

# ***Lessons Learned from the Foot and Mouth Disease Outbreak in the United Kingdom and Our National Plan in the Event of Such an Outbreak***

*Colleen S. Bruning-Fann*

## **Introduction**

Agriculture is a very important component of the U.S. economy. The likelihood of accidental introduction of a foreign animal or plant disease, agroterrorism, or biological warfare occurring in the U.S. is at an all-time high. In the last two years, there have been 14 incidents of accidental incursion of animal or plant pests and diseases into the U.S. Recent outbreaks of Foot and Mouth Disease (FMD) in Taiwan, (1997) and in the United Kingdom (2001) remind us of the great costs associated with disease incursion and of the importance of safeguarding American agriculture.

In the period from 1900 to 1929, the U.S. experienced six outbreaks of FMD. The largest outbreak occurred in 1914 and involved 22 states. The last outbreak occurred in California in 1929 and involved wild deer. Direct costs associated with these six outbreaks exceeded \$23 million dollars. Estimated indirect costs due to the loss of export markets, decreased value of products, and economic losses to allied industries, were ten times more than the direct costs. A recent study projected that losses from an outbreak of FMD in the US would cost \$14 billion dollars in decreased farm income, \$6.6 billion in decreased US export values, and an increase of \$1.8 billion in government support payments (Paarlberg et al., 2002).

The last reports of FMD in North America occurred in Canada in 1952 and in Mexico in 1954. The disease remains widespread in South America, Africa, the Middle East and parts of Europe and Asia.

---

*Dr. Colleen S. Bruning-Fann*  
Area Epidemiology Officer  
USDA, APHIS, VS  
3001 Coolidge Road, Suite 325  
East Lansing, MI 48823

*Colleen.S.Bruning-Fann@usda.gov*

*Proceedings of the 55<sup>th</sup> Reciprocal Meat Conference (2002)*

## **Foot and Mouth Disease**

FMD is a highly contagious viral disease that causes fever and the formation of vesicles in the mouth and on the feet. This disease primarily affects cloven-hoofed animals such as cattle, sheep, pigs, goats, and deer although other species, such as elephants and hedgehogs, can become infected. The extent of illness and clinical signs are dependent on the strain of the organism and the species affected. In general, clinical signs in sheep and goats are mild and often overlooked, whereas cattle and pigs are markedly affected. Pigs are amplifiers of FMD and can excrete virus in exhaled air at a rate of 400 million infectious units per day (Donaldson, 1987). This amount of virus is estimated to be sufficient to infect 10,000 pigs.

FMD virus is present in vesicular fluids, saliva, exhaled air, milk, semen and manure. Infected animals may excrete virus up to four days prior to the development of clinical signs (Donaldson, 1987). Under favorable conditions, the virus can survive for long periods in the environment. Animals become infected through direct contact with an infected animal or indirect contact through contaminated equipment, facilities, people, feedstuffs and other materials.

Many species of ruminants can harbor the virus for extended periods of time (up to 2.5 years in cattle) resulting in apparently healthy animals that are capable of spreading FMD (Salt, 1993). Experiments reveal that deer can transmit the disease to cattle and that FMD virus could be recovered from esophageal-pharyngeal fluid of deer for at least eleven weeks post infection (McVicar, et al., 1974). These findings suggest that wildlife species could serve as a reservoir for FMD in North America.

FMD vaccines are available; however, the vaccine must be specific for the type and subtype of FMD (there are seven types and at least 60 subtypes) and protection lasts only 3-6 months. Although vaccination decreases clinical signs and the amount of virus excreted, it neither prevents infection of animals with the FMD virus nor the development of unapparent carriers of the disease (Salt, 1993).

## Foot and Mouth in the United Kingdom

The index case in the United Kingdom (UK) is believed to have resulted from uncooked FMD contaminated products that were fed to swine on a farm in Heddon-on-the-Wall. Despite the development of clinical signs, the owner did not immediately notify agricultural officials. FMD spread from this swine farm to seven nearby farms in Tyne and Wear. In this outbreak, sheep showed minimal clinical signs and any lameness seen was mistakenly attributed to foot rot. Sheep from one of the nearby farms went to a Hexham market thereby exposing more sheep. Sheep from the Hexham market went to markets in Longtown and Cumbria where more animals were exposed which further dispersed this disease as these animals moved over the country. Within ten days of the original sheep movement, hundreds of FMD infected animals were dispersed throughout much of the country.

