

## **Project Summary**

**Evaluating the Effects of Pre-Harvest Feeding, Feeding Duration, and Inclusion of a  $\beta$ -Agonist on Market Dairy Cow Carcass Characteristics, Value, and End-Product Eating Quality**

**Principal Investigators: J. K. Ahola, A. L. Ewing, M. Chahine, M. W. Ayers, M. E. Doumit, D. L. VanOverbeke, J. I. Szasz, C. W. Hunt, G. K. Murdoch, & R. A. Hill,  
University of Idaho**

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# **Evaluating the Effects of Pre-Harvest Feeding, Feeding Duration, and Inclusion of a $\beta$ -Agonist on Market Dairy Cow Carcass Characteristics, Value, and End-Product Eating Quality: Project Summary**

## **Background**

The overall quality of market dairy cows has not improved over the past several years based on results of the 2007 National Market Cow and Bull Beef Quality Audit (NMCBBQA). This may be due in part to the fact that the income received from the sale of market dairy cows and bulls has historically only made up about 5% of the total income on a dairy. In 2007, market dairy cows had more visible quality defects than market beef cows based on the fact that 22.2% were emaciated or extremely emaciated, and 48.6% had some level of lameness in the 2007 NMCBBQA.

Over 95% of market dairy cows go directly to harvest after being culled from a dairy (USDA, 1996), indicating that few dairies add value prior to harvest. However, the majority of the economic losses due to quality defects (estimated at \$68.82/hd) could be reversed or avoided by either culling cows earlier or via short duration pre-harvest feeding. Pre-harvest feeding has been shown to improve muscling, marbling, fat color, dressing percentage and carcass weight in market beef cows. However, the effect of pre-harvest feeding on large numbers of market dairy cows is generally unknown. Additionally, since much of the increased weight gain resulting from conventional market cow feeding occurs as adipose tissue, a recently-approved  $\beta$ -adrenergic agonist feed additive may offer an opportunity to increase muscle gain, product quantity and value. Therefore, the objectives of this research project were to evaluate the effects of pre-harvest feeding, feeding duration and supplementation of a  $\beta$ -adrenergic agonist in market dairy cows on carcass characteristics, value and end-product eating quality.

## **Methodology**

One hundred-sixty market dairy cows culled from lactating dairy herds were weighed, examined for pregnancy and health status by a licensed veterinarian, and tested for Johne's disease, Bovine Leukosis Virus (BLV) and antibiotic residues with a Pre-Harvest Antibiotic Screening Test (PHAST). Cows were also subjectively evaluated for body condition score (BCS), muscle score (MS), locomotion score (LS) and udder size. In a completely randomized design, cows were assigned to one of five treatments, which included: 1) harvest on day 1 (Control, n = 52), 2) feed for 70 days with zilpaterol hydrochloride (Zilmax®, Intervet Inc., Millsboro, DE; 70zil, n = 27), 3) feed for 70 days without zilpaterol (70no, n = 27), 4) feed for 105 days with zilpaterol (105zil n = 27), or 5) feed for 105 days without zilpaterol (105no, n = 27).

Cows assigned to the control treatment were harvested immediately. Cows to be fed were provided a starter for 13 days and an intermediate ration for 18 days before being fed a potato byproduct-based finishing ration for the remainder of the feeding period (70 or 105 days). During 21 of the last 24 days of each feeding period, half of the pens received zilpaterol (70zil and 105zil cows) at a rate of  $90 \text{ mg} \cdot \text{hd}^{-1} \cdot \text{day}^{-1}$ . Cows were weighed and subjectively evaluated for BCS, LS, MS and udder size throughout the feeding period.

Complete carcass data was collected approximately 24 hours after harvest and one strip loin was collected from each carcass during fabrication and cut into steaks. Steaks were evaluated for proximate analysis, mechanical tenderness via Warner-Bratzler shear force (WBSF) and palatability by a trained sensory panel. Panelists evaluated market cow steaks and 20 USDA Select steaks

(acquired separately) for initial and sustained juiciness, initial and overall tenderness, connective tissue amount and three flavor attributes.

