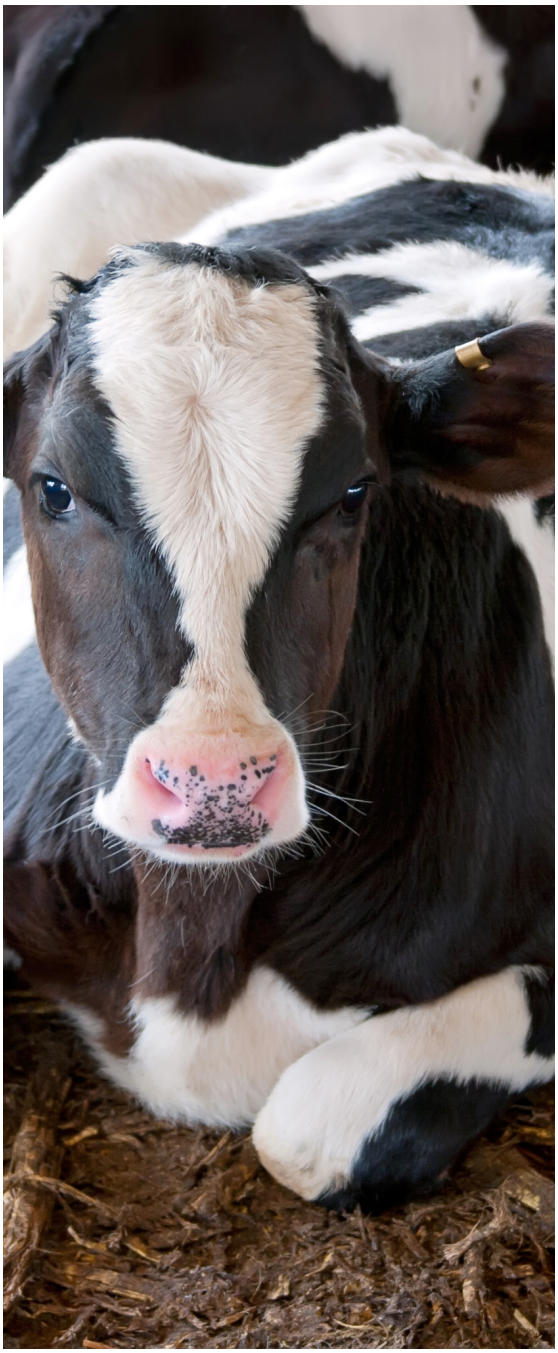
Igenity®

Trait and Conditions Results Key



NEOGEN® invests in genomic innovations enhancing the value and use of DNA testing for dairy producers. This commitment includes rapid turn-around time, reliable, accurate delivery of results and cost-effective testing. The Igenity dairy portfolio includes bundled packages of traits and conditions for convenient, affordable screening in a dairy breeding program.

Igenity's Trait and Conditions product packages include:

① SeekSire Cattle Parentage
② Dairy Milk Protein Traits
③ Dairy Breeding Stock Traits
④ Dairy Recessive Traits
⑤ CVM
⑥ Coat Color
⑦ Fish Milk
⑧ BVD-PI

Seeksire™ Cattle Parentage

World standard for cattle parentage.

In modern dairy reproductive protocols, parentage verification is a key tool in genetic improvement. SeekSire parentage measures a unique mix of world standard parentage markers recognized by the USDA and the International Society of Animal Genetics (ISAG). This is an essential tool for confirming the genetic contribution of parent stock and making reliable decisions in genomic-assisted mating, trait screening and herd improvement. All NEOGEN bovine genomic tests use this unique set of parentage markers.

Confirmed: The reported sire/dam was confirmed through genomics.

Unconfirmed: The submitted sire/dam has not been genotyped and therefore cannot be confirmed or excluded.

Excluded: The submitted sire/dam was excluded through genomics.

Dairy Milk Protein Traits

Selection tool for milk protein management, including A2 beta casein, kappa casein, beta casein AB and beta lactoglobulin.

A2 Beta casein – A2 beta casein protein that is less common than the A1 beta casein protein typically found in milk. Some studies have demonstrated human health benefits associated with A2 milk. The milk does sell for a premium which is why some producers are choosing to select for it.

A2/A2: A2 Milk

A2/A1: A2 carrier

A1/A1: A1 Milk

Kappa casein – There are several forms of kappa casein – A, B and E – that are associated with milk protein and quality. These variants are related to the renneting process for cheese production. Studies have also shown that cheddar cheese yield can be up to 8% higher and mozzarella up to 12% higher with BB milk versus AA milk. The E variant has an adverse effect on cheese production.

BB: preferred result for cheese production

AB and BE: intermediate for cheese production

AA and AE: least favorable result for cheese production

Beta casein AB – Like kappa casein, there are several different forms of beta casein (A and B). Higher milk yield is associated with the A variant while higher protein and casein yields are associated with the B variant. Beta casein B is similar in effect to kappa casein B.

