

pan american foot-and-mouth disease center

FOOT-AND-MOUTH-DISEASE
PROGRAMS IN SOUTH AMERICA
1967-1971



pan american health organization
pan american sanitary bureau, regional office of the
world health organization

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This document was prepared by the Field Advisory Services of the PAN AMERICAN FOOT-AND-MOUTH DISEASE CENTER with the collaboration of the Regional Veterinarian from FAO assigned to this Center.

Rio de Janeiro, February 1973.

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INTRODUCTION

This work is a revised version of the part on South America in Document 18, entitled "Situation of the national programs for combat and prevention of foot-and-mouth disease and vesicular stomatitis in the Americas (Five - year period 1967 - 1971)", presented by the Pan American Health Organization at the fifth Inter-American Meeting on Foot-and Mouth Disease and Zoonoses Control, held in Mexico City from April 10 through 13, 1972.

It has been drafted in accordance with Resolution VIII of that Meeting, whereby PAHO is requested to create, promote and coordinate the South American Foot-and-Mouth Disease Committee, to study and coordinate the activities undertaken on the continental level to combat the disease. Pursuant to what is suggested in Paragraph 5 of the Resolution, it is intended to serve as a frame of reference for the work of the commission and it is with this end in view that the Pan American Foot-and-Mouth Disease Center offers it to the countries of South America, affected by the disease.

The Pan American Health Organization has called upon these countries to meet in Rio de Janeiro, Brazil, on February 26, 27 and 28, 1973 for the purpose of setting up the South American Foot and Mouth Disease Committee.

I. FOOT-AND-MOUTH DISEASE SITUATION

A. GEOGRAPHICAL DISTRIBUTION OF FOOT-AND-MOUTH DISEASE

On the American continent, foot-and-mouth disease is confined to South America, with the exception of the territories of Guyana, French Guiana and Surinam. Maps 1 and 2 summarise the general situation in 1967 and 1971. The disease does not exist in North America, Central America, Panama and the Caribbean.

According to the frequency of the disease, it is possible to distinguish three types of area:

1 - Free area

In 1967, the following stretches of land area were considered free of foot-and-mouth disease:

Argentina: Province of Santa Cruz to the south of the River Chico, and the National Territory of Tierra del Fuego.

Colombia: Northwestern region of Chocó department, and the municipio of Leticia in the commissariat of Amzonas.

Chile: Magallanes province.

Venezuela: States of Amazonas, Anzoátegui, Bolívar, Delta Amacuro and Monagas.

During the five years under review, outbreaks of foot-and-mouth disease occurred in the free areas of the four countries, as shown in Section B of this Chapter. According to the evolution of the disease, the steps taken to fight it and the requirements of the International Zoosanitary

Code, some places lost their disease free status, others recovered it, and new free sections were added.

In 1971, the free area was made up as follows:

Argentina: Provinces of Santa Cruz (1968) and Chubut (1969) and the National Territory of Tierra del Fuego.

Colombia: Northwestern region of Chocó department, and the municipio of Leticia in the commissariat of Amazonas.

Chile: Province of Magallanes, and Aysén (1971).

Venezuela: State of Amazonas and the south of Bolivar state.

2 - Area of sporadic outbreaks

In view of the scarce occurrence of foot-and-mouth disease, such areas are considered preparatory to being eventually declared disease-free. In Argentina a zone with these characteristics in the last five years covers the area between the Colorado and Barrancas rivers and the northern border of the province of Chubut. It includes the whole of the provinces of Rio Negro and Neuquén and the extreme south of the province of Buenos Aires bordering Rio Negro, forming an intermediate fringe between the free and endemic areas.

In Chile, the three northernmost provinces: Tarapacá, Antofagasta and Atacama, are considered to be a zone of sporadic outbreaks.

In Paraguay, the extreme northwest of the Chaco (Boquerón department) is thought to be a sporadic outbreak area. Plans for the necessary investigation are under consideration.

The greater part of the remaining countries affected have a

similar area represented by their share of Amazonia where, owing to the low density of the cattle population, foot-and-mouth disease very rarely occurs.

The absence of systematic vaccination programs is common to all the intermediate areas. The appearance of sporadic outbreaks is countered, preferably, by strict isolation measures and in general by strategic vaccinations.

3 - Endemic area

This area is defined by the more or less permanent occurrence of some foot-and-mouth disease virus type. According to the distribution of the virus types, the countries fall into two classes:

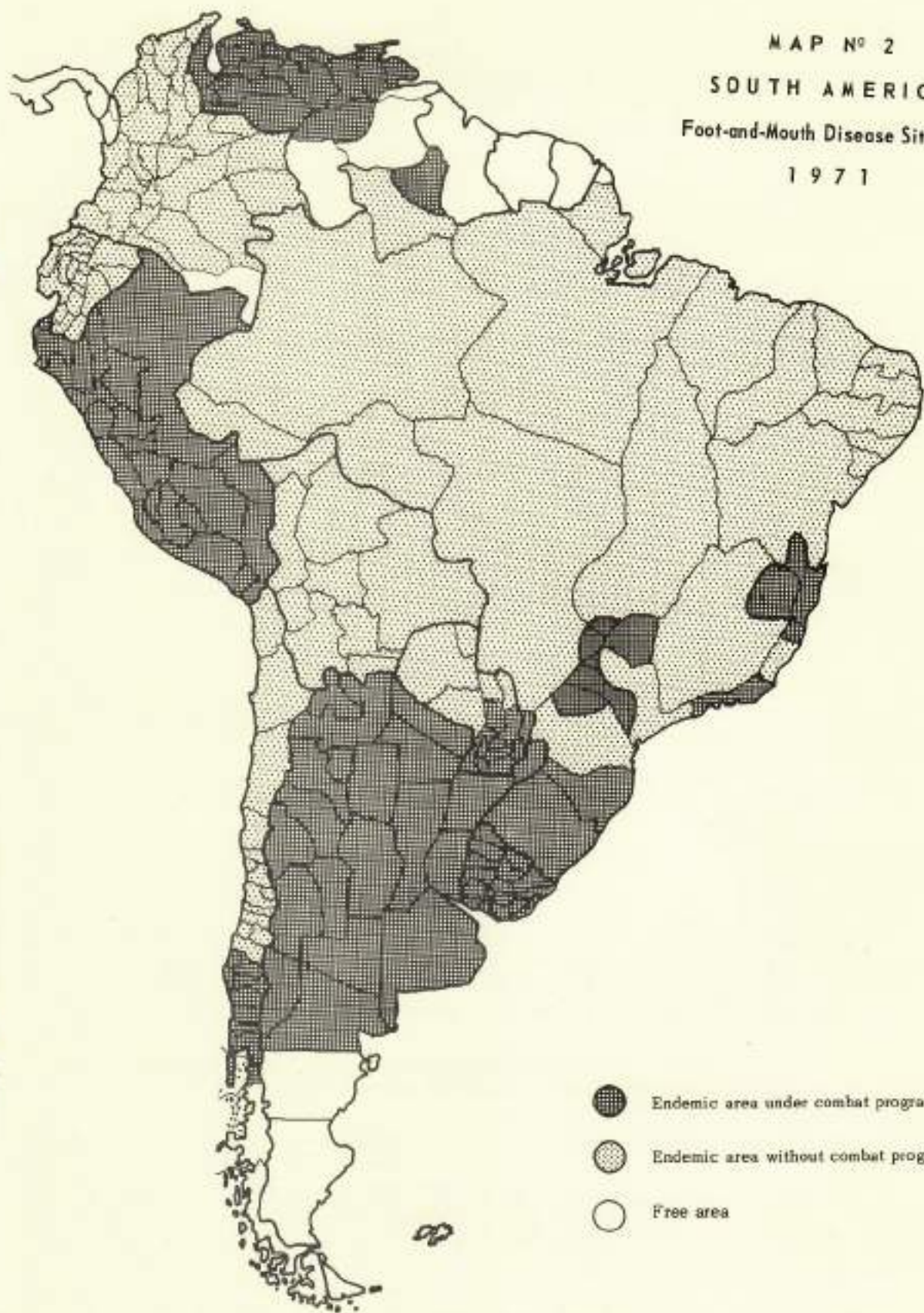
a) Foot-and-mouth disease virus types O, A and C are current. This can be said of the following countries, except for the free or intermediate areas mentioned above: Argentina, Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay. It should be pointed out, however, that there are broad areas in Chile, Perú and Uruguay where the occurrence of virus C has only been recorded sporadically of recent years. The same thing may be happened elsewhere with any of the virus types. Available information only enables this possibility to be suspected on the grounds of certain circumstantial evidence. Thus, for instance, in the Brazilian territory of Roraima, only foot-and-mouth disease virus type O has been diagnosed in the period 1967-1971.

b) Only types O and A are present: the area covers Colombia, Ecuador and Venezuela. The only virus C outbreaks in this region occurred in Leticia, in the extreme south of Colombia, in 1967 and 1970. Both were stamped out.

MAP Nº 1
SOUTH AMERICA
Foot-and-Mouth Disease Situation
1967



MAP Nº 2
SOUTH AMERICA
Foot-and-Mouth Disease Situation
1971



B. EVOLUTION OF FOOT-AND-MOUTH DISEASE BY COUNTRIES

1 - Argentina

As was pointed out before, Argentina is divided into three areas, according to the incidence of foot-and-mouth disease. In the area considered free from the disease, four outbreaks occurred in the period under review, but were successfully stamped out with the application of the slaughter policy.

Between December 1966 and February 1967 an outbreak occurred in the island of Tierra del Fuego, caused by a virus type C. Only one farm was affected, and there 611 cattle and 30 swine were slaughtered.

In June 1969 the Chubut province was incorporated into the sub-area, but the following year two outbreaks occurred, one in July in the locality of El Maitén, in Cushamen department, and the other in October in Nahuel Pan. In both cases virus type A was identified. A total of 123 cattle, 461 sheep, 371 goats and 27 swine were slaughtered in the first case, and 208 cattle, 625 sheep and 263 goats in the second.

The last attack took place in July 1971, in the locality of Rio Gallegos, Santa Cruz province, and was started by a virus type O. On this occasion the livestock slaughtered totaled 39 cattle, 2 414 sheep, 3 goats and 806 swine.

The provinces of Neuquén and Rio Negro were recognized in 1969 as a subarea where the disease occurs sporadically and therefore there is no need for a systematic vaccination program. In Neuquén, an outbreak of foot-and-mouth disease was recorded in January 1971 and another in May the same year, both caused by virus type A. In the last quarter of 1970, the origin of an

epidemic outbreak in Rio Negro which affected numerous properties in the northeast of the province may have been related to possible infection spreading from a local slaughterhouse. A virus type A was isolated. In the early months of 1971, a constant decline in the outbreak was observed, only occasional cases of foot-and-mouth disease occurring the rest of the year.

The situation in the endemic area stayed within the range of the epidemiological characteristics usually ascribed to the disease in Argentina, and it was impossible to detect any significant change in the trend recorded in previous years.