Rates for mortality (3.1%), animal removal due to extreme morbidity (1.3%) and carcass condemnation (1.9%) were much higher than anticipated. Data from cows that did not complete the experiment were removed prior to analysis, except for the economic analysis data. Data were evaluated with replicate (pen) as the experimental unit. The main effects of feeding, feeding duration and zilpaterol supplementation were determined via contrast statements for the following comparisons: 1) fed (cows fed for 70 or 105 days) versus non-fed (control), 2) feeding length (70 vs. 105 days), and 3) zilpaterol supplementation versus no zilpaterol supplementation. If there was a feeding duration  $\times$  zilpaterol supplementation interaction, differences among the four means (70no, 70zil, 105no, 105zil) were identified. The tendency ( $P < 0.06$ ) for a feeding length  $\times$  zilpaterol interaction resulted in the use of initial BW as a covariate for all traits related to BW.

### Findings

Cow performance during the feeding period indicates that initial BW ( $704.5 \pm 108.56$  kg) was highly variable. Final BW was equally variable ( $814.3 \pm 110.52$ ), yet 105zil cows had greater ( $P < 0.05$ ) final BW compared to control and all other fed treatments, and 70no, 70zil, and 105no cows had greater ( $P < 0.05$ ) final BW versus controls. The inconsistent effects of zilpaterol and feeding length on final BW was likely due to the large amount of variation inherent to these cows (i.e. BW, age, health status, etc.), possibly exacerbated by source, hours since last milking, previous diet and the amount of time since water and/or feed was last available. Treatment means for ADG during the feeding period were desirable at 0.91 kg/d or higher, yet the effects of feeding length and zilpaterol supplementation on ADG were inconsistent. The 70no, 70zil and 105zil cows had greater ( $P < 0.05$ ) ADG versus 105no cows.

Dry matter intake (DMI) averaged over  $14 \text{ kg}\cdot\text{hd}^{-1}\cdot\text{d}^{-1}$  throughout the feeding period, with a large range from 10.9 to  $15.8 \text{ kg}\cdot\text{hd}^{-1}\cdot\text{d}^{-1}$ . Cows fed for 105 days had lower DMI ( $P < 0.02$ ) than cows fed for 70 days. The average DMI among these cows was approximately 60% higher than calf- or yearling-fed steers and heifers. As a result, feed-to-gain ratio (F:G) was highly undesirable and highly variable. However, no differences were observed ( $P > 0.10$ ) for the main effects of feeding length or zilpaterol supplementation on F:G.

The improvement in BCS was greater ( $P < 0.05$ ) among 105zil cows compared to all other treatments. In both 70 and 105 day cows, those receiving zilpaterol had a greater ( $P < 0.05$ ) change in BCS. Similarly, all fed treatments had an increase ( $P < 0.05$ ) in BCS as a result of the feeding period. Interestingly, overall change in LS during the feeding period among fed cows was not different ( $P > 0.10$ ) from control cows, indicating that LS was not improved via the strategies evaluated.

Fed cows had greater ( $P < 0.07$ ) HCW vs. control cows; however, feeding length did not have an effect ( $P > 0.10$ ) on HCW and cows receiving zilpaterol had greater HCW ( $P < 0.03$ ) than cows not receiving zilpaterol. Interestingly, there were no main effects ( $P > 0.010$ ) of feeding, feeding length or zilpaterol on DP. Fat thickness was greater ( $P < 0.0002$ ) in fed versus control cows, but not different ( $P > 0.10$ ) among 70 and 105 day cows or due to zilpaterol. Measured ribeye area (REA) was greater among fed ( $P < 0.001$ ) versus control cows and also greater ( $P < 0.01$ ) among cows receiving zilpaterol compared to no zilpaterol. Fed cows had a less desirable ( $P < 0.002$ ) calculated

YG than control cows, but neither feeding length nor zilpaterol inclusion had an effect ( $P > 0.10$ ) on calculated YG.

