UW-Madison Division of Extension * Aerica Bjurstrom, Regional Dairy Educator
920-388-7138 * aerica.bjurstrom@wisc.edu

Precision-Feeding Dairy Heifers

Dairy heifers represent a large expense of resources including feed, buildings, and labor, yet they return no money to the dairy farm until they calve. Our overall management of these heifers must be handled in a manner that yields the best quality heifer, with the highest potential to be productive and profitable, with a minimal cost to the farm and the environment.

A great deal of research studying dairy heifers has occurred in the past 10 years, much more than in previous decades. We know that Holstein heifers should grow 1.7 to 1.9 lb per day before puberty and should reach 85% to 90% of mature body weight (BW) by calving to achieve optimal first-lactation milk production. Heifers should calve at 22 to 23 months of age to minimize heifer raising costs and to maximize their milk production during the first lactation.

For the dairy heifer, dry matter intake (DMI) is inversely related to diet digestibility. Reducing DMI by the heifer results in slower rates of feed passage out of the rumen, and therefore more time is allowed for rumen microorganisms to break down fiber and other nutrients in the feed. The end result is often an improvement in feed digestibility. Therefore, as an animal consumes less dry matter (DM), provided that DM contains the amounts of nutrients required for growth, more of the energy in the feed will be used for growth, and less is lost in the feces. The combination of these two nutritional principles can yield dramatic improvements in feed efficiency of dairy heifers. The concept of precision-feeding is the combination of more precisely knowing targeted growth rates and the nutrient requirements to meet these rates and utilizing tools to improve digestibility and feed conversion.

Much of the recent heifer nutrition research has evaluated precision-feeding of highly digestible diets to dairy heifers for improving feed efficiency and reducing manure. Feed represents the largest component of the total cost of heifer production, and it clearly represents the major way to control heifer costs. Diet type and the amount fed can be large factors that affect feed efficiency and are the major aspects that we use in precision-feeding heifers. Ration digestibility is also obviously important. The more digestible the feedstuffs used in the ration, the more efficient the heifer will be.

Based on published research for precision-fed dairy Holstein heifers, nutrient specifications as currently understood are as follows:

- **Protein:** Balance primarily for crude and soluble protein.
    - 14% to 15% CP for pre-pubertal heifers based on DMI of 2.15% BW/day.
    - 13% to 14% CP for post-pubertal heifers based on DMI of 1.65% BW/day.
    - Maintain at least 30% to 35% soluble CP in the rations at all times to allow for optimal rumen microbial protein production.
    - Rumen undegradable CP levels in excess of 25% to 30% of the CP are not required; use only standard feed sources based on price and availability and not feeds specifically designed for high bypass protein values.
    - Soluble protein (SP) and rumen degradable protein (RDP) are efficiently utilized by dairy heifers.
- **Energy:** The energy requirement of the heifer will be influenced by BW, growth rate, and the environment in which the heifer is being raised. Diets can be formulated at a fixed (generally higher) energy content and precision-fed to specifically meet the heifers' energy requirement for growth.
- **Fiber:** Traditionally, high levels of fiber or low-quality forage are fed to dairy heifers to control dietary energy intake; however, precision-feeding high-concentrate, low-fiber diets effectively accomplishes the same goal. Economics and the mix of forages available to a farm usually drive the forage level to feed. Research has revealed that the ratio of forage to concentrates can be extremely wide, from 95% forage to 25% forage.
- **Vitamins and minerals:** In precision-feeding systems, it is important to balance diets to current National Research Council (NRC) specifications for vitamins and minerals. With limited newer data, there are no indications to suggest vitamin and mineral requirements are altered when heifers are precision-fed.

Monitor Heifer Weight

Weighing heifers is a relatively simple means to monitor animal performance, *and this practice is a must for precision-feeding dairy heifers successfully*. With a precision-feeding system, heifers must be weighed to allow one to know what amount of feeding is required, while maintaining the growth rates needed for breeding at a given age or for calving at a given BW. Scales or weight tapes can be used for heifers with equal success.