There were two epidemic waves due to virus O, one in 1967 and the other in 1971. In both cases the seasonal nature of spread and distribution were similar, though the former seems to have struck deeper into the province of Buenos Aires, affecting moreover cattle markets and fairs. The latter is related to the spread of an epidemic in Rio Grande do Sul, Brazil, towards the end of 1970, which extended to a major part of the northeastern region of Argentina.

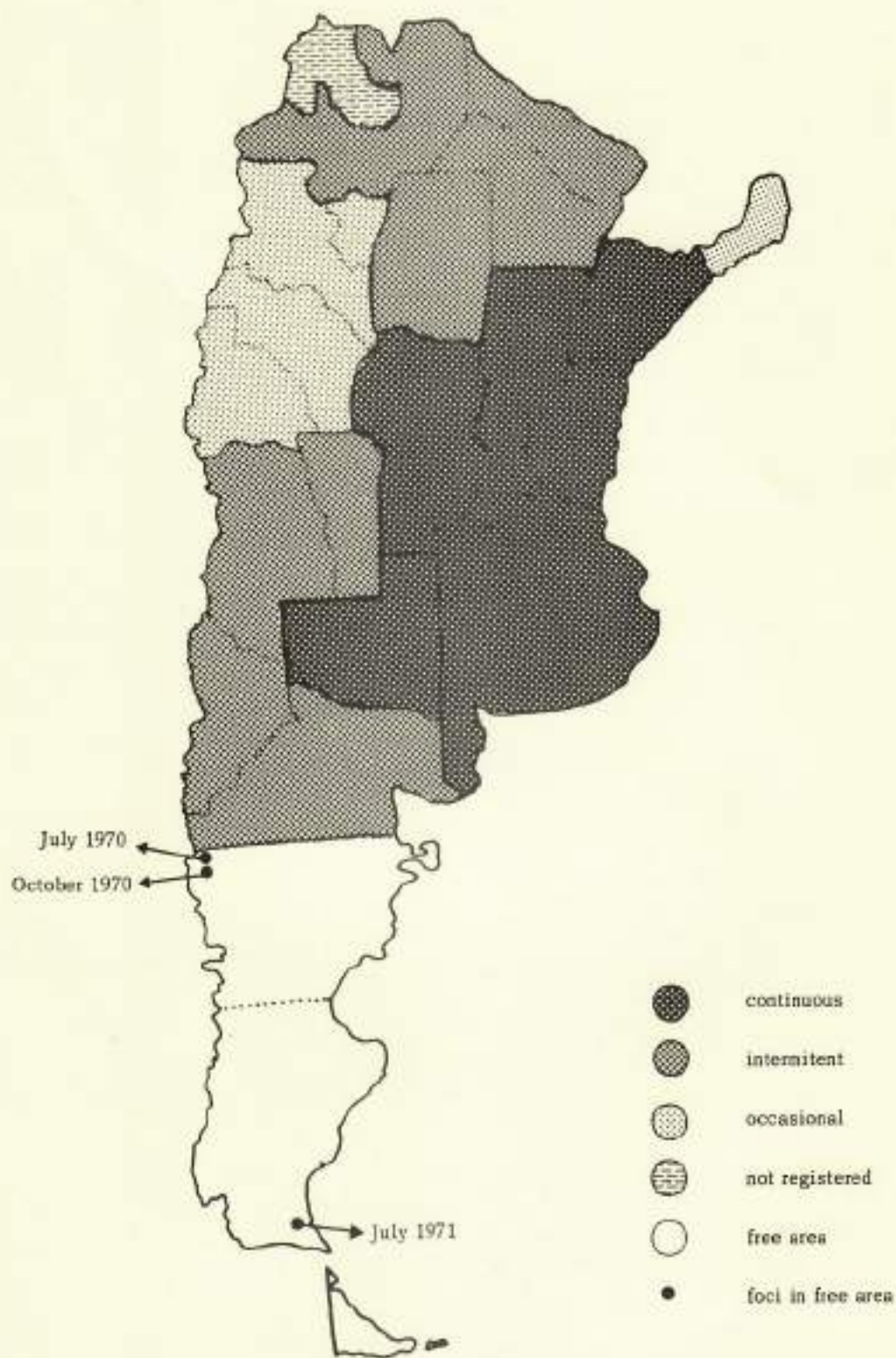
Virus A was prevalent in the years 1968 and 1969, with a sharp rise in the number of foci observed in Santa Fé and Córdoba towards the end of 1968. During 1971, the number of virus A foci was again high in those provinces, resulting in an extremely serious situation when taken in conjuncture with the wave of virus O sweeping down from the northeastern coast of the country. Thereto must be added the outbreak already mentioned as occurring in Rio Negro at the end of 1970 and beginning of 1971.

As regards virus C, emphasis need only be laid on an epidemic wave occurring towards the end of 1969 and characterized by affecting a

high percentage of cattle from herds that had been systematically vaccinated. A strain (C-Argentina/69) was isolated and preliminarily identified by the Pan American Foot-and-Mouth Disease Center as a new subtype and later classified by the World Reference Laboratory as virus C₅.

Map N° 3 gives an approximate idea of the epidemiological areas of foot-and-mouth disease to be distinguished in Argentina. In preparing it, the monthly register of virus typing in the years 1969, 1970 and 1971 were taken into account, considering only the presence or absence of the corresponding laboratory diagnosis. The same procedure has been applied further on to other countries in possession of similar information.

ARGENTINA - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



2 - Bolivia

Few data on the characteristics of foot-and-mouth disease in Bolivia are available.

It is admitted that the disease exists endemically throughout the country. The three types of FMD virus, O, A and C having been isolated, as well as several of their subtypes.

Due to an official pilot program having been carried out for some years in the department of Cochabamba, it is possible to reflect to some extent the evolution of the disease in this department. From May through June, 1968, various outbreaks occurred in herds of cattle that were being vaccinated regularly, and a relatively high morbidity was recorded. Subtyping of samples, which corresponded to virus type A, displayed certain serological characteristics distinct from those of the known subtypes. The outbreak continued to spread and, by the end of 1968 and beginning of 1969, nearly all the department of Cochabamba was affected. Nevertheless, by this time the typing made corresponded mostly to FMD virus subtype O₁, which leads one to suppose the existence of two overlapping waves.

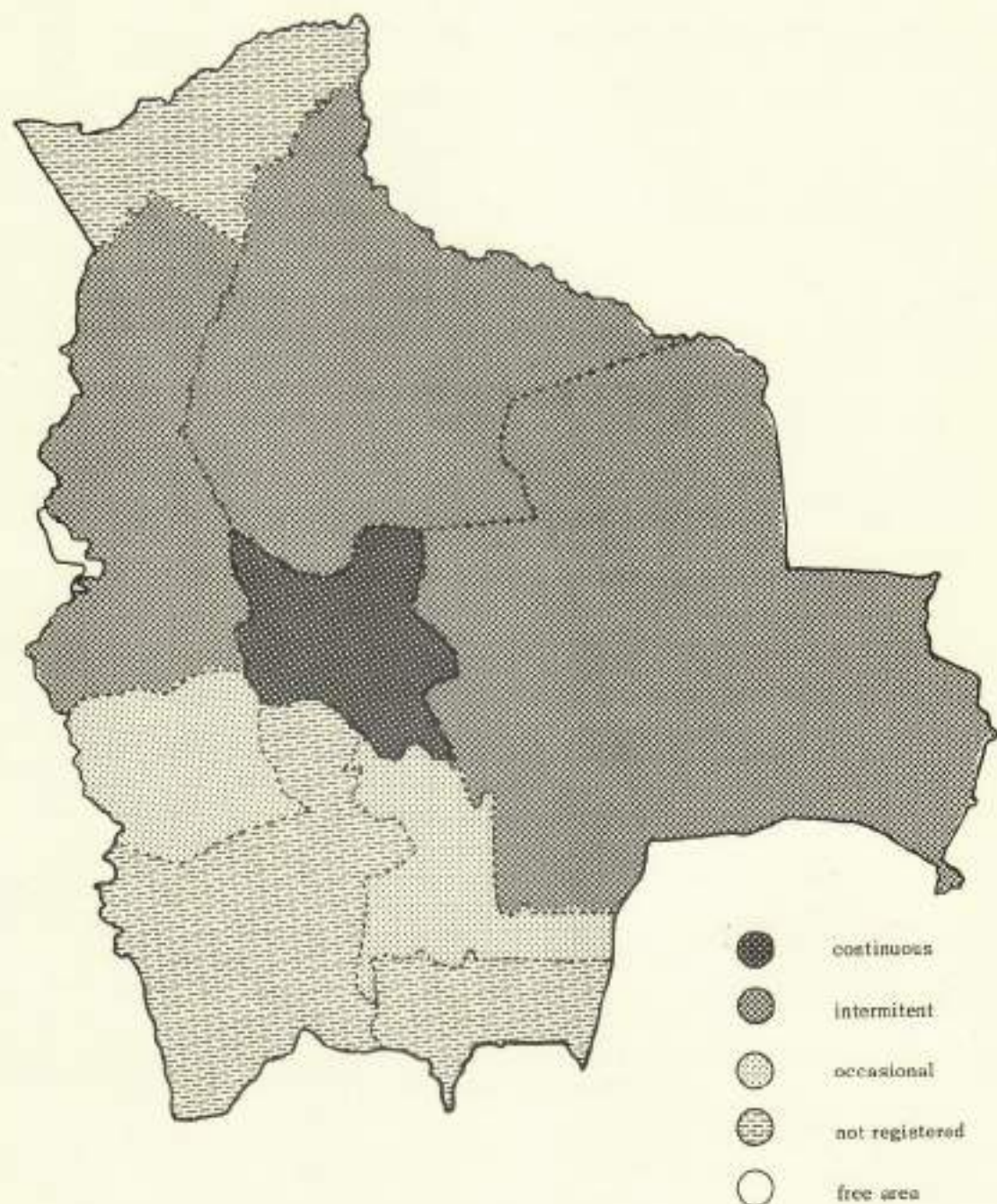
During 1970, another serious outbreak occurred in the departments of Cochabamba and Santa Cruz. Again a virus type A was isolated, which was shown, to have a certain degree of parentage with strain A-Colombia/69 (A₂₁), though not close enough to justify classifying it as such. provisionally it was termed A-Bolivia/70. In the second six months of 1970, numerous foci were observed anew in Cochabamba caused by virus O₁.

In 1971 viruses types O and C were typified, but no particularly outbreaks of epidemic nature were reported. That year the disease was, recorded in seven of the nine departments of Bolivia.

On Map 4, the available information is indicated schematically.

MAP Nº 4

BOLIVIA - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



3 - Brazil

The epidemiological data available on Brazil are partial and incomplete, making it impossible to form an overall conception of the development of foot-and-mouth disease in this country in the last few years. Besides in most of the states where records are kept, the entries are not chronologically continuous. Outstanding among the exceptions is the state of Rio Grande do Sul, where the statistics enable the course of the disease in the last five years to be traced with accuracy.

