

## The successful control and eradication of Foot and Mouth Disease epidemics in South America in 2001

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### Historical background

In 1981 Chile was the first country in South America to be declared officially free of FMD. The eradication strategy was based on the gradual elimination of the disease working in a south-to-north direction; applying quarantine measures across different regions of the country and a vaccination campaign using aqueous vaccines of guaranteed quality, mainly produced in Uruguay. The country suffered two re-introductions of FMD caused by illegal animal movements in March 1984 and in March 1987. Both episodes were eradicated by stamping-out and quarantine measures. Chile is recognized by OIE as free of FMD since 1988.

In the nineties the EU decision to stop general vaccination of the cattle population provided an important stimulus for the meat exporting countries of South America to proceed with the eradication of FMD from the region. As a result the following countries were recognized by OIE as “Free of FMD”:

<b>Free of FMD</b>	with vaccination	without vaccination
Uruguay	1994	1996
Argentina	1997	1999
Paraguay	1997	1999
Brazil: Southern states (Rio Grande do Sul and Santa Catarina)	1998	2000
Brazil: Central and Western Regions	1999	
Brazil: Remaining Central-Western Region and Eastern Region	2000	

These areas combined created in the South Cone of South America a FMD free region with a total of some 193 million cattle. However, this exposed that region to severe FMD risks as a consequence of the following factors:

- Progressive loss of protection against FMD of large cattle populations over a short period of time.
- Continual danger of spread of FMD from remaining endemic areas into the susceptible livestock population.
- Movement of large numbers of the now susceptible young cattle to fattening areas.
- Failure of epidemiological surveillance and communication systems between countries and increased vulnerability to spread of disease across country borders.
- Deficiencies in the first barrier of sanitary prevention (movement controls) because of serious limitations in human resources and insufficient logistical support.
- Substantial reduction in communication, education and training of public and private human resources and veterinary services.
- Insufficient assessment of risks and incomplete contingency plans for the transition to a non-vaccination policy.
- Dominance of political and commercial interests over sanitation requirements.
- Serious omissions in the fulfillment of the norms of the International Animal Health Code (OIE, 1999) and international agreements, as well as lack of transparency and veracity of the information on the real sanitary situation.

As a consequence, like in Europe, the veterinary infrastructure guaranteeing awareness, alertness, and sufficient surveillance was weakened. When FMD invaded the southern region of South America only Chile (without vaccination) and Paraguay (with vaccination) were able to maintain the status of FMD free countries.

## **Recent developments**

### ***Argentina***

In April 2001, the government of Argentina notified the OIE of the epidemic of type A virus of FMD in its territory. The country lost the status as a FMD free country and a new FMD eradication plan was adopted based on general vaccination of the cattle population with the exception of Patagonia. This region was traditionally free of FMD and remained free without vaccination, which facilitates the export of mutton-in-bone to Europe. The last notified outbreak occurred in Vicuna Mackenna, Cordoba Province in January 2002. In 2001 a total of 122 million bivalent (types O and A) doses of oil adjuvant vaccine were distributed. For the first round of vaccination this year this amounted to more than 52 million doses.

### ***Brazil***

In August 2000, the zone comprising the states of Rio Grande do Sul and Santa Catarina had its FMD free status suspended, due to a FMD outbreaks by type O<sub>1</sub>. The outbreaks were eradicated by stamping-out and quarantine measures. A total of 8,183 cattle, 2107 pigs, 783 sheep and a few goats were destroyed.

In May 2001 Rio Grande do Sul suffered another introduction of FMD, this time of type A, as a consequence of the expansion of the FMD epidemic of that type in Argentina with spread to Uruguay. Early in May 2001, the State of Rio Grande do Sul re-established the general vaccination of the cattle population, which continues up to the present time.

