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Abstract

Concerns regarding management of animal disease and related perceptions about food safety have escalated substantially in recent years. Terrorist attacks of September 2001, discovery of bovine spongiform encephalopathy (BSE) in a dairy cow in December 2003 in Washington, subsequent discoveries of BSEinfected animals in Texas in 2005 and Alabama in 2006, and recent worldwide outbreaks of highly contagious animal diseases (i.e., foot-and-mouth disease [FMD] and Avian influenza) have made apparent the need for animal traceability in U.S. livestock production and marketing. In addition, animal identification systems are rapidly developing throughout the world, effectively increasing international trading standards. One way to combat and more quickly arrest spread of contagious diseases is through animal ID. Capability to rapidly identify locations where an animal has been affects the ability to isolate, trace, and arrest spread of a disease. Animal ID systems are rapidly developing throughout the world and the U.S. is behind many other countries in this development. Efforts to develop animal ID systems in the U.S. were launched prior to the initial BSE discovery, but they gained considerable momentum afterwards. The National Animal Identification System is intended to identify specific animals in the U.S. and record their movement over their lifetime. The goal is to enable a 48-hour trace-back of the movements of any diseased or exposed animal. This will limit spread of animal diseases by enabling faster trace-back of infected animals; limit production losses due to disease presence; reduce the costs of government control, intervention, and eradication; and minimize potential international trade losses3. The purpose of this research is to determine the economic implications of increased improvements in animal ID systems in the event of an FMD outbreak in southwest Kansas. Specifically, a disease spread model is used to determine the probable spread of a hypothetical FMD outbreak. Results from the disease-spread model are integrated into an economic framework to determine economic impacts.

Keywords

Cattlemen's Day, 2007; Kansas Agricultural Experiment Station contribution; no. 07-179-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 978; Beef; Cattle; BSE; Foot-and-mouth disease

VALUE OF ANIMAL TRACEABILITY SYSTEMS IN MANAGING A FOOT-AND-MOUTH DISEASE OUTBREAK IN SOUTHWEST KANSAS

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Introduction

Concerns regarding management of animal disease and related perceptions about food safety have escalated substantially in recent years. Terrorist attacks of September 2001, discovery of bovine spongiform encephalopathy (BSE) in a dairy cow in December 2003 in Washington, subsequent discoveries of BSE-infected animals in Texas in 2005 and Alabama in 2006, and recent worldwide outbreaks of highly contagious animal diseases (i.e., foot-and-mouth disease [FMD] and Avian influenza) have made apparent the need for animal traceability in U.S. livestock production and marketing. In addition, animal identification systems are rapidly developing throughout the world, effectively increasing international trading standards.

One way to combat and more quickly arrest spread of contagious diseases is through animal ID. Capability to rapidly identify locations where an animal has been affects the ability to isolate, trace, and arrest spread of a disease. Animal ID systems are rapidly developing throughout the world and the U.S. is behind many other countries in this development. Efforts to develop animal ID systems in the U.S. were launched prior to the initial BSE discovery, but they gained considerable momentum afterwards. The National Animal Identification System is intended to identify specific animals in the U.S. and record their movement over their lifetime. The goal is to enable a 48-hour trace-back of the movements of any diseased or exposed animal. This will limit spread of animal diseases by enabling faster trace-back of infected animals; limit production losses due to disease presence; reduce the costs of government control, intervention, and eradication; and minimize potential international trade losses[3].

The purpose of this research is to determine the economic implications of increased improvements in animal ID systems in the event of an FMD outbreak in southwest Kansas. Specifically, a disease spread model is used to determine the probable spread of a hypothetical FMD outbreak. Results from the disease-spread model are integrated into an economic framework to determine economic impacts.

Experimental Procedures

To accomplish the objectives of this study, an epidemiological disease-spread model, using alternate intensity levels of animal ID, was used to simulate a hypothetical FMD outbreak using alternate intensity levels of animal ID.

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[3]Other potential benefits of trace back systems include better supply chain coordination, increased consumer confidence in meat products, and verifiable credence attributes.

This study evaluates contagious animal disease spread for three different animal identification levels in cattle, referred to as high, medium, and low levels of identification intensity. High animal identification intensity is a system that has a 90 percent success rate of both direct and indirect trace-back within 24 hours. In other words, the trace-back of a herd will be successful 90 percent of the time when coming in direct and indirect contact with an infected herd. This would be roughly akin to an animal identification system that has 100% industry-wide adoption. Medium- and low-level identification systems have 60 percent and 30 percent trace-back success rates, respectively. A 30 percent trace-back is roughly where US beef industry is today. Because a majority of swine are owned and managed by one entity in the geographic area where an out break is hypothetically introduced in this study, only one level of animal identification for swine is assumed at the herd level at 75% trace-back. The results from the disease-spread model, including total number of fed and feeder cattle, market hogs that were destroyed, and total costs associated with the FMD outbreak, were integrated into an economic model. The economic framework consists of a set of supply and demand equations for beef, pork, and poultry sectors that provides horizontal and vertical linkages within the farm-retail marketing chain. The economic model was used to evaluate consumer and producer losses for beef, pork, and poultry sectors.