The typings made in field samples since 1967 show a marked predominance of virus type O, to which the epidemic occurring at the end of 1970 and beginning of 1971 in the southwest of Rio Grande do Sul is attributed, though virus type A was identified also, but on a smaller scale. The counties mainly effected were Bagé, Dom Pedrito and Uruguaiana. From this region the epidemic spread nearly all over the state, causing high morbidity, but relatively low mortality. The virus O isolated belonged to subtype O₁, but with serological characteristics different from those of the other known strains of the same subtype, and it was given the provisional denomination of subtype O-Brazil/70, subsequently being also identified in Argentina and Uruguay.

This wave was followed, and in some cases accompanied by another epidemic which began in the western region of the state, near the river Uruguay and provoked by a virus A strain, spread in the opposite direction. This virus A strain was termed A-Brazil/70 II.

Map 5 gives a general idea of the available information on the presence of foot-and-mouth disease in Brazil.

MAP N° 5

BRAZIL - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



4 - Colombia

Foot-and-mouth disease is prevalent throughout the stockraising zone of Colombia, except for the southeastern and extreme northwestern regions where livestock is scarce.

The disease has shown the following characteristics:

In August 1967, it was recorded for the first time in the Leticia region of the Amazonas commissariat. The causative agent was diagnosed as virus C, never before identified in the country. The outbreak was stamped out by slaughtering 1 232 cattle, 8 sheep and 21 swine.

Another outbreak, not so widespread, occurred in the same locality in July 1970. Virus type C was again isolated. On this occasion, the disease was eradicated by means of isolation, quarantine and ring vaccination. Four farms with 390 cattle were affected.

At the beginning of 1967 an epidemic wave was observed in the dairy-farming areas of the departments of Cundinamarca, Antioquia and Valle de Cauca, where a virus A strain was isolated and classified as subtype A₂₇ by the Pirbright World Reference Laboratory.

In 1969 there occurred a remarkably widespread and infectious outbreak, affecting more particularly the whole of the savanna of Bogotá, Ubaté and Chiquinquirá. The outbreak started in February and was characterized by affecting an unexpectedly high percentage of vaccinated cattle. A virus A strain was isolated with different antigenic components from those of the subtypes known up till then. The World Reference Laboratory

confirmed the initial diagnosis of the Center, giving this strain the classification subtype A₃₁. The problem was tackled by injecting homologous vaccine for the field strain.

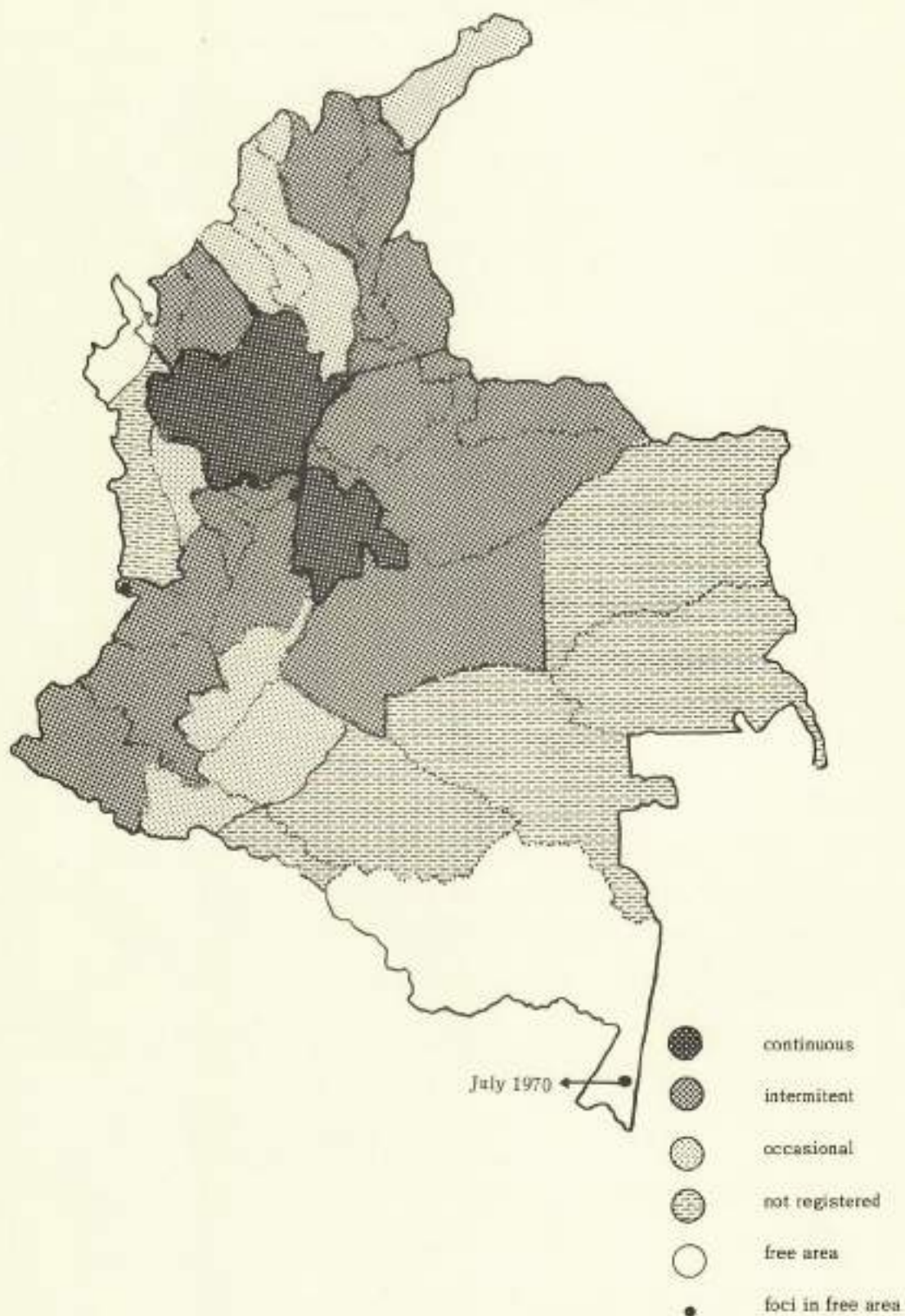
That same year, the south of Colombia was stricken with an epidemic caused by virus type O, subtype O₁, which spread rapidly throughout Nariño department. It was related to a wave which had been attacking the livestock in the neighboring province of Carchi, in Ecuador.

In 1970 there was only one epidemic outbreak, and that was on the Atlantic coast, caused by a type O virus. While it was not particularly serious, it impaired the meat trade with the Netherlands Antilles.

In 1971, the foot-and-mouth disease broke out again in various parts of the country, and more particularly in the plains of the departments of Meta and Boyacá and the Intendencia de Arauca. A similar quantitative identification showed virus types O and A. The epidemic was attributed to a higher concentration and internal mobilization of cattle, which at other times was marketed in Venezuela. Attention was also called to an outbreak in Turbo county that, though not displaying any very serious features, worried the authorities on account of the proximity to the Panamanian border.

Map n° 6 gives a classification of the territory of Colombia, as regards the presence of foot-and-mouth disease, in accordance with the virus diagnosis data for the years 1969, 1970 and 1971.

COLOMBIA - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



5 - Chile

As regards distribution of foot-and-mouth disease in Chile, three regions are usually recognised: a northern region, where the disease is not very frequent, which includes the provinces of Tarapacá, Antofagasta, Atacama and Coquimbo; a central region, between Aconcagua and Llanquihué, which contains 90% of the cattle in the country and in which foot-and-mouth disease is endemic; and a southern region, which includes the provinces of Aysén and Magallanes that are considered free of the disease. In the province of Chiloé, outbreaks are sporadic.

In the period under review, there continued to be occasional outbreaks of foot-and-mouth disease in the Northern Zone, with virus types O, A and C alternating.

In the Central Region, the three types of virus were identified in endemic form. Attention should be drawn to a strong tendency of the increase in foci to remain stationary every last four-month period. Two epidemic waves were particularly severe: one in 1968 with predominance of virus type A and the other in 1969 when type O predominated. In 1970, again a greater incidence of type A was observed, though apparently the number of foci occurring that year was far less than in previous years. In 1971, there were notably less FMD foci than before, in particular in Region I of the National Combat Plan for the disease. Map nº 7 represents the current situation prior to the effects of this plan.

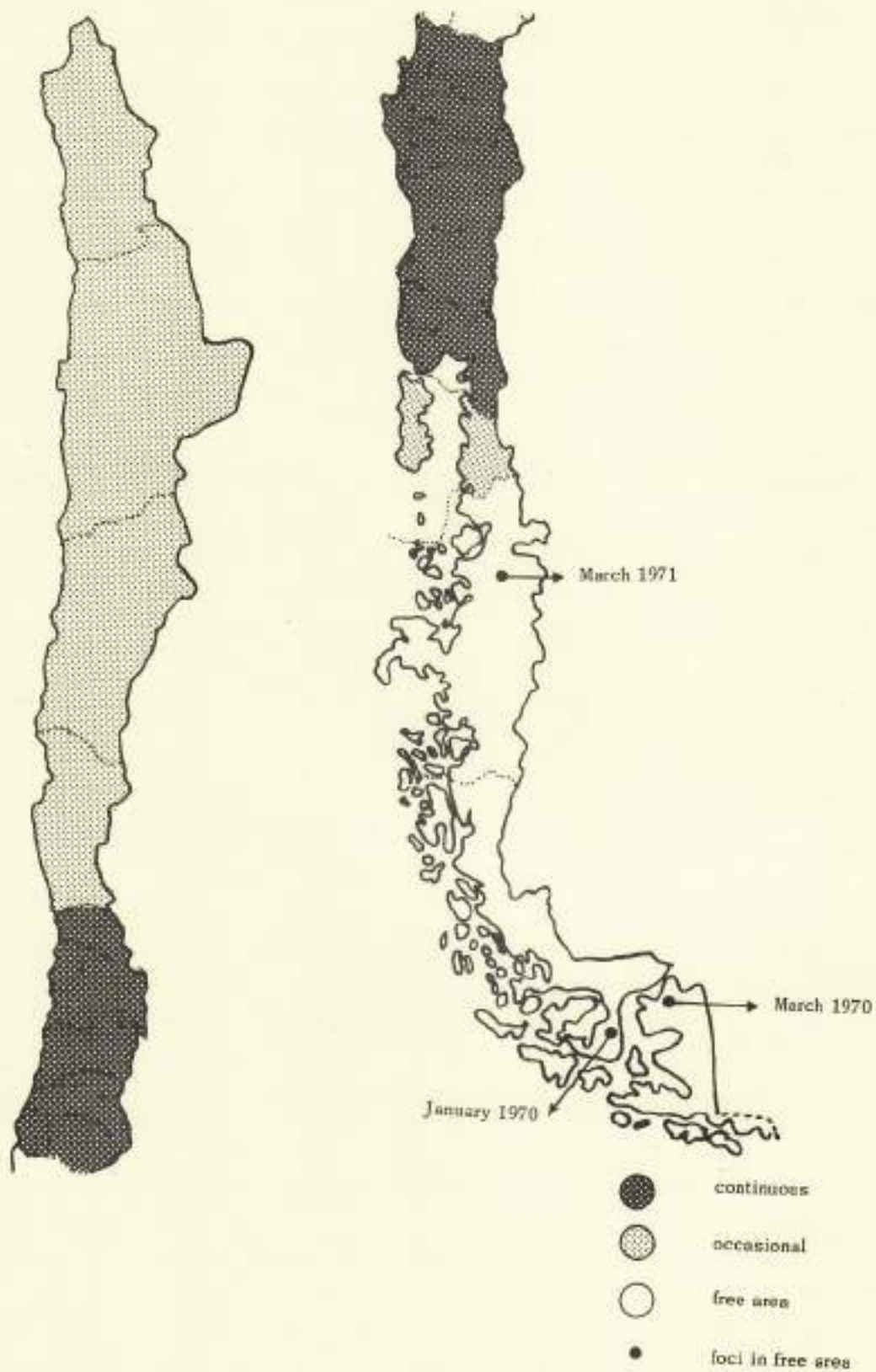
In the extrem south, two outbreaks of foot-and-mouth disease were recorded at the beginning of 1970 in the Magallanes province. On both

occasions, in January and March, virus subtype O₁ was isolated, and all the animals affected, totaling 751 cattle, 14 688 sheep and 951 swine, were slaughtered. The last case was observed on March 22.

