Food and Agriculture Organization of the United Nations

Report of FAO Ad Hoc Group Meeting on Lumpy Skin Disease

Belgrade, Serbia, 25th July 2016

Purpose of the Meeting

FAO was requested by a number of Chief Veterinary Officers from Central and South-Eastern European countries to organize an ad-hoc group of lumpy skin disease (LSD) experts to meet and review current measures in relation to scientific evidence on LSD prevention and control.

Meeting Agenda

The following topics were tabled for discussion in order to inform any required revision of existing legislation. Any changes proposed must be technically sound, scientifically based, risk assessed and feasible.

1. Review and rank the potential ways that LSD virus could be transmitted from one infected holding to another, from the point of infection of animals to their carcass disposal on the site, including but not limited to
    a. presence of virus in cattle tissues and products, and notably in milk (and then in milk products), originating from affected cattle
    b. role of direct contact between animals in the transmission of LSD
    c. role of the ingestion of milk, water and feed in the transmission of LSD
2. Review current measures, and propose updated guidance, to be taken after confirmation of LSD on a holding, including the question of alternatives to on-site burial;
3. Review the Bulgarian proposals for modification to measures to be taken after confirmation of LSD in animals recently vaccinated against LSDV;
4. Review the Bulgarian proposals for (a) modification to measures relating to restocking of holdings depopulated after LSDV, and (b) movement of animals and animal products after vaccination;

In relation to potential future spread of LSD,

5. Identification of likely scenarios for spread of infection within the Balkan and Central European region and impact and likely duration of control options, that could be assisted by modelling and other studies;
6. Identify essential information that need to be collected and shared by affected countries, particularly to assist modelling of spread and impact of measures, and to enable review of the effectiveness of currently used vaccines

Participants

See Annex 1.

Item 1. *Review and rank the potential ways that LSD virus could be transmitted from one infected holding to another, from the point of infection of animals to their carcass disposal on the site.*

Conclusions: The main risks for transmission are associated with transfer of virus by vectors feeding on live infected animals and possibly direct contact between infected and naive animals. Illegal movements of live animals were highlighted as a problem in Bulgaria. The possibility of virus transmission by non-biting arthropod vectors that feed on infected carcasses and mechanically transmit virus cannot be excluded although no studies have been published on the role of non-biting vectors in transmission of LSDV. Other indirect routes of transmission are of much lower risk. Meat is not considered to be a significant risk for transmission and the risk posed by milk not destined for animal consumption can be mitigated by pasteurization and transportation in closed containers. Raw hides are more likely to be contaminated with virus than meat or milk. The relative risk of transmission from subclinically infected and recently vaccinated remains to be determined. By 21 days after vaccination, animals should develop protective immunity and are expected not to transmit infection.

Recommendations: More transmission studies are needed to better understand risks. The priority actions to prevent transmission are culling and safe destruction of infected animals, vaccination to reduce shedding and susceptibility, and movement controls to avoid long distance spread via direct contact or via insect transmission at arrival or during transport.

Commodities from healthy animals vaccinated at least 28 days earlier carry a very low and probably negligible risk for spreading LSD.

Item 2. *Review current measures, and propose updated guidance, to be taken after confirmation of LSD on a holding, including the question of alternatives to on-site burial;*

Conclusions: The practicality of different measures of carcass disposal depends upon many factors, including the numbers of animals involved, the environment and the availability of resources and facilities. Some affected countries rely on the routine veterinary services and do not have specialist teams to assist with such operations. Alternatives to on-site burial include other on-site disposal methods and off-site disposal. On-site incineration by pyres or mobile incinerator units may be possible in some circumstances. Off-site alternatives include movement of suspected or apparently healthy in-contact live animals for slaughter at abattoirs to provide heat treated meat products. This practice is used in the Russian Federation, depending on the availability of on-site disposal units, but there is a risk of vector-borne spread from the live animals during transit and at the abattoir. However, animals with severe clinical manifestation are to be killed on site, followed by transportation of carcasses to incinerating facilities. On-site killing followed by movement of carcasses for rendering, burial, or incineration, etc. might carry some risk due to the possible feeding of non-biting arthropod vectors on the carcasses prior to their disposal. Vector control is difficult and may lead to environmental damage for little benefit. There is a need to further assess the survival of the virus in the environment and its infectious potential as well as the role of different vector species in transmission.