Thirty outbreaks were reported in Rio Grande do Sul, but none in Santa Catarina. Initially, 1,164 cattle, 29 sheep and 2 pigs were destroyed, but there was strong resistance by the farmers to the stamping-out policy. Later on, 11,670 contact animals were slaughtered locally in order to comply with OIE regulations. The last case in Rio Grande do Sul occurred in July 2001

The State of Santa Catarina maintained the non-vaccination policy in order to obtain the status "free of FMD without vaccination" in the near future. It is the state with the largest pig population (5.8 million head) and pork production of Brazil. At present pork is being exporting to Russia.

### *Paraguay*

In October 2000, Paraguay, in view of the dissemination of FMD in adjacent areas and the vulnerability of its sanitary infrastructure, re-instated the general vaccination of its cattle population. At present, Paraguay maintains its status as country free of FMD with vaccination.

### *Uruguay*

Livestock breeding is the principal agricultural activity of Uruguay and the mainstay of the economy. It represents more than 65 percent of the Uruguayan exports in the form of meat, wool, milk, hides and industrialized agriculture by-products. The area of Uruguay is 176,215 km<sup>2</sup> (approximately the size of the UK) of which the greater part is developed for agriculture.

The human population is 3.15 million. In 2001 there were 10.6 million cattle, 12.1 million sheep, 480,000 horses, and only 270,000 pigs on 57,100 farms and developed land surface was 16,4 million ha. Cattle and sheep share the same pastures, thanks to the moderate climate and the even distribution of precipitation throughout the year. This mixed grazing and the presence of the unvaccinated sheep did not hamper the eradication of FMD by vaccination of the cattle only. The introduction of general cattle vaccination in the late eighties was successful despite the fact that sheep outnumbered the cattle by almost 3-fold.

In October 2000 FMD type O was diagnosed in Artigas Department in a farm situated in the border with Brazil.

### **FMD outbreak of subtype O<sub>1</sub> in 2000**

October 23, 2000	FMD reported on farm with 322 cattle, 63 sheep and 47 pigs in the Artigas Department, close to the frontier with Rio Grande do Sul, Brazil.
October 24-25	A zone with a radius of 25 km was fully quarantined. A total of 6,924 cattle, 12,371 sheep and 257 pigs destroyed.

November	November 1: Stamping out an disinfection completed November 30 : Susceptible young cattle and pigs introduced as sentinels
	Serological survey in a buffer zone with a 5-25 km radius from the infected farm. All the samples were negative for FMD antibodies(ELISA and VIAA) tests. All sentinel animals remained healthy and free of FMD antibodies.
January 25, 2001	OIE re-established the status of free of FMD without vaccination

In April 2001, Uruguay again lost the FMD free status as a consequence of the introduction and spread of the type A epidemic from Argentina.

### **FMD outbreak of type A (related to subtype A<sub>24</sub>) in 2001**

April 23, 2001	FMD was reported in Palmitas, Soriano Department, approximately 70 km from the Argentina border, On the farm with 430 cattle and 640 sheep, 39 of 1-2 years-old steers showed FMD
April 24	Discontinuation of Export Certificate and slaughter for export. Infected and exposed animals destroyed and buried.(5,093 cattle, 1,511 sheep and 333 pigs)
April 25	FMD on neighboring farm with 773 cattle, 474 sheep and 10 pigs.
April 26	FMD outbreaks in the Colonia Department, about 40 km from the first discovered cases. Immediate standstill of all animal movements
April 26	Affected departments were quarantined. Start of ring vaccination of cattle Vaccination of area with 10-km radius around the infected farms
April 27 - June 7	Ban on the movement of animals and transit was extended to whole country, with the support, enforcement and back-up of the National Police and National Army.
April 29	Spread of the disease to other departments of the country. Stamping-out procedure suspended due to the strong resistance of local farmers and dissemination of infection to other departments of the country.
April 30	Vaccination of cattle was extended to form protective barrier (Brazil)
May 5	Massive systematic vaccination of all cattle was re-established in the total cattle population of the country.
June 7	End of first vaccination round. Movement and transit restrictions relaxed
June 15 - July 22	Re-vaccination of cattle population
August 21	Last outbreak on a dairy farm situated in San Jose Department.
November	Vaccinated and re-vaccination of 4.5 million young cattle; each animal was identified by double ear-tags.