Beta lactoglobulin – A major whey protein that has a significant effect on casein number and cheese yield. The B variant has higher casein and cheese yields.

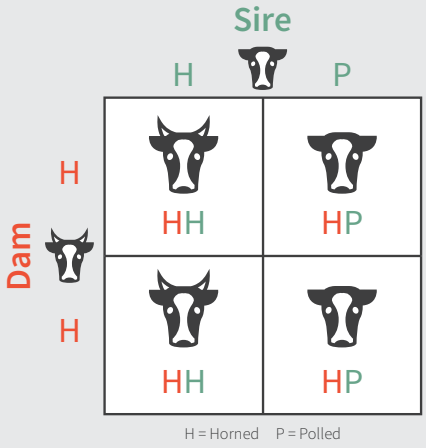
Beta casein AB and Beta lactoglobulin

BB: most favorable result for casein and cheese yield

AB: intermediate result for casein and cheese yield

AA: least favorable result for casein and cheese yield

Inheritance of Traits and Genetic Conditions



Genetic traits such as milk proteins, coat color or polled, rely on the fact that desirable traits can be passed from one generation to the next. For example, if a heterozygous polled sire (HP) is mated with a horned dam (HH), they will have a 50% chance of having a polled offspring (HP) and a 50% chance of having a horned offspring (HH). Polled is a dominant trait in dairy cattle.

Genetic conditions, such as BLAD, DUMPS or Brachyspina, are caused by a recessive gene mutation. This means an animal must receive a copy from each parent to be affected. Animals that only receive one copy are considered carriers and can pass it on to their offspring. These animals need to have their mates carefully selected to avoid the chance of an affected offspring.

Dairy Breeding Stock Traits

Broad genomic screening tool for breeding cattle selection, including the dairy milk protein bundle, a panel of embryonic lethals and horned-polled status.

Dairy Milk Protein Traits – Selection tool for milk protein management, including A2 beta casein, kappa casein, beta casein AB and beta lactoglobulin.

Embryonic Lethals – A screening panel of breed-specific embryonic lethal traits. Researchers have thoroughly evaluated the database of genotypes and identified that certain combinations of genotypes that should be present in the population are simply not present. This absence suggests that the unique combination of those genotypes is somehow lethal to the developing embryo. Upon investigation, researchers discovered that bulls (or females) that are carriers of the haplotype are less fertile, suggesting embryonic mortality. In several instances, they have actually been able to identify the causative mutation and confirm that the change in the DNA does result in a lethal mutation. There are several embryonic lethal causative mutations known to exist:

① Holstein Embryonic lethals (HH1, HH3, HH4, HH5)

② Jersey Embryonic lethal (JH1)

③ Ayrshire Embryonic lethal (AH1)

④ Braunvieh/Brown Swiss Embryonic lethal (BH2)

T: Tested Free **C:** Carrier **A:** Affected

Horned/Polled – Polled is a dominant trait in dairy cattle – only animals with two horned recessive genes will appear horned. Animals appearing polled will not require the labor associated with dehorning. Animals will be reported as HH (meaning they carry two horned genes) HP (meaning they appear polled, but carry the horned gene), or PP (meaning they carry two polled genes). If an HP animal is mated with an HH animal, 50% of the offspring will be HP. If an animal is PP, all of its offspring will appear polled (HP or PP).

HH: Horned

HP: Horned carrier

PP: Polled

Dairy Recessive Traits

Screening tool for genetic health, including Brachyspina, BLAD, DUMPS, Mulefoot, Citrullinemia, Holstein Cholesterol Deficiency, SMA, SDM, SAA and Weaver.

For Holstein cattle:

Brachyspina – A lethal recessive that usually causes abortion within the first 40 days of gestation. This is a test for the causative mutation associated with Brachyspina and is the definitive test for the disease.

T: Tested Free **C:** Carrier **A:** Affected

Bovine Leukocyte Adhesion Deficiency (BLAD) – BLAD is a disease which results in impaired function of the white blood cells of the immune system in Holstein cattle. For an animal to demonstrate clinical signs of the disease, it must have two copies of the gene.

T: Tested Free **C:** Carrier **A:** Affected

Deficiency of Uridine Monophosphate Synthase (DUMPS) – DUMPS is characterized by early embryonic death in Holstein animals that have two copies of the gene.

T: Tested Free **C:** Carrier **A:** Affected

Mulefoot – Mulefoot is a recessive congenital disease in Holstein cattle that causes fusion of the hoof. It is not lethal, but leads to locomotive difficulties in affected animals.

T: Tested Free **C:** Carrier **A:** Affected

Citrullinemia – Citrullinemia is a genetic metabolic disorder affecting the urea cycle in Holstein cattle. Citrullinemia causes ammonia accumulation in the blood that will lead to various neurological signs in affected cattle.