In the province of Aysén, where foot-and-mouth disease had not been notified for 11 years, the disease broke out in February and March of 1971. Virus subtype A₂₄ was typified. The outbreak was arrested by slaughtering 1 085 animals, 20 of which were cattle, 810 sheep and 5 swine.

CHILE

Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



6 - Ecuador

Prior to 1967, foot-and-mouth disease was confined mainly to certain places along the coast. That year, however, it extended inland in the seaboard provinces of El Oro, Guayas, Los Ríos and Manabí, on to a large section of the sierra, where the provinces of Carchi, Cotacachi, Imbabura, Fichincha and Tungurahua. There was predominant diagnosis of a virus subtype O₁, although at the end of the year a subtype A₂₇ strain began to appear, which had never before been identified in Ecuador.

The year 1968 elapsed with a significant decline in the disease, except in the province of Manabí, which suffered from quite a serious epidemic, caused by that virus subtype. The following year an extensive epidemic spread all over the country invading for the first time the eastern region. It seems more likely to have been caused by a virus subtype O₁, though at the same time subtype A₂₇ was diagnosed.

In the course of 1970, the disease was prevalent on the coast and in the mountains, displaying similar characteristics as the year before, an almost absolute diagnosis of virus subtype O₁ being registered. At the outset of 1971, the disease caused by this virus gained ground, particularly in the seaboard provinces of Guayas, Los Ríos and Manabí. Towards the middle of the year, virus type A began to be diagnosed more frequently, particularly in outbreaks in the south of Ecuador.

The overall epidemiological situation is outlined on Map nº 8.

MAP N° 8

ECUADOR - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



- continuous
- intermittent
- ▨ occasional
- ▤ not registered

7 - Paraguay

Since the National Foot-and-Mouth Disease Combat Service (SEMAIPE) came into action in 1968, data on the epidemiological situation in Paraguay has been systematically compiled.

Formerly, a few sporadic sampling has already revealed the existence of virus type O, A and C in the country, but the distribution and gravity of the disease was unknown.

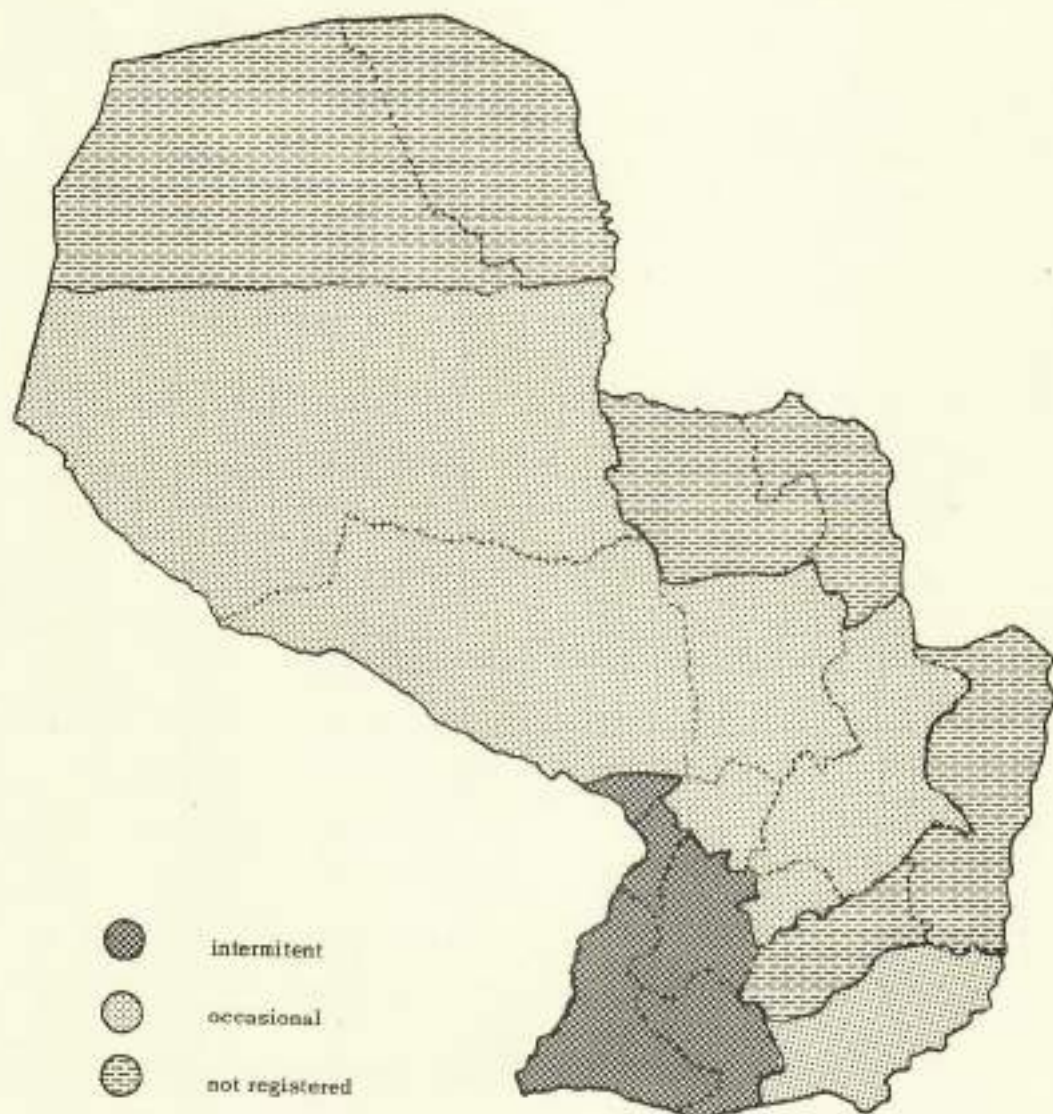
The typings made in 1969 at first showed a greater quantity of foci produced by virus O, but there was no very striking excess over A and C. By mid-year an increase was observed in the foci due to virus C, and a strain was isolated and preliminarily named C-Paraguay/69, subsequently included in subtype C₃. During the second six months virus A, subtype A₂₄, was seen to advance, predominating in 1970, to the exclusion of virus type C.

In 1971 virus type O came to the fore again in typings made in the campaign area. Mention should be made of an outbreak occurring in the second half-year in the Paraguayan Chaco, from which subtype O₁ was isolated, that proved a source of concern for the SEMAIPE authorities inasmuch as there are sectors in the region where no register of the disease exists. For this reason, a pilot plan was programmed and is now in execution. Towards the middle of the year the strain O-Brazil/70 was identified in a single focus occurring on the Argentine border, but was efficiently brought under control by isolation and ring vaccination.

Map n° 9 gives an idea of the distribution of foot-and-mouth disease in Paraguay.

MAP N° 9

PARAGUAY - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



8 - Peru

In 1967 several foci recognized in the south of the country, in areas near the Bolivian frontier Puno department, caused by virus subtype A₂₆. Other limited foci were recorded in the dairy-farming areas of the north (Piura and La libertad departments), central coast (Lima department and the constitutional province of Callao,) and the southern coast (Arequipa and Tacna departments), where virus subtype O₁ and A₂₄ were isolated. In the last quarter of that year, a batch of steers imported from Colombia arrived at the port of Callao, assigned to the local slaughterhouse. Some of the animals showed vesicular symptoms and virus subtype A₂₇ was isolated.

In 1968, at that same port and in similar circumstances, virus subtype A₂₇ was again isolated. The infection spread from the Callao packing-house to some nearby cowbarns and thence to a ranch in the Selva Alta Central (Tulumayo zone). All the foci were brought under control in due course, without any serious consequences. That same year, foci caused by virus subtype A₂₆ were recorded in the Southern Sierra (Puno, Arequipa and Tacna departments), which spread with the cattle having been rounded up for fattening and consumption.

In the course of 1969, three clearly defined epizootic waves were identified. The first emerged in the south (Arequipa department) where it severely affected the dairy cattle. The virus strain isolated was classified as subtype A₂₉. The infection was also recorded as being spread by virus subtype A₂₇ to the southern sierra in livestock proceeding

from the central seaboard (from Lima to Arequipa and Puno).

That same year, an epizootic wave was registered in the department of Piura connected with the traditional trade in cattle for fattening and consumption that is carried on in the Ecuador border zone. With the movement of cattle the infection spread to other departments on the north coast (Lambayaque and La Libertad) and central coast (Lima). The causative agent belonged to a virus subtype O_1 .

The third epizootic started from Callao, a port at which eleven shipments of beef cattle affected by virus type C arrived. The samples corresponded to subtypes C_3 and C_5 . These animals came from Argentina via Chile. The infection spread to a hog farm and to fattening centers in the south of the department of Lima and to another on the southern coast of Tacna department. The same thing happened in 1970, virus subtypes C_5 and A_{24} being diagnosed on that occasion.

That year, a strong epizootic wave spread inland from the central coasts, Lima department, to the southern sierra, Lucanas and Parinacochas provinces of Ayacucho department. Virus subtypes O_1 and C_3 were isolated. Another epidemic outbreak spread from the department of Puno to the sierra, Cuzco department, and to the coastal department of Arequipa and Ica.

In 1971, foot-and-mouth disease was caused by virus subtype A_{24} on the north coast in the departments of Piura and La Libertad. During the last quarter, virus subtype A_{27} was also identified, affecting a large quantity of cattle on the north and central coast in the departments of Piura and Lima.

