Why are Genomics Important?

Demand for food is increasing at a rapid rate as the global population continues to expand. Animal products have been in higher demand than ever, and yet farmers are required to use less resources and be better stewards of the land each year. The solution for this is to produce better, and more efficient, animals and to manage them the best way possible. By using genomics to make breeding decisions and to decide which animals remain in the herd, it is possible for farmers to increase milk production while minimizing the number of animals that must be kept on the farm to meet these goals.

After having participated in this activity, we hope that the participants will:

- See what measures farmers are taking to improve their dairy herds

Why are Genomics Important?

Demand for food is increasing at a rapid rate as the global population continues to expand. Animal products have been in higher demand than ever, and yet farmers are required to use less resources and be better stewards of the land each year. The solution for this is to produce better, and more efficient, animals and to manage them the best way possible. By using genomics to make breeding decisions and to decide which animals remain in the herd, it is possible for farmers to increase milk production while minimizing the number of animals that must be kept on the farm to meet these goals.

After having participated in this activity, we hope that the participants will:

- See what measures farmers are taking to improve their dairy herds

An Educator's Guide to Introductory Dairy Genomics

ERIK JORGENSEN & LAUREN HILL

Cornell University College of Agriculture and Life Sciences

Selecting a Good Sire

What Complements the Herd's Goals?

There are various indices that account for different production goals by putting varying weight on specific traits. For example, net merit is the most common index, and it distributes the perceived significance across a number of health, type and production traits. Cheese merit puts greater weight on the amount of protein that will come out of each of the cows in the herd. Below is an excellent example of a bull with a high genomic score. He fits into all of the target categories outlined in the chart on page 2.

AN EXAMPLE

VIEW-HOME CASHFLOW-ET

How it Works

Sampling and Results

On the farm, genetic samples can be taken using blood, hair, or tissue samples. These samples are then sent to the company that will create the genomic report. This company identifies single nucleotide polymorphisms (SNPs), which are essentially DNA markers that can be used to identify particular traits. From this, the company will produce a report that resembles that pictured below:

These results then can be interpreted to better understand the potential for the individual animals in the breeding herd. The information that is gained can be used for a variety of mating decisions.

In the following page, there is a chart that explains the target trends in each of the categories, to better understand what all these acronyms and numbers mean about the genetic potential of the cows.

Sire Proof

United States Proof ▼

GENOMIC USDA SIRE SUMMARY, 201504

TPI 2580	NET MERIT	+1017	CHEESE MERIT	$+854
MILK	+707Lbs	+74% Rel	EFI	+7.5%
PROTEIN	+43Lbs	+0.09%	DPR	+2.2
FAT	+77Lbs	+0.19%	SCS	+2.70
Dtrs/ Herds 100% US Dtrs			PL	+7.6

Name	TPI	NM$	PTAM	PTAF	PTAF%	PTAP	PTAP%	MREL	PL	SCS	DPR	HCR
Supershot	2659	853	2117	73	-0.02	70	0.02	76	7.5	2.81	2.5	2.1
Glamor	2587	746	1608	86	0.10	62	0.05	74	4.9	2.87	0.8	2.5
Cashflow	2580	807	707	77	0.19	43	0.09	74	7.6	2.70	2.2	2.9
Victory	2557	687	1976	58	-0.05	57	-0.01	74	5.9	2.76	1.8	3.0
Zyke	2552	759	1506	69	0.05	49	0.01	76	6.8	2.72	1.3	2.6
Mardi Gras	2549	710	883	70	0.13	38	0.04	78	6.8	3.00	2.3	1.8
Jump	2545	709	1396	53	0.00	35	-0.03	77	7.4	2.80	2.6	3.8
Mookie	2532	743	599	96	0.28	35	0.06	78	5.6	2.94	1.1	1.0
Megafortune	2523	671	1518	66	0.04	50	0.02	77	5.9	3.02	1.3	3.9

Decoding Genomic Report

Acronym	Trait	Goal	Purpose
PTAM	Milk	Positive	Increase pounds of milk produced by each cow.
PTAP	Protein	Positive	Can be selected to increase the protein percentage in the milk, or the total pounds of protein produced by the cow.
PTAF	Fat	Positive	Can be selected to increase the fat percentage in the milk, or the total pounds of fat produced by the cow.
PTAT	Type	Positive	Combines body and udder conformation.
SCC	Somatic Cell Count	Negative	Indicative of udder health, as higher SCC indicates infection in mammary tissues.
DPR	Daughter Pregnancy Rate	Positive	Represents the ease of getting offspring pregnant.
EFI	Fertility Index	Positive	Represents overall inherited fertility traits.
PL	Productive Life	Positive	Indicates health traits, represents expected life in herd.
NM	Net Merit	Above 250	One composite index of important traits in dairy cattle.
TPI	Total Production Index	Above 2000	One composite index of important traits in dairy cattle, used by the Holstein association.

HOW CAN WE USE THIS DATA?

Better management:

After receiving the genomic reports, a farmer has the ability to manage the herd differently in a way that will allow him or her to rapidly progress the potential in the herd. This can be done by:

- Making better breeding decisions: breeding cows with low scores in some categories to bulls that will improve upon those traits.
- Making informed culling decisions: animals with scores that fall far below the target range can be removed from the breeding herd as heifers, before the farmer puts all the money into raising the animals.
- Aiding in purchasing decisions for new animals.
- Identifying or confirming parentage.
- Selecting better bulls, and more quickly. Genomic data reduces the generation interval because young bulls can be recognized as having high genetic potential without having to wait multiple generations to see physical proof from their daughters.

Management programs:

In addition to the decisions that an individual producer can make, there are a variety of software programs that use herd genomic data to produce lists of breeding decisions for the herd. These programs are inexpensive, and can be modified to accommodate for the various goals that each producer may have. Some farmers get paid a premium for fat or protein composition in the milk, or for having low somatic cell counts, and therefore put a higher weight on those traits in their milk herd than others.