Food and Agriculture Organization of the United Nations

TAD SCIENTIFIC

FMD Technical Bulletin

Food and Agriculture Organisation of the United Nations Initiative: Assistance to Zimbabwe with development of an updated foot and mouth disease control strategy

(Part of a wider regional project aimed at development of non-geographic approaches to management of FMD trade-risk through application of commodity-based trade)

Introduction

Foot and mouth disease (FMD) occurred widely in cattle in Zimbabwe in 2014 and 2015 (a total of 158 outbreaks being reported to the World Organisation for Animal Health [OIE]) with the result that livestock farming and the beef industry in Zimbabwe were severely affected, not so much by the disease itself but the consequent animal health control actions (*Figure 1*). The Food & Agriculture Organisation (FAO) - using funds from two FAO TCPs (TCP/ZIM/3502 and TCP/ZIM/3503), together with the European Union (EU) funded project GCP/ZIM/022/EC, assisted the Ministry of Agriculture Mechanization Irrigation and Development (MAMID) through the Division of Livestock and Veterinary Services (DLVS), to respond to the FMD emergency primarily through the purchase of vaccine. Additionally, a consulting company – TAD Scientific, based in South Africa – was contracted by FAO in early December 2015 to provide technical support to the DLVS to update its FMD management strategy.

Activities associated with this consultancy have so far involved fact-finding visits to various locations including Gokwe, Tsholotsho, Gwanda, Beit Bridge and Chiredzi with consultative workshops held in Harare, Bulawayo (twice each) and Masvingo over the periods 7-12 December 2015 and 1-19 February 2016. This enabled an appraisal of the current FMD situations in the country and consultation with a broad spectrum of stakeholders covering both the public-and private sectors. Issues of concern so far identified by stakeholders and the consultants are summarised in *Table 1*.

This is the first of regular Bulletins that will be released over the next 5-6 months on the progress of this FAO/EU initiative.

General information on FMD

Foot and mouth disease (FMD) affects cloven-hoofed animals and is caused by a group of viruses belonging to the Aphthovirus genus. This genus is a member of a large family of viruses (Picornaviridae) that cause a number of human diseases such as poliomyelitis (polio), the common cold and hepatitis (hepatitis A), as well a wide range of infections of mammals, birds, reptiles, amphibians and fish.

Animals suffering from FMD develop blisters in the mouth and skin just above and between the 'claws' of the hoof. Although the disease kills few animals it can result in serious production losses in intensively farmed livestock such as pigs and dairy cattle. On the other hand, the types of FMD that occur in Zimbabwe and most other southern African countries generally cause a mild disease in cattle raised in extensive production systems and is therefore sometimes difficult to detect by simple visual inspection. Almost all affected animals recover uneventfully within a week or two. The importance of the disease is largely due to its effect on trade in cloven-hoofed animals and their products because developed countries from which FMD has been eliminated fear re-introduction of the disease.

Resting buffaloes

Important features of FMD viruses in Zimbabwe

Two broad groups of FMD virus occur in the world today: (1) the so-called 'Eurasian' types (O, A & Asia 1 – type C seems to have spontaneously disappeared worldwide) that evolved in Eurasia in association with domestic livestock and (2) the SAT types (1, 2 & 3) that evolved in sub-Saharan Africa in association with African buffalo. An important difference between these two groups of viruses is that the SAT types are more difficult to control or eliminate

