

Manure Belt Dryers in Alberta Layer Barns

Overall Economics and Learnings

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. Main goals for the investigation were to understand:

- Manure moisture and nitrogen content after being dried
- Economics of purchasing and operating manure belt dryer systems
- In-barn ammonia (NH₃) and dust levels



Background

The use of manure belt dryer systems has the potential to help manage in-barn air quality, improve manure nutrient value, decrease manure volume and weight, reduce transportation costs and allow for further secondary processing such as litter pelletizing. However, the advantages and potential challenges, as well as economic impact of adopting manure belt dryer systems in Alberta is not well known.

Economic Analysis

To determine the economic implications of incorporating manure belt drying systems in Alberta layer barns, the following variables were analyzed based on results from nine scenario testing combinations of drying time and manure removal frequency (Table 1):

- Market value of manure nitrogen content and total amount of manure produced
- Operational costs of belts and dryers, based on annual energy use and cost
- Labour cost, based on annual hours required
- Hauling cost, based on annual hours, equipment and fuel use

Table 1. Testing Scenarios

Manure Drying Time	Manure Removal Frequency		
	1 Day	3 Day	7 Day ⁱ
No drying	Nd1	Nd3	Nd7
10 hrs	10h1	10h3	10h7
20 hrs	20h1	20h3	20h7

ⁱDuring winter testing the seven day removal scenarios were dropped to six days due to high in-barn ammonia levels.

Results

Annual gross revenue (income minus expenses) was heavily influenced by variability in the manure nitrogen content and the total amount of manure produced, which in turn was influenced by the age of the flock and natural bird losses over the flock cycle. In the aviary barn (Fig. 1), the no drying scenarios provided a higher return than the drying scenarios. However, in the furnished barn, the opposite was observed (Fig. 2).

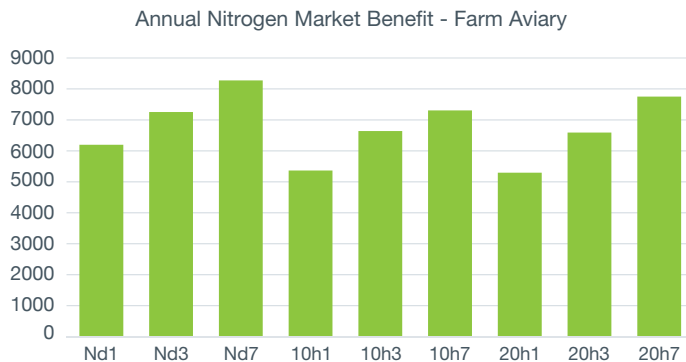


Figure 1. Market value of nitrogen for the aviary barn

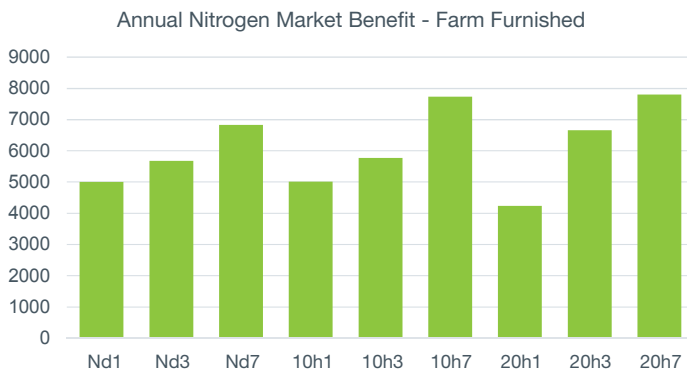


Figure 2. Market value of nitrogen for the furnished barn.

