Heifer Management Blueprints

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Application of Genomics in Grazing Management

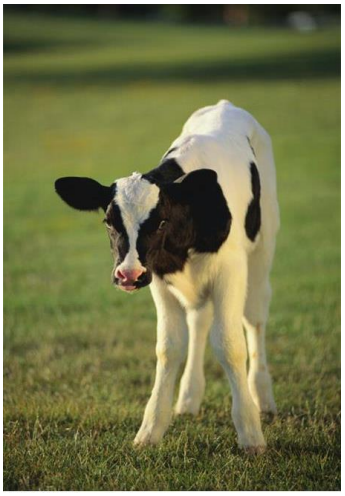
Introduction

Determination of the best possible cow for a particular grazing herd involves many facets of breed characteristics including milk production, longevity, reproduction traits, and milk components. One particular breed or style of dairy cattle may not be appropriate for every herd and a choice must be based on individual needs. To date, this crucial decision has generally been based on very qualitative observations of the physical and behavioral characteristics of grazing cows as well as past experiences. Quantitative data has been difficult to obtain and therefore has been minimally used when evaluating a particular breed or cow's contribution to the grazing herd. Genomics testing, having become commercially available in 2009, has potential to provide quantitative data for use in decisions involving breed traits as well as individual cow and heifer traits.

What is Genomics?

Genomics in terms of dairy cattle is the study of genetic material in the bovine genome. In dairy cattle, the focus is generally on production oriented traits, though there is also potential to evaluate other traits as well. Certain DNA markers along the 30 chromosomes of the bovine genome can provide information that can be used to predict the future performance of a calf or heifer in the areas of milk, fat, and protein production from a simple hair or tissue sample.

To utilize the information provided on the genomes, the genetic information inherited from a calf, heifer, cow, or bull's parents are compared against a reference population for their breed. This reference population is composed of previously genotyped cattle of known phenotypes who's genomic information has been compiled in an extensive database at the USDA Animal Improvement Programs Laboratory (AIPL). Holstein, Jersey, and Brown Swiss are all candidates for genomic testing, but the animal in question cannot be a crossbred unless they are at least 7/8 Holstein, Jersey, or Brown Swiss.



Dairy calves can be genomically tested to predict their potential to be a good grazing cow.

Genomic Measurements

With the submission of a hair or tissue sample, a myriad of performance related traits can be revealed to show whether a calf has promising genetic potential or could be a potentially unsuccessful addition to the herd.

For $45 a dairy calf or heifer can be tested to predict her future production, conformation, health, longevity, and milk quality as compared to herd average.

Effectiveness of Genomic Predictions on Grazing Cows

A pilot survey evaluating the relationship between genomic predictions and actual animal performance of grazing cows was conducted at the University of Wisconsin-Madison during the summer of 2012. Hair follicle samples were collected from 112 Holstein grazing cows from commercial grazing dairy herds in Wisconsin with available production data. Participating grazing operations were asked to identify two "good" grazing cows and two "poor" grazing cows from their herds to make up the group of 112 cows. Hair follicle samples were submitted to Zoetis (Clarifide) for DNA testing to obtain genomic proofs. Not all cows tested met the basic criteria for the study for either breed or age reasons and so 70 of the original 112 grazing cows were used in the final results.

Genomic predicted transmitting abilities (GPTA's) for milk production, fat, and protein levels were compared against true production traits of cows defined as "good" or "poor" grazers. Cows defined as poor grazers were found to have inferior (DNA) genetics as compared to those defined as good grazers. The odds of a dairy cow with positive GPTA's for milk, fat, and protein levels producing above herd average were found to be 5.8, 3.0 and 3.2:1 respectively. Table 1 shows a comparison between average production and GPTA values of Holstein cows defined as a good grazing cows and those defined as a poor grazing cows. Actual production values were based on pounds of milk, fat, and protein for 305 day milk. Genomic PTA values were based on dollars Net Merit, pounds milk, fat, or protein, or percent fat or protein above or below herd averages. Net Merit represents the expected profit of a calf or heifer over her lifetime as compared to herd average. Longevity, health, yield, and fertility are all factored into Net Merit value. Parent averages show the performance of the dam and sire in regard to milk, fat, and protein yield as compared to breed averages.

Table 1.

Item	Good grazing cows	Poor grazing cows	P<
Production, lbs/305 d			
Milk yield	21805	16511	<0.001
Fat yield	782	642	<0.001
Protein yield	613	498	<0.001
Total fat-protein yield	1398	1150	<0.001
Genomic PTA			
Net Merit, $	135	28.8	<0.001
Milk yield, lbs	259	-406	<0.001
Fat yield, lbs	15	-3	<0.001
Protein yield, lbs	5	-8	<0.001
Fat, %	0.01	0.04	0.25
Protein, %	-0.01	0.02	0.01
Parent average			
Milk, lbs	126	-236	0.02
Fat, lbs	6	-5	0.01
Protein, lbs	2	-3	0.15

It is observed in Table 1 that the cows defined as good grazers had significantly higher GPTAs for Net Merit, milk yield, fat yield, and protein yield. This relationship suggests that genomic testing of these cows when they were calves could have predicted their above average grazing genetic potential.

Implications for Grazing Producers

Genomics has the potential for grazing producers to "pre-screen" calves and heifers for producing ability in comparison to current herd averages. Improvement in overall herd production would be possible over time by culling calves or heifers below a certain genetic standard.

There is also an opportunity for future research to possibly detect the existence of genes that could influence feed efficiency for diets based soley on grass. This discovery could further aid in grazing cow selection if one breed or one line of cattle had greater genetic propensity for feeding efficiency on grass only diets.