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Genomics: A Growing Dairy Production Tool

What does genomics technology have to do with dairy nutrition? A lot more than you might think, according to Dick Wallace, DVM, MS, Senior Technical Service Veterinarian for Zoetis based in McFarland, Wis. Genomics technology allows for evaluation of specific bovine DNA markers to predict traits in dairy animals such as milk yield, physical factors, fertility and longevity. Its results are more accurate than previous predictions based on pedigrees alone, and sampling can be performed on cattle as young as one day of age. Genomics testing became commercially available to cattle producers in 2009. Currently, the service is available to U.S. dairy producers through the Holstein, Jersey and Brown Swiss breed associations, as well as Zoetis.

Regardless of provider, all genomics testing interfaces with the USDA Animal Improvement Programs Laboratory (AIPL) database.

“When genomics technology first became available, it was perceived by many to be a tool strictly for registered-cattle breeders seeking to develop superior breeding stock and elite genetics,” says Wallace. “While that remains one application of the technology, genomics testing now is being embraced on an even larger scale as an early tool for heifer selection.”

Nutritionist Jim Barmore, with GPS Dairy Consulting, Verona, Wis., says there are a number of reasons why dairies are becoming selective about which heifers they raise:



- Improved reproductive technology and greater focus on reproductive programs has resulted in more pregnant cows at closer intervals, ultimately producing more calves.
- The use of sexed semen means a greater percentage of those calves are heifers.
- Increased knowledge and application of successful calf rearing practices have resulted in faster calf growth rates and higher survival rates.
- Calf and heifer rearing facilities on many farms are maxed out, leaving producers to weigh the decision between building more housing or reducing heifer inventories.
- Increased knowledge of the results of overstocking facilities — including detrimental effects on heifer growth rates, foot health and reproductive efficiency — has made producers more mindful of controlling stocking density.
- Improved understanding of heifer nutrition programs has resulted in earlier breeding ages and heifers moving through the production pipeline more quickly.
- And, perhaps most critical, heifer-raising feed costs have increased significantly — as much as 40 percent or greater — in the past few years.

Additionally, many lactating herds currently are at static growth. “For all of these reasons, a good share of producers need strategic assistance to help them evaluate which heifers to keep and which ones to sell — preferably at a fairly young age before substantial feed costs are incurred,” says Barmore. “Genomics technology has become an important tool they can use to tighten their inventory of replacement heifers and select the potential ‘all-stars’ for the limited spots on their teams.” Wallace says genomics testing of young calves is the logical path to the most cost-efficient herd inventory decision-making. “Testing a two-year-old cow does not yield the same value as testing a week-old heifer calf,” he states. “By then, the rearing investment already has been made in her, and she needs to remain in the milking string for at least another year to ‘pay back’ that investment.”

While Wallace admits that the culling of young heifers or even baby calves is a mindset change that requires a bit of a leap of faith, the producers who are employing the strategy already are realizing the benefits. “Typically, they can sell enough heifers to pay for the test outright,” he says. “Then, they have reduced feed, labor and housing costs because they are raising fewer replacements. Finally, in the longer run, they will realize more rapid genetic improvement in their herds.”

Barmore says genomics-based heifer selection has been an important consulting strategy as he advises dairy producers who are eager to trim their feed costs or purchased feed needs. “Currently, many producers in the Midwest and other parts of the country have limited feed inventories, and are looking for ways to avoid purchasing high-priced feedstuffs,” he explains. “Because it currently costs more to raise a heifer than she is worth at today’s springer market prices, reducing the number of heifer raised, if they are not needed as herd replacements, is a huge financial relief for these herds. An important consideration to this strategy is genomics testing, which provides solid, science-based information as to which heifers to keep and which ones to cull.”

Incorporating those results into a pre-determined strategic plan might include selling some heifers right away; breeding a percentage to beef bulls so they are retained in the herd but do not transmit their genetics; retaining a percentage as “regular” replacements; and enrolling the highest-genomic animals into advanced reproductive technology programs such as embryo transfer or breeding to sexed semen.

“As more well-managed herds incorporate genomics in their long-term herd-management strategies, it should result in a win-win in terms of both cost containment for feed and other expenses, as well as more rapid and strategic herd genetic improvement,” says Wallace. “I think it is a tool that will help turn good dairies into great dairies.”

