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Nutritional depletion of total mixed rations by European starlings: Projected effects on dairy cow performance and potential intervention strategies to mitigate damage

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ABSTRACT

European starlings are an invasive bird species in North America that are known to cause damage to commercial dairies through the consumption of total mixed rations (TMR) destined for dairy cows. We hypothesized that large foraging flocks of starlings alter the physical composition of TMR, and that this change may be significant enough to affect milk production. To better determine if production losses could potentially occur in commercial dairies as a consequence of feed consumption by foraging flocks of starlings, we conducted controlled feeding experiments using a TMR sourced from a commercial dairy that is chronically plagued with seasonal starling damage. European starlings selected the high-energy fraction of the TMR and reduced starch and crude fat availability. Using the Dairy National Research Council production model equations, the nutritional changes measured in the controlled feeding experiments could potentially reduce the productivity of dairies. Model output suggests that for Holsteins producing 32 kg of milk/d, total required net energy intake (NE_I) was 31.5 Mcal/d. Within the reference TMR, NE_I supplied was 29.3 Mcal/d, whereas within the starling-consumed TMR NE_I supplied was 27.7 Mcal/d. Following our nutrition experiments, we assessed the efficacy of pelleted feed as a deterrent strategy for bird damage management in commercial dairies. Six different pelleted feed treatments of differing diameter were offered to starlings. All pellets of 0.95 cm diameter or larger inhibited starling consumption by ≥79%.
Key words: dairy production, bird damage management, nutrition

INTRODUCTION

European starlings (*Sturnus vulgaris*) are native to Eurasia and North Africa and have successfully established populations on each continent except Antarctica (Feare, 1984; Linz et al., 2007; Rollins et al., 2009). Starlings seasonally congregate in large roosting groups and exploit the abundant and nutritious food sources found on concentrated animal feeding operations (Besser et al., 1968; Dolbeer et al., 1978; LeJeune et al., 2008). Starlings have been documented consuming livestock feed in animal agricultural operations in the United States, Europe, and Australia (Feare et al., 1992; Bentz et al., 2007; Carlson et al., 2011).

Livestock feed consumption by starlings appears to cause economically significant damage to feedlots and dairies in the United States (Glahn and Otis, 1981; Twedt and Glahn, 1982). Estimates of bird damage in commercial dairies within Wisconsin, New York, and Pennsylvania suggest that starling damage resulted in $64,000 of feed loss annually within dairies experiencing 10,000 or more birds per day, and feed costs per cwt increased 42% in dairies with 10,000 or more birds (Shwiff et al., 2012).

Feed consumption by starlings may negatively affect animal performance. Wright (1973) and Feare and Swannack (1978) found increased weight gain in cattle when fed in bird-excluded areas. Feare (1984) suggested that if feed consumption by birds occurs at the bunk, then removal of high-energy feed ingredients by starlings may reduce animal performance, and these losses may be economically significant to producers. Depenbusch et al., (2011) provided nutritional comparisons of cattle rations before and after starling damage and concluded these changes could potentially decrease growth rates and feed conversion efficiency of feeder cattle. The producer survey conducted by Shwiff et al., (2012) did not reveal differences in milk production between dairies experiencing and not experiencing bird damage.

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To better determine if production losses could potentially occur in commercial dairies as a consequence of feed consumption by foraging flocks of starlings, we conducted controlled feeding experiments using a TMR sourced from a commercial dairy that is chronically plagued with seasonal starling damage. The objectives of these experiments were to (1) estimate the nutritional offsets caused by starling consumption of a TMR; (2) predict the effect on dairy cow performance caused by starling consumption of TMR using the Dairy NRC (2001) production model equations; and (3) identify if particle size influences starling consumption of dairy TMR.

