

Economics of Vaccinating Sheep against Bluetongue Disease

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Introduction

Bluetongue (BT) disease is a serious and recurring threat to sheep producers in Wyoming and surrounding states. Bluetongue virus (BTV) is transmitted by biting midges (*Culicoides sonorensis*) in late summer and early autumn, just before lambs are typically sent to market. Symptoms of BT include inflammation and congestion, a bluish discoloration of the skin, hemorrhages and ulcerations (most visible in the mouth and nose), and lameness. These symptoms can be fatal, or cause sheep to go off feed, lose weight, and fail to breed.

Currently, no vaccine for BTV—specifically, serotype 17—is readily available for sale in Wyoming. Modified-live virus vaccines for BT are available for purchase through the California Wool Growers Association, but cannot be legally imported to Wyoming. It is possible, however, for vaccine companies to manufacture custom-made killed-virus vaccines for susceptible premises within an affected region of Wyoming, upon special approval by the Wyoming state veterinarian.

For this study, we (1) estimate the cost to a representative sheep producer of a BTV-17 outbreak that causes relatively severe clinical symptoms; (2) estimate the cost of administering a custom-ordered BTV-17 vaccine to our hypothetical sheep flock; and (3) explore the potential cost-effectiveness of using a BTV-17 vaccine to prevent catastrophic outbreaks.

Objectives

Our primary objective is to provide economic information that sheep producers can use to evaluate whether vaccinating their flock against BTV might be economically worthwhile.

Materials and Methods

To estimate the farm-level economic consequences of a BT outbreak on a Wyoming sheep operation, we built enterprise budgets for three representative range flocks with 256, 640, and 1,440 breeding ewes. We then used partial budget analysis to estimate changes in an operation's resource use, output, costs, and revenues due to a BT outbreak or adoption of a BTV-17 vaccine.

Results and Discussion

Preliminary results are available for the 640-ewe flock. Under a worst-case scenario, when the flock is naïve to the virus (has not been exposed in recent years), we assume 36% of the flock becomes infected and 20% of the flock dies (this is based on an actual outbreak in the Bighorn Basin in 2007). When all costs associated with supportive care, pharmaceuticals, death loss, weight loss, and labor are considered, the producer incurs a loss of \$72,120 (Table 1).

Regarding BT vaccines, two types can be custom-made—modified-live virus (MLV) or killed virus (KV)—in coordination with the Wyoming state veterinarian, the Wyoming State Veterinary Laboratory, and a manufacturing company. **The MLV vaccine** currently costs \$0.32 per dose to manufacture, and one dose is required per animal. We assume that the flock is vaccinated every other year, in late spring or early summer, when ewes are not pregnant (otherwise, there is a risk of vaccine-induced abortions). With labor costs included, the MLV vaccine costs \$498 to obtain and administer to a 640-ewe flock (Table 2). **The KV vaccine** costs \$1.20 per dose to manufacture, and it requires two doses per animal. We assume that the flock is vaccinated every other year and is safe to use any time of the year, regardless of pregnancy status. With labor costs included, the KV vaccine costs \$3,500 to obtain and administer to

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a 640-ewe flock (Table 2). We assume **both vaccines** protect 84% of vaccinated sheep.

Bluetongue disease tends to occur cyclically, roughly every 5–10 years. For a five-year return period, given the MLV’s cost and efficacy, an outbreak in a 640-ewe flock would only need to cost \$1,479 to justify vaccinating the flock every other year (i.e., to just break-even). Given the KV’s cost, an outbreak would need to cost \$10,404 or more to justify vaccinating the flock. Our outbreak cost estimate of \$72,120 is much higher than these “break-even outbreak costs,” indicating that the vaccine is very likely to be economically worthwhile. In fact, with an outbreak cost of \$72,120, vaccinating would still be worthwhile, even if BT occurred only once every 48 years (for the MLV) or every 18 years (for the KV).

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Table 1. Economic costs incurred during a bluetongue outbreak, 640-ewe flock.

Category	Description	Flock-Level Costs (Year 2014)
Supportive Care	Tube with water and creep-feed mixture	\$5,143
Pharmaceuticals	Permethrin 10%	\$38
	Nuflo [®]	\$4,855
	Dexamethasone	\$48
BT Death Loss	Rams, Ewes, Lambs lost	\$56,678
Sickness	Lamb weight loss	\$1,919
Labor	Treatment and Flock Checks	\$3,439
Total		\$72,120

Table 2. Annual costs of purchasing and administering a bluetongue vaccine. Two types of vaccines are considered: modified-live virus (MLV) or killed virus (KV).

Cost of vaccinating with MLV (one dose per year)	
Labor	\$ 42.06
Vaccine	\$ 455.44
Total	\$ 497.51
Cost of vaccinating with KV (two doses per year)	
Labor	\$ 84.13
Vaccine	\$ 3,415.80
Total	\$ 3,499.93