CONSULTANT'S CORNER

Advising Herds on Heifer Strategies

By Jim Barmore, MS, PAS
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One might think involvement with genomics testing of heifers is a bit of a stretch for a dairy nutrition consultant. But I have found involvement with calves and heifers to be an important part of advising dairy owners as we look at the big picture of how to improve the long-term efficiency and quality of their herds. The keys to this approach have been:

1. **Start with calves.** Calf nutrition is just as important as cow nutrition because you are helping to determine the quality of the herd's future replacements. For a nutritionist to fully influence the quality of the herd, his or her advice should not be confined to the lactating herd only.
2. **Emphasize replacement rearing costs.** It is critical to help producers comprehensively assess and appreciate the true cost of raising heifers to adulthood. Feed costs represent an even greater percentage of the total investment in heifers than they do the lactating herd, as feed represents more than 70 percent of total expense of raising heifers. Simply raising every heifer because "that's what we've always done" could be a critical financial error in today's dairy economy.
3. **Spend time on heifer grower rations.** Measuring and maximizing feed conversion and efficiency can help to not only minimize feed costs, but accelerate heifers' entry into the breeding pen. Traditionally, our industry has focused on heifer feed costs per day. But the more telling metric is days on feed and getting a quality heifer. Heifers that are physically mature enough to breed at 400 or even 380 days of age start generating positive cash flow by joining the milking herd more quickly. And, research has shown that physically mature earlier-bred animals achieve greater milk production and greater future lifetime productivity.
4. **Help the herd set breeding goals.** Strive to achieve a pregnancy rate of 40 percent or higher in virgin heifers and have at least 90 percent of heifers inseminated within 30 days of the voluntary waiting period.
5. **Earn the trust of the dairy producer.** Involvement in these somewhat nontraditional aspects of dairy nutrition consulting is dependent on your delivering value and developing a trusted relationship with the herd owner. Once this credibility is established, you can become a key member and sometimes a facilitator of the dairy's management team, which likely will include other outside advisors such as the herd veterinarian, A.I. consultant, pharmaceutical representative and banker.

If this level of involvement in a herd's heifer-development program is achieved, advice regarding genomics testing may be the next logical step. Anything we can do to help producers economize feed costs, yardage, depreciation and use of capital will help put them in a better financial position going forward. In well-managed herds that are doing an excellent job addressing the fundamentals of calf- and heifer-rearing, chances are good that they have excess heifer inventories. Advising such herds on genomics strategies, and experts to contact on genomics, could take their herd performance, and your role in it, to the next level of success.

MATERNITY PEN

Dry Cow Diet Impacts Calf Health and Performance

Concern for transition-cow health and metabolic disease avoidance has heightened attention to dry-cow diets. But what influence does the nutrition of a dry cow have on the fetus she is carrying? A recent Chinese study shows that it is significant. Researcher Feng Gao and his colleagues in the College of Animal Science at Inner Mongolia University, Hohhot, China, examined three diets for 30 Holstein cows during the last 21 days of gestation. Their study, published in the *Journal of Dairy Science*, assigned 10 cows each to one of three feeding groups:

- Low energy — net energy of lactation (NEL) = 5.25 MJ/kg of dry matter (DM).
- Medium energy — NEL = 5.88 MJ/kg of DM Aim for weight loss during the first 30 DIM of no more than 0.75 BCS, or approximately 90 pounds.
- High energy — NEL = 6.48 MJ/kg of DM.

All three diets contained varying levels of straw, corn silage, Chinese wild rye, alfalfa hay, corn, wheat gluten, proteins (soybean meal, cottonseed meal, rapeseed meal, DDGs and extruded full-fat soy) and a vitamin-mineral premix.

After calving, birth weight and measurements of the calves in each group were recorded, and blood samples were analyzed for CD4, CD8, CD 21, IL-2, IL-4, IL-6, total antioxidant capacity, superoxide dismutase (SOD), glutathione peroxidase, and maleic dialdehyde.

They found that the low-energy group produced calves that had significantly lower birth weight, body height, body length, thoracic girth, and umbilical girth. They also showed decreased expression of CD4 and CD4:CD8 and lower concentrations of IL-2, IL-4, total antioxidant capacity and SOD.

