(H/P) test — \$45 per head the test only tests for the horned/poled gene. Does not identify scur genes.

Full package — \$85 includes profile, parentage (needs to be requested), abnormalities, GE-EPD, H/P (needs to be requested).

Genomic terms

ALLELE: Different forms or variants of a gene are known as alleles. Each animal inherits two alleles of each gene, one from its sire and one from its dam. These two alleles can be identical (making the animal homozygous), or different (making the animal heterozygous) for any given gene.

DNA: Deoxyribonucleic acid (DNA) is a nucleic acid present in the cells of all living organisms. It is often referred to as the “building blocks of life,” since DNA encodes the genetic material which determines what an organism will develop into. In addition to maintaining the genetic blueprints for its parent organism, DNA also performs a number of other functions, which are critical to life. The bases found in DNA come in four varieties: adenine, cytosine, guanine and thymine – often abbreviated as A, C, G and T, the letters of the genetic alphabet.

DNA MARKER TESTING: A test to determine the genetic make-up of an animal using DNA markers, which are regions of DNA thought to be associated with different genes.

DISCOVERY POPULATION: The population of cattle that was used to find an association between a DNA marker and the trait of interest.

GE-EPDs: Genomic-enhanced expected progeny differences (EPDs) are derived from blending conventional EPDs with genomic data collected from DNA testing.

GE-EPDs PANEL: This is a DNA panel where more than 50,000 DNA markers are genotyped for each animal. This tool is used to help with discovery and validation of markers in a Hereford specific panel. The 50k panel is utilized to generate GE-EPDs and will help breeders more dependably predict genetic merit in young, unproven cattle, as compared to non-parent EPDs.

GENOTYPE: The genetic makeup of an animal.

GENOTYPING (DNA MARKER TESTING): The process by which an animal is tested to determine the particular alleles it is carrying for a specific genetic test.

HD TEST: High density (HD) marker test.

HOMOZYGOUS: Having two copies of the same allele for a single gene such as BB.

HETEROZYGOUS: Having different copies of alleles for a single gene such as Bb.

MICROSATELLITE: A microsatellite looks at a large section of a DNA strand with multiple segments where a SNP looks into each individual segment and each nucleotide combination.

NUCLEOTIDE: A structural component of DNA that includes one of four basic chemicals: adenine (A); thymine (T); guanine (G) and cytosine (C).

PHENOTYPE: The outward appearance of an animal that can be measured. Phenotypes are influenced by the genetic makeup of an animal and the environment.

SNP (single nucleotide polymorphism — referred to as a ‘snip’): A type of genetic marker where alleles different from each other by the sequence of only a single nucleotide base pair. SNP genetic tests focus on detecting precise single nucleotide base pair differences among the 3 billion nucleotide base pairs that make up the bovine genome.

TRAINING ANALYSIS: The process of characterizing the EPDs of genomic fragments.

VALIDATION: A study conducted to confirm a reported association between DNA-marker alleles and the trait of interest. Validation studies play an important role in ensuring that potential markers have a real association with the trait of interest in commercial cattle populations.

WHOLE GENOME SEQUENCING: This process figures out the order of DNA nucleotides, or bases, in a genome – the order of As, Cs, Gs and Ts that make up an organism’s DNA.

Managing Herefords

DNA Q&A



Q: What DNA products are available?

- A:** 1) **Basic test** — \$38 (no bulk rate available) includes profile, parentage, abnormalities
- 2) **(H/P) test** — \$45 per head the test only tests for the horned/polled gene. Does not identify scur genes.
- 3) **Full package** — \$85 includes profile, parentage (needs to be requested), abnormalities, GE-EPD, H/P (needs to be requested).

Q: What is the basic test?

A: The AHA basic test allows you to:

- 1) **AI (artificial insemination) permit a sire** — This requires parent verification. If the parents were originally tested using microsatellite technology they may need to be redone using SNP technology.
- 2) **ET (embryo transfer) permit a dam** — Only a profile is required on the ET dam for this permit.
- 3) **Genetic abnormality testing — idiopathic epilepsy (IE), dilutor (DL) and hypotrichosis (HY).**
- 4) **Parentage verification** — This is used when parents maybe unknown or when breeders use multiple sire pastures.

Q: What is the GE-EPD test?

A: The GE-EPD test evaluates the genetic merit of animals. DNA marker tests reveal the genotype of an animal for specific DNA markers for a particular trait. AHA will blend marker information with phenotypic information and pedigree to produce an EPD that will allow breeders and commercial producers to select animals with less risk due to the increase in accuracy. For more information, contact Stacy Sanders or Jack Ward at 816-842-3757.

Q: What is the horned/polled panel? Does it test for abnormalities too?

A: The horned/polled test only tests for the horned/polled genotype. No abnormalities will be tested for and it does not identify scur genes.

Q: How long will it take to get my results?

