



J. Dairy Sci. 101:1–14
<https://doi.org/10.3168/jds.2017-13199>
 © American Dairy Science Association®, 2018.

Effects of straw processing and pen overstocking on the growth performance and sorting characteristics of diets offered to replacement Holstein dairy heifers

W. K. Coblenz,^{*1} M. S. Akins,[†] N. M. Esser,[‡] R. K. Ogden,^{*} and S. L. Gelsinger[†]

^{*}USDA-Agricultural Research Service, US Dairy Forage Research Center, Marshfield, WI 54449

[†]Department of Dairy Science, University of Wisconsin, Madison 53706

[‡]Marshfield Agricultural Research Station, University of Wisconsin, Marshfield 54449

ABSTRACT

Our objectives were to evaluate the effects of pen-stocking density and straw processing on the growth performance, feed-bunk sorting behaviors, and hygiene of Holstein dairy heifers. Two corn silage-alfalfa haylage diets diluted with wheat straw were offered; diet composition was identical, except that one diet contained short (well-processed) straw (SS; 46.0% neutral detergent fiber, 12.9% crude protein, 60.7% total digestible nutrients, TDN), and the other long (poorly processed) straw (LS; 46.5% neutral detergent fiber, 12.6% crude protein, 60.0% TDN; % of dry matter basis). A 2 × 3 factorial arrangement of straw-processing (SS or LS) and pen-stocking-density [100, 125, or 150% of capacity] treatments was evaluated with 240 Holstein dairy heifers (410 ± 56.3 kg) that were blocked by weight, and then assigned to 24 pens with 4 pens/interactive treatment. For 91 d, diets were dispersed at 1100 h daily, and bunks were sampled subsequently at 1300, 1600, 1900, 2200, 0100, and 0600 h during 3 evaluation periods throughout the trial. Diets were offered for ad libitum intake, but with minimal orts (<3%); as such, particle-size concentration factors were calculated as bunk concentration/initial concentration. For the LS diet, particle-size concentration factors for large (>19 mm) particles increased linearly from 1.26 to 2.82 across sampling times, differing from the SS diet at 2200, 0100, 0600, and 0900 h (orts). Similar factors calculated for the SS diet also increased linearly across sampling times, but these responses were less severe (1.27 to 1.97). Overall, particle-size concentration factors for physically effective fiber exhibited responses similar to those observed for large particles, except they were limited to narrower ranges for both the SS (1.04 to 1.14) and LS (1.03 to 1.26) diets. Despite these

differences, daily dry matter intake was not affected by treatment (mean = 9.65 kg of dry matter/d), nor was daily intake of TDN (mean = 5.92 kg of TDN/d). For SS, heifers housed within overstocked pens exhibited reduced average daily gain (ADG) compared with the 100% stocking rate (0.93 vs. 0.99 kg/d). With LS processing, ADG differed between the 125 and 150% stocking rates (0.96 vs. 0.88 kg/d), as did the within-pen coefficient of variation for ADG (10.7 vs. 18.6%). Hygiene scores (1 = clean, 4 = caked-on manure) for legs (range = 2.1 to 2.3) and flanks (range = 1.6 to 1.9) indicated heifers stayed acceptably clean, but the within-pen coefficient of variation for legs (14.4 vs. 9.0%) and flanks (34.2 vs. 23.8%) was greater for overstocked pens compared with the 100% stocking density, thereby suggesting hygiene scores were more variable without a free stall for each heifer.

Key words: Holstein dairy heifer, sorting behavior, stocking density, wheat straw

INTRODUCTION

Management programs for dairy replacement heifers generally seek to raise replacement animals at a low economic and environmental cost without compromising their subsequent performance as lactating cows (Hoffman et al., 2007). Most often, diets for dairy heifers are forage based, especially for gravid animals, whose requirements for energy are less than those of younger heifers (NRC, 2001). In many dairy operations, corn silage is readily available, but becomes problematic for gravid heifers when it comprises large proportions of the total diet offered for ad libitum intake. Frequently, this results in excessive weight gains and over-conditioning; in 2 recent trials we conducted, heifers offered negative control diets comprising approximately 50:50 blends (DM basis) of corn silage and alfalfa haylage gained 1.16 and 1.09 kg/d (Coblenz et al., 2012, 2015), which exceeds frequently suggested daily growth targets for gravid heifers (Hoffman, 1997) by approximately 0.25

Received May 19, 2017.

Accepted October 7, 2017.