The researchers concluded that reducing the maternal energy density during the last 21 days before parturition had a negative effect on growth and development, immunity and antioxidation capacity of neonatal calves. They suggest that high maternal energy density at three weeks prepartum might improve the postnatal growth and health of calves. The study's results could provoke consideration of changes in dry-cow nutrition programs.

BEYOND BYPASS

What Type of Corn Hybrids Makes the Best Silage?

Do brown midrib (BMR) corn hybrids measure up to the silage-making merits for which they are promoted? What about waxy corn hybrids? A team of researchers at the University of Georgia conducted a study to find out.

The group evaluated the nutrient intake, digestibility and milk production response of 36 lactating dairy cows fed diets based on corn silage made from conventional, BMR and waxy corn hybrids. In all three diets, the corn silage made up 36.4 percent of the total dietary dry matter. During the 11-week trial, all cows were fed conventional corn silage for the first two weeks, and then were switched to their assigned feeding groups for the remaining nine weeks. All cows in the study were at 66 + 22 days in milk at the start.

Lead researcher John Bernard, PhD, reports that there was no significant difference in dry-matter intake (DMI) between the three groups throughout the trial. Other findings include:

- Milk yield was higher for the cows fed BMR corn silage (82.72 lbs./day) compared to waxy corn (77.44 lbs./day) but similar to those fed conventional corn silage (79.64 lbs./day).
- Milk fat percentage was lowest in the conventional group (3.28 percent), compared to 3.60 percent for the BMR group and 3.55 percent for the waxy group
- Milk protein percentage also was lowest in the conventional group (2.79 percent) compared to 2.89 percent for the waxy group, and 2.85 percent for the BMR group.
- There was no significant difference among any group for total yield of milk components; energy-corrected milk yield (ECM) or dairy efficiency (ECM:DMI).
- Cows fed BMR corn silage gained more bodyweight than those in either of the other two groups.

The researchers concluded that the increased milk yield and improved body condition for the BMR group was due to greater NDF and ADF digestibility. “The results of this trial are consistent with previous reports that cows fed diets based on BMR hybrids have higher milk yield compared with those fed other hybrids,” says Bernard. “However, our results lead us to conclude that this increase in milk production should be attributed to improved fiber digestibility of BMR corn silage, rather than an increase in DMI as has been reported in most previous trials.”

Bernard adds that all of the cows in the study had experienced chronic heat stress in the summer prior to calving in the fall. “While this trial was not conducted to evaluate the effects of heat stress, the potential of using high-quality forage to overcome these challenges is something producers and their nutritionists should consider,” he suggests.

QUALITY CORNER

Pre-Partum Energy Supply May Affect More Than Energy Supply

In the Maternity Pen section of this issue of Nutrition Plus, the effects of energy supply in a pre-partum diet on calf growth and health were summarized. Examination of the full article by Gao et al. (*Journal of Dairy Science* 95:4510) brings to light the fact that many good research trials actually lead to a number of new questions that need answers. One obvious question that comes to mind from this work is “what was the impact of the varying prepartum energy supplies on the delivery of metabolizable protein (MP) to these cows?” As you know, the ruminal availability of fermentable carbohydrates has a tremendous influence on microbial protein synthesis. The large amount of straw (even though it was “corn straw” rather than the wheat straw that has become so popular in the U.S.) in the low energy diet, which yielded relatively high ADF and low NFC concentrations, obviously contained less fermentable carbohydrate than the higher energy diets. Thus the low energy diet could well have impaired the microbial contribution to MP.

Amid the shortage of research on this subject, there is active conversation among nutritionists regarding the potential benefits of supplying additional bypass protein during both the pre-partum and immediate post partum periods. Naturally, most of these conversations include the question “what does the research show related to this?” That is just another call out to university scientists to make yet another contribution to the body of knowledge that sustains and advances our dairy industry.

HAPPENINGS

New Product Websites Coming Soon

West Central will soon be releasing a new website specifically for users of the organization's SoyPLUS, SoyChlor and PASTURChlor products. The new website will combine the product and general information for all of West Central's value-added products into one easy-to-navigate site. The new site will include a market information section, product videos and newsletters section. Product information on the site will also be available en Espanol.

The new site is set to launch in June 2013 and will be available at both www.soyplus.com and www.soychlor.com.



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