Understanding and Preventing Bird Damage on Dairies

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ABSTRACT: Wild birds cause significant damage to dairy farms through the consumption and spoilage of cattle feed. A survey of Washington State dairy farmers revealed approximately $14 million in bird damage losses for the Washington State dairy industry, annually. Furthermore, farms that reported the presence of more than 10,000 birds per day were more likely to report the presence of *Salmonella* spp. or Johne's disease (caused by *Mycobacterium avium* subsp. *paratuberculosis*). Over the course of three years, we assessed the impact of bird populations on the presence of bacteria in bird feces and the nutritional composition of cattle feed. Five dairies were enrolled into the study and visited to collect bird fecal samples and cattle feed samples. Several pens were monitored on each dairy. Bird fecal samples were analyzed for three bacterial populations. Fresh and bird-depleted feed samples were analyzed for dry matter, total digestible nutrients, protein, crude fiber, ash, fat, and net energy. The prevalence of bacterial populations in bird fecal samples did not differ among farms, but *Campylobacter jejuni*, a bacterial strain known for causing abortions in cattle, was discovered in one location. The number of birds observed at the feed bunk and the percentage of nutritional loss in cattle feed differed among pens. Understanding where birds prefer to feed on dairies may improve the effectiveness of bird deterrent management techniques. A variety of bird deterrent methods are available for dairy farmers but, at best, the most commonly used methods were considered only "somewhat effective" by farmers. The use of more sustainable methods, such as attracting native birds of prey to dairies, may be beneficial to dairy cattle well-being as well as dairy farmer economic sustainability.

KEY WORDS: *Campylobacter jejuni*, dairies, deterrent, economic survey, *Escherichia coli*, European starling, pest bird, *Salmonella*, *Sturnus vulgaris*

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INTRODUCTION

European starlings (*Sturnus vulgaris*) have been linked to millions of dollars in damages to agriculture in the United States (Linz et al. 2007). On dairy farms, European starlings as well as other pest birds are known to cause damages through the transmission of pathogens to dairy cattle in addition to feed loss from the consumption of cattle feed. Pest birds carry multiple pathogens, including *Salmonella* spp., *Escherichia coli*, and *Campylobacter spp.* For example, between 0.5% and 80.3% of birds sampled in two studies were positive for *E. coli* (Hancock et al. 1998, Pedersen et al. 2006). The proportion of birds positive for *Salmonella* spp. ranged from 0.07% to 12% of birds (Faddoul et al. 1966, Gaukler et al. 2009).

Pest birds consume between 2.8% and 4.9% of feed on dairies (Shwiff et al. 2012). While information on the types and nutrients of dairy feed consumed is limited, it has been reported that dry matter, crude protein, starch, neutral and acid detergent fibers, ash, and starch decreased by 24.2% to 83% in one feedlot study. Starch content decreased the most from bird depredation, while ash content showed the smallest decrease (Allen et al. 2012).

The specific objectives of this study were to: 1) conduct a survey of Washington State dairy farmers to determine the economic impact of pest bird damage on dairies; 2) determine the prevalence of pathogens present in bird fecal matter on dairy farms; and 3) measure nutrient loss in dairy cattle feed from bird depredation.

METHODS

Economic Survey

The Washington State University Institutional Review Board reviewed all survey materials and categorized this research as exempt. Hard copies of the survey were distributed and collected from Washington State dairy farmers at the 2017 Washington State Dairy Conference. Survey questions related to the number of pest birds present per day, estimated cattle feed loss from bird depredation and spoilage, current use of pest bird deterrence methods, and prevalence of cattle diseases on each respondent's dairy.

Farm Selection

Five primarily Holstein dairy farms were selected in Washington State on a volunteer basis. Each farm housed an average of 300 cows per barn and had previously reported bird populations as a problem on their dairies. Bird density was calculated in each pen by dividing the total number of birds observed in the feed at the feed bunk by the feed bunk size.

Prevalence of Bacteria in Bird Feces

Two to five cow pens from each farm were selected for bird fecal sampling, with three to ten fresh bird fecal samples collected per pen. Samples were collected using a sanitized metal spatula and placed into sterile 7-ml screw-top test tubes (Karter Scientific, Lake Charles, LA). They were then shipped in a cold storage box (FedEx, Memphis, TN) to the Washington Animal Disease Diagnostics Lab in Pullman, WA, within 24-48 hours of collection.

