

Temperature conditions prevailing within wool stores and within wool bales shipped in containers

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Introduction

Wool, which is a hygroscopic material, falls under the classification group of cargo that requires particular temperature, humidity and possibly ventilation conditions when stored or transported. From the Procedures for inactivation of Foot Mouth Disease Virus (FMDV) present in wool and hair for industrial use, article 8.8.32 of the **The World Organisation for Animal Health (OIE) Terrestrial Animal Health Code** based on work done by McColl et al⁽¹⁾ the following storage “minimum” conditions are required to remove FMDV inactive : 4°C for four months, 18°C for four weeks or 37°C for eight days.” As shown in Figure 9, McColl demonstrated and recommended that simple storage of FMDV-contaminated wool at 18°C, or higher, for 4 weeks or scouring of contaminated wool at 60°C to 70°C would be sufficient to prevent FMDV-contaminated wool being infectious to other animals. Depending upon the initial temperature of the wool and other factors, approximately four weeks should allow time for the temperature of wool throughout a bale to reach the required temperature of say 18°C, at which inactivation of FMDV can take place, provided sufficient time is allowed. From Figure 9, one can conclude that for FMDV to be inactivated (destroyed) in wool, the conditions of storage must be such that the number of storage days at a specific storage temperature, lies above the curves in Figure 9, i.e. if the number of days is plotted against the storage temperature, the point should be above the lines of McColl.

Since 90% of SA wool is exported in greasy form, and no work had been done on the temperature conditions during the transporting of wool within containers, an investigation was launched to find out under what temperature conditions SA wool is being stored in wool stores and, especially, during the transport of the wool bales in containers to overseas companies. This was with a view to establish whether the conditions of such storage would cause the FMDV to be inactivated and render the wool safe for processing.

Methods

The temperature within and outside (around) bales in containers shipped to various countries during all four seasons was monitored at five positions (Figure 1) in each container with pairs of temperature loggers (Figure 2). Within the containers, the five sets of loggers were mounted at the different positions on top of the bales (Figure 3) with probes also inside the bales, thereby recording the ambient

temperature and humidity within the container and within the bale. Temperature readings were also taken at the two wool stores (Figure 4), store 1 during December 2016 and February/March 2017 and store 2 during March/April/May 2017 and May/June/July 2017, however only ambient temperature outside the bales within the stores near the area of dispatchment was measured.

Two brokers, Modiano and Standard Wool, collaborated in the project to ship wool from both stores respectively. From store 1, five consignments were sent during Sept, Oct and Dec 2016 and Feb and May 2017. From store 2, seven consignments were sent during Sept, Oct and Dec 2016 as well as Feb, April, June and September 2017 periods respectively. All consignments were dispatched from Port Elizabeth and were destined for Czech Republic (Prague), China and India (thus via the Atlantic Ocean and Indian Ocean, respectively).

Results and Discussion

The temperatures were generally recorded over a period of some 44 days, of which some 25 to 28 days were when the ship was on the open sea. During this time the average temperature on sea along the Atlantic Ocean to Prague was 19.8°C and on the Indian Ocean 28°C to China and 34°C to India, (Figures 5 to 7) (more other results can be seen in a more compiled report by Botha²). The temperatures within the stores over similar periods than that of the shipments, were recorded as shown in Figure 8, having average temperatures 22.5°C, 23.7°C, 20.2°C and 16.9°C, respectively. As was reported in the final report² for the shipments, comparing the shipments recorded data versus that of the stores, one could see that they are similar (the variations from night to day of the ambient results on the ships). If one would have recorded the temperature readings within a bale in the store, much even recorded data would also have been recorded, thus the concluded results can also be as that of the consignments for the stores.

From this study and the work of McColl et al⁽¹⁾ and taking both land (stores, trains, or trucks) and sea storage into consideration, in all cases the criteria for FMDV inactivation were met, or exceeded (Figure 9). Hence according to this study, **South African wool will be safe if transported to countries abroad, like China, India and Prague, or kept in stores waiting to be transported, if DMDV brakes out.** It is also concluded that a minimum of 20 days storage at a minimum temperature of 15°C or higher to ensure inactivation of FMDV, based upon the work by McColl.