A: Approximately 15 business days or three weeks from the time the lab receives the DNA.

Q: How much time should I allow for DNA testing to be performed on my animals prior to a production sale?

A: It is appropriate to begin testing three months in advance of any sale if you intend to include the DNA results or abnormality information in your sale catalog.

Q: How do I request test kits? In what format do I receive the kits?

A: Call AHA customer service at 816-842-3757 to request a DNA test kit. You can request your forms to be sent to you via mail, e-mail or fax. Please note: by receiving the forms via fax, the barcodes on the forms can be scrambled in the process of faxing and can cause problems at the lab.

Q: Do I need to have my calves registered prior to ordering the DNA kit?

A: No. Animals do not have to be registered, but they must at least be recorded at AHA as an unregistered animal. This gives them a unique registration number that is used to create a barcode for each kit. The decision to register the animal can be made once the DNA results are available to the breeder.

Q: Where do I send the DNA kit and sample to be tested?

A: All DNA kits should be sent to GeneSeek, not the American Hereford Association. If you send your DNA kit to AHA the turnaround time is slowed down.

GeneSeek
4131 N. 48th St.
Lincoln, NE 68504

Q: I received my DNA kit, but I would like to request an additional test on the sample. Can I write the additional test on the form?

A: The forms are barcoded specifically for the test to be performed on the sample. The lab will NOT recognize handwritten instructions for additional tests. If you would like to request additional tests, please return the kit to AHA and request a new kit be sent to you.

Q: Why would I need to retest a parent if they have a DNA profile on file?

A: Animals with a DNA test result prior to June 16, 2012, will have a microsatellite DNA profile. With the switch to GeneSeek we will be using SNP-DNA profiles. Therefore it may be necessary to generate a new DNA profile for parents using the SNP panel so that their progeny can be verified back to them. Most animals that have a microsatellite DNA profile already have a hair sample at the lab and it may be possible to generate the SNP-DNA profile from that existing sample. The lab will notify AHA if a sample isn't usable for generating the new profile. In these cases, a new DNA kit will be requested for the animal and sent to the member. If the parent is not available, it is possible to run a microsatellite DNA profile for the progeny to be able to conduct the parent verification.

Managing Herefords

DNA Q&A



Q: If my animals have already been tested, will I need to send a new sample to the DNA lab?

A: If an animal has previously been tested, a sample still remains at the lab for testing procedures. There are times, when the sample is unavailable or unusable for testing and a new sample is required. At that time, you will be informed and sent a new DNA kit for that animal and a new sample must be submitted.

Q: Can I DNA profile only?

A: You can DNA profile animals for in-herd sire use, donor dam permits and legacy animals with the AHA basic panel.

Q: If I have an animal that has a GE-EPD panel, will I need to request an updated DNA basic profile to parentage verify their progeny? For example, if you have a herd bull with GE-EPDs and you would like to parentage verify his progeny.

A: If an animal has a GE-EPD panel, they will automatically have a SNP panel (basic profile) on file. Progeny can be verified back to that animal without running a new basic panel on the parent animal.

Q: Which abnormalities will be included in the test?

- A:**
- 1) Hypotrichosis (Hairlessness) — partial to almost complete lack of hair
 - 2) Dilutor — carrier animals when mated with black cattle can produce offspring with a gray, smokey or chocolate hair color.
 - 3) Idiopathic epilepsy — seizures occurring from birth to several months of age (lethal abnormality)

Q: How will I know if my animals are carriers of a genetic abnormality?

A: The abnormalities test results will show up on their pedigree, both online and on paper. There will be three denotations on the pedigree pertaining to the abnormality test. The denotations are IEF (idiopathic epilepsy free), DLF (dilutor free) and HYF (hypotrichosis free). If they are all missing, typically that animal has not been tested. Note: Genetic abnormalities will be included in your result statements from the GeneSeek lab.

Q: How do I need to collect my DNA sample to send in?

A: Four forms of DNA can be submitted: 1) hair; 2) semen; 3) blood ; or 4) tissue (ear punch). Hair is the preferred method for DNA sampling (See “The process: Hereford testing procedures” for instructions on how to submit hair and semen). For deceased animals, bone can be submitted but there may be an additional charge for bone DNA sampling.

Q: I have received multiple result statements for the same animal. What does this mean?

A: The lab is currently processing information through multiple channels. This creates multiple result statements that are sent to the breeder separately because individual pieces of data are processed faster than others. Breeders may receive parentage information separate from abnormalities.

Q: How will GE-EPDs on parent animals affect progeny pedigree estimates?

A: The current method of calculating blended GE-EPDs only enhances the EPDs of the subject animal. All resulting progeny will have a pedigree estimate that is calculated from the parents' base EPDs. GE-EPDs will not affect pedigree estimates of progeny. AHA is currently working to build a full genetic evaluation that includes the GE-EPDs.