Fecal samples were plated on MacConkey agar plates and XLT-4 agar plates and incubated overnight at 35°C. *Escherichia coli* was identified by lactose fermenting colonies on the MacConkey agar plates. *Salmonella* spp. was identified by non-lactose fermenting colonies on the MacConkey agar plates, or by colonies with black centers on the XLT-4 agar plates. For the detection of *Campylobacter* spp., fecal samples were plated onto Columbia blood agar plates and incubated at 42°C for up to seven days. If growth was observed within seven days, a Victoria Blue stain was used to determine if each isolate was *Campylobacter*. Matrix Assisted Laser Desorption/ Ionization Time of Flight Mass Spectrometry (MALDI TOF MS) was used to identify the bacterial isolates. Pathogen data were analyzed using a log linear model with CATMOD in SAS (SAS Institute, Cary, NC). Significance was determined if $P < 0.05$; trends were determined if $P < 0.1$.

Nutrient Loss in Cattle Feed

Nineteen pens across the five dairies were used for collecting cattle feed samples for nutritional analysis pre-bird depredation and post-bird depredation. Handfuls of feed were collected from five areas of the feed bunk for each pen and placed into 180-ml sterile bags (Nasco, Fort Atkinson, WI). Fresh feed samples (pre-bird depredation) were collected after feed was delivered to each pen, and bird-depleted samples (post-bird depredation) were collected after approximately 50 birds had undisturbed access to the feed for 30 minutes. Bird-depleted samples were collected in areas at the feed bunk that were not accessible to cows but were occupied by pest birds. Multiple samples were collected and mixed from each area so that each pen had one representative feed sample. Samples were dried and ground for analysis. The samples were then analyzed for net energy for lactation, total digestible nutrients (TDN), fat, crude fiber, ash, dry matter, and protein were analyzed using methods from AOAC International (Gaithersburg, MD).

RESULTS

Economic Survey

The response rate for this survey was approximately 50%. Respondents reported that European starlings and pigeons (*Columba livia*) were the first and second most common pest birds located on their dairies. Fifty-one percent of dairy farmers estimated that 1,000 to 10,000 pest birds were present on the farm each day. Ninety percent of respondents reported using shooting as the preferred method of pest bird deterrence. Although the prevalence of Johne's disease or *Salmonella* among respondents was low (Figure 1), farms that reported a bird abundance of over 10,000 birds per day had greater odds of having Johne's disease or *Salmonella* present. The average estimated loss of cattle feed to bird depredation and spoilage was 4.4%. Using an average number of dairy cows in Washington State and current feed prices, pest bird depredation and spoilage of feed resulted in a total annual economic loss of about $14 million for the Washington State dairy industry.

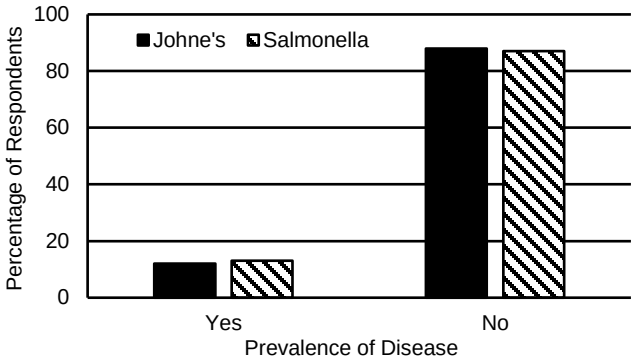

Figure 1. Prevalence of Johne's Disease and *Salmonella* on dairies, as reported by Washington State dairy farmers in 2017.

Prevalence of Bacteria in Bird Feces

Pest bird density at the feed bunks ranged from one bird/m^2 to four birds/m^2, with most birds found in the feed bunks of pens located at the ends of the barn. Eighty-eight fresh bird fecal samples were collected, in which *E. coli* was isolated from 34 samples, *Campylobacter jejuni* was isolated from one sample, and no *Salmonella* spp. were isolated from the samples. No significant differences in the number of positive *E. coli* samples were found between locations ($P = 0.14$).