MATERIALS AND METHODS

We partnered with a commercial dairy in northern Colorado to conduct these experiments. During the winter of 2011 to 2012, we observed that this commercial dairy experienced approximately 5,000 to 15,000 starlings per day between November 15 and March 31. The dairy had a herd size of 2,767 cows, and 1,403 of these cows were in production. The herd consisted of 80% Holstein and 20% Holstein × Jersey cross. Milk cows on average were 43 mo old, weighed 589 kg, and were approximately 200 DIM. Bulk tank milk contained 3.48% milk fat and 3.02% milk protein. Feed intake and milk production data for late-lactation cattle (DIM ≥160) were used in these analyses. Feed intake for late-lactation cattle was approximately 25.5 kg (dry weight)/head per day. Milk production per head per day for late-lactation cattle was approximately 31.75 kg.

Starlings were live trapped from the commercial dairy using mist nets and modified Australian crow traps. All starlings were transported to the United States Department of Agriculture, National Wildlife Research Center (**NWRC**) in Fort Collins, Colorado, for feeding experiments. Nutrition experiments were conducted in 2012 and particle size testing was conducted in 2016. All starlings were quarantined for 2 wk with ad libitum access to feed (Layena poultry pellets, Purina Animal Nutrition LLC, St. Louis, MO) and water. Starlings were maintained in their quarantine cages until the pretest period of the experiment (4.9 × 2.4 × 2.4 m, length × width × height, respectively).

European Starling Feeding Experiments: Estimating Nutritional Offsets Caused by European Starlings

On February 29, 2012, starlings (n = 55) were moved from quarantine and housed 5 birds per 3.05 × 3.05 × 2.4 m (length × width × height, respectively) cages for the pretest and test. Birds used on test were selected arbitrarily from quarantined starlings. If a bird was injured or appeared sick it was excluded from the nutrition experiment. The pretest lasted 5 d. During pretest, birds within each cage were fed 1 kg (as fed) of the TMR test diet daily. The TMR offered was a late-lactation ration fed to milk producing cows (DIM ≥160). The TMR offered during pretest was also used for the nutrition experiment.

The nutrition experiment was conducted from March 5 to 8, 2012. Starting March 5, a total of 15 kg of premixed, late-lactation TMR (as fed) was collected directly from feed trucks at 0600 h and brought to NWRC-Fort Collins for nutritional testing. Fresh TMR was offered daily within each of 10 cages (n = 10; 5 starlings per cage). For 4 consecutive days, 1.1 kg of feed, as fed, was weighed out for each cage. A total of 1 kg was offered to starlings within an aluminum tray (0.9 × 0.6 × 2.54 cm, length × width × diameter, respectively) and the remaining 100 g were used as a reference sample. This process of subsampling was used to ensure that the reference ration was representative of the feed offered to starlings in each respective cage. The reference sample was placed outside each respective cage in a paper bag. Both reference and starling-consumed rations were identified by cage number and day. An additional 1-kg TMR sample, as fed, was placed in a cage absent of starlings to estimate daily feed desiccation (e.g., evaporative water loss). Following 24 h of starling foraging, the starling-consumed and desiccation samples were weighed. The starling-consumed and reference samples were then placed in a drying oven at 75°C for 24 h. After drying was complete, all samples were ground using a Model 4, Thomas Wiley mill (Thomas Scientific, Swedesboro, NJ). The Wiley mill was opened and brushed clean after processing each individual sample to eliminate cross contamination. Ground samples were stored in a walk-in cooler, set to 4°C, until all samples were processed and ready to ship to a laboratory for nutritional analysis.

For the purpose of assessing component selection, 1 additional cage of group-housed starlings (5 starlings) was provided TMR separated into the 7 ration components (i.e., 7 bowls, each containing 100 g of individual ration components). This assessment was not replicated; it was conducted to better identify what feed components were likely being consumed to cause the measured changes between rations exposed to starlings and reference TMR formulations. The feed offered consisted of the high-energy components within the TMR: steamed-flaked corn (**SFC**), Propel energy nugget (**EN**; Nestle Purina, St. Louis, MO), corn gluten (**CG**), dry distillers grains (**DDG**), canola meal (**CM**), corn