References

1. McColl, KA, Westbury, HA, Kitching, RP and Lewis, VM, ***The persistence of foot-and-mouth disease virus on wool***, Australian Veterinary Journal, 72(8), Aug 1995.
2. AF Botha, The measurement and control of temperature conditions within wool bales being transported, CWSA Final report, 16 Jan 2019.

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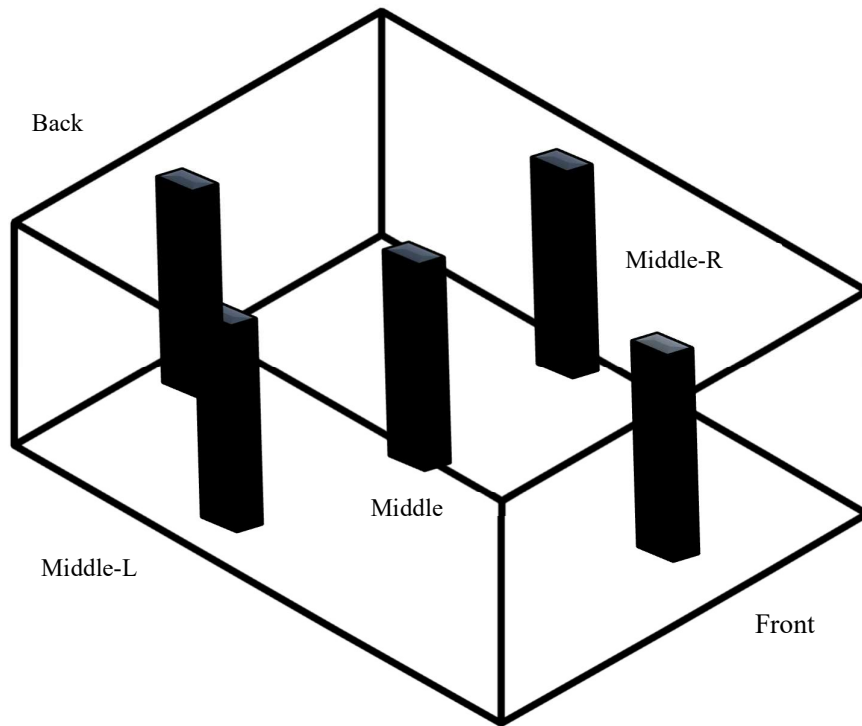


Figure 1 : Position of Bales in a container



Figure 2 : Ambient & Flex Probe Temperature



Temp logger with a flex probe inserted into the bale

Ambient Temp logger with no flex probe

Figure 3 : Temp loggers mounted on a bale (pressed bale loosened). Flex probe was inserted to the middle of the bale.



Figure 4 : A typical consignment of bales of Modiano from one of the stores before loading into a container