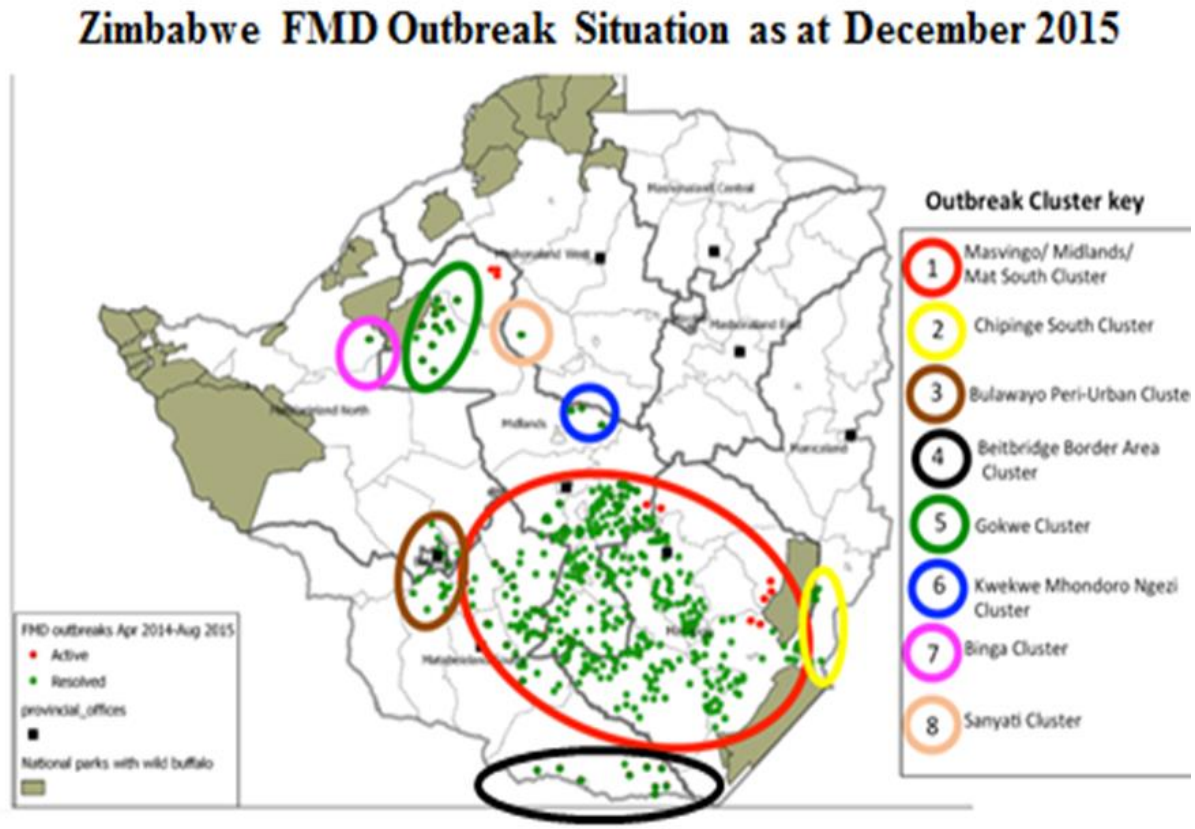

Fig. 1 Most recent available map of FMD outbreaks in Zimbabwe (kindly supplied by Dr J. Nyika), DLVS

Note: The circles denote FMD outbreaks that were associated by time and place, i.e. had temporal and spatial association, but do not take phylogenetic relationships between the causative viruses into account. It needs to be recognised that at least two serotypes (SAT1 and SAT2), including three lineages of SAT2, were involved in these outbreaks. This information cannot be included in this map because the viruses causing most outbreaks were not sequenced.

In one sample of epithelium from Gokwe, both SAT1 and SAT2 viruses were identified, i.e. indicating that the animal concerned suffered dual infection (not uncommon where more than one virus is involved in disease causation in a locality)

than the Eurasian types, not only due to their intimate association with wildlife, but also for other technical reasons. Among these is the difficulty of producing vaccines that 'match' the wider diversity of SAT type viruses that are currently endemic to many locations in sub-Saharan Africa.

So FMD viruses endemic to Zimbabwe are essentially buffalo viruses that have been present in the region for about 1000 years. However, these viruses have little or no ill-effect on the buffaloes themselves, but they occasionally 'spill over' into cattle especially, as well as other cloven-hoofed animals (goats, sheep, pigs & antelope), that come into contact with buffalo.

All three SAT types of FMD virus are endemic to buffalo in Zimbabwe's major national parks (Hwange, Gonarezhou, Matusadona, Chizarira, Mana Pools and Zambezi) as well as some other conservation areas – although some of the latter contain only artificially reared FMD-free buffalo. Historically, different topotypes (topotype = genotype with a specific geographic distribution) of all three SAT viruses were associated with different national parks in Zimbabwe. For example, for SAT2/topotype II was originally restricted to buffalo in and around Hwange NP, Botswana, southern Zambia and the Zambezi Region of Namibia, while SAT1/topotype II was originally

Cattle grazing close to the Buffalo Fence – Hwange National Park

associated with Gonarezhou (south-east Zimbabwe), northern South Africa (Kruger National Park) and adjacent areas of Mozambique.