A total of 24 million doses of FMD oil-adjuvant vaccines were distributed during the two vaccination rounds each covering a population of 10.6 million cattle. The average rate of vaccination was 350,000 cattle per day. For each round the veterinary services established a vaccination timetable, scheduling routes, dates and time. Most of the vaccinations were done by the farmers and farmhands. In some cases private

veterinarians performed the vaccinations. The official veterinary services had an active role in the control of the vaccination procedures at farm level. Dairy cattle stock was vaccinated in one week with a vaccination rate of 67.000 head per day.

The total number of outbreaks was 2,057 (Figure 1 shows the distribution of outbreaks in the country) of which 264 were dairy farms. Animals were killed and buried (a total of 6,937) during the first week of the epidemic only. After that infected premises and contact farms were quarantined with total prohibition of livestock movements until 30 days after the last case. The last outbreak occurred on a dairy farm on August 21<sup>st</sup>.

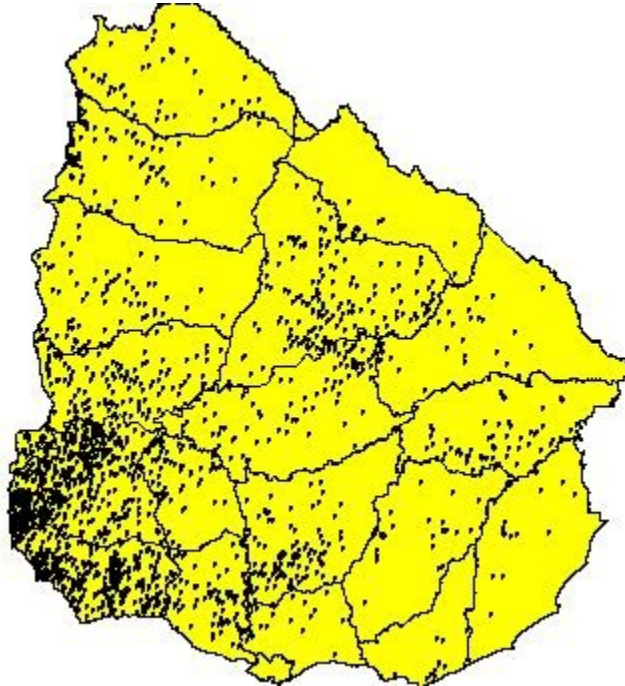


Figure 1. *Uruguay: Distribution of infected farms during the 2001 FMD epizootic caused by FMD virus type A.*

In Figure 2 it can be seen that at the height of the epidemic there were 40-60 new infected farms per day. Shortly after the end of the first vaccination round, in spite of the relaxing of livestock movement restrictions, the number of new cases decreased dramatically to single numbers. A few day after the completion of the re-vaccination round, there only were a few sporadic cases and at the time of writing (August 2002) one year has elapsed without further cases.

Thus, Uruguay was able to control and eradicate this extensive outbreak with the application of livestock movement restrictions and the vaccination of the cattle population only, in spite of having a large and fully susceptible sheep population in close contact and proximity to the cattle. The total cost of the eradication effort was 13.6 million US\$, of which 7.5 million were spend on the purchase of vaccine, and the

remainder on compensation payments to farmers, cleaning and disinfection and operating expenses. These expenses do not include of the expenses of the Army (for eg. salaries). The Armed Forces collaborated, for instance by controlling border areas for illegal livestock movements.