Nutrient Loss in Cattle Feed

No clear relationships were detected between bird density at the feed bunks and loss of nutrients in the cattle feed. However, anecdotal evidence showed that differences in nutrient loss occurred among pens and dairies. Post-bird depredation, about half of the pens lost net energy for lactation and TDN, whereas the other half of the pens gained net energy for lactation and TDN (Table 1).

DISCUSSION

The outcomes of the economic survey conducted in this project provided useful information about the current pest bird management issue on Washington State dairies. While most dairies use shooting for pest bird deterrence, this method appears to be ineffective at preventing pest bird damages. Alternative deterrence methods or a combination of methods is needed to reduce the $14 million in damages pest birds cause Washington State dairies each year.

Results in the present study suggest that pest birds have the potential to disseminate *E. coli* to cattle on Washington State dairies. Approximately 39% of the bird fecal samples collected were positive for *E. coli* in the present study, which falls within prevalence rates previously reported (Pedersen et al. 2006, LeJeune et al. 2008). However, it is important to note that the present study did not measure the prevalence of *E. coli* in the bird population but merely provided a percentage of bird fecal samples that were

Table 1. Change in nutrient content of dairy cattle feed due to pest bird depredation for 30 minutes.

Location (Farm.Pen)	Change in Dry Matter (%)	Change in Net Energy Lact (Mcal/kg)	Change in TDN (%)	Change in Crude Fiber (%)	Change in Ash (%)	Change in Fat (%)	Change in Protein (%)
1.2	1.96	0	0.23	0.78	0.06	-0.89	-1.13
1.3	-17.0	-0.309	-13.59	-2.62	0.82	-0.35	-3.34
4.1	-8.28	-0.136	-5.64	0.21	-1.6	-0.12	-1.7
4.3	-0.04	-0.03	-0.96	2.97	-0.62	-0.1	0.29
4.5	2.71	0.044	1.71	0.57	-0.03	-0.22	-0.27
5.1	2.04	0.044	1.48	0.88	-0.14	0.12	0.36
5.2	10.82	0.132	5.88	4.52	0.38	-0.45	0.54

positive for *E. coli*. Only one fecal sample was positive for *C. jejuni* and no samples were positive for *Salmonella spp.* In comparison, Adhikari et al. (2004) used an enrichment technique to detect the presence of *C. jejuni* in wild birds, which can explain why they detected the bacteria in 40% of samples. The higher detection rate discovered by Adhikari and colleagues (2004) could also be attributed to differences in infection rates between starlings (present study) and sparrows (Adhikari et al. 2004). Future studies are needed to determine how environmental conditions and seasonality influence the prevalence of *Salmonella* and *C. jejuni* found in wild bird feces.

Anecdotally, no differences were observed between bird density and the change in TDN, dry matter, net energy, crude fiber, fat, or protein. In the present study, some pens had increases in specific nutrients post-bird depredation while other pens had decreases in specific nutrients. These differences between pens appear to be related to the type of feed offered. For example, pens that were fed grass silage versus corn silage differed in the types of nutrients depleted by the birds. Two previous studies also found conflicting results in which bird depredation caused decreases in dry matter and crude protein (Allen et al. 2012) in one study but caused increases in crude fiber, crude protein, and crude fat post-bird depredation (Depenbusch et al. 2011). Future studies are needed to validate whether the type of TMR fed has an impact on the nutrients lost due to wild birds.

Pest birds have the potential to influence the health and well-being of dairy cattle. It is, therefore, important to understand the interactions between pest birds and dairy cattle. In the current study, feces from pest birds were positive for *C. jejuni* and *E. coli*, suggesting the potential for pest birds to transmit these bacteria to dairy cattle. In addition, bird densities appeared to differ among locations, suggesting that birds have preferential feeding areas on dairies. However, nutritional components did not differ due to bird densities. Altogether, these results highlight important issues regarding the interactions between pest birds and dairy cattle. Understanding where birds prefer to feed on dairies would allow farmers to target specific areas for deterrence strategies, thereby potentially making them more effective.

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