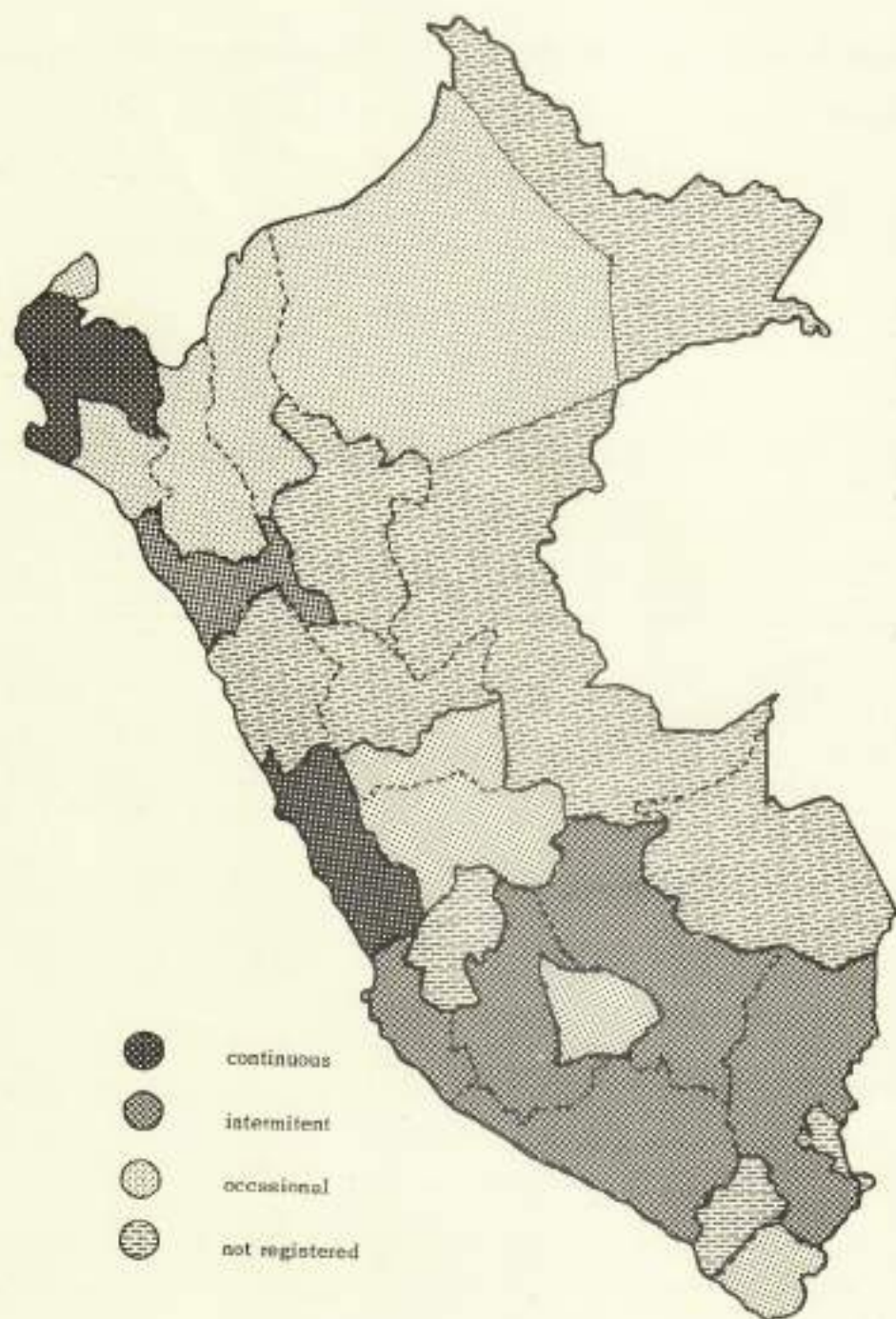
It should also be mentioned that an extensive outbreak of vesicular stomatitis occurred in the departments of Cuzco and Apurimac, caused by virus type New Jersey in the southern sierra, being the first time that this virus has been isolated in the south of Perú. Vesicular foci caused by virus type Indiana were later recognized in the northern sierra in the Cajamarca department, where vesicular stomatitis is enzootic.

The statistics on this domain are presented schematically on Map 10.

MAP N° 10

PERU

Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



9 - Uruguay

Foot-and-Mouth Disease virus types O, A and C exist endemically in Uruguay.

There is relatively little statistical information available on the occurrence of the disease in Uruguay, particularly in the period prior to 1969, the year in which the national foot-and-mouth disease combat campaign began to take shape.

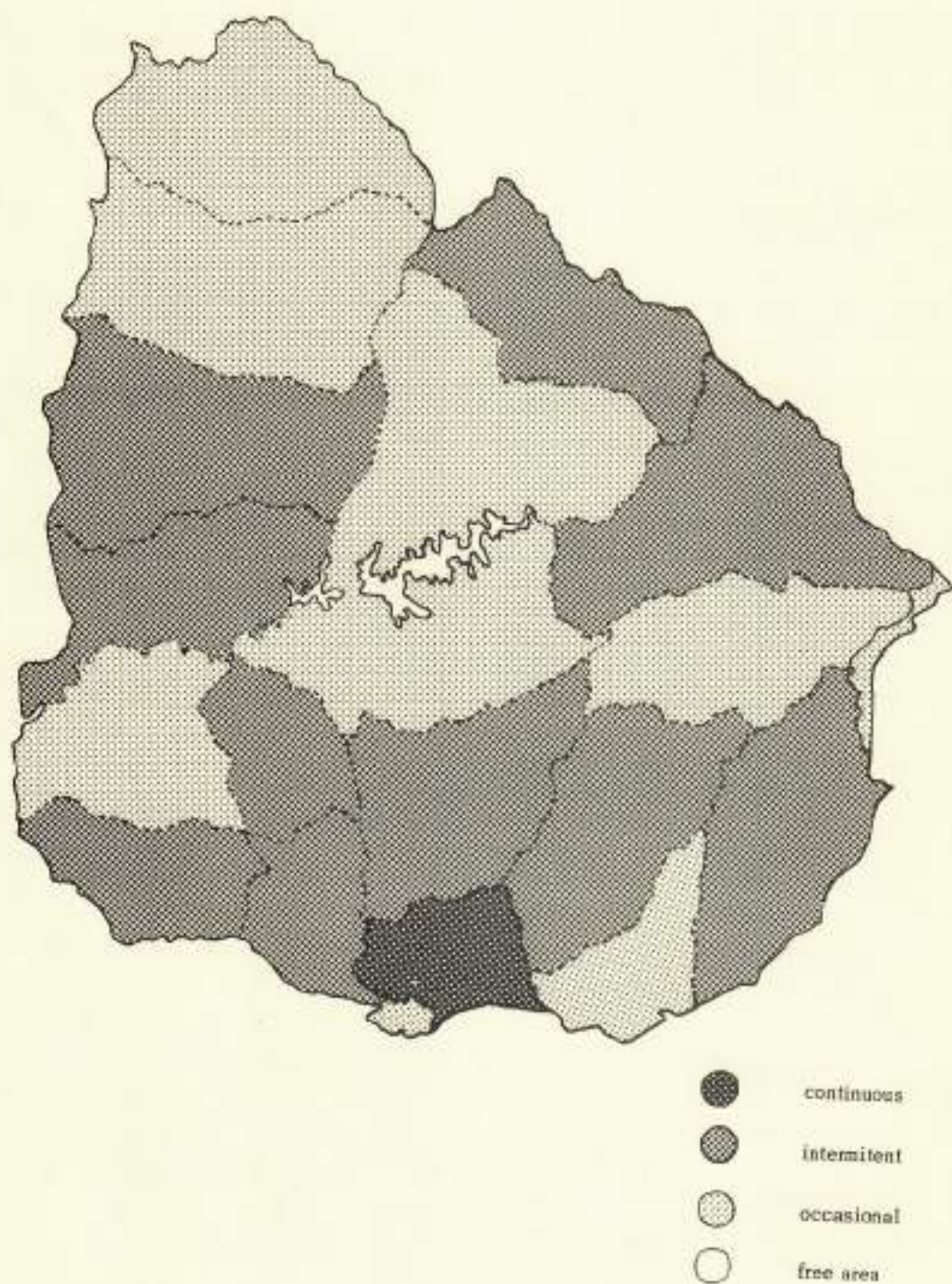
Nevertheless, it may be said that the incidence of the disease from 1967 through 1971 has been exceeding low, without the presence of epidemics. It is true that the virus O₁ wave occurring in the south of Brazil (state of Rio Grande do Sul) towards the end of 1970 and beginning of 1971, had some effect in every department of Uruguay, but it should be stressed that few farms were affected, and even so to a very slight degree of morbidity and intensity.

During the other years covered by this document, the disease only cropped up sporadically and on circumscribed locations. Thus, amongst others, several foci of virus O were identified towards the end of 1967, and there was an outbreak of virus A in Lavalleja department at the end of 1969, and another in Salto department at the end of 1971 provoked also by virus A.

In Map 11, the departments of Uruguay are classified according to the percentage of months in which the FMD virus was diagnosed in the period 1969-1971.

MAP Nº 11

URUGUAY - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



10 - Venezuela

In Venezuela two foot-and-mouth disease virus types are prevalent, O and A while the existence of virus type C never having been determined.

There are three zones fairly well delimited with regard to occurrence of the disease: a FMD-free zone covering the southeastern part of the country; a zone of sporadic outbreaks throughout the eastern region; and an endemic zone extending to the rest of the territory. Map n° 12 is an interpretation of the results of combining the virus diagnosis data for the period 1969-1971.

While several Venezuelan states used to be considered free of foot-and-mouth disease prior to 1967 (Amazonas, Bolívar, Delta Amacuro, part of Anzoátegui and Monagas), the appearance and persistence of the disease in certain parts has restricted the area so considered. It is a fact that in this area certain sporadic outbreaks did occur in the 1967-1971 period, such as the first appearance in July 1967 of foot-and-mouth disease in the extreme south of the state of Bolívar, lining the Brazilian border. On this occasion virus type A was isolated and the origin attributed to the possible spread of an outbreak from the neighboring Brazilian Territory of Roraima. Towards the end of 1968, an outbreak with serious consequences occurred in the state of Anzoátegui. It was caused by virus type O, sub-type O₁, and spread to the state of Monagas, which had been free of foot-and-mouth disease for several years.