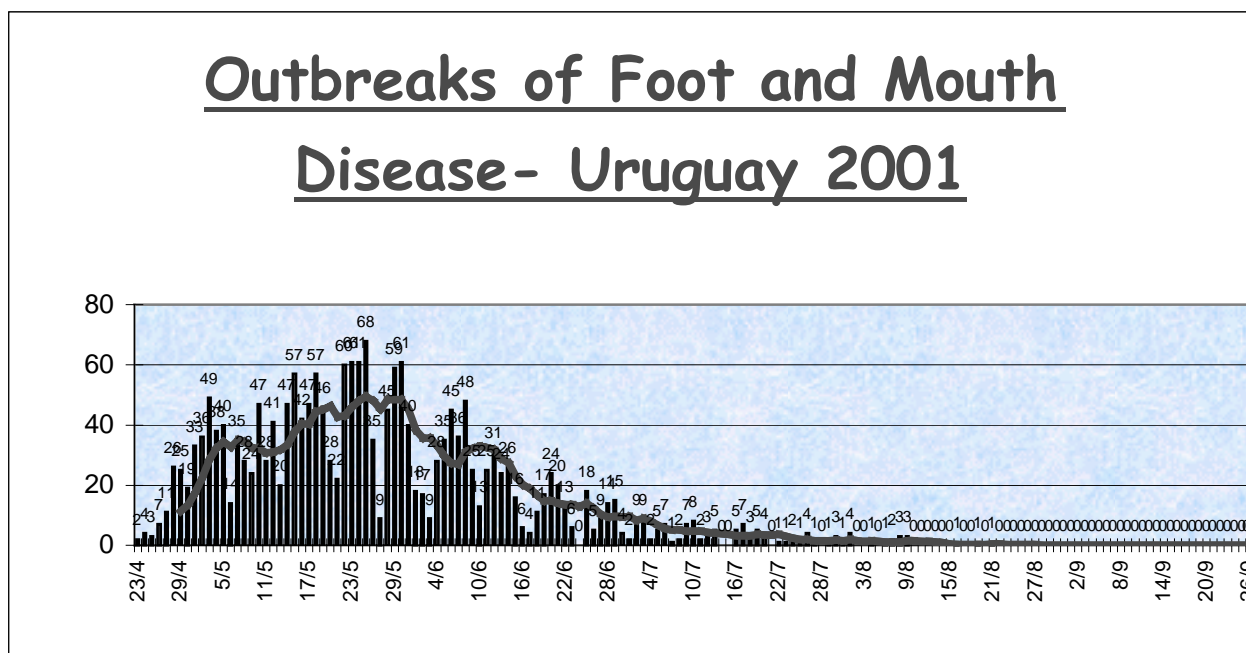


Figure 2. Evolution of the FMD epidemic in Uruguay 2001. Daily number of outbreaks. Red line: Moving 7- day average

Source: Direccion General de Servicios Ganaderos, Direccion de Sanidad Animal, Ministerio de Ganaderia, Agricultura y Pesca, R.O. del Uruguay

A first serological survey was carried out in the infected area during August 2001 to determine the extent of eventual spread of FMD to the non-vaccinated sheep population. A total of 7,684 sera collected of which showed 2.7% positive for VIAA antibodies. A second survey was carried out in September 2001 on neighbouring farms with 7,677 serum samples collected of which only 0.76% were positive for VIAA antibodies. During April-May 2002 a total of 18,356 sheep sera were collected on 358 randomly selected farms that had sheep (the sheep population had not been vaccinated!) for 17,101 sera have been tested of which only 20 were VIAA antibody positive. Apparently very little spread of the disease occurred to sheep even on infected farms, despite the fact that cattle and sheep shared the same grazing grounds.