Recommendations:

- **Weigh heifers at the same time of day** (relative to feeding); otherwise, alterations in gut fill can impact average daily gain (ADG) calculations.
- **Weighing heifers once per month is best**, but once the system is stable, less frequent weighing can work as long as body condition is observed regularly.
- **It is best to weigh all heifers**; however, on some farms, it may not be realistic, as heifer numbers may be labor prohibitive. In this case, weighing a representative group (10% to 25%) of the heifers in a pen each time will suffice. It is important to be sure that this group is representative of the entire group.
- **Monitor individual heifer and group gains against benchmark weights**, and alter management, specifically feed intake strategies, as needed.

Group Sizes

In any group-housed heifer facility, minimizing variation in size and age of heifers in each group is important, and it remains important in managing a precision-feeding system. Typically, beyond 4 months of age, heifers should be housed with other heifers as close to the same age as possible and always in groups with less than 200 pounds (90 kg) of BW variation within the group. Often, this means having groups with 2 to 4 months of age variation at the most. Post-breeding, this number can be increased to 300 pounds (136 kg) of BW spread between animals within a group.

In precision-feeding systems, heifers will need adequate bunk space, often 14 to 24 inches of feed bunk space per heifer as they progress from 4 months of age to pre-calving or 22 months of age. Precision-fed heifers will not have access to feed available at all times of day; thus, all heifers in a pen must have access to the feed bunk at the same time. Overly aggressive and timid heifers are very susceptible to over- or under-nutrition when feed bunk space is limited. If precision-fed heifers on a high-forage diet have feed available 12 to 16 hours/day, feed bunk space is often not an issue. If heifers are fed 30% to 40% concentrate diets and feed access is limited to 6 to 8 hours/day, feed bunk space can become an issue. Use common sense to see if all heifers are satisfied and are growing uniformly when using these feeding systems.

Two strategies can be used when feed bunk space is limited. The first is simply grouping animals with peers of similar BW. The second strategy is to provide impediments to free motion at the feed bunk, such as headlocks or closely placed divider posts. This will likely be effective to some degree but not completely. Feeding twice daily is not recommended as this has been shown to increase heifer competition and weight gain variability within a pen.

At the initial implementation of the precision-feeding protocol, heifers will likely vocalize immediately prior to feeding, with the frequency and magnitude increasing toward the next feeding. Experiences are that this behavior will diminish and virtually disappear 10 to 14 days after the implementation of the precision-feeding strategy. This is not unlike the transition that calves have from milk at weaning time. As long as the heifers are growing according to the ADG goals of your operation and receiving a correctly balanced ration, they are being adequately fed.

Precision-feeding heifers until 30 to 45 days before calving has had no adverse effects on calf birth weight, dystocia, metabolic problems, DMI of cows in early lactation, or first-lactation milk production. Any changes in rumen and gut volume when using this feeding system late in gestation have been shown to occur rapidly and do not limit postpartum DMI; therefore, milk production is the same for these heifers as compared to conventionally fed heifers.

Written by: Jud Heinrichs, Professor of Dairy Science, Pennsylvania State University

UW-Madison Division of Extension * Aerica Bjurstrom, Regional Dairy Educator
920-388-7138 * aerica.bjurstrom@wisc.edu

Does Starch Fuel Inflammation in Dairy Cows?

Feeding cereal grains high in fermentable starch is an effective way to deliver energy in lactating dairy rations. But unlike monogastric pigs, ruminants walk a fine line in their ability to utilize those feedstuffs while maintaining digestive integrity.

Michigan State University researchers Kirby Krogstad and Barry Bradford recently took a deep dive into data sets evaluating starch in dairy diets, and its link to systemic inflammation. They conducted a literature review of studies that examined the relationship between dietary starch concentrations and inflammation.

Their findings, summarized recently in the Journal of Dairy Science, revealed:

1. "Grain challenges" -- defined as an abrupt increase of grain to 20% or more of diet dry matter (DM) to experimentally induce a drop in rumen pH and ruminal acidosis -- have been used to measure markers of inflammation like luminal lipopolysaccharide (LPS) concentration and acute-phase proteins (APP). In the studies evaluated, forage also was removed and substituted with a 20% protein barley-wheat pellet, which added an additional load of starch. The grain challenges in these studies proved to significantly increase LPS and APP.
2. When rumen fluid from grain-challenged donor cows was infused abomasally into non-challenged recipients, no increase in APP was observed. And in studies when starch was directly infused into the abomasum, no change in inflammation or gut-barrier integrity was observed, even though it did lower fecal pH. Furthermore, infusing starch abomasally has proven to dramatically increase fecal levels of butyrate, a short-chain fatty acid that has been linked to positive effects on gut health and integrity.
3. Abruptly switching from alfalfa hay to pelleted alfalfa caused a drop in rumen pH similar to that incited by grain challenges. However, when rumen microbial population shifts were evaluated, the two challenge types created significantly different rumen microbiome changes. The presence of E. coli in the rumen was significantly higher in grain-challenge studies, and E. coli was found to be the greatest predictor of severity of acidosis. Alfalfa pellets also did not cause increases in the markers for inflammation.
4. There is little evidence that feeding higher-starch diets to fresh cows increases their level of systemic inflammation.
5. Barley and wheat were shown to incite greater systemic inflammation than corn-based diets. This inflammation was more pronounced in grain-challenge studies compared to feeding barley or wheat at high levels consistently in the daily ration.