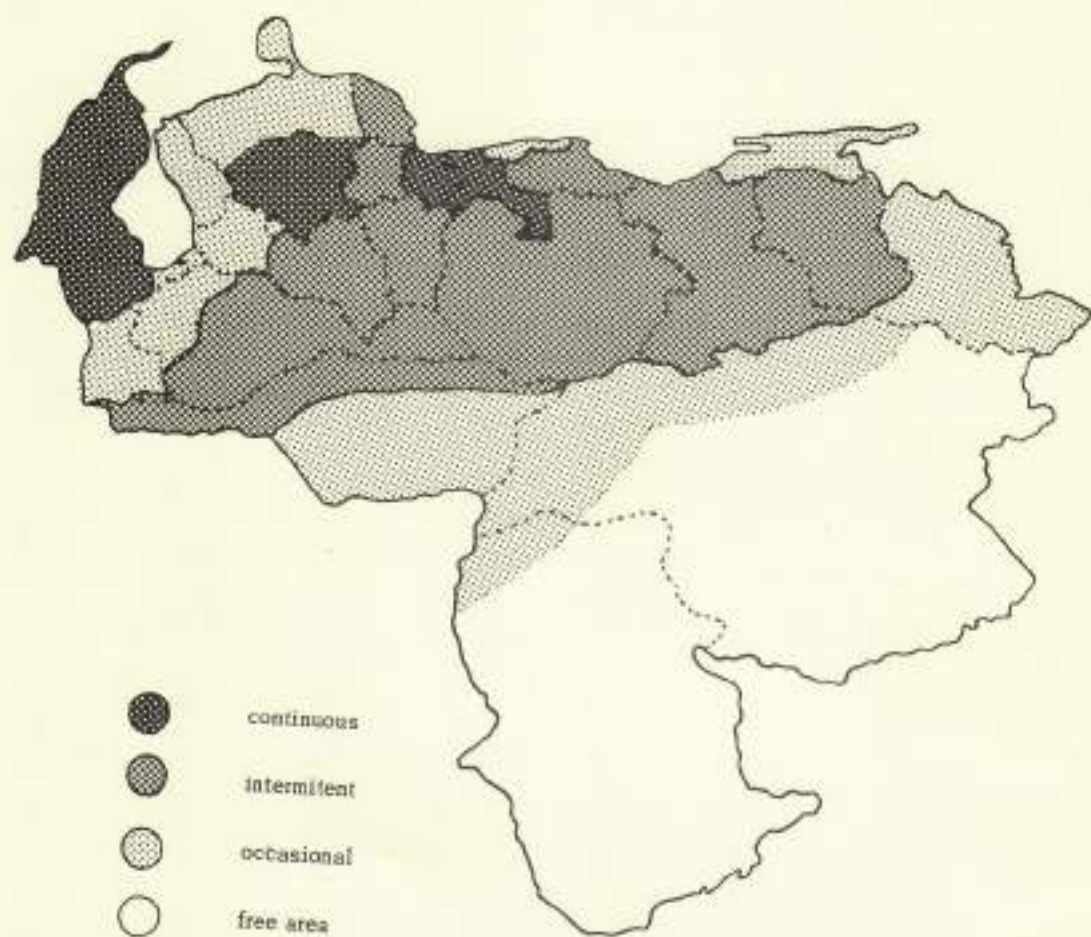
At the beginning of 1970, an epidemic wave of foot-and-mouth disease reached the state of Bolívar via the state of Guárico, where it had been

noted at the end of 1969. This wave, simultaneously detected in various states belonging to the endemic zone (Apure and Zulia, amongst others), was occasioned by a new subtype of virus A, classified as A₃₂ by the World Reference Laboratory. This outbreak was fought in the state of Bolívar with ring vaccination and slaughter of sick animals and contacts. Nevertheless, various foci due to the same virus subtype were again noted at the beginning of 1971. Later, in September, the disease swept so far north as to affect stock farms in Delta Amacuro and Monagas.

As to the endemic zone, two epidemic waves in the 1967-1971 period are worth noting, one due to virus O in 1968 and the other to virus A in 1969. Areas with numerous outbreaks of foot-and-mouth disease, mainly caused by virus A, were recorded in 1970 and 1971. An uptrend in the number of virus O typings began to take shape in the second half-year of 1971.

MAP N° 12

VENEZUELA - Geographic classification according to monthly notification of foot-and-mouth disease presence during the years 1969/1971



C. SUMMARY

In spite of the risk involved in forming an opinion based on insufficient evidence, with the contents of the foregoing chapters, supplemented by observations of its own made by the Pan American Foot-and-Mouth Disease Center, it is possible to reconstruct an approximate overall estimate of the evolution of foot-and-mouth disease in South America during the 5-year period 1967-1971.

Tables 1, 2 and 3 group the statistical data supplied by the countries with regard to the official registry of foot-and-mouth disease. A mere glance is enough to call attention to the discordance of these data, in most cases, with the descriptions in the foregoing pages. As will be seen in the following chapter, on FMD Combat Program, this situation is fundamentally the outcome of the rudimentary way in which notification is made and statistics applied in the animal health services. Towards the end of the 5-year period, however, a distinct improvement is to be observed in some places, notably in Chile and the Brazilian state of Rio Grande do Sul. PAHO is endeavoring to set things to right in this domain and the first results of this top priority promotion allow it to be presumed that by the next few years more reliable figures will be available to gauge the evolution and significance of foot-and-mouth disease.

In general and despite the interference of man, serious flare-ups of the disease have been observed, as well as a tendency to spread. In the first place, it has succeeded in invading and getting a foothold in regions

where it has never before been recorded, or which had been freed of the disease, as in the case of southeastern Venezuela and the sierra and east of Ecuador. In the second place, it has managed to get conveyed even to isolated regions far from the large livestock centers of the continent, and for that reason partly naturally free of foot-and-mouth disease, such as the southern extremes of Chilean and Argentine Patagonia, Colombian Amazonia, the extreme south of the Venezuelan state of Bolívar and likewise the Rupununi savanna in Guyana, although in all of these localities the disease was brought under control and stamped out. Most of these outbreaks correspond to epidemics in the regions where the disease is endemic.

Fortunately there are favorable sectors in this overall setting, where though the disease expanded, often after neighboring epidemics, incidence remained remarkably low. This control was clearly evident in the last few years of the 5-year period in three countries: Chile, Paraguay and Uruguay, furnishing an encouraging example of what it will be possible to achieve on a continental scale as soon as the other countries bring their programs up to the same level, above all as regards immunizing their cattle with vaccines of proven quality. It should not fail to be noted that this is a unique factor common to the three countries mentioned.

II. SITUATION OF FOOT-AND-MOUTH DISEASE COMBAT PROGRAMS

A. GENERAL SITUATION

The 5-year period from 1967 through 1971 may be defined as a preparatory period that will be decisive for the overall combat of foot-and-mouth disease in South America, backed by the determination of all the affected countries to study, draw up and develop national plans for control of the disease.

At the outset of the period, three countries: Venezuela, Argentina and Peru were carrying out programs or activities of nation-wide scope, begun in 1956, 1961 and 1964 respectively. Brazil has a plan for seven states, starting with Rio Grande do Sul in 1965 and incorporating Paraná in 1966 and Santa Catarina and São Paulo in 1967. Independently, Rio de Janeiro had a program of its own under way the same year.

Successively, the following integrated programs were undertaken: in 1968, Paraguay, Uruguay, and the Brazilian states of Bahia and Roraima; in 1970, Chile and the states of Goiás and Mato Grosso in Brazil; and in 1971, the states of Espírito Santo and Minas Gerais in the latter country.

By the end of the period, Colombia was preparing to launch a national foot-and-mouth disease control program, while Peru and Venezuela had reformulated their activities; Ecuador had reached the final stage of drafting the corresponding document; Bolivia was actively engaged on preliminary studies, and Argentina was considering a revision of its combat strategy.

Maps 1 and 2 and Tables 4 and 5 provide a statistical view of this advance.

There is a factor in the development outlined above that should be highlighted. Towards the middle of the sixties or thereabouts, the fight against foot-and-mouth disease comprised a series of classic health actions, among them the systematic vaccination of cattle, considered the most important, and set up as the fundamental parameter for measuring combat progress. Under no circumstances were these activities embodied in a programmatic schedule as it is understood today.

In 1965, PAHO succeeded in enrolling the Inter-American Development Bank in the fight against foot-and-mouth disease in South America, and obtaining an offer of financial aid in the form of loans for national projects, considered as parts of a regional problem. This moment marks the introduction of modern programming methodology, as applied to the controlling the disease.

The joint efforts of the IDB and PAHO are reflected in the documents prepared by the countries on projects for the control of foot-and-mouth disease, in chronological order: Paraguay, Chile and Brazil in 1968; Colombia and Venezuela in 1971.

In the following pages, some of the most important aspects in the foot-and-mouth disease combat programs are discussed.

1. Human resources

As may be seen in item 3 of this chapter, which deals with the administrative structure of foot-and-mouth disease combat programs, the status of those programs and their degree of dependence on animal health

services varies from one country to the next. Likewise the personnel and the work they actually do vary considerably. At present it is impossible to quantify the time and effort that veterinarians devote to foot-and-mouth disease in the countries where such activities come within the scope of the animal health service. Table 6 gives the number of employees engaged in the combat of foot-and-mouth disease, indicating whenever the work is not full-time.

It is pointed out further on in this document that, in any case, the field personnel employed is insufficient to meet the present demands of the service, particularly at times when the upsurge of the disease is especially violent. If to this be added, not just the expansion of the programs, since necessarily this will be paralleled by a personnel increase, but the need of intensifying the corresponding activities, above all in the domains of epidemiological surveillance, planning, evaluation and health education, the shortage becomes even more evident.

On the other hand, the necessity of filling a large number of positions in a relatively short lapse of time and the failure of the curricula of most of the university study programs to keep pace with the new trends in health planning for Latin America, have been the causes of the relative lack of qualification in various skills on the part of professionals holding office. To fill this gap, the highest priority should be assigned in the immediate future to training this personnel at all levels, and bringing them up-to-date with each new development in technology.

Finally, it should be mentioned that the low hierarchical position held by Animal Health Services, in some countries, is a reason for discouraging certain highly specialized professionals from joining that branch of public service.

2. Planning

The usual way of envisaging the fight against animal diseases on the continent has been in the form of stereotyped action campaigns without calculated targets or measurement of results, designed rather to "get things done" as predetermined, without evaluating the effects they have on the health situation of the animal population.

The campaigns were prepared and carried out intuitively, in accordance with the experience of the veterinarians who took part in them, with scarce and unreliable information, based on very vague estimates of the health requirements of the livestock population and the resources needed to meet them. In short, the procedure of combating animal diseases was inclined to be hazy and hazardous.

In the last ten years, the countries have laid increasingly greater emphasis on planning their global and sectorial development. In each case the different sectors of the economy compete for distribution of the available resources. This has obliged the animal health authorities to justify the appropriation of funds for organizing and looking after the livestock population, and to establish a scale of priority so as to combat preferably the diseases that cause the most damage.

Since the mid-sixties a new outlook on how best to meet the needs in the sphere of animal health has been taking shape. Thus, all the affected countries have prepared foot-and-mouth disease control programs, in certain cases extending to other communicable diseases. To finance these programs, it has been found necessary to increase the national resources

earmarked for animal health. In this respect, an appeal was successfully made to the Inter-American Development Bank which can now be relied upon to provide invaluable backing.

Even though at times the programs under way may contain methodological defects from the programmatic point of view, it must not be forgotten that they constitute a first attempt to incorporate, in the field of animal health, techniques that are standard practice in the area of social science and tend to provide a sounder base for decision-taking in health administration. In short, it is a matter of optimizing the distribution of available resources so as to minimize every possible risk to the livestock population.

Inasmuch as an increasing number of countries are adopting planning, management and evaluation as working disciplines in the stockraising sector, it is necessary to be able to count on a staff veterinarians fully trained in these techniques. Realizing the urgency of this requisite, in 1971 the Pan American Health Organization established the first international course in animal health planning, with a duration of 6 months. Likewise it has afforded technical assistance in the field of statistical systems, to meet the informational requirements of planning.

