

Lumpy Skin Disease: Tackling a Global Threat

Lumpy skin disease (LSD) is a highly infectious disease of cattle and Asian water buffalo caused by the lumpy skin disease virus (LSDV). The virus is spreading at an alarming rate and the geographical distribution of LSD has reached unprecedented levels; the disease is now endemic across most of Africa and in recent years there have been outbreaks in many of the major cattle producing regions of Asia, with fears that it will continue to spread further. Prompt action and effective disease control are vitally important in reducing the impact of this disease on farm incomes and improving animal welfare.

LSD is classified as a transboundary animal disease (TAD) meaning it is a highly contagious epidemic disease with the potential to spread rapidly across the globe with devastating effects on both local and international trade. The substantial economic impact of LSD led the World Organization for Animal Health (OIE) to categorise LSD as a notifiable disease (OIE, 2015). Whilst LSD generally has lower morbidity and mortality compared to some other OIE listed livestock diseases, the prolonged loss of production in both dairy and beef cattle, together with the impact on international trade, means that LSD is one of the most important infectious cattle diseases facing the global livestock industry. Indeed, LSD has been reported to produce chronic debility in affected cattle comparable to that caused by foot and mouth disease.¹

Direct economic losses result from decreased milk production, reduced weight gain, infertility, abortions, damaged hides and death of severely affected cattle. There are often substantial indirect losses too, caused by national and international cattle movement and trade restrictions.

Lumpy Skin Disease Symptoms: Knowing What to Look Out for
The LSD virus belongs to the Capripoxvirus genus which also includes the sheep pox and goat pox viruses. The first phase of infection when the virus enters the bloodstream is known as the viraemic stage. At this time, infected cattle may have:

- Fever (40–41°C)
- Loss of appetite
- Depression

- Discharge from eyes and nose
- Enlarged glands (lymph nodes)
- Increased salivation

Diagnosis is often based on the characteristic skin lesions that give the disease its name (Figure 1 and Figure 2). They start to develop in the following days and often in multiple animals at the same time:

- Circular, firm, elevated nodules (up to five centimeters diameter, sometimes larger)
- Lesions may be localised to the head, neck and limbs or may cover the whole body
- Scabs form within one to two weeks which usually slough to leave an ulcer
- High risk of myiasis (fly strike) on open sores

Confirmatory samples including scabs, saliva, nasal secretions or blood may be taken for laboratory testing. The Polymerase chain reaction (PCR) test is one of the least expensive and quickest methods of detecting LSDV.

Transmission of the Virus: How Does it Spread?

The first (index) case in a herd is often associated with movement of cattle. In the early stages of an infection, clinical signs are usually mild and difficult to recognise even by experienced farmers or veterinarians. The incubation period of the virus can be as long as five weeks and by the time the characteristic skin lesions associated with more severe cases are detected, the virus has probably been circulating for some time and is likely to be well established within the herd. LSD is mainly transmitted by insect vectors. These vectors pick up the virus when they bite an infected animal and spread it to uninfected animals at their next blood meal. The most likely vectors are stable flies (*Stomoxys calcitrans*), mosquitoes (*Aedes aegypti*) and ticks (*Rhipicephalus* and *Amblyomma* species). Biting insects thrive in the warm, wet seasons and so there tend to be seasonal spikes in LSDV infection at these times, whilst disease incidence reduces in cooler winter months.

Once infection is established, morbidity (the number of cases within a herd) ranges from 5% to 45%. Mortality rates tend to remain fairly low and are usually below 10%.²

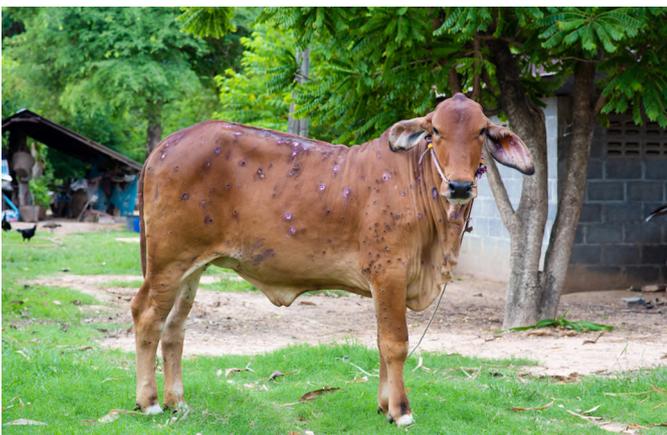


Figure 1. Generalised skin lesions



Figure 2. Characteristic lumpy skin disease lesions

The recent spread of LSD has been concerning and with global warming looking set to continue, insect vectors are likely to flourish, providing the perfect conditions for virus multiplication. Without adequate control measures, LSD is likely to become more of a threat to livestock in the coming years.