The net result of this situation is that Zimbabwe historically suffered from a more complicated FMD situation than any other southern African country because the SAT viruses endemic to Zimbabwe represent more viral variants than are present in other southern African countries. It always was, and remains, difficult to manufacture FMD vaccines that are effective against all topotypes of SAT viruses endemic to Zimbabwe.

Conservancy fence – South-east Zimbabwe

The current FMD situation in Zimbabwe

Between April and August 2015, 19 samples were collected from cattle involved in some FMD outbreaks in progress at that time (*Figure 1*). These samples were submitted to the FAO's World Reference Laboratory for FMD (Pirbright Laboratory, UK) with the assistance of FAO Zimbabwe and FAO HQ, in Rome. The results obtained in December 2015 revealed that four significantly different SAT viruses were associated with the 19 samples sent to the Pirbright Laboratory: SAT1/topotype II and three different lineages of SAT2/ topotype II. Most of these viruses were obtained from outbreaks in widely separated locations, indicating multiple routes and/or mechanisms of spread (*Table 2*).

The historic distribution of SAT viruses in Zimbabwe would suggest that the SAT1/topotype II viruses originated in south-east Zimbabwe while the three lineages of SAT2/topotype II virus were likely to have originated in the Hwange NP area, i.e. western Zimbabwe. However, there is a problem with this interpretation because on several occasions in the past, large numbers of buffalo (almost 1000) were moved from Hwange and Matusadona NPs to conservancies in the south-east of the country. Therefore, it could be that new topotypes have been introduced to and are maintained by buffalo in the south-east lowveld of the country and from there are able to spread to cattle in that region.

Whatever the case, there is reliable evidence that two different types (SAT1 & SAT2) of FMD virus, comprising two topotypes, one of which (SAT2/topotype II), comprised three separate lineages, some of which circulated widely in the cattle population of Zimbabwe in 2015. It is likely that in most instances these viruses are no longer present in areas in which outbreaks occurred. On the other hand, it is possible that some of these viruses are still circulating at a low level in cattle because infection in cattle as well as goats, sheep and wildlife is sometimes difficult to detect by visual inspection. The laboratory results also indicate that the SAT virus topotypes in Zimbabwe are no longer confined to their historical locations.

Conclusion

The molecular epidemiology of FMD in Zimbabwe in recent years would appear to be more complex than was the case historically; this is important in developing an up-dated strategy against the disease. In particular it needs to be ascertained that available vaccines 'match' the diversity of FMD viral variants involved in recent FMD outbreaks in Zimbabwe.

Acknowledgements

This Bulletin was assembled with information gathered from a spectrum of livestock value chain actors; additionally, technical advice and laboratory data were provided by the Department of Livestock and Veterinary Services (DLVS), Zimbabwe. Dr. Nick Knowles of the Pirbright Laboratory, UK, also provided helpful input. The professional excellence of these inputs is gratefully acknowledged.

Table 1: **Issues related to FMD identified during the three stakeholder workshops held in Bulawayo, Masvingo & Harare over the period 7-11 December 2015[1]**