Marbling score was greater ( $P < 0.04$ ) among fed compared to control cows, but there was no effect ( $P > 0.10$ ) of feeding length or zilpaterol on marbling. Control cows had subcutaneous fat that was more yellow ( $P < 0.0001$ ) than fed cows. Fed cows had a greater ( $P < 0.0001$ ) percentage of Premium Fed carcasses versus controls. The 105zil cows had fewer ( $P < 0.05$ ) Premium Fed cows than the other fed treatments, and the frequency of Premium Fed carcasses among 70no, 70zil, and 105no treatments was not different ( $P > 0.10$ ). Feeding resulted in a higher percentage of cows ( $P < 0.0001$ ) grading Breaker, Boner and Cutter in the control versus fed cows. However, the percentage of cows in the Breaker, Boner or Cutter grades was not affected ( $P > 0.10$ ) by feeding length or zilpaterol supplementation.

There was no effect ( $P > 0.10$ ) of feeding or zilpaterol supplementation on initial or sustained juiciness, initial or overall tenderness or connective tissue. In addition, feeding length had no effect ( $P > 0.10$ ) on juiciness (initial or sustained) or initial tenderness. However, there was a tendency ( $P < 0.09$ ) for cows fed for 105 days to be more tender when rated for overall tenderness compared to cows fed for 70 days. Painty or fishy flavor was more pronounced ( $P < 0.01$ ) in control vs. fed cows; however, it was not different ( $P > 0.10$ ) due to feeding length or zilpaterol supplementation. Tenderness, as evaluated by WBSF, tended ( $P < 0.08$ ) to be more desirable in 105 versus 70 day-fed cows. No other main effects ( $P > 0.10$ ) were observed for WBSF.

When USDA Select steaks were evaluated alongside market cow steaks, market dairy cow steaks (including both fed and control combined) had more desirable initial juiciness ( $P < 0.01$ ) and sustained juiciness ( $P < 0.004$ ) versus Select steaks. However, market cow steaks were not different ( $P > 0.10$ ) for initial tenderness, overall tenderness, or incidence of connective tissue vs. Select steaks. Beefy flavor was less detectable ( $P < 0.02$ ), painty/fish flavor was more pronounced ( $P < 0.0001$ ), and livery/metallic flavor was greater ( $P < 0.02$ ) among Select steaks compared to market cow steaks. However, no differences ( $P > 0.10$ ) were observed when comparing WBSF of Select steaks to market cow steaks.

### **Implications**

This study provides dairy producers with valuable information about the option of feeding market dairy cows prior to harvest, and the intrinsic value of market dairy cow carcasses. Due to significant economic losses from mortality, condemnation and morbidity, coupled with poor feed conversion ratios, results indicate that feeding market dairy cows without closely scrutinizing cows at culling is not advised for financial reasons, particularly during times of high grain prices and volatile market cow prices. Additionally, pre-harvest feeding (regardless of duration) and  $\beta$ -agonist supplementation did not consistently improve the quality or palatability of carcasses from market dairy cows. However, when compared to USDA Select steaks, market dairy cow steaks had more desirable juiciness and flavor characteristics with similar tenderness. These data suggest that striploin steaks from market dairy cow carcasses in the current study were undervalued, at least based on palatability. Therefore, it's feasible that the inherent palatability of market dairy cow carcasses could be exploited to increase demand for (and value of) some market dairy cow carcasses in order to provide dairy producers with a stronger incentive to cull earlier rather than consider pre-harvest feeding, and ultimately improve market dairy cow quality at harvest.

## References

NCBA. 1994. Executive Summary of the 1994 National Non-Fed Beef Quality Audit. National Cattlemen's Beef Association, Englewood, CO.



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***For more information contact:***  
National Cattlemen's Beef Association  
9110 East Nichols Avenue  
Centennial, Colorado 80112-3450  
(303) 694-0305