Approximately 4.2 million animals that were affected by FMD were destroyed on 10,511 premises. An additional 2.5 million unaffected animals were slaughtered due to the loss of export markets and inability to transport livestock because of movement restrictions enacted to stop the spread of FMD.

### What We Learned from the United Kingdom

In the UK, ownership of several separate, distinct parcels of land and the pasturing of animals was very common. The numerous quarantines and movement restrictions necessary to stop the spread of disease meant that the farmer's ability to move his or her animals to fresh pastures for grazing or to markets for slaughter was often severely restricted. In addition, the United Kingdom's tuberculosis control program was adversely impacted as veterinarians who would have normally performed the tuberculosis testing and certifying of animals for movement were re-assigned to the foot-and-mouth disease eradication program. This resulted in the inability to market animals even when the farm was located in a FMD-free area.

With a highly contagious, rapidly disseminating disease, it is critical to know the livestock inventory and location of all farms. Because of subsidy programs in the UK, this information was readily available. An additional advantage was that farmers were used to government involvement and with keeping records of livestock movements. A number of farms had "pet" livestock that were emotionally difficult to euthanize. There is also a strong animal welfare movement in the UK. On occasion, protestors dressed up like sheep and marched in front of agriculture offices to express their dissatisfaction with government policies.

Disposal of carcasses was difficult, costly and contentious. It was difficult to bury carcasses in the UK as there are few isolated tracts of land available and the water table is high in many places. The sites utilized were frequented by protestors who, at times, camped at the facilities. Burning of carcasses had its own set of problems. A lot of fuel was re-

quired, the fire burned for days producing smoke that could be seen for miles, and the resulting ash had to be buried. The visually graphic nature of carcass burning was often exploited by the media resulting in frequent images of these events in the news. Although rendering worked well, there just wasn't enough capacity to handle the number of carcasses requiring disposal.

During a disease outbreak, personnel and logistic needs are tremendous. The number of veterinarians required to eradicate FMD in the UK far exceeded the number available. These needs were partially met by the inclusion of veterinarians from a number of other countries including the U.S. A wide variety of other skills were also necessary. Experienced "advance" people were needed to visit areas to ascertain what was needed in terms of personnel, laboratory capabilities, animal handling, euthanasia, disposal, cleaning, and disinfection. Logistical personnel were required to locate hotels, vehicles, equipment, supplies and people with the necessary skills (veterinarians, truckers, laborers, livestock appraisers, etc.). A great effort was made in the UK to use unemployed local personnel whenever possible (i.e. unemployed slaughterhouse employees to euthanize livestock). Geographic information and mapping ability were very important in locating and describing the outbreak and insuring that personnel and equipment could be dispatched in sufficient numbers to the proper areas.

Training on biosecurity is critical to prevent the transmission of FMD by everyone who enters or exits a farm. There have been reports of the dissemination of FMD virus through mail delivery and the grooves of tires (Gailiunas, 1969). Thus, training must involve not only eradication program personnel, but also include livestock and milk haulers, feed trucks, private practitioners, and equipment service personnel. Communication is essential to ensure that FMD personnel, farmers, and the livestock industries understand their roles in the eradication effort. In addition to meetings, press releases, and other common media outlets, a daily on-line newsletter was made available to communicate with farmers and others in the UK.

### Our Plan to Prevent a FMD Outbreak in the U.S.

Previous FMD outbreaks in the US were caused by the accidental introduction of the disease agent in livestock, food, and biological products such as vaccines. FMD virus can remain infectious on meat packing materials for up to 398 days (Gailiunas et al., 1969). There is strong evidence that the former Soviet Union and Iraq had biological weapons programs that included animals and crops as targets (Wilson et al., 2000). The increase in international travel and trade and the rapid transit speed of people and products suggests that it will be increasingly more difficult to prevent disease incursions in the future.

A number of steps have been taken to prevent the accidental or deliberate introduction of disease into the US and to respond rapidly if an incursion should occur. These steps include increased passenger screening, security and bag-

gage inspection at ports of entry into the US. All food waste and garbage from international flights is disposed of in a manner that precludes exposure to livestock. Public education efforts and professional training have been expanded along with laboratory and diagnostic capabilities. There are strong controls in place to prevent the introduction of FMD through livestock movements into the U.S. or through the importation of animal or biological products.

The USDA APHIS has a long and successful history of disease outbreak investigation and disease eradication. The first line of defense includes specially trained veterinarians who investigate suspected cases of foreign animal disease within 24 hours of notification. Samples are sent to the National Veterinary Services Laboratories for testing. Upon confirmation of a disease outbreak, an emergency response team would be activated to control and eradicate the disease.