Recommendations: A range of different options are possible, but movement of live animals with clinical disease is a high risk strategy and even after death, measures should be taken to prevent access of potential vectors to carcasses prior to disposal, including spraying with disinfectant and insect repellants and covering. Timely and thorough cleaning and disinfection of affected, stamped out premises are essential.

Item 3. *Review the Bulgarian proposals for modification to measures to be taken after confirmation of LSD in animals recently vaccinated against LSDV. The proposal is for modified stamping out of herds vaccinated in the last 28 days, with only clinical cases culled.*

<u>Conclusions:</u> Vaccination with Neethling vaccine strain is expected to provide immunity against infection within 21 days. Most outbreaks that have occurred in vaccinated holdings in Bulgaria and Serbia have taken place within 14 days of vaccination, although one case was reported in Serbia after 19 days. In the Russian Federation, a live attenuated sheep pox virus vaccine strain is used.

Vaccinated animals can sometimes show clinical signs that resemble mild LSD (sometimes referred to as "Neethling disease"). Differentiation between vaccine and wild type virus by laboratories may be possible within 1-2 days using differential PCR or sequencing. This may delay slaughter of affected animals, especially if samples have to be referred to specialized laboratories in other countries.

As clinical cases represent the highest risk for virus spread, they should be culled and destroyed as soon as possible. Subclinical cases are probably a lower risk and in a vaccinated population, susceptibility of potential recipients to become infected will also be reduced.

In Israel, different culling approaches have been combined with vaccination from complete stamping out in the first outbreak in 1989 through modified stamping out and vaccination in 2004 to vaccination of the whole country cattle population with very limited culling of severe clinical cases in 2013. This latest approach was found to be effective at controlling the disease, which has not recurred in the last three years. Other vector borne diseases such as bluetongue in Europe have been controlled using vaccination without culling but applying a strict movement control. This incorporated a waiting period of 60 days post vaccination (dpv) before allowing movement, or 28 dpv after serological testing, or 14 dpv after testing using PCR.

In some recently affected countries, such as the Russian Federation and Serbia, modified stamping out is used in vaccinated herds and only clinical cases are culled. It is not yet possible to evaluate the effectiveness of such approaches in these countries. The experience of the Russian Federation in fighting LSD in 2015, when total stamping out (diseased and in-contact apparently healthy animals) was carried out, was that this approach was effective but very costly.

Current EU legislation in place requires Member States to cull all animals in an infected herd even if that herd has been vaccinated.

Culling of clinical cases in vaccinated herds could be supplemented by laboratory tests on the remaining animals subject to available laboratory capability. Serological tests could be used to check post vaccination immunity and virological testing to identify and cull viraemic animals sub clinically infected with wild-type LSD virus. However, false negative test results for viraemia are possible and there will be a time delay between sampling and test results during which further spread of the virus might occur.

Culling of vaccinated animals is not well accepted and may reduce the uptake of vaccination as well as the reporting of clinical cases. The former may have a negative impact on solidarity for preventive vaccination to protect neighboring countries.

The measures required for eradicating infection as quickly as possible may differ from those that may be sufficient for more cost-efficient disease control and eventual eradication.

<u>Recommendations:</u> Countries without the laboratory capacity to differentiate vaccine and wild type virus and to undertake serology require support for training and/or in referral of samples for testing by reference laboratories.

The case for using modified stamping out in vaccinated populations has a rational basis and should be subjected to socioeconomic analysis and further modeling to determine the cost benefit under different situations. A flexible approach is probably warranted but a minimum time after vaccination must be agreed upon.

Item 4. *Review the Bulgarian proposals for modification to measures relating to (a) restocking of holdings depopulated after LSDV, and (b) movement of animals and animal products after vaccination.*

(a) The proposal on restocking is that animals vaccinated at least 28 days before could be moved onto premises that have been stamped out once at least 40 days have elapsed after cleansing and disinfection and so long as there have been no outbreaks within 20 km.