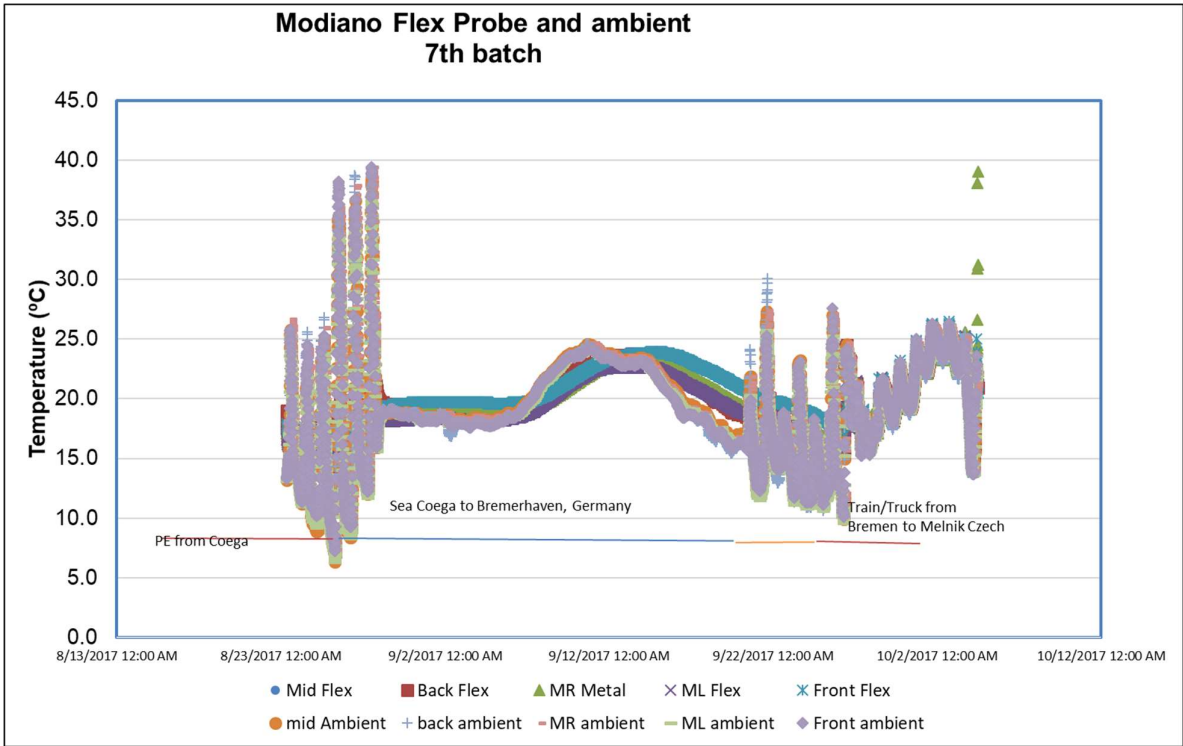


Figure 5 : Temperature readings within the container and wool bales in the consignment from SA to Czech Republic during Sept 2017

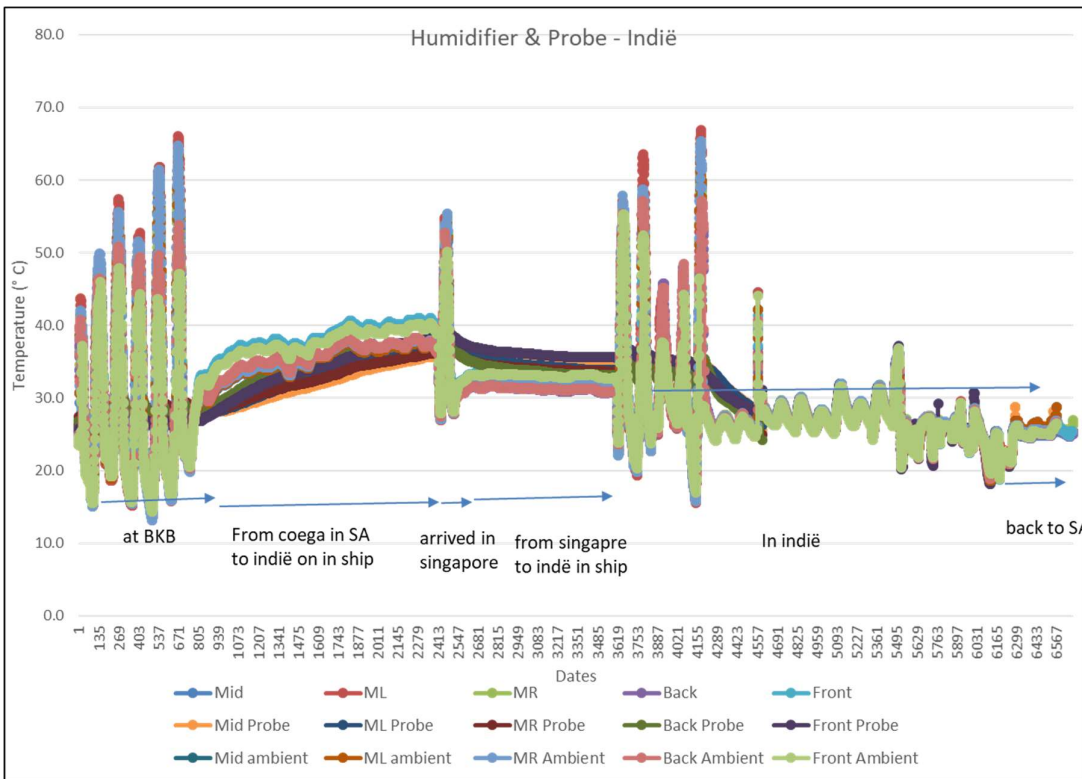


Figure 6 : Temperature readings within the container and wool bales in the consignment from SA to India during Feb 2017