Collectively, the researchers concluded that – based on currently available data -- feeding diets with less than 30% starch to lactating dairy cows in "chronic," non-abrupt fashion does not contribute to systemic inflammation. Krogstad and Bradford said there is an industry need for more research exploring the role of various carbohydrate sources and concentrations in influencing ruminant hindgut health, integrity, function, structure, and microbiome.

Written by Maureen Hanson

https://www.dairyherd.com/news/dairy-production/does-starch-fuel-inflammation-dairy-cows?fbclid=IwAR2-FP4FDO2brZcs6NFFgXRsgYJu-jhBK7uyDSbP_r9t6Iexll-gGm5EzhzU

Farm Sustainability Metrics

Speakers at the recent Minnesota Nutrition Conference in Mankato, Minn., focused on opportunities and challenges associated with improving the sustainability of livestock operations. While it is extremely important that everyone in the dairy industry focuses on how we can reduce our environmental impact, the term sustainability is sometimes hard to define from a practical or scientific standpoint. The conference provided some valuable insights that I think are worth sharing.

Erin Cortus, a professor in the UMN Bioproducts and Biosystems Engineering Department, clarified that sustainability is not a single metric, but rather a set of attitudes, practices and systems that reduce the environmental burden and waste from a system. Because of this, the way in which the term is applied is often context-dependent and specific to a certain operation or industry's goals.

Factors including greenhouse gas emissions, land use, water use, water quality and promotion of biodiversity are all important to consider when determining the sustainability of a livestock operation. Typically, assessments of the sustainability of any system are determined using a modeling approach called a life-cycle assessment (LCA). This approach considers the entire environmental impact of a product at all stages of development.

For dairy farms, this means the environmental costs of raising livestock, growing or transporting feed, and harvesting and transporting cattle and milk are all considered.

One of the challenges with LCA is that, like with any model, it is completely dependent on the inputs. Because of this, factors such as the timescale, geographic scale, inputs and outputs can all affect the calculated carbon footprint of a system. It is important to understand what environmental footprint values mean and to make sure that producers and the allied industry clearly communicate with scientists and policymakers to ensure that our goals and contributions are being appropriately reflected.

Market and policy decisions related to sustainability are largely driven by financial investors. Many of today's investors require that a company makes a sustainability claim before they are willing to provide financial backing. This requirement is largely market-driven and companies that make sustainability claims have been shown to be six times more profitable than those that do not.

The dairy industry has a huge marketing opportunity in highlighting the ways in which we contribute to global environmental sustainability. Several state and national commodity groups have already begun setting sustainability goals to capitalize on this market trend. The Securities Exchange Commission is currently discussing a policy that would require companies to provide proof that sustainability goals were met in order to claim them publicly.

Animal agriculture plays a crucial role within the context of a circular agricultural economy. A circular economy is one in which products are used, reused, recycled, and put back into the system. A great selling point of the livestock industry is that 40% or more of feed inputs are by-products and animals recycle waste from other food industries. Using methane digesters to produce renewable natural gas and feeding unique by-products like grocery waste to animals are other ways to work animal agriculture into a circular economy.

Overall, the conference highlighted that the dairy industry has to both promote the strides we have made in improving our environmental sustainability and continue to make improvements in this area.

Author: Isaac J. Salfer, Assistant Professor of Dairy Nutrition, University of Minnesota

https://extension.umn.edu/dairy-news/farm-sustainability-metrics

VOLUNTEERS EAT FREE! Sign-up online to volunteer today! Visit bit.ly/BOFsignup to register!