¹Corresponding author: wayne.coblenz@ars.usda.gov

to 0.30 kg/d. There are compounding causes for excessive weight gains under these conditions: (1) normal corn silage is energy dense (68.8% TDN; NRC, 2001), and exceeds the energy requirements for gravid heifers; and (2) corn silage contains inadequate NDF (45%; NRC, 2001) for suppression of voluntary intake. Hoffman et al. (2008) has determined that voluntary intake by heifers is limited to approximately 1.0% of BW daily as NDF; therefore, high proportions of corn silage permit greater voluntary intakes of high-energy forage DM before meeting the daily NDF constraint required to limit intake via gut fill.

Generally, 2 approaches are used for maintaining daily weight gains within acceptable ranges and avoiding subsequent over-conditioning: (1) dilution of the ad libitum diet with low-energy forages, such as chopped straw, corn fodder, or perennial warm-season grasses (Hoffman et al., 1996; Greter et al., 2008; Coblenz et al., 2015); or (2) offering a diet of greater energy density, but deliberately restricting the amount of feed available for consumption (limit-feeding; Hoffman et al., 2007; Zanton and Heinrichs, 2007, 2008; Kruse et al., 2010). Potential advantages of dilution with low-energy forages include the option of formulating diets containing energy densities that meet specific producer goals for growth, reducing feed costs, and allowing opportunities for natural foraging behaviors (Greter et al., 2008). Limit-feeding management has demonstrated increased digestibilities via slower passage rates and greater residence times in the digestive tract (Loerch, 1990), reduced fecal outputs, and improved overall feed efficiencies (Hoffman et al., 2007; Kruse et al., 2010). Disadvantages of limit-feeding include increased vocalization and standing time (Hoffman et al., 2007); in addition, the combination of inadequate bunk length coupled with limit-feeding management has been shown to increase variability of individual growth rates within the pen, but not necessarily the mean growth rate of the group (Longenbach et al., 1999). Largely, this variability has been explained on the basis of increased social tension within the pen group, as well as inadequate opportunity for some heifers to consume adequate nutrients, which can be complicated further by the dominant and subordinate personalities expressed by heifers or cows (Longenbach et al., 1999; DeVries et al., 2004). Under such circumstances, smaller or less aggressive heifers could be forced to accept the consequences of their social position (Longenbach et al., 1999). The inclusion of low-energy forages can permit heifers to aggressively sort against less desirable, low-energy dilutants or longer particles (Greter et al., 2008). Furthermore, sorting behaviors are forage specific. A recent study by our group (Coblenz et al., 2015) indicated that chopped corn fodder is extremely sortable, whereas eastern

gamagrass [*Tripsacum dactyloides* (L.) L.] haylage is largely unsortable, and chopped wheat straw is intermediate with respect to heifer preference. By ensuring feed is always present in the bunk, ad libitum feeding of diets diluted with low-energy forages has the benefit of reducing animal frustration, such as the increased vocalization observed for limit-fed heifers (Hoffman et al., 2007). However, it also may increase within-pen variability with respect to animal performance, particularly when confounded by overstocking coupled with dominant and subordinate heifer personalities. Under these conditions, feeding behaviors are altered, and the diet actually consumed by various heifers within the pen may be unbalanced (DeVries and von Keyserlingk, 2009) with dominant animals discriminating against low-energy dilutant forages, and passive heifers forced to accept these forages as a greater percentage of their diet. In an effort to mediate these within-pen dynamics, extension recommendations (Shaver and Hoffman, 2010) have included (1) using a bale chopper or tub grinder to limit long particles to ≤ 7.5 cm in length; (2) always blending straw or other similar dilutants within a TMR mixer; and (3) adhering to close management coordination of voluntary intake with regular feed allotments, such that the diet is totally consumed before additional feed is dispersed.

Our objectives for this study were to examine the effects of straw processing and overstocking of pens on nutrient intakes, growth performance, feed-bunk sorting behaviors, and the hygiene of Holstein dairy replacement heifers.

MATERIALS AND METHODS

Housing, Animals, and Diets

Animals. All animal handling procedures for this experiment were approved by the Research Animal Resources Committee of the University of Wisconsin–Madison (protocol #A005189). Two hundred forty Holstein heifers (410 ± 56.3 kg) were blocked by weight, and then assigned to 1 of 24 identical research pens (6 pens/block). Stocking densities were established by assigning 8, 10, or 12 heifers to a pen, which correspond to pen stocking rates of 100, 125, or 150%, respectively, at both the feed bunk, and with respect to available free stalls.

Housing. Each research pen was configured with continuous access to fresh water, an automated mechanical alley-scraping system, 8 free stalls with foam-core mattresses covered with a shallow layer of dried organic solids, and 8 head-locking feeding gates positioned adjacent to a drive-by feed alley. Head-locking feeding gates allowed for a total of 4.9 m of linear bunk

Download English Version:

<https://daneshyari.com/en/article/8501541>

Download Persian Version:

<https://daneshyari.com/article/8501541>

[Daneshyari.com](https://daneshyari.com)