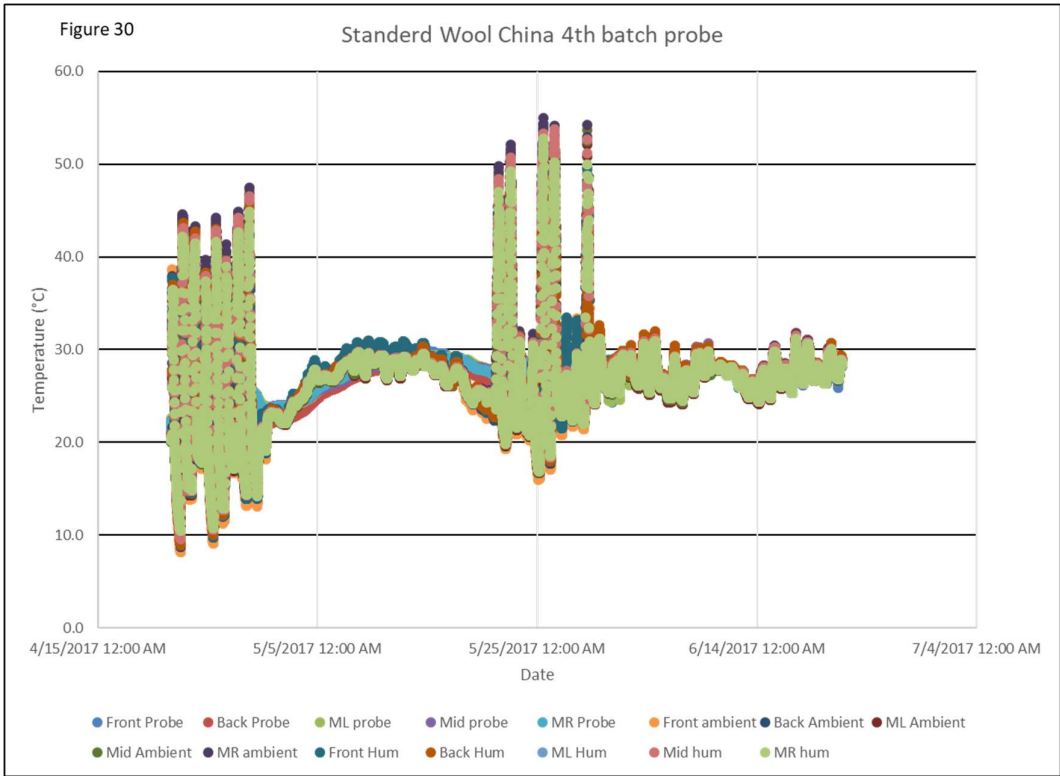


Figure 7 : Temperature readings within the container and wool bales in the consignment from SA to China during May/June 2017

