

Leveraging Data for Heifer Management

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Abstract

Heifer rearing is a significant investment, yet it often receives less attention than lactating cow management. This paper summarizes outreach efforts from the “Raising Your Dairy Best Heifer” initiative by the Iowa State University Extension Dairy Team, which focused on optimizing heifer rearing programs. Farm visits revealed key areas where consistent data collection and targeted management can improve heifer performance. The paper highlights the importance of aligning growth with maturity, managing body condition relative to mature body weight, and adjusting nutrition strategies to fit forage availability. It also outlines practical data collection methods that integrate into daily routines, emphasizing that success in heifer programs is built on strategic inputs, consistent monitoring, and clear performance targets.

Introduction

A strong heifer program delivers efficient growth and development, low mortality, and improved production and longevity in the lactating herd. Raising replacement heifers may account for 15 to 20% of a dairy's production costs (Heinrichs et al., 2022). Yet, on many farms, they often receive less attention than the lactating herd. Optimizing return on investment (**ROI**) for heifers depends on data-driven

nutrition and management. To address this, the Iowa State University Extension Dairy Team developed an initiative that we referred to as “Raising Your Dairy Best Heifer,” working with dairy producers in Iowa to identify strategies to enhance heifer performance and ROI. This paper summarizes key lessons from our outreach efforts.

As part of this project, the team visited farms to collect body weights, assess management practices, and review breeding strategies within each farm's facilities. Specialists gathered data and herd records and provided targeted recommendations. Most participating herds were small, so the dataset does not yet support large-scale analysis. Still, anecdotal results and conversations with producers point to clear areas where better data collection can improve outcomes. This paper summarizes the content of our outreach efforts regarding age at first calving (**AFC**), heifer nutrition, and data management.

Age at First Calving

Growth and AFC must be balanced with heifer rearing costs and long-term ROI. While pushing for earlier AFC to reduce rearing expenses may be tempting, earlier is not always better when maturity is compromised. Heifers are an investment—and like any good investment, they may require strategic input to yield a return.

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A study by Ettema and Santos (2004) analyzed the impact of AFC on lactation performance, reproductive health, and income in first-parity Holstein cows across three commercial herds. Heifers were grouped retrospectively into low (≤ 700 days), medium (701–750 days), and high (> 750 days) AFC categories. Most animals calved around 700 days, or approximately 23 months. The results highlighted that heifers calving too early often lacked maturity and underperformed. Yet, it is important to note that the analysis was retrospective and does not establish causality. AFC differences often resulted from failed conceptions or missed estrus, not intentional breeding strategies. The study did not evaluate narrow AFC intervals (e.g., 23 vs. 23.5 months) or define an optimal target.

A more recent analysis from the University of Wisconsin (Lauber and Fricke, 2023) approached the question differently. Using body weight quartiles at calving rather than AFC, they found that heavier heifers were typically older as a result of reduced reproductive performance. While this analysis is associative, it seems that the heifers who calved at a higher body weight had more time to mature as a result of needing to be bred more times to conceive.

Ultimately, ideal AFC is multifaceted and unique to a farm's management and goals. Thus, in our outreach messaging to dairy producers, we emphasize key practices that can enhance heifer performance across all farms. Optimizing AFC is effective if animals are healthy and well-grown; thus, improving ROI begins with reducing mortality and morbidity. Nulliparous and primiparous performance is built on a foundation of strong day-one management, sound nutrition, and consistent management for health and overall welfare. We encourage producers to avoid retaining chronically ill or poor-performing animals. Repeated respiratory

illness, for example, is strongly linked to poor lifetime productivity, regardless of age at calving (Buczinski et al., 2021). Ultimately, the target of 80 to 85% of mature body weight (**MBW**) at first calving remains the standard for growth targets, and this should be accomplished alongside a focus on producing healthy animals.

Nutrition and Management

Nutrition and management drive heifer growth and rearing costs. Managing body condition while optimizing growth is a cornerstone of heifer development and having an accurate estimate of MBW is ideal for developing rations. This is discussed in depth by Van Amburgh (2016). As animals mature, body composition shifts as they deposit fat more readily than protein. This shift impacts nutrient requirements and should be reflected in diet formulation. Two heifers of the same age and weight but different MBW, e.g., one at 1,400 lb, the other at 1,800 lb, will not have the same requirements. The heifer with greater MBW is further from her mature size and will more readily deposit protein. Smaller-maturity heifers gain more fat on the same diet because they are closer to maturity. Ignoring MBW risks overconditioning smaller-framed heifers or underfeeding larger ones.

