Manure Belt Dryers in Alberta Layer Barns

In-Barn Air Quality

In Collaboration with Egg Farmers of Alberta

A team from Alberta Agriculture and Forestry (AF) and Egg Farmers of Alberta (EFA) investigated gaps related to benefits, costs and challenges of using manure belt dryers in Alberta layer barns.

Staff investigated manure drying effectiveness and its impacts on in-barn ammonia and dust levels in both summer and winter conditions.

Egg Farmers of Alberta

In-Barn Ammonia

The indoor environment of a layer barn has a tremendous effect on animal health, welfare and overall bird performance. About 50-80% of nitrogen (N) in the manure can be converted to ammonia (NH_3), which can cause respiratory challenges in humans and animals. According to the *2017 Code of Practice for the Care and Handling of Pullets and Laying Hens*, released by the National Farm Animal Care Council, egg farmers must take action to manage in-barn NH_3 if levels of 20-25 ppm occur.

Various aspects of egg production can influence in-barn NH_3 levels:

- housing or barn design
- bird age and health
- drinker management and maintenance
- methods of manure management
- outside weather conditions

Manure belt dryers is one manure management strategy egg farmers use to deal with air quality concerns as it relates to in-barn ammonia (NH_3) and dust.

In-Barn Dust

The dust generated in poultry barns comes from the birds, in terms of feather and skin particles, as well as the manure and litter material. This dust,

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when inhaled by both birds and workers, can affect the respiratory system. A common concern among egg farmers regarding manure drying is whether the drying system increases in-barn dust levels. In an effort to answer this question, in-barn dust levels were monitored with the use of particle counters in both summer and winter conditions.

In-Barn Testing

Methods

Both the aviary and furnished barns selected for this project were equipped with in-barn sensors to log NH_3 concentrations. For comparison, instantaneous readings were taken at the in-barn sensors with RAE gas detection dosimeter tubes (Fig. 1) once per day.

Figure 1. RAE gas detection pump and dosi-tube (left); Dylos DC1700 dust monitor (right)

Results

In-barn NH_3 results, from both summer and winter tests, suggest that removing manure every day is more effective at reducing in-barn ammonia levels than using manure belt dryers. However, manure belt drying did provide reductions of in-barn NH_3, by up to 50% in some scenarios. Higher in-barn NH_3 concentrations were typical during winter months, likely due to reduced ventilation rates. Thus increasing removal frequency should be considered during the winter.

At both farms there was a correlation between bird activity and in-barn dust levels. In the aviary barn (Fig. 2), dust rapidly increased as the lights turned on in the morning as the hens became more active. Dust generally increased again at about 12:00 pm as the hens finished laying eggs and moved to the litter areas. Dust concentrations dropped off as lights went off and birds became less active.

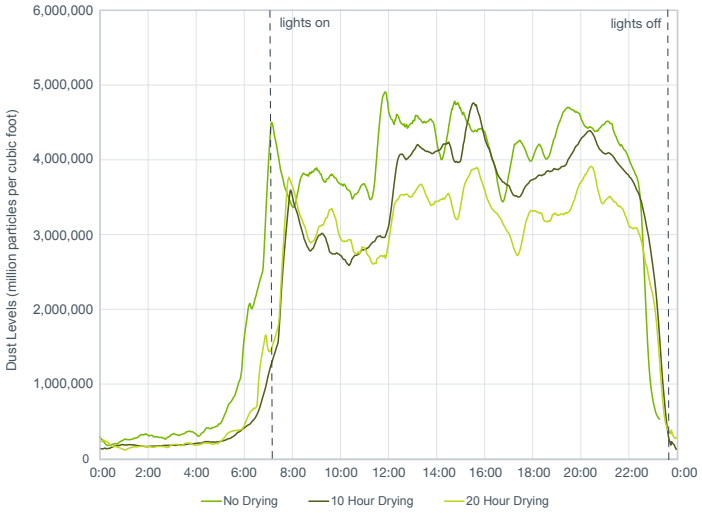

Figure 2. Aviary barn dust through the day

Similarly, the furnished barn (Fig. 3) showed an increase in dust when lights turned on, even though there was no litter, and decreased when lights turned off. Data shows dust did not increase with the use of manure belt dryers. In fact, trends suggest dust levels without drying were typically higher than with drying (Figs. 2 and 3).

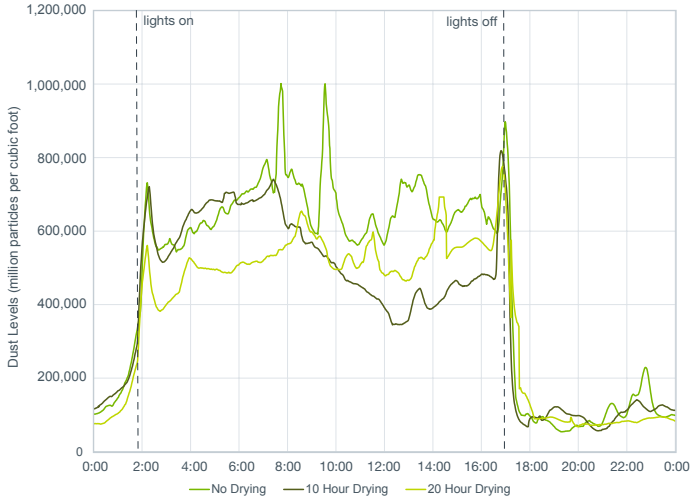

Figure 3. Furnished barn dust through the day

Similar dust trends were observed in both summer and winter conditions. The average dust levels were higher in the winter than in summer. This is attributed to reduced ventilation rates typical with winter conditions.

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Economic Analysis

Daily manure removal resulted in the lowest in-barn ammonia concentrations. However, daily removal had the highest cost in terms of labour and equipment use. Manure removal every 7 days had the lowest associated costs, but in-barn ammonia levels were the highest and at risk of exceeding Code of Practice guidelines. Manure removal every 3 days appears to be the most cost effective method of controlling in-barn NH_3 to acceptable levels while optimizing labour and equipment input costs.

Key Learnings

- Removing manure from the barn is more effective at reducing NH_3 levels than using manure belt dryers, especially in winter.
- Dust levels did not increase with the use of manure belt dryers.
- Manure removal every 3 days with no drying is the most cost effective method of controlling in-barn NH_3.

Additional Learnings

Results showed in-barn NH_3 sensors were not consistently accurate and did not respond quickly to changing air quality conditions. Therefore, egg producers should:

- Frequently calibrate their in-barn sensors, or
- Investigate other methods as an alternative or back-up for detecting NH_3.

Future Research Considerations

Measuring the economic benefit of improved in-barn air quality in terms of bird health and egg production could greatly influence the economics of operating manure belt dryers.

For recommendations to improve manure dryer efficiencies in reducing NH_3 and operational costs, see the following factsheets:

- Project Overview
- Manure Moisture and Nitrogen
- Overall Economics and Learnings

For more information on this project, read the Evaluating Manure Belt Dryers in Alberta Layer Barns Final Report.

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