Protecting the Herd: Lumpy Skin Disease Vaccines

The reality is that LSD is an incredibly difficult disease to contain once it is established in a region. However, the advent of a number of safe, effective commercially available vaccines has been instrumental in placing control back in the hands of livestock farmers. Indeed, large scale regional vaccination has proven to be a very effective tool to prevent spread and vaccination is now key to controlling the disease. Due to cross-protection within the Capripox genus of viruses, sheep and goat pox vaccines provide some degree of protection against lumpy skin disease and heterologous poxvirus vaccines have been widely used in several countries to try and control the spread of LSD. However, the protection that such vaccines provide against LSD has been shown to be incomplete³ and in addition, these vaccines are associated with a number of adverse reactions in cattle. Live attenuated homologous vaccines based on LSDV (Neethling strain) are now considered preferable, with better efficacy and a reduced incidence of side effects. Attenuation of the virus strain ensures that the live virus is still able to stimulate an immune response to create immunity but is not capable of causing disease. One such vaccine is the MEVAC™ LSD vaccine from Kemin Biologics.

Efficacy of Live Attenuated LSD Virus Vaccine (Neethling Strain)

High quality LSD vaccines (Neethling strain) are advised to ensure adequate protection against LSDV infection. Poor quality vaccines with lower efficacy give a false sense of security and ultimately higher production losses, so should be avoided.

The degree of protection provided by a vaccine depends on a number of factors, including the level of attenuation, master seed strain virulence and the titre of the vaccine virus. High antigenic concentration (LSDV Neethling strain > 10^{3.5} TCID₅₀ in MEVAC™ LSD) will ensure a good immune response and high level of protection.

While experimental data is of value, proven field protection is of the utmost importance to farmers and their livestock, and at a wider regional and national level too. A field study in the Balkans, demonstrated excellent efficacy of Neethling strain vaccines, when LSD outbreaks in 2016 and 2017 were successfully eliminated by mass vaccination.⁴ The effectiveness of these vaccines was further confirmed by a challenge trial, in which vaccinated animals were purposefully exposed to LSDV – none of these experimentally challenged animals showed clinical signs of LSDV.⁵

Safety of Live Attenuated LSD Virus Vaccine (Neethling Strain)

Safety is just as important as efficacy when it comes to vaccine selection. LSD vaccines need to be safe for use in the whole herd, to include all age groups, all breeds and bovine species and both sexes, including pregnant cattle. The use of live attenuated LSD virus vaccines has been associated with mild side effects, sometimes termed a 'Neethling response'. These are generally self-limiting with no long-term adverse effects and can be considered a good indication that the vaccine is triggering an immune response.

The whole herd should be vaccinated in the spring before the higher risk seasons and booster vaccinations should be



given annually. Calves from vaccinated cattles should be inoculated from three months of age, with maternal immunity conferring protection in the first few months after birth. However the vaccine can be used from any age to ensure protection of calves born to unvaccinated cattle. One study showed that the vaccine gives high levels of immunity and no significant adverse effects when given at the recommended dose.

Case Study: The Thailand Vaccination Success Story

The successful control of an LSD outbreak in Thailand, demonstrates the key role that vaccination must play in combatting this global threat. On April 5th 2021, the first case of LSD was reported in Thailand. By December 2021 the virus had spread rapidly with cases in 68 out of 77 provinces and a total of 273,298 farms affected. The economic and welfare implications of this outbreak were significant, so it was vital that an effective control policy was implemented without delay.

An emergency vaccination program targeting dairy cattle, beef cattle and buffalo was instigated, using live attenuated Neethling strain LSD vaccines. This was divided into two main phases:

Phase One: Ring Vaccination

In the initial immediate response to the outbreak, 360,000 doses of a live attenuated Neethling strain vaccine were

administered to control the LSD outbreak by ring vaccination. Ring vaccination targeted all susceptible animals in a delineated area surrounding the outbreak and commenced soon after detection of the first case.