T: Tested Free **C:** Carrier **A:** Affected

Holstein Cholesterol Deficiency (HCD) – Holstein Cholesterol Deficiency causes affected animals to be unable to produce cholesterol. Carriers of the disorder will have a decreased ability to produce cholesterol.

T: Tested Free **C:** Carrier **A:** Affected

For Brown Swiss cattle:

Spinal Muscular Atrophy (SMA) – A neurological condition affecting the nervous system characterized by skeletal muscle atrophy, decreased spinal reflexes and motor weakness known to be present in Brown Swiss cattle. Animals with one copy of the gene (carriers) are normal, but will have a 25% chance of producing an affected offspring if bred to another carrier.

T: Tested Free **C:** Carrier **A:** Affected

Spinal Dysmyelination (SDM) – A neurodegenerative disease known to be present in Brown Swiss cattle that leads to inability to stand immediately upon birth. Animals with one copy of the gene (carriers) are normal, but will have a 25% chance of producing an affected offspring if bred to another carrier.

T: Tested Free **C:** Carrier **A:** Affected

Syndrome of Arachnomelia and Arthrogryposis (SAA) - Also known as Spiderleg, SAA is due to an inherited neuromuscular dysfunction early in gestation. Affected Brown Swiss calves are born with both muscular and skeletal deformity.

T: Tested Free **C:** Carrier **A:** Affected

Weaver – Also known as Bovine Progressive Degenerative Myeloencephalopathy, it is characterized by a noticeable weaving gait of the affected Brown Swiss animal.

T: Tested Free **C:** Carrier **A:** Affected

Additional Screening Tools

① Complex Vertebral Malformation (CVM)

② Coat Color

③ Fish Milk

④ Bovine Viral Diarrhea - Persistently Infected (BVD-PI)

Complex Vertebral Malformation (CVM)

A standalone test for a lethal malformation causing abortion or death of Holstein calves.

A lethal hereditary syndrome found in Holsteins responsible for malformed calves that usually are aborted or die shortly after birth. This is an independent test for the causative mutation associated with the malformation and is the definitive test for the disease.

T: Tested Free **C:** Carrier **A:** Affected

Coat Color

A standalone test for coat color.

Identifies the genotype combination that determines coat color. The black (ED) gene is dominant over red (e). Wild Type (E+) is neutral to red and black, and generally allows the expression of the other gene.

EDED Homozygous Black

E+e Red Carrier, Wild Type

EDe Red Carrier

EDE+ Black Carrier, Wild Type

ee Red

E+E+ Wild Type, Any Color

Fish Milk

Metabolism error associated with a fishy off-flavor in cow's milk due to elevated levels of trimethylamine in Ayrshire and Swedish Red cattle.

T: Tested Free **C:** Carrier **A:** Affected

Bovine Viral Diarrhea - Persistently Infected (BVD-PI)

BVD-PI testing is a laboratory report that indicates the BVD status of the tested animal. The aim is to detect persistent infection with BVD (Bovine Viral Diarrhea) virus. If the animal is suspected to be positive, genomic testing will not proceed unless advised otherwise. It is advisable to cull persistently affected animals as they are sub-optimal performers and a source of infection for other animals, leading to infertility, abortion, illness and death.

Negative: Negative for BVD-PI. Genomic testing will proceed.

Positive: Positive for BVD-PI. Confirmation of BVD-PI status is strongly recommended. Genomic testing will not proceed.

Inconclusive: Sample tested weakly positive for BVD-PI but a final diagnosis regarding the BVD-PI status cannot be made at this time. Confirmation of actual BVDV status is strongly recommended. Genomic testing for original sample will not proceed.

Example output for Igenity Dairy Trait and Condition testing for Holstein animals tested for dairy breeding stock and dairy recessive traits

Farm ID	A2 Beta Casein	Kappa Casein	Beta Casein AB	Beta Lac.	Horned/ Polled	Embryonic Lethals	BLAD	BY	Cit.	DUMPS	HCD	Mulefoot
1501	A2/A2	AB	BB	AA	HP	HH1C HH3T HH4T HH5T	T	T	T	T	T	C
1502	A2/A2	BB	AA	AB	PP	HH1T HH3T HH4T HH5T	T	T	T	T	A	T
1503	A2/A2	AA	AB	BB	HH	HH1T HH3C HH4T HH5T	C	T	T	T	C	T
1504	A1/A1	AB	BB	BB	HH	HH1T HH3T HH4T HH5C	T	T	T	T	T	T
1505	A1/A2	AA	AA	AA	HH	HH1T HH3T HH4C HH5T	T	T	T	T	T	T

In the example above, #1501 is a carrier for Mulefoot and Holstein embryonic lethal, HH1. It will be important to choose a mate that is not a carrier for these conditions so that there is no chance for an affected offspring.