RESEARCH PERSPECTIVES:

NAVIGATING SUCCESS IN THE SEAS OF CHANGE

2012 ADSA-ASAS Joint Annual Meeting research presentations had a unifying theme: Times, they are a-changin'.

By Emma Wall

A variety of research topics – presented by scientists from multiple disciplines of animal science – were discussed at the 2012 American Dairy Science Association-American Society of Animal Science (ADSA-ASAS) Joint Annual Meeting in Phoenix, Ariz. The unifying theme across many of these presentations was that times they are a-changin', and we need to be prepared to meet the new and evolving challenges the agricultural community will inevitably face. Some of the topics that are particularly relevant to dairy producers included:

1) Improving feed efficiency to ensure food security and environmental sustainability

• How can we ensure feed security when there is an increasing demand for food, but a decreasing land-base for agriculture?

• What are ways to decrease greenhouse gas (GHG) emissions?

2) Climate change and managing heat stress

3) Alternative feeding strategies in a changing environment

• How do we deal with changes in availability, cost and quality of feed sources?

4) Refining and optimizing calf nutrition

• Do we need to update nutritional requirements for modern production animals?

Improving feed efficiency

According to scientists from Washington State and Cornell, "whole-farm" efficiency and environmental sustainability go hand in hand, and can only be achieved by improving efficiency throughout the food production system, despite the fact that management at the cow (production) level probably has the highest impact.

Although intensive farming has received negative attention from the media, it has become clear that intensive, efficient production systems are associated with decreased emissions of GHG. This is due to a "dilution of maintenance" associated with improved production, combined with using smaller numbers of animals to maintain output of milk. Researchers suggested a global, integrated analysis of dairy and beef production systems is required to define practices contributing to true environmental sustainability.

Virginia Tech researchers looked across dairy herds in California and reported – not surprisingly – the herds with higher feed efficiency are more profitable.

Michigan State scientists found improving dairy cow feed efficiency is not simply a matter of increased milk production. In fact, further productivity increases might have a negative impact on feed efficiency. Lifetime production efficiency can be increased by improving the efficiency of digestion, and research is needed to better understand the genetic basis for feed efficiency. These researchers suggest the most accurate measure of feed efficiency is residual feed intake – the difference between actual feed intake and predicted intake based on production and maintenance requirements.

Although residual feed intake is partly genetic and can be used as a selection tool, research from the University of Alberta indicated it can change between the first and second lactation; therefore, it should be re-calculated occasionally to ensure accuracy.

Improving sustainability

Strategies to improve dairy farm environmental sustainability largely focused on reducing methane production and GHG emissions. New Zealand researchers explained that farms with lower GHG emissions are usually more profitable, and animals have higher feed efficiency. In agreement with suggestions by Cornell researchers, scientists from Canada reported the greatest potential for reducing GHG emissions is through lactating herd management changes, whereas there's little room for improvement among young animals.

Scientists from Michigan State reported some milk fatty acids can be used to predict methane emissions from lactating dairy cows. This could potentially be used on-farm to determine the efficacy of management strategies to reduce methane emissions. In addition, researchers from Belgium suggested that because of the high heritability estimates for some of the fatty acids, there must be a high genetic contribution to methane emissions. This presents the opportunity to use genetic selection to minimize methane emissions.

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Stocking density appears to influence predicted GHG emissions, but it is highly dependent on farm-level factors such as feeding, manure storage and housing. Therefore, scientists from University of Wisconsin-Madison stressed the importance of approaching emissions management on a case-by-case basis.

Feed additives and GHG

How can GHG emissions be decreased by changes in the diet? Several groups reported on different feed additives:

• **Multiparous dairy cows** supplemented with palmitic acid produced more milk, milk fat and had higher feed efficiency (Michigan State).

• Still a hot research topic, **the effect of essential oils in the diet on methane production** was studied by a group from Ohio State. All essential oils they looked at, including clove, eucalyptus, garlic, oregano, and peppermint, reduced methane emissions in a dose-dependent fashion. However, for all

FYI

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but garlic there was an accompanying decrease in dry matter degradability. Future studies (in vivo) are needed to determine the potential for use of essential oils to decrease methane emissions.

• **Manure-derived gaseous emissions** can be altered by dietary inclusion of saponins (from tree, plant and seed sources), whereas direct application of saponins to manure had no effect (Michigan State).

• **Simply decreasing dietary crude protein** content may reduce methane emissions, with no effect on milk yield or composition (Penn State).

• **Feeding linseed oil to grazing dairy cows** increased milk and protein yield, and decreased methane emissions (Ireland).