Basis issue	Questions/remarks offered by stakeholders	Comment
Management of FMD	⇒ System required to monitor and enforce compliance with standard operating procedures (SOPs) once Implementation framework is endorsed	Implies the need for an system within DVS to ensure uniformity
	⇒ The strategy must not lower the veterinary standards that have been achieved by the country so far (strategy should augment and improve existing veterinary standards)	Perhaps need to identify which standards are under particular threat
	⇒ Diagnostic capacities need to be improved to validate disease absence, particularly in the so called 'free zones' ⇒ There is need to capacitate Department of Veterinary Services (DVS) in terms of vaccine allocation to the provinces, laboratory capacity needs to improve, and also mobility of personnel	
	⇒ What if the disease spreads to all parts of the country? Would there be a need for veterinary restrictions?	Probably – although in modified form – because such a situation would need to be countered
	⇒ Conservancies should pay fees, veterinary services to control the disease at source, and develop policies that contain cattle-to-cattle transmission	Need for private sector/value chain stakeholder involvement in control of FMD. However, if the private sector is obliged to contribute it would need to have a say in policy & implementation
	⇒ Some quarantine properties in the province (Masvingo) have been converted to private property and these need to be repossessed by Government so they serve the intended purpose.	This is an important consideration when it comes to future animal identification & traceability policy & possibly if we want to follow the Namibia route linking quarantine stations with CBT
	⇒ Lack of resources cited by ZRP is affecting their mobility in carrying out anti-stock theft duties ⇒ There is need for a dedicated unit for anti-stock theft (i.e. not employed for other tasks) ⇒ Primary outbreaks have always been linked to buffalo cattle contact	This opinion was reiterated by many people but there is little evidence that that is so
Animal movement & traceability	⇒ Fences are broken down and movement of cattle and game is free of barriers (increased cattle/wildlife interaction or interface due to broken down fences) ⇒ There is need to control cattle movement; currently there is free movement of cattle, particularly in drought prone areas, in search of grazing and water sources	Fences around conservancies identified as a major issue (see below)
	⇒ Current penalties for illegal movement not effective; judiciary needs to impose more severe penalties	Penalties are guided by existing statutory instruments/regulations and therefore this needs to be part of the legislative review process that has been initiated by DVS. FAO is to help fund this process.
	⇒ Poor grazing has resulted in cattle being moved around illegally	Water also presumably
Effect of FMD on livestock & livestock owners	⇒ The farming environment is now different. An old commercial farm has now been divided into 40 to 50 plots	
	⇒ Stakeholders want to know the effect of the disease on the animal itself ⇒ Farmers bemoaned loss of formal cattle sales, the main source of livelihoods for both communal and commercial farmers/ All that farmers need are permits for them to move and sell their cattle	The inference is that loss of trade is the major issue; the effect of FMD on productivity was not mentioned by stakeholders This was identified as a vital issue
	⇒ Stakeholders are sometimes being required to fund vaccine procurement	Nothing on the ground as yet, but dairy farmers are purchasing own vaccines and also vaccine for surrounding communal farmers in order to protect their stock

[1]Based on notes taken by Dr. Wilmot Chikurunhe, DLVS

Table 1 cont: **Issues related to FMD identified during the three stakeholder workshops held in Bulawayo, Masvingo & Harare over the period 7-11 December 2015[1]**

Basis issue	Questions/remarks offered by stakeholders	Comment
Trade effects of the current FMD situation	⇒ There is need to address the marketing system with the idea of getting rid of the 'speculator' ⇒ The 'middlemen' do a lot of harm to the value chain: (1) the farmer does not get good value for his/her animals & (2) there is risk of disease spread as he/she moves cattle all over the country in search of good prices	How does one define a speculator? With the demise of the CSC what alternative is there to 'middlemen'? This is an issue around which there are stark differences of opinion
Trade effects of the current FMD situation cont:	⇒ The European market is likely to present other hurdles even if we were to meet their FMD requirements ⇒ Consider the cost of compliance in an environment of limited resources	Common opinion in some other SADC countries Compliance rules vary with the target market – some much lower than EU
	⇒ We must identify markets that will take our beef	Common conclusion in some other SADC countries
	⇒ Following an outbreak, abattoirs are closed for significant periods of time causing huge losses to business ⇒ The most harmful effects of FMD outbreaks result from movement restrictions that always follow the outbreaks	Question: Is the trade-loss worth the benefit afforded to disease control by movement restriction? Same question as above
	⇒ All abattoirs sending meat to Harare to have a pH metre to monitor maturation	This opinion can be seen in a wider context than simply pH metres – what about other infrastructural & regulatory requirements?
	⇒ There is need for an abattoir in Mwenezi so that most of the cattle are slaughtered and only moved as meat	Can also be interpreted in a more general sense, i.e. need to maximise carcass movement in order to minimize movement of live cattle (carcasses present a much lower risk than live animals)
	⇒ Can farmers still trade when animals are in a vaccination or endemic zone?	Important to understand that safety of meat can be ensured in ways other than creation of zones free from FMD where vaccination is not practised
Wildlife issues	⇒ There is need to strongly involve the wildlife sector	
	⇒ Why does National Parks issue hunting licenses to unregistered properties? Local Parks office has no power as quota-setting is done centrally in Harare ⇒ Farmers in Mateke Hills refused buffalo to be moved to parks and conservancies when they were settled there 4 years ago. Now they apply to National Parks and get hunting permits for buffalo that are on unfenced properties	High-pressure hunting does present the risk of buffalo dispersion. However, if hunting is limited the risk is probably not high The meat of hunted buffalo probably presents a low risk – lower than cattle
	⇒ Masvingo farmers see a double fence around buffalo properties as being very important and spoke strongly against the idea of a single fence as perimeter fencing for conservancies	This is an debatable technical issue that needs to be addressed & take previously published studies in Zimbabwe into account
	⇒ Conservancies and other value chain players have to play a part in financing FMD control activities	This opinion was voiced by a number of stakeholders
	⇒ FMD always comes from conservancies and affects surrounding communities who themselves do not benefit from the proceeds derived by conservancies ⇒ Conservancy perimeter fences must be maintained without compromise	This contention that FMD is always derived from wildlife is a widely-held belief but proof is lacking
	⇒ There are people who have been legally resettled in the conservancies especially Save Valley Conservancy. There is need for a solution to this problem ⇒ People illegally settled in conservancies must be moved out	Livestock owners living legally within conservancies was identifies as a fundamental issue for future FMD management