When developing heifer feeding strategies, two common general practices are precision feeding and forage-based *ad libitum* feeding. Precision feeding involves offering a higher-energy diet at restricted intake. This works well when grain prices are low and feed access is uniform but fails under overcrowding or uneven bunk space. This has been reviewed in depth (Erickson et al., 2020). In contrast, *ad libitum* feeding of lower-energy, forage-rich diets helps utilize lower-quality forages. However, this strategy should be used with caution for younger heifers with limited rumen capacity or when the forage supply is short.

Either of these strategies can be leveraged effectively, and this is largely because heifers offer flexibility in response to feed inventory or cost changes that lactating cows do not. Alternating faster and slower gain periods can align with feed availability without compromising long-term performance (NASEM, 2021). When done correctly, periods of slower growth during prepubertal and breeding stages do not reduce productivity and may improve lifetime performance.

Feed availability and price are constantly shifting. Heifers can serve as forage sinks, but forages must be used wisely, especially in young calves. Rumen size limits intake, which can be especially problematic if feeding low-quality, less digestible forages to calves with small, undeveloped rumens. NDF intake typically caps at about 1% of body weight (Hoffman et al., 2008). Heifers will eat more low-NDF forages, which should be considered when designing diets.

Alternative forages may offer a viable solution. Biomass crops like cup plant and switchgrass yield large volumes with little nutritional quality (Lemay et al., 2020; Nagle et al., 2020). These forages are not suited for a substantial proportion of a high-producing cow ration but can meet the needs of heifers when adequately balanced. They also offer agronomic advantages; both grow well on marginal land, support soil health, and aid in land reclamation (Samson et al., 2016). These crops may be a practical and environmentally sound addition to the feeding strategy for herds facing forage shortages or aiming to diversify rotations.

Data Collection and Management

Effective heifer-rearing strategies must be built on a foundation of data-driven decisions. Two key lessons have emerged from on-farm

visits during the “Raising Your Dairy Best Heifer” project. First, multiple herds faced variation in AFC, even if the average was acceptable. Wide variation can be a result of different factors, including inconsistent growth, management, or breeding decisions. Second, data must be easy to collect. Whether it is body weights, breeding events, or health records, simplicity in data recording is essential for consistent use and long-term success.

Limiting variation in AFC is as important as achieving the target average. That process begins with managing heifers for consistent growth and maturity. Some variation is expected, and delaying breeding by a cycle or two to allow smaller heifers to catch up can be a sound strategy. The goal is not to eliminate all variation but to avoid breeding animals that are not physically ready by considering both age and body size.

Reducing variation in AFC is driven by reducing variation in age at first breeding. It is important to consider the root causes of variation in breeding age at a given farm. For example, variation in age at first breeding may stem from differences in size but also from inconsistent heat detection and loose adherence to breeding protocols. Especially compared to lactating cows, heifers do not receive the same daily attention, and breeding can be delayed simply because no one saw the heat if relying on visual detection. Tools like synchronization protocols, controlled intravaginal drug release (**CIDR**), activity monitors, or more frequent visual checks can help. The solution does not have to be complex, but it needs to be a priority.

We have developed several practical points from our experiences with dairy producers regarding data management for heifers. First, data must be recorded where it can be used. The system must be simple, repeatable, and

integrated into existing routines. Habit stacking, or linking data collection with existing tasks, is an effective strategy. Second, data should not stay siloed. Many producers underestimate the value of the information they collect. Consultants, nutritionists, and Extension specialists can often extract insights the producer may not see, so sharing data with trusted advisors is a critical step toward making it worthwhile. The same principle applies to collecting measurements of MBW. It is a key metric but difficult to capture without planning. Ultimately, records must be detailed enough to be helpful but straightforward enough to be used consistently.

As an example of this framework, the concept of calf birth and death certificates offers a practical approach to improving heifer development records and maintaining a consistent recording strategy (NASEM, 2021). The idea of a calf birth certificate is a simple sheet that follows the calf during its first weeks that can provide essential information at a glance. It improves both data quality and daily calf management by giving caregivers quick access to each animal's history.

Conclusion

Heifer development is a long-term investment that requires consistent management, strategic nutrition, and reliable data. Success depends on hitting targets like AFC, reducing variation, aligning growth with maturity, and making informed decisions grounded in accurate records. Practical, consistent systems for monitoring and managing heifer growth that are built into daily routines can improve performance and ROI. The foundation of a productive herd begins long before first calving.

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