Climate change and heat stress

Climate change continues to be an area of focus, especially as it relates to heat stress. Heat stress is not only an issue of climate change, but has also become more complex over the years because of the high metabolic potential of the modern dairy cow. To make matters worse, Iowa State researchers pointed out the understanding of the nutritional requirements of dairy cows undergoing heat stress is lacking, making it difficult to manage these animals for optimal performance under heat stress conditions.

Researchers found exposure of pregnant dairy cows to heat stress during the end of gestation has a negative impact on colostrum antibody absorption by the calf.

Virginia Tech and University of Georgia researchers reported that heat-stressed cows undergo a metabolic shift, and hormonal changes occur that alter metabolism and decrease milk yield. In addition, they suggested the decrease in feed intake during heat stress may be a protective mechanism to limit metabolic heat.

Management strategies to alleviate heat stress included cooling during the dry period, which improves immune function, according to University of Florida researchers. Cows cooled during the dry period produced more milk in the subsequent lactation, with no effect on milk composition. Researchers also found exposure of pregnant dairy cows to heat stress during the end of gestation has a negative impact on the colostrum antibody absorption by the calf. Louisiana State researchers suggested newborn calves need adequate shade and cooling, because antibody absorption is compromised during heat stress, with obvious implications for calf health.

Other critical times to keep a close eye on heat stress management in heifers include immediately post-weaning, puberty and pre-calving (Virginia Tech). Water intake is important, because it increases during heat stress and is positively correlated with feed intake.

In high-producing lactating dairy cows, supplementation with an orange extract decreased somatic cell count, according to research from the University of California Davis.

Alternative feeding strategies

According to the American Feed Industry Association, many factors are causing changes in costs, sustainability and utilization of grains and other feedstuffs. Issues include the dynamics of grain production, the use of grains for fuel production, use of natural resources and climate change. Purdue researchers suggested focusing on quality, quantity and affordability of energy-containing feeds, and also efficiency of feed conversion. They also emphasized the importance of adopting alternative feeding strategies, such as the use of distillers grains, and feed processing technologies, which can improve the digestibility of residues. This may enable grain substitution.

Due to rising costs of traditional energy-containing ingredients, there is a need to explore the nutritional value of corn milling co-products and their potential impact on milk yield and composition. University of Nebraska-Lincoln researchers focused on the increasing availability of ethanol co-products, distillers grains and solubles for animal feed. Importantly, distillers grains have been reported to negatively impact milk composition. However, this usually occurs when the diets are poorly balanced. When nutritional management is optimized, co-products can be used as effective feed for lactating dairy cows.

University of Saskatchewan scientists also presented alternatives to starch-based feeding programs, including distillers grains, canola meal and wheat bran. They suggested the key to success in using these alternative feeds is to understand their contribution to metabolizable energy and protein; their effect on the site and extent of digestion; as well as pricing compared to traditional feeding programs.

Refining, optimizing calf nutrition

Do the nutrient recommendations need to be updated to meet the needs of the modern dairy calf? Yes, according to researchers from the Nurture Research Center at Provimi, who evaluated the 2001 NRC for protein requirements and found room for improvement in calf feeding management. It also appears different amino acids are used for growth, with different efficiencies, and this can change over time.

Kansas State researchers suggested the need to improve accuracy of current equations, and modifications to predicted efficiency of amino acid digestion and maintenance requirements.

With respect to energy requirements, Cornell researchers reported incorporating recently acquired knowledge on the apparent energy supply to calves pre-weaning onward into growth models has not occurred. This has led to potential biases in energy requirements in the current net energy equations.

Cornell research revealed pre-weaning nutrition can have a marked effect on lifetime milk production, with a highly significant and positive relationship between pre-weaning daily weight gain and first-lactation milk yield. Therefore, nutrition status early in life positively impacts long-term productivity.

How can pre-weaning performance be improved? Scientists from the Nurture Research Center reported feeding calves more milk replacer, along with weaning them gradually, increased daily weight gain. University of Minnesota research agreed, finding late-weaned calves had higher daily weight gain, weaning weight and weaning hip height than early-weaned calves.

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The presence and amount of bacteria in colostrum has a big impact on calf performance. Research from Dairy Experts in California found antibody absorption efficiency decreased with high coliform counts. In addition, total bacteria and coliform count were positively associated with mortality.

Dry cow management is another way producers can get a head start on optimizing heifer performance. New Zealand research confirmed previous work showing early pregnancy nutrition can impact mammary development and future milk production of offspring.