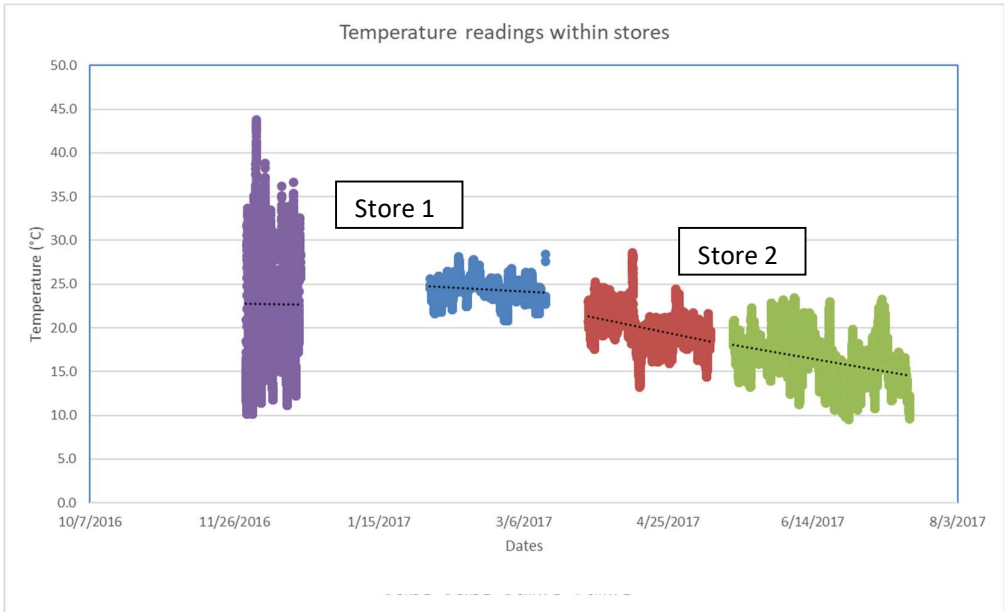


Figure 8 : Ambient temperature readings within the two stores in SA

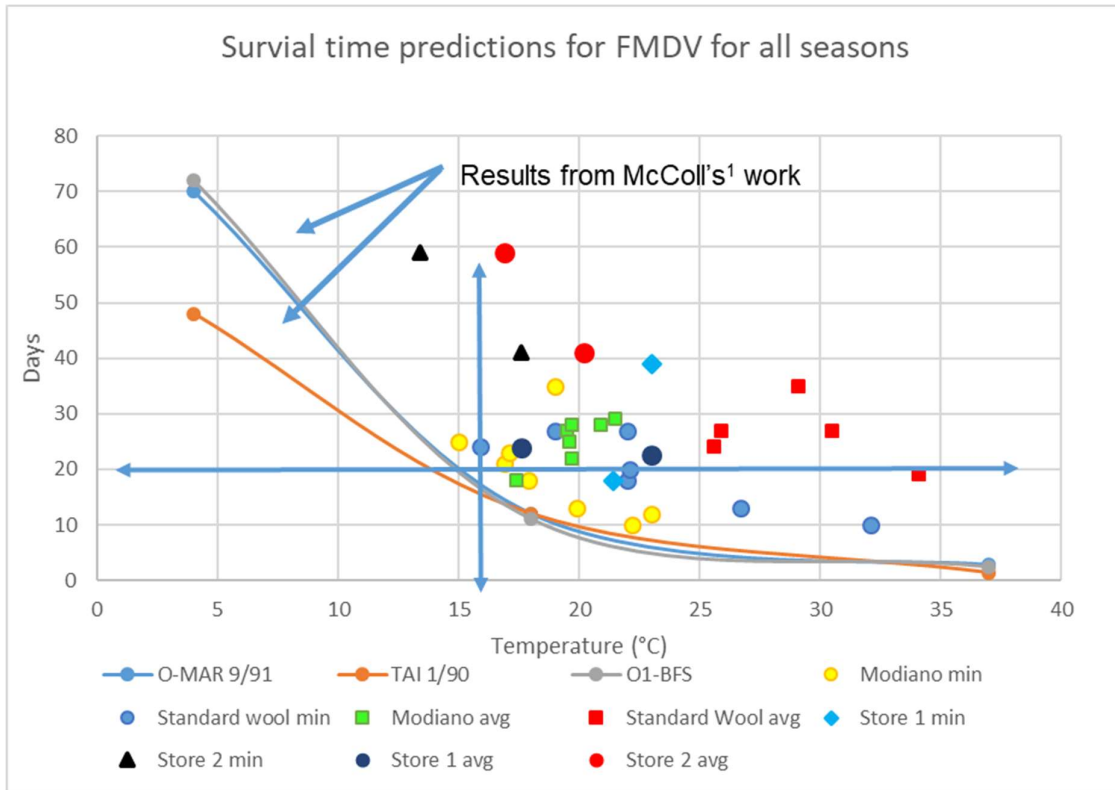


Figure 9 : Survival time predictions for FMDV for all seasons