[1]Based on notes taken by Dr. Wilmot Chikurunhe, DLVS

Table 1 cont: **Issues related to FMD identified during the three stakeholder workshops held in Bulawayo, Masvingo & Harare over the period 7-11 December 2015[1]**

Basis issue	Questions/remarks offered by stakeholders	Comment
Education & Training	⇒ There is need for capacity building to educate farmers in understanding of FMD	Is this only the case for farmers?
Issues raised by the consultant	⇒ SAT serotype FMD in Southern Africa is generally different from Eurasian serotypes in that the disease generally spreads slowly & is often manifest as mild or unapparent disease	This implies that current international standards are not necessarily the best option for managing FMD in southern Africa.
	⇒ Zimbabwe has a more complicated FMD problem than other SADC countries because for all three SAT serotypes, three 2 or 3 topotypes exist within the borders of the country. This implies multiple variants of SAT viruses within the country	Obtaining vaccines that cover effectively against all the SAT variants is therefore at least difficult
	⇒ The fear is that SAT serotypes of FMD virus will become endemic in the cattle populations of Zimbabwe (as has happened in some other African countries).	The possibility that this has already occurred needs to be investigated. If that is not the case it should be demonstrated scientifically
	⇒ Beef is a very safe product. Non-geographic trade standards can be exploited to harvest and market beef from FMD endemic areas	Examples given of Farmers Choice in Kenya & Indian beef producers who have found a way of producing and marketing beef in the face of FMD endemicity
	⇒ At least 5/20 leading international beef exporting countries are endemically infected countries that lack FMD-free zones. So successful trade is possible even in the presence of FMD	This demonstrates that FMD freedom is not as vital when it comes to trade as some believe, though of course reducing the impact of the disease remains essential

[1]Based on notes taken by Dr. Wilmot Chikurunhe, DLVS

Table 2: **Summary of conclusions based on phylogenetic analysis provided by the Pirbright Laboratory (FAO World Reference Laboratory, UK) on viruses involved in FMD outbreaks in cattle in Zimbabwe in 2015**

FMD virus type	Topotype designation	Historic distribution of topotype/lineage by province (location)	Topotype lineage designation	Province(s) where the topotype/lineage occurred in cattle in 2015 (location)	Comment
SAT1	II	Masvingo (Gonarezhou NP)	N/A	Midlands (Gokwe); Manicaland (Chipinge)	
SAT2	II	Matabeleland North (Hwange NP)	a	Midlands (Gokwe)	
SAT2	II	Matabeleland North (Hwange NP)	b	Bulawayo	This outbreak virus is likely to have been introduced by cattle from elsewhere in Zimbabwe because no infected buffalo are located in the Bulawayo vicinity
SAT2	II	Matabeleland North (Hwange NP)	c	Bulawayo; Midlands (Gweru, Shurugwi, Kwekwe); Manicaland (Chipinge)	This lineage appears to be related to SAT2 outbreak viruses that were sequenced from locations in Zimbabwe in 2013, 2014 & 2015, i.e. it appears to be a well-established lineage in cattle in Zimbabwe

COMMENT/DISCUSSION

Should you have any questions or comments relating to this edition of the FMD Technical Bulletin, please send an email to the following:

Elma Zanamwe-Sikala: Elma.Sikala@fao.org and/or **Patrick Otto**: Patrick.Otto@fao.org