Results and Discussion

Two factors—total number of infected animals and time of disease outbreak—matter most in determining potential economic impact of an infectious disease outbreak. As the level of surveillance and ability to trace cattle increases, the number of animals that have to be destroyed and related costs decrease (Figure 1). With a low-level ID system, approximately 790,000 head of livestock were destroyed. The numbers destroyed at medium and high surveillance levels were lower (550,000 and 265,000, respectively). This is equivalent to a reduction in Kansas fed cattle of 14% with low-intensity animal identification, 10% with medium-, and 5% with high-intensity identification.

Table 1 reports changes in consumer and producer welfare, assuming a 2% decrease in beef and pork demand and a 1% increase in poultry demand for the short run in the event of an FMD outbreak. In general, as animal surveillance levels increased, consumer and producer losses associated with an FMD outbreak became smaller. The simulation models estimate that total losses (cattle producer, beef processor, and beef retailer) at $584 million, $502 million, and $405 million with low-, medium-, and high-level animal ID systems, respectively. Total consumer losses in the short run were $271 million, $220 million, and $154 million for low, medium, and high animal surveillance levels, respectively.

These results estimate the potential value of animal identification systems in mitigating economic losses associated with a contagious disease outbreak. As the intensity of animal identification increases, the number of animals destroyed decreases, as does the associated disease-related costs. Further, increases in animal traceability levels result in smaller consumer and producer losses.

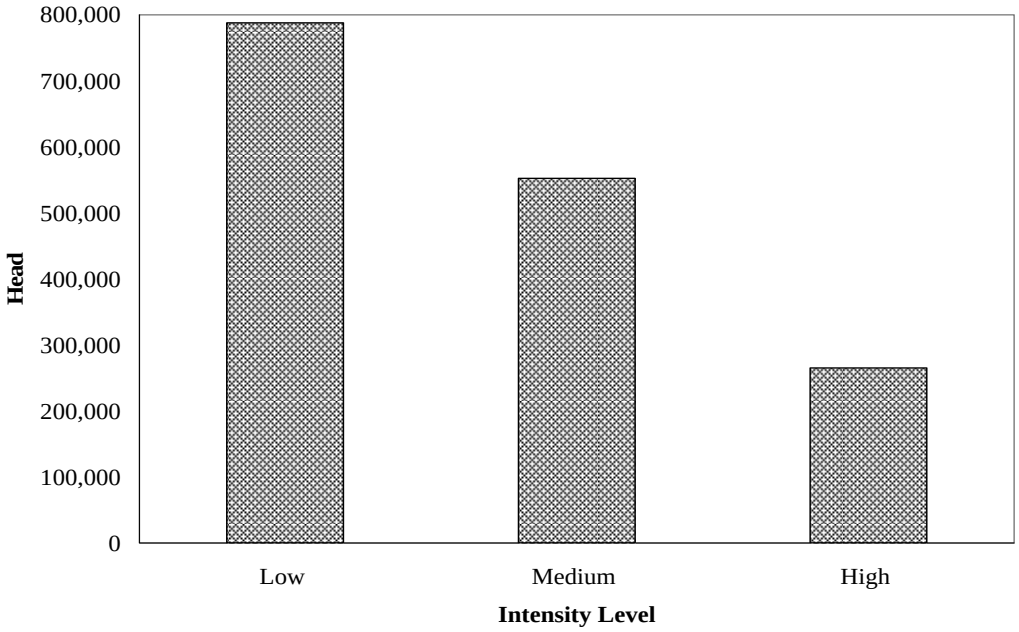

Figure 1. Cumulative Number of Animals Destroyed in a Hypothetical FMD Outbreak in Southwest Kansas with Varying Levels of Animal Traceability Intensity.

Table 1. Changes in Consumer and Producer Welfare in Short-Run with 2% Decrease in Beef and Pork and 1% Increase in Poultry Demand (in millions of dollars)

	Animal Identification Intensity		
Beef Production Sector Loss:	Low Level	Medium Level	High Level
Retailers	-238.72	-228.29	-214.89
Wholesale/Processors	-144.76	-121.79	-92.18
Other States' Fed Cattle Producers[a]	-65.46	-57.69	-48.10
Kansas Fed Cattle Producers	-69.27	-43.51	-22.21
Other States 'Feeder Cattle Producers	-64.51	-48.51	-27.62
Kansas Feeder Cattle Producers	-1.18	-2.06	-1.16
Total Beef Industry	-583.91	-501.85	-405.00
Total Pork Industry	-80.33	-84.58	-90.05
Total Poultry Industry	129.29	114.59	95.76
Total Meat Industry Production Sector Loss	-534.95	-471.83	-399.29
Retail Consumer Loss:			
Retail Beef	-188.79	-149.73	-99.21
Retail Pork	-51.52	-47.88	-43.59
Retail Poultry	-30.68	-22.18	-11.30
Total Retail Consumer	-270.98	-219.80	-154.11

[a]Other States refers to the U.S. excluding Kansas.