Uruguay received several missions from trading partners and as a result markets for the exports of chilled, deboned meat were re-opened for the following countries:

Country	Date	Country	Date
Argentina	July 2001	Saudi Arabia	January 2002
Brazil	July 2001	UAE	January 2002
Hong Kong	July 2001	Russia	March 2002
Israel	October 2001	Hungria	March 2002
Venezuela	November 2001	Poland	March 2002
European Union	November 2001	Czechia	March 2002
Algiers	December 2001	Bulgaria	March 2002
Egypt	December 2001	Chile	April 2002
Peru	December 2001	USA*	

\*In July 2002 an expert mission of the NAFTA region, comprising USA, Mexico and Canada visited Uruguay for review of the sanitary situation and a risk analysis. It is expected that the proposal for re-opening the USA market after August 21<sup>th</sup> 2002 (one year after the last case) will be published in the Federal Register for public comments for a period of 60 days, conform normal import procedures.

The temporary interruption of the export markets and the pronounced decrease of livestock prices proved very costly for Uruguay in terms of economic losses by the livestock production sector and the national trade. In particular, the financial losses of meat and dairy producers have had great negative impact on the national economy. In addition, the paralyzation of the whole of the livestock sector, including the packing plants, for several months also affected many workers of livestock dependent activities. It is estimated that the total losses as a result of the closing of 70 external markets for products of animal origin exceed the total of more than 200 million US\$. In addition, 380 containers with meat in transatlantic transit were returned for security reasons. This loss in combination with the losses related to the closed packing plants amounted to a total of 30 milion US\$

From the Uruguay experience the following lessons can be learned:

- Susceptible livestock populations are at risk when the first line of defense against the importation or re-introduction of FMD is not well maintained.
- The transition from a “FMD free *with* vaccination” status to a “FMD free *without* vaccination status” requires a different mind set of all stakeholders and the preparation of flexible contingency plans.
- Vaccination of cattle only, in combination with livestock movement standstill can control an extensive outbreak in a very short time, with minimal disruption of the rural society and economy.
- Strong and continuous programs of education and training of the public and private veterinary services as well as farmers and public in general are required.
- FMD banks of purified and potent antigens and vaccines must be available for immediate emergency use.

The above examples of successful eradication of extensive epidemics in South America shows that even with conventional FMD vaccines it is possible to eradicate FMD in a short time without having to rely on such devere measures as used in Great Britain and

the Netherlands last year. Moreover, at present, there are additional powerful tools available. The antigens and vaccines in national and international vaccine banks are potent and highly purified and can be made available at short notice.. These vaccines can protect animals against FMD after 4-6 days after vaccination, and because of the purification they allow the detection of eventual carriers among vaccinated animals when combined with serological tests based on the detection of antibodies against non-structural proteins. Eventhough these tests are not 100% sensitive (what biological test is?) they can be used to detect infected animals at the herd level.

We submit for consideration therefore the following scheme in the case of a (limited) confirmed FMD outbreak\*:

1. An immediate prohibition of all movement of livestock and livestock products within the affected region;
2. Stamping-out and disinfection of infected premises;
3. Immediate vaccination of all susceptible livestock species in well defined geographical areas around the outbreak farm, as well as of dangerous contacts farms;
4. Lifting movement restrictions for livestock and livestock products *with the exception of vaccinated farms*, as soon as the epidemiological situation is clarified (this is likely not later than 15 days after the last vaccination in the region);
5. Lifting of the movement restrictions for milk and other livestock products such as manure, *from vaccinated farms*, 10 days after vaccination.
6. Lifting of movement restrictions for cattle, sheep and goats of vaccinated farms, when serological evidence shows the absence of sub-clinically infected vaccinated animals;
7. Lifting of movement restrictions of vaccinated pigs 30 days after vaccination (pigs do not develop the carrier state);

The region can be considered free of FMD virus infection 30 days after removal of the last herd in which carrier animals were detected and 60 days after the last vaccination of pigs. Such a rule would be consistent with the OIE recommendations following stamping-out.

A concerted effort must be made to inform the public to avoid consumer resistance to products from animals vaccinated against FMD.

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\* A widespread FMD epidemic or a bio-terrorist FMD attack would probably require large-scale use of vaccination in combination with limited destruction of infected animal. The above scheme will have to be adjusted accordingly, in order to prevent major disruptions of the socio-economical structure of the country.