<u>Conclusions:</u> Although LSD virus has the potential to survive for prolonged periods in the environment, the risk of infection from environmental contamination is low (especially for vaccinated animals) and should be greatly diminished by proper cleansing and disinfection. The possibility of long term virus survival in vector populations cannot be excluded with certainty.

Vaccinated animals, once immune, have greatly reduced susceptibility to infection, whether from residual infectivity on depopulated, cleaned and disinfected premises or from risks attributable to virus activity on neighboring premises. General depopulation is not part of the strategy for reducing the spread of LSD.

Where culling has been used without vaccination or where the use of vaccination has been limited, there may be logistical difficulties in finding vaccinated animals for repopulating premises after stamping out.

<u>Recommendations:</u> Restocking should be possible after a minimum period of 21 days, as specified in current EU legislation, providing that the restocked animals have been vaccinated at least 28 days before and that thorough cleansing and disinfection have been carried out, both mitigations being confirmed by veterinary certification.

(b) The proposal on movement of animals and animal products after vaccination is that animals could be moved from one vaccination zone to another once 28 days have elapsed since vaccination. Furthermore, this could include movement from a vaccination zone in one country to a zone of the same status in another country.

<u>Conclusions:</u> Movement of animals is not possible from protection or surveillance zones, so this proposal applies only to animals outside such zones or after such zones have been lifted.

Vaccinated animals have a greatly reduced risk of becoming infected or of spreading infection.

It is logical to allow movements of animals between vaccination zones of equivalent health status.

Due to the potential for vector-borne spread of LSD, transiting animals through a zone of higher health status is an unacceptable risk, especially if such transit is in other countries.

<u>Recommendations:</u> Movement of vaccinated animals should be allowed between vaccinated zones of equivalent health status within the same country and within different countries providing that transit does not take place across a region of higher health status and that all animals to be moved are subject to veterinary inspection and health certification.

Item 5. *Identification of likely scenarios for spread of infection within the Balkan and Central European region and impact and likely duration of control options that could be assisted by modelling and other studies*

<u>Conclusions:</u> In Southern Central Europe, LSD has been reported this year from Greece, Bulgaria, FYR of Macedonia, Serbia, Albania, Montenegro and the Republic of Kosovo.. Vaccination has nearly been completed throughout Bulgaria, Serbia and FYR of Macedonia. The threat to Western Europe is likely to be through Romania or via Bosnia and Herzegovina and Croatia. There has been little evidence that topography interferes with virus spread. All available evidence so far indicates that preventive vaccination is crucial to combating the spread of the virus. Further, preventive vaccination in Bosnia and Herzegovina, Croatia and northern Serbia would create a buffer zone to protect Hungary, Romania and beyond.

The restricted zone in countries applying emergency vaccination should be large enough to prevent the spread to other regions. Countries facing a threat of LSDV introduction should urgently establish a vaccination programme.

<u>Recommendations:</u> Contingency preparations for preventive vaccination are essential to support and encourage any newly affected countries to extend their vaccination zones beyond the initial foci of infection and thereby stop onward spread to further countries. Modelling studies may be helpful, but the needs are relatively obvious.

Item 6. *Identify essential information that needs to be collected and shared by affected countries, particularly to assist modelling of spread and impact of measures, and to enable review of the effectiveness of currently used vaccines*

<u>Conclusions:</u> Collection of full information about outbreaks, risk factors, epidemiological enquiries, vaccination coverage, vaccine breakdowns, etc. is essential to establish and quantify risk factors for the spread of infection. Countries should have a cattle identification database that includes vaccination and laboratory test result data at both individual and herd levels. EuFMD has been collaborating with regional veterinary services to collect outbreak

data as well as regional denominator and vaccination data. This can be combined with geographical information (lakes, rivers, roads, topography, etc.) and climatic data.