3. Administrative organization

From the point of view of administrative organization of the programs or activities in the fight against foot-and-mouth disease, three general setups can be distinguished.

First, an autonomous government agency exclusively assigned to the problem of foot-and-mouth disease, the sole example of which is the National Foot-and-Mouth Disease Combat Service (SENALMA) in Paraguay.

Secondly, a sector of the Ministry of Agriculture dealing specifically with foot-and-mouth disease, with a specific budget for the purpose, as in the case of the Coordinating Agency for Combating Foot-and-Mouth Disease in Brazil and the Foot-and-Mouth Combat Directorate (DILPA) in Uruguay. Both of these sectors are independent of, and parallel to, the general animal health services.

Thirdly, a function included within the animal health services of the ministries of agriculture with a varying degree of individuality as regards the use of the resources for foot-and-mouth disease. In nearly all the countries where this disease is given preferential attention, as in Chile for instance, a specific budget and the exclusive use of a large part of the available resources in manpower and materials can be relied upon.

In Brazil, the states that participate in the national foot-and-mouth disease combat program have create special units within the state secretariats of agriculture, in some cases subordinated to the division of animal health control and in others independent therefrom. Their coordination with the Federal government is obtained by means of mixed state directive groups known as GECCOPA.

As regards the executive side, decisions are concentrated in the central power in Argentina, Bolivia, Colombia, Ecuador, Paraguay, Uruguay and Venezuela. On the contrary, in Brazil, Chile and Peru, they are spread more or less widely over the state, regional and zonal levels.

4. Financial resources

Table 7 contains a summary of the annual global budgets for foot-and-mouth disease combat programs in the period 1967-1971, according to the figures sent in by the countries. The wide variation apparent is due to a series of factors linked to the development of the different programs. Thus the start of each program is accompanied by investments, which are obviously not spread over the entire period under review. Besides, in some cases the data correspond to the activities of the Animal Health Service as a whole. This occurs in cases where the specific foot-and-mouth disease programs have no structure of their own. Where Brazil is concerned, only the figure for 1971 groups the Federal budget assignment and those of the states participating in the national foot-and-mouth disease combat program. In previous years, the data presented referred solely to the contribution of the Ministry of Agriculture.

To give a more accurate idea of the overall costs, Table 8 summarizes the situation of the national programs for the affected area by the end of 1971. Attention should be drawn more especially to the remarkable impetus imparted to the fight against foot-and-mouth disease by partial financing of the programs by the Inter-American Development Bank.

Besides the IDB, other institutions help to finance some of the programs, USAID for instance, which in 1971 furnished Uruguay with US\$ 115 700 and Ecuador with US\$ 800 000 to support their foot-and-mouth disease combat programs.

5. Statistical units

The Animal Health Services of the continent rely on rudimentary forms of statistical mechanisms to supply information on the occurrence of animal diseases and the gravity they acquire. Nevertheless, in most of the countries these mechanisms are inefficient. In general they are not specifically organized for the functions they are intended to perform, i.e. collecting, processing and publishing data. Sometimes they are merely an ill-adapted copy of public health statistical services.

The work being done is evidenced by forms for collecting information in the local units, and the presence, in some countries, of a centralized "Statistical Office", often run by personnel not specifically trained for the job. A common defect lies in issuing too many forms and asking for too much information, without bearing in mind the indispensable objectives called for by the programs. In practice, they represent a bureaucratic obstacle for the field veterinarian, instead of a handy tool to use in his work, with the result that the mass of information they contain is seldom consulted on account of the complexity of doing so. At the central level the forms are filed away, without being processed with a view to contributing to epidemiological and administrative analysis. With rare exceptions, as in the case of Chile since 1970, the statistical units have failed to fill the logistic role which devolves upon them as infra-structural elements in animal health services. On the other hand, this situation may reflect scant development, in animal health services, of certain sectors that are the natural consumers of statistical data, such as epidemiology, planning, administration and evaluation.

In the last five years, however, a new outlook on animal health problems has brought out the importance of being able to rely upon efficient statistical systems. International aid in financing foot-and-mouth disease programs, particularly from the Inter-American Development Bank, added to massive investments by the countries themselves, have shown the need of incorporating, in the fight against diseases of livestock, some of the advanced techniques of planning and evaluation used in social science and mathematics, allied to a deep knowledge of the epidemiology of such diseases. To take full advantage of those techniques, it is necessary for there to be efficient animal health statistical services available to provide reliable data upon the problem subject.

This concern has taken concrete shape since 1970, on account of the following developments:

- a) The preparation of two technical documents by the Center for the guidance of countries in organizing and starting up statistical units to deal with animal health information. One of them was presented, at RICA 4 IV in 1971, with the title of "Project for Developing Systems of Animal Disease Notification and Data Registry" (RICA 4/24). The same year another was published, dealing specifically with the organization of statistical systems for foot-and-mouth disease control.
- b) The putting into operation of certain specific projects for developing statistical units with advisory assistance from the Pan American Foot-and-Mouth Disease Center. In Paraguay the first step to be

taken was a diagnosis of the situation, and a short-time consultant was contracted for the purpose, acting in collaboration with the Center and the IDB.

Towards the end of 1971, a project for developing systems of animal health statistics for the Brazilian state of Rio Grande do Sul began to be tested in the border counties of that state. This project forms part of an agreement between PAHO and the Brazilian Government to set up a technical demonstration zone there. Once the statistical system has been expanded to the whole of the state of Rio Grande do Sul, it will be used for the in-service training of personnel intended to take charge of statistical units in other countries.

6. Epidemiological services

While it is recognised that the development of specific statistical units is of paramount importance for animal health in Latin America, it must be clearly established that statistics is not an end in itself. Among the principal consumers of animal health statistics, no doubt, must be the epidemiologists, as much for the description of actual happenings, as for their interpretation and extrapolation therefrom. At a later stage, the statistical systems become consumers, in turn, of epidemiological analyses for the formulation of mathematical models.

The consumer market for statistical information is, for the most part, exceedingly poor. The lack of interpretation of the data available to some countries, in a more or less organized form, makes it difficult

to bring the knowledge of the epidemiological features of the disease up to date and consequently detracts from the use of such knowledge in planning the steps to be taken to fight it. In the final instance, then, there would seem to be little point in statistical operations as such.

Similar, too, is the situation of the laboratories, where on both the diagnosis and research level, a large part of the effort expended is dispersed through a lack of integration with the rest of the program, and as a true system of feedback, this integration can only be effective by passing through an epidemiological unit.

In the animal health services of the Latin American countries, it is very rare to find personnel specializing in epidemiology. Up till now, rudimentary epidemiological analysis has only been performed, in general, by chiefs of field operations together with their assistants, whose main concern is administrative work.

It is therefore indispensable to train specialized personnel; instill epidemiology-mindedness in the field personnel; and finally integrate a team at the central level, made up of the statistical unit, the laboratory diagnosis and research services, the chiefs of field operations, ecologists and epidemiologists.

It may then be hoped that the foot-and-mouth disease combat programs will be fully qualified to build up an aggressive strategy that will ensure a steady reduction in the prevalence of the virus until it is eventually stamped out entirely. Meanwhile the services will pursue top-priority programs

aimed at nonoptimized protection of the host from the agent, and only indirectly, through overall diminution of the susceptible substratum, will the chances of multiplication of the virus be lessened. Programming along these lines is very unlikely to achieve the objective in view.

The Pan American Health Organization is assigning maximal priority to the development of epidemiological activities in its own field, and to encouraging and collaborating with the countries, primarily as regards the training of human resources.

7. Epidemiological surveillance

Epidemiological surveillance is an indispensable element in foot-and-mouth disease combat programs. Nevertheless, in general it is not very widely developed, in comparison with the progress in other activities, such as vaccinations for instance, which are expected to cover practically the whole of the cattle population in the endemic areas of South America within the next five years.

Priority has been assigned to data collection and notification on recent years, both on the peripheral and on the central level of the countries, and where the Pan American Foot-and-Mouth disease Center is concerned.

Basic collection of data on the occurrence of foot-and-mouth disease is performed by field veterinarians or their assistants. The efficiency of this activity varies on the state of development of the national programs for fighting the disease. In Argentina, where the combat plan has been operating at the national level for a number of years, the information available is quite reliable, though incomplete, for it only concerns the

foci visited where samples were taken for laboratory diagnosis. The data collected on the first visit are often filled out on a second visit. Since every veterinary officer in the zone generally has to cover a very broad area, and, besides foot-and-mouth disease, is in charge of the field activities in connection with other diseases included in the programs of the Health Combat Services, it will be readily understood that only a limited number of establishments can be visited in a given lapse of time. This means that, if the incidence of foot-and-mouth disease rises above a certain level, the greater the number of infected establishments visited, the less, proportionately, will be the information collected.

In the Brazilian state of Rio Grande do Sul, as new areas were incorporated into the Combat Program, the surveillance system continued to expand, until by 1970 the whole of the state was covered by a network of about 135 field veterinarians, with the same drawbacks as in Argentina.

In Uruguay, where the entire country is embraced by the combat program, the surveillance program was not developed parallel to the vaccination programs, which is left to direct action taken by the community. Recently impulsion has started to be given to these activities, both on the professional level and by means of community education.

In the remaining countries, the field of informational coverage is generally restricted to the area assigned to the campaign and is very haphazard elsewhere.

The most striking defects in the systems of notification can be summarized as follows:

- 1) Not enough veterinarians for suitable coverage, above all in times of epidemic, combined with a relative failure to realize the importance of data collecting for the combat program.
- 2) Temporal discontinuity in the visits needed to obtain full information about the outbreaks.
- 3) Geographic discontinuity, adversely affecting the zones most difficult of access.
- 4) Lack of uniformity in data collecting. Some forms are so extremely complex as to make it impossible for the data to be properly processed and furthermore make the veterinarian's work difficult and tedious. Others, on the contrary, fail to cover all the material necessary for a sound analysis.

Some of these points, which will be analysed in greater detail in the chapter on "Special Technical Problems", are being dealt with satisfactorily. This is true of Chile, in the two combat regions, as regards point 1 and, partially, point 2. Others, such as point 4, are the object of maximal attention on the part of the Pan American Foot-and-Mouth Disease Center.

The situation of notification in the countries and the extent to which information about the occurrence of foot-and-mouth disease is passed on to the Center is as follows:

Argentina

Up till 1967, Argentina informed the Pan American Foot-and-Mouth Disease Center every month about the results of laboratory analysis of field samples. From 1968 on, the Health Combat Service (Servicio de Luchas Sanitarias

SELSA) has been publishing a Fortnightly Epizootiological Bulletin giving the details of all the diagnoses of foot-and-mouth disease and other diseases within the scope of the service. Moreover, since 1967, SELSA has been publishing four-monthly and yearly epizootiological bulletins summarizing the situations of those diseases and the steps taken to fight them. In the case of foot-and-mouth disease a brief epidemiological summary is included, with the number of foci registered and typed, rates of incidence, number of vaccinations, samples analysed by the laboratory, etc. In 1968 through 1970, only the foci with positive diagnosis of the virus were mentioned, while in 1971 negative results were again included. Nothing is known of the number and particulars of the foci that were only diagnosed clinically.