To rapidly and appropriately respond to an introduction of a foreign disease agent in the U.S., the USDA APHIS has instituted the National Animal Health Emergency Management System and prepared emergency disease guidelines for dealing with an outbreak. To prepare for a much larger or multiple-site FMD incursion, USDA APHIS has drafted, edited, and sent out for external review, the Federal Emergency Response Plan. This plan would utilize the resources of animal disease specialists along with biohazard specialists and generalized logistical support personnel. To provide sufficient personnel for an extensive outbreak, the Emergency Veterinary Medical Officer program will train and allow the utilization of retired federal and nonfederal veterinarians.

### **Our Plan to Eliminate a FMD Outbreak in the U.S.**

A determination that FMD has entered the U.S. would result in a rapid mobilization of trained, experienced disease eradication personnel to the affected area. Infected (>6.2 miles around an infected premises) and surveillance zones would be established. Quarantines would be imposed to stop the movement of all potentially infected and susceptible animals and products. Extensive biosecurity measures would be required prior to all movements onto and off of infected premises and between zones. Infected animals would be euthanized and properly disposed of within 24 hours. A supply of readily available FMD vaccine is stored at the North American FMD Vaccine bank. If it is determined that vaccination would significantly benefit the FMD eradication program, this vaccine could be utilized to vaccinate all farms in a ring around the FMD affected area. All vaccinated animals would be specially identified and eliminated once the outbreak was under control.

Upon report of a FMD outbreak, agricultural authorities will immediately notify the USDA, Office of Inspector General (OIG). OIG would coordinate the law enforcement response to the outbreak with the appropriate local, state, and federal law enforcement agencies as the situation warrants. If criminal activity is suspected, OIG will conduct the

subsequent criminal investigation. Suspicion that the outbreak is due to an act of terrorism would result in a joint investigation by OIG and the Federal Bureau of Investigation (FBI), Weapons of Mass Destruction unit.

### **Potential Problems in Dealing with FMD in the U.S.**

Vesicular stomatitis is a disease whose clinical appearance mimics FMD in cattle, sheep, and swine. This disease has been found only in the Americas. Outbreaks have periodically been reported in the western U.S. (most often in Colorado and New Mexico). An incursion of FMD at a time when we are experiencing vesicular stomatitis would likely slow the discovery of the outbreak thereby allowing the disease to spread.

We do not have a farm registry system and therefore, do not know the locations or inventory of livestock operations in the U.S. Also, some livestock in the U.S. are spread out over a wide geographic area or located in areas that are not readily accessible. To prevent the spread of FMD, infected and exposed animals must be located and destroyed as quickly as possible which would be very hard to do under these circumstances.

The destruction of inapparent carriers of FMD is critical to eradicating the outbreak, but it can be difficult to accomplish as the clinical appearance is one of a healthy animal. Litigation is possible and may result in infected animals remaining on farms for an extended period of time. In the meantime, these infected animals could serve as a source of FMD virus to other livestock and wildlife.

### **References**

- Donaldson, A. 1987. Foot-and-mouth disease: the principal features. *Irish Veterinary Journal*, 41:325-327.
- Gailiunas, P.; Cottral, B.E.; Scott, F.W. 1969. Survival of foot and mouth disease virus on meat packing materials. *Proceedings of the 73rd Annual Meeting of the United States Animal Health Association*, Milwaukee, Wisconsin, pp. 425-436.
- McVicar, J.W.; Suttmoller, P.; Ferris, D.H.; Campbell, C.H. 1974. Foot-and-mouth disease in white-tailed deer: clinical signs and transmission in the laboratory. *Proceedings of the 78th Annual Meeting of the United States Animal Health Association*, Roanoke, Virginia, pp. 169-180.
- Paarlberg, P.L.; Lee, J.G.; Seitzinger, A.H. 2002. Potential revenue impact of an outbreak of foot-and-mouth disease in the United States. *Journal of the American Veterinary Medical Association*, 220:988-992.
- Salt, J.S. 1993. The carrier state in foot and mouth disease – an immunological review. *British Veterinary Journal*, 149:207-223.
- USDA, APHIS, VS, 2001. Foot and mouth disease emergency disease guidelines.
- Wilson, T.M.; Logan-Henfrey, L.; Weller, R.; Kellman, B. 2000. Agroterrorism, biological crimes, and biological warfare targeting animal agriculture. In C. Brown and C. Bolin eds. *Emerging Diseases of Animals*. ASM Press, Washington, DC. pp. 23-57.