Disease control operations tend to take priority over activities directed at improving future understanding. For example, during culling, sampling of sufficient animals to determine holding attack rates and the extent of subclinical infection or to evaluate diagnostic tests may be neglected. Additional resources may be provided by researchers and local veterinary schools. Even where laboratory capacity to immediately test such samples is lacking, there is value in their collection for later evaluation.

The manufacturers of the Neethling strain vaccines are not licensed in Europe and might not meet the GMP standards normally expected. In Israel, but not Europe, the quality of each batch of vaccine purchased for LSD control was checked for potency and inocuity.

The LSD vaccine manufacturers recommend annual revaccination. This is partly dictated by animal turnover but the duration of immunity is poorly understood, even if a figure of 2-3 years appears in the literature. Correlates of protection are not established, but it would be useful to obtain information about post-vaccination antibody dynamics.

There is a need to collate data on levels of adverse reactions to vaccination and especially numbers of cases presenting with clinical signs similar to LSD.

In Bulgaria, some potential vector species have been collected to test for carriage of LSD virus but no systematic studies are being made.

Recommendations: FAO should coordinate the development of a check list for the minimum required information to be collected during outbreak investigations to harmonize data collection for modelling to quantify risks of disease spread in different countries, whether currently experiencing outbreaks or that may do so in future.

Collaborations should be established between veterinary services of affected and at risk countries and suitable national and international experts in epidemiology, modelling, diagnosis and vector biology. They should cooperate in developing and implementing applied field studies to evaluate questions that can only be answered during outbreaks, such as which vectors are carrying LSD virus and how far they can fly, what is the attack rate of animals in affected herds, what are the antibody dynamics of the immune response to vaccination. Small longitudinal studies to follow up outbreaks or vaccination are required. A portfolio of study designs could be drawn up by reference laboratory experts. Potential sources of funding for such studies should be investigated.

Israel has not used stamping out after the 2013 outbreaks and so animals are alive that could be studied for duration of immunity including their possible purchase and challenge under controlled conditions in biosecure facilities.

Countries using vaccination should monitor vaccination coverage. Contingency preparations for vaccination should include quality checks on vaccines purchased for future emergency use.

As a general conclusion, it is clear that there are many gaps in knowledge that need to be filled by research, for example about the nature, onset and duration of vaccine induced immunity, and the presence, survival and significance for transmission of virus in animal products, the environment and different vectors. Applied research is also needed, for example to develop and validate simple tests for differentiating wild type and vaccine virus and for high-through put serological assays.

Annex 1. List of participants of ad-hoc meeting of Lumpy skin disease experts, Belgrade, Serbia 25 July 2016

Name	Institution
Pip BEARD	The Pirbright Institute
Friedrich SCHMOLL	NRL – AGES
Giovanni CATTOLI	Joint FAO/IAEA Division, Vienna, Austria, Head of the APH Laboratory
Nadav GALON	Chief Veterinary Officer of Israel
Kris DE CLERCQ	Coda-Cerva, Belgium
Eeva TUPPURAINEN	Veterinary Expertise for Controlling Lumpy skin disease, Sheep pox and Goat pox, Finland
David PATON*	FAO Consultant
Budimir PLAVŚIĆ	Ministry of Agriculture and Environmental Protection, Head of Veterinary Directorate
Márk HÓVÁRI	National Food Chain Safety Office, Hungary
Eran RAIZMAN	FAO HQs, Head of EMPRES
Andriy ROZSTALNYY	FAO Regional Office for Europe and Central Asia
Marius MASILIUS	FAO HQs, EuFMD
Alexander SPRYGIN	Head of the Reference Laboratory for Bovine Diseases
Daniel BELTRAN-ALCRUDO	FAO Regional Office for Europe and Central Asia
Klaas DIETZE	The Friedrich Loeffler Institute, Germany
Petya IVANOVA	Deputy Executive Director of the Bulgarian Food Safety Agency (BFSA), Bulgaria
Tsvyatko ALEXANDROV	Head of department, 'Animal health and welfare and feed control' Directorate (BFSA), Bulgaria

*** Meeting Chairman and Rapporteur**