American Angus Association®
PRKG2 Gene Mutation for Dwarfism (D2) Fact Sheet

ANGUS
THE BUSINESS BREED

The following fact sheet was developed to respond to questions commonly asked by American Angus Association members. Additional information may be found online at www.angus.org.

What is PRKG2 Gene Mutation for Dwarfism (D2)?
D2 was recognized as a specific strain of dwarfism on September 7, 2007. There are several types of dwarfism, but all dwarfs appear shorter and some smaller than normal. The legs are short and body is short, and the animal may appear to have a potbelly and a thick or blocky shape. The head may be normal (long-nosed or long-headed dwarf) or the face may appear shortened. Muscling is often normal and, thus calves may be a thick appearance.

What causes D2?
D2 is caused by a recessive mutation on a single cattle chromosome. Cattle that are homozygous for the mutated gene will exhibit D2.

What is a D2 carrier?
For the purpose of this response, a D2 carrier is an Angus or Angus-cross cow, heifer, bull or steer that carries the recessive D2 mutation in their DNA.

Why are carriers of D2 important?
Carriers of D2 used in breeding programs (registered or commercial) are responsible for propagating the recessive mutation within the cattle population.

What does a D2 carrier look like?
A D2 carrier looks perfectly normal; there is nothing in the way an animal looks (its phenotype) that indicates that the animal is a carrier of the D2 mutation.

If a cow has a D2 calf, what does that mean?
If a cow has a D2 calf, and if it is the cow's natural calf, it means that the cow is a carrier of the D2 mutation and the sire of the calf is also a D2 carrier.

If a recipient cow has a D2 calf, what does that mean?
If a recipient cow has a D2 calf, it means only that both the donor cow and the sire of the calf are carriers of the D2 mutation. It doesn't tell you anything about the D2 carrier status of the recipient cow.

If a bull sires a D2 calf, what does that mean?
If a bull sires a D2 calf, it means that the bull is a carrier of the D2 mutation and that the dam of the calf is also a D2 carrier.

I have never had a D2 calf. Does that mean my cows are non-carriers?
Not necessarily.

What is the risk of having a D2 calf if I breed a D2 carrier cow to a D2 carrier bull?
Every time you breed a carrier to a carrier, there is:
- A 25% risk of having an affected D2 calf;
- A 50% risk of having an otherwise normal-appearing calf that carries the D2 mutation;
- A 25% chance that you will have a normal-appearing, non-carrier calf.

If I breed a D2 carrier cow to a D2 carrier bull and have three live calves, will the fourth calf have D2?
The risk is the same every time you breed a carrier to a carrier. There is always a 25% risk of having an affected D2 calf, a 50% risk of having a carrier calf, and a 25% chance of having a non-carrier calf.

If I breed a D2 carrier cow to a non-carrier bull, what is the chance of having a D2 affected calf?
Zero. You will never have a D2 affected calf if you breed a carrier cow to a non-carrier bull. (excluding the possibility of a spontaneous mutation)

If I breed a D2 carrier cow to a non-carrier bull, what is the risk of having a carrier calf?
Every time you breed a carrier cow to a non-carrier bull there is:
- A 50% risk of having a normal-appearing calf that carries the D2 mutation; and
- A 50% chance you will have a non-carrier calf.

Is there a test to identify D2 carriers?
Yes. A DNA test is available to determine if an animal carries the D2 mutation in their DNA. The type of DNA sample required to perform the test varies from lab to lab but includes; hair root samples, blood-spot or FTA cards, whole blood in "purple–top" tubes, tissue samples from ears and semen samples.

A video on ***www.angus.org*** explaining how to collect the sample can be found **here**.

What do I do with the confirmed non-carrier females in my herd?
If the females are tested non-carriers and they are bred to non-carrier bulls, they will never produce affected D2 calves or carriers. These non-carrier females can be used throughout your breeding program with no risk of propagating the D2 mutation.

What do I do with confirmed female carriers in my herd?

You have several options:

- If you have a cow that carries the D2 mutation and you want to produce calves from her; you must make a commitment to test all offspring retained for breeding; (check policy regarding registration requirements)
- If you have both a registered and a commercial herd, retain your carrier cows in the commercial herd, breed to a non-carrier bull, and test any calves retained for breeding purposes;
- If you always breed your carrier cows to a non-carrier bull, you will never have a D2 calf. Then, treat the resulting calves as market animals, not as breeding stock.
- Use your D2 carrier cows as ET recipients. As a recipient female, she has no genetic effect on the embryo calf she raises.

D2 potential carrier report & potential carrier management tool

AAA Login users can access interactive tools to generate a report of owned animals and their PRKG2 Gene Mutation for Dwarfism (D2) status based on the D2 test results received to date. From the AAA Login menu, go to the "interactive" section and click on "Potential Carrier Report AM/NH/CA/DD/M1/D2" or "Potential Carrier Management Tool (PCMT)." The PCMT can identify those animals in your herd that have the most descendants in your herd and would be the most logical animal to start a testing scheme should you decide to test for a particular genetic condition. If you are not a current AAA Login user, you can sign up to create an online profile at *www.angusonline.org.*

What is the AAA registration policy regarding D2?

		One or both parents test D2C (confirmed carriers)
Heifers		All calves must be tested and can be registered regardless of the test outcome.
Bulls		All bull calves registered after 8/29/2011, must be tested and only those that test D2F can be registered.
E.T. Calves		Registration is based on the date of birth, sex of calf and if they are sired by a bull that is an A.I. sire as described below.
Steers		No test required.
A.I. Sires that are confirmed carriers		Calves cannot be registered that are conceived more than 60 days after the date a non-owned bull (a bull that would require an A.I. Service Certificate) is listed as a carrier animal (D2C).
Definitions		D2C - D2 Carrier, has been tested and carries the D2 mutation. D2F - D2 Free, has been tested and does not carry the D2 mutation. D2P - D2 Potential Carrier, animal that traces to one or more confirmed tested carrier animals in its pedigree that have no intervening ancestors that have been tested free of D2.

Testing Procedures

Submit Samples through American Angus Association/AGI

Use **AAA Login** to order test. Samples are submitted to the American Angus Association and archived for future testing requests. Login at ***www.angusonline.org*** and use menu option: Order--Testing for AM/NH/CA/DD/D2/M1.