Phase Two: Widespread Vaccination

After phase one, the vaccination program was rapidly scaled up and five million doses of the MEVAC™ LSD vaccine from Kemira Biologics were administered. Initially areas where there were outbreaks, or regions of forest or natural park were prioritized with 80% coverage of the cattle population. Other areas were assessed individually, and vaccination programs determined on a local basis. Blanket vaccination, with vaccination of all susceptible animals in an area or province was frequently employed. By March 2022, 5 million doses were administered.

In 2021, there were a total of 1,747 outbreaks of LSD in Thailand. However, through the implementation of a prevention and control policy which focused on vaccination, by the end of 2021, 1,722 of these outbreaks had been resolved. With no outbreaks of LSD in the vaccinated population, the vaccination program was very effective (Figure 3).

Vaccination: Part of a Wider Prevention and Control Strategy

Vaccination is just one part of the wider strategy used to prevent and control LSD. Specific control strategies vary

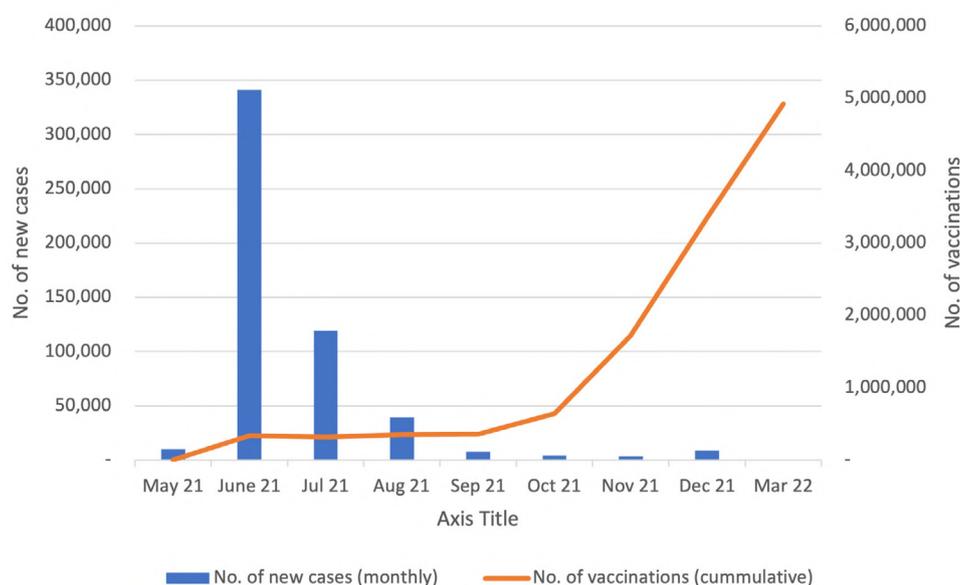


Figure 3. Case Study: Thailand 2021^{6,7}



in different countries so advice should be sought from the relevant national authorities and veterinarians. Most control strategies in the event of an outbreak will include:

- Movement control (quarantine)
- Vaccination
- Slaughter
- Management strategies including cleaning, disinfection, safe carcass disposal and vector control programs

However, quarantine restrictions have proven to be of relatively limited use, whilst slaughter programme rely on detecting disease early, are expensive to implement and have a substantial negative impact on farmers. Thus widespread vaccination campaigns together with prompt detection of the index case, remains the cornerstone of LSD control.

References

1. Dr. F. Glynn Davies, Lumpy skin disease of cattle: A growing problem in Africa and the Near East, FAO
2. Tuppurainen, E. et al (2017) Lumpy skin disease field manual – A manual for veterinarians. FAO Animal Production and Health Manual No. 20. Rome. Food and Agriculture Organization of the United Nations (FAO)
3. Hamdi, J. et al (2020) Experimental evaluation of the cross-protection between Sheeppox and bovine Lumpy skin vaccines. Sci Rep 10:8888
4. Calistri, P. et al (2020) Scientific report on the lumpy skin disease epidemiological report IV: Data collection and analysis. EFSA J, 18
5. Haegeman, A. et al (2021) Comparative Evaluation of Lumpy Skin Disease Virus-Based Live Attenuated Vaccines. Vaccines, 9:473
6. Data from Thailand Bureau of Disease Control and Veterinary

7. Service, Department of Livestock Development https://rr-asia.woah.org/wp-content/uploads/2021/12/02_thailand_lsd_control_vaccination_update_sp.pdf



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