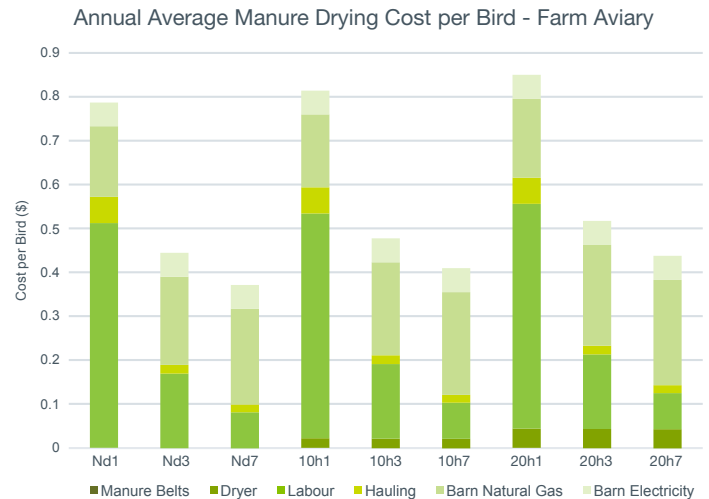


Figure 3. Manure drying cost per bird in the aviary barn

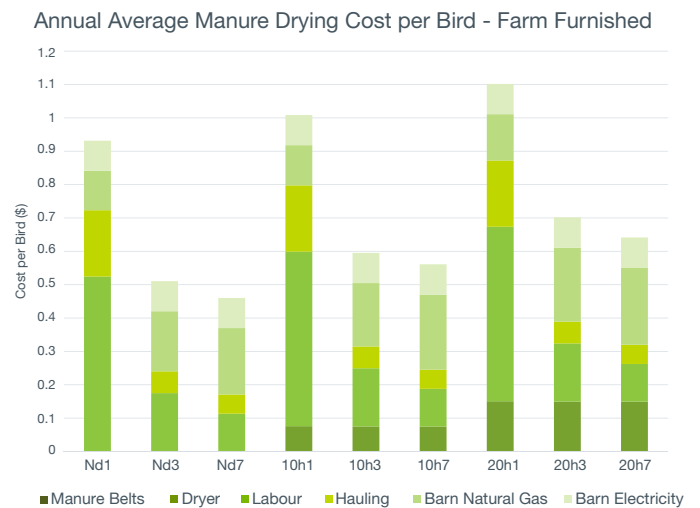


Figure 4. Manure drying cost per bird in the furnished barn

In terms of annual average cost per bird, the daily manure removal scenarios resulted in the highest cost due to increased labour and hauling costs as compared to the 3 and 7 day removal frequencies. Cost breakdowns are shown in Figures 3 and 4. The cost of running the manure belts is included in the cost breakdown shown in Figures 3 and 4, but is not seen on the graphs as the cost to operate is less than 1 cent per bird on an annual basis. It is also important to note that differences in barn size and configuration will result in different costs per bird; thus, the two barns in this case should not be compared.

Net Present Value (NPV) calculations analyzed the

implications of the investment and considered the following variables: purchase cost, annual operation cost (energy use), labour and hauling costs. Results indicate that NPV improves as the days between manure removal increase. However, all scenarios resulted in a negative NPV. Small variations in bird population, manure nitrogen content or higher drying costs affect the financial viability of the investment.

Energy measurements show power used by the manure belts is minimal compared to the manure dryer fans (Tables 2 and 3). Thus, it is cheaper to run the manure belts more frequently than it is to run the dryers.

Table 2. Annual energy cost for the manure belts and dryers for the aviary barn.

Scenario	Annual Energy Cost (\$0.05/kWh)	
	Belts	Dryer
Nd1	\$ 25.10	\$ 0
Nd3	\$ 9.40	\$ 0
Nd7	\$ 4.85	\$ 0
10h1	\$ 23.45	\$ 319.00
10h3	\$ 8.10	\$ 319.00
10h7	\$ 4.05	\$ 319.00
20h1	\$ 24.35	\$ 638.00
20h3	\$ 8.75	\$ 638.00
20h7	\$ 4.35	\$ 638.00

Table 3. Annual energy cost for the manure belts and dryers for the furnished barn.

Scenario	Annual Energy Cost (\$0.05/kWh)	
	Belts	Dryer
Nd1	\$ 15.00	\$ 0
Nd3	\$ 5.75	\$ 0
Nd7	\$ 2.95	\$ 0
10h1	\$ 14.55	\$ 825.75
10h3	\$ 5.20	\$ 825.75
10h7	\$ 2.70	\$ 825.75
20h1	\$ 15.25	\$ 1651.50
20h3	\$ 5.35	\$ 1651.50
20h7	\$ 2.55	\$ 1651.50

Key Learnings

- Manure removal frequency had the biggest impact on the cost per bird because of the extra labour and hauling needed.
- Weekly manure removal costs were lowest. However other considerations, such as in-barn air quality, should be kept in mind when determining the optimum removal frequency.
- Net Present Value (NPV) calculation costs showed no economic return on the installation and operation of manure dryer belts for the variables considered in this project.
- Economic analysis showed that potential revenue from manure is heavily dependent on nitrogen content.

Additional Considerations

- Check to see if your system is operating properly. Dryer system testing at the aviary barn found a problem with the system, which affected performance.
- Be curious and ask questions when the system is being installed about expected performance. If you have concerns, talk with your supplier about the potential for further investigations.

Summary

Manure belt dryers are a management tool that can reduce manure moisture content and reduce in-barn ammonia emissions, particularly in the winter months. Based on nitrogen market benefit, investing in manure belt dryers does not have a positive economic outcome. However, other benefits of the system, which cannot currently be captured in terms of monetary gain, may make the investment worthwhile.

Future research considerations of factors beyond the scope of this project such as the environmental benefits to bird populations from more frequent manure removal may have a significant impact on the financial investment analysis of manure belt drying systems.

“Bottom line, when deciding whether to invest in a manure dryer system, egg farmers should consider how they operate their barn, their limitations in time and labour, and how they intend to manage manure after it leaves the barn to achieve their sustainability goals.”

Source: Evaluating Manure Belt Dryers in Alberta Layer Barns Final Report