Bolivia

Bolivia has not regular system of notification of vesicular diseases. The only data received by the Pan American Foot-and-Mouth Disease Center is supplied by the Foot-and-Mouth Disease Section of the National Institute of Animal Biology (Instituto Nacional de Biología Animal - INBA) in quarterly reports on laboratory activities. Even these reports generally come to hand with delay and irregularity.

Brazil

Even the Technical Team of the Ministry of Agriculture for the Defense of Animal Health began to publish a monthly zoonosanitarian bulletin with the results of the diagnoses made all over the country of foot-and-mouth disease and the other animal diseases with which it is concerned. This is the only information published on the national level dealing with the surveillance of

foot-and-mouth disease. On the other hand, the states involved in the campaign issue bulletins giving sundry information of various origins. Thus, the state of Rio Grande do Sul communicates data by means of: (1) a fortnightly bulletin published by the Animal Health Division, in Brasília, which prints the number and geographical distribution of foci and sick animals, and corresponding morbidity rates. (2) a monthly report from the Desidério Pinamar Institute of Rio Grande do Sul on the field samples processed by this laboratory, and (3) since 1970, fortnightly coded telegrams sent out by the State Statistical and Epizootiological Service to the Pan American Foot-and-Mouth Center, furnishing information on typings and number of counties, properties and animals affected.

In the remaining states, the information is not so abundant, and generally reduced to reports, monthly for the most part, on the field samples processed by the regional laboratories. The only exception is the state of Paraná, which began in 1970 to send the Pan American Foot-and-Mouth Disease Center monthly reports on the program activities in that state. To this information should be added the publication, periodically or not, by some states, of an account of the progress made in their anti-FMD campaigns.

Colombia

Up to 1969, Colombia acquainted the Pan American Foot-and-Mouth Disease Center through the Colombian Crop and Livestock Institute with the monthly geographical distribution of the field samples typed. In 1970, this information was supplemented by fortnightly epidemiological bulletins with the format recommended by the Center in RICA2/3-17. In 1971 the bulletins ceased to come in regularly.

Chile

Up to July 1970, Chile issued monthly reports on the diagnosis of vesicular samples analyzed by the Bacteriological Institute. From then on, it adopted the fortnightly Epidemiological Bulletins recommended by the Pan American Foot-and-Mouth Disease Center. These contained detailed information on the regions covered by the National Foot-and-Mouth Disease Combat Program and an overall report on the rest of the country. Likewise, since 1968 the epizootiological branch of the Agriculture and Livestock Service (Servicio Agrícola Ganadero, SAG) publishes half-yearly and yearly informative bulletins containing elaborate processed data on the occurrence of the disease and activities of the combat program covering the whole country. To these should be added other special bulletins with retrospective or up-to-date epizootiological data in connection with the provinces included in the program.

Ecuador

Starting from January 1968, the Pan American Foot-and-Mouth Disease Center regularly received monthly reports from the Ministry of Agriculture, Department of Serology and Diagnosis of Vesicular Diseases on the field samples processed by that laboratory. Prior to that date, reports were sent in, but not regularly. Since July 1970, Ecuador has been using the fortnightly Epidemiological Bulletins recommended by the Pan American Foot-and-Mouth Disease Center. Similar information, corresponding to records for 1966 through 1970, was compiled by the Ecuadorian Animal Health Center and sent in to the Pan American Center. At the end of 1970, Ecuador began to send fortnightly coded cables through the Telex Service of the Pan American Sanitary Bureau (PASB).

Paraguay

No field information of any kind relating to foot-and-mouth disease was collected in Paraguay until the SENALPA Combat Program went into operation in 1968. Since then, data on foci of foot-and-mouth disease without any other specifications were included in the Animal Health Bulletin of the Ministry of Agriculture every fortnight or every month. The epidemiological case data were computed quarterly by the SENALPA Laboratory Service and sent to the Pan American Foot-and-Mouth Disease Center. In the middle of 1970, the fortnightly Epidemiological Bulletin recommended by the Center began to be prepared, but it was not sent in regularly until 1971. Since the end of 1970, Paraguay has been using the telegraph service for transmitting fortnightly epidemiological information.

Peru

Since the start of 1970, Peru has been sending in monthly bulletins with the layout recommended by the Center of the fortnightly Epidemiological Bulletin. The same year, it incorporated in its notification system the practise of reporting every fortnight over the PASB telex. Prior to 1970, Peru had issued results of field sample typings in irregularly spaced communications from the Livestock Research Institute. (Instituto de Investigaciones Pecuarias).

Uruguay

In January 1970, the Foot-and-Mouth Disease Combat Directorate (DILPA) began to publish a monthly Epizootiological Bulletin regularly, containing information on the number and geographic distribution of outbreaks with a clinical and/or laboratory diagnosis, illustrated with a chart on graph paper.

Venezuela

Venezuela has been publishing the number of laboratory-confirmed foci of foot-and-mouth disease twice monthly for the last ten years. This information is included in the Bulletin of Domestic Animal Disease (liable to Compulsory Declaration, published by the Animal Health Division. Since 1971, this bulletin has been appearing regularly every month. Likewise the Center has been receiving yearly reports on the appearance of foot-and-mouth outbreaks all over the country. Since 1970, Venezuela has been using the Pan American Sanitary Bureau telex service for communicating typed foci and vesicular diseases.

The return to the field services of data processed on the central level is a very inefficient part of the notification system in affected countries. In general the field veterinarian receives very little information on the occurrence of the disease in his own country, and less still, or practically none, where the neighboring countries are concerned. Except for fortuitous contacts, he only knows the results of the typings of the samples he himself sends to the laboratory. Thus it is that, in general, those workers who should benefit the most from a timely notification service, remain, in practice, unaware of the epidemiological situation of the disease in areas that are likely to have an influence on their own zones.

The epidemiological information sent in by the countries is processed and published by the Pan American Foot-and-Mouth Center in an Epidemiological Report, distributed to all the official public health services of the Americas and to other organizations or institutions, both public and private, which are interested in the problem, including the European continent.

The Report is intended primarily for the national authorities responsible for directing the combat against foot-and-mouth disease, with permission to disseminate the contents as they think fit. In special cases, by common accord, it is sent directly to local functionaries who need to be acquainted in good time with the epidemiological situation of the disease on a wider range than that of their own working areas, such as for instance border veterinarians and those in disease-free zones.

The report began to be published in 1969, appearing every four months, then monthly in 1970, and finally fortnightly in January 1971. It contains data on virus typings and subtypings from samples collected on cattle ranches affected by vesicular diseases, morbidity registers, and news of epidemic outbreaks or the emergence of outbreaks on areas free of foot-and-mouth disease.

8. Virus diagnosis

An outstanding place should be reserved in the field of epidemiological surveillance for diagnosis of the causative viruses of vesicular diseases. With the exception of Paraguay, by 1967 all the countries of South America affected by foot-and-mouth disease had an official laboratory for diagnosis. Paraguay began this activity in 1970 in temporary premises pending construction of a definitive laboratory. It is important to point out that all the countries use homogenous techniques for diagnosis, recommended by the Pan American Foot-and-Mouth Disease Center, so that real continental unity has been achieved as regards typing and subtyping vesicular viruses. The Center performs a reference and classification function, at the same time assuring liaison with the Pirbright World Reference Laboratory.

During the 5-year period, Brazil has incorporated several regional laboratories in the system, and now has eight available for purposes of diagnosis. Five belong to the Ministry of Agriculture and are located at Belem, Recife, Belo Horizonte, Barretos and Porto Alegre, while three are subordinated to the state Secretariats for Agriculture of Bahia, São Paulo and Rio Grande do Sul. Their services extend to states that have no laboratories. Thus, for instance, the Federal laboratory of Porto Alegre attends to the requirements of Santa Catarina and Paraná. These states, and Espírito Santo too, will shortly have services of their own. As a complementary service, the Pan American Foot-and-Mouth Disease Center analyzes samples sent from localities not covered by the regional laboratories. In 1971, 279 field samples from Brazil were processed for initial diagnosis or for confirmations and subtypings.

Likewise, Argentina, Colombia and Venezuela are studying the problem or have made plans for establishing regional laboratories subordinated to the central or national laboratory, with the object of encouraging taking samples and so making it easier to perfect an epidemiological knowledge of the distribution of virus. Meanwhile, the construction of new diagnosis laboratories is under consideration in Ecuador, Chile and Peru.

9. Vaccines

In 1971, 35 vaccine-producing laboratories were operating in South America, mostly belonging to private industry, and in that year they prepared 370 million doses, which represents an increase of almost 40% over the 1967 output. Tables 9 and 10 illustrate this situation.

This rate of growth is particularly evident in Brazil, Colombia, Paraguay

and Uruguay. When a laboratory was started up in Paraguay in 1970, at the end of the 5-year period, all the countries affected by foot-and-mouth disease were producing vaccines, though some has to fall back on imports to complete their requirements. Among the latter were: Bolivia, Chile, Ecuador, Paraguay and Peru, to a widely varying extent. The greatest volume of exports originated in Uruguay and Argentina, and to a minor degree Colombia.

Hence, the trend lies toward self-sufficiency. In Argentina this has been achieved for the whole country; in Brazil, for the states taking part in the national plan, and in Colombia, Peru and Venezuela for the current demand of the stock-raisers and for localized official action. All of these countries, and Bolivia, Chile, Ecuador and Paraguay too, are taking steps to promote an industry to meet vaccine requirements for nation-wide programs.

However, the general development of production has not been accompanied by parallel development in the official control system to ensure the quality of the vaccines.

Uruguay alone has enforced, from start of its campaign, complete systems of quality control on all the batches of vaccine made in the country, combining direct methods in cattle with indirect methods, in accordance with the recommendations of the Pan American Foot- and-Mouth Disease Center. Chile has recently begun to apply direct methods in cattle, Argentina controls about half the production in the same way. Paraguay controls all batches, but only indirect methods. The remaining countries have no efficient controls or only make use of them intermittently on a relatively small number of doses, but all are studying the question and preparing to implement suitable controls.

The Center is taking an active part in the guidance and development of this initiative.

10. Vaccination

The main activity of the present anti-FMD combat programs consisting in vaccination, the number of vaccinations made during the five increased considerably, and particularly in 1970 and 1971, in Brazil, Chile, Paraguay and Uruguay (Table 7).

According as to whether vaccination is done preferably by the State or by the stock-raisers themselves, the countries can be grouped in two categories. To the former, Chile, Ecuador, Peru and Venezuela belong. To the latter, Argentina, Bolivia, Brazil, Colombia, Paraguay and Uruguay. This situation is illustrated in Table 8 with data obtained in 1970. Whichever the category, in all the countries it is the government that determines when the vaccination is to be done.

The official system of control over vaccination done by stockmen, varies very widely, ranging from mere notification to registry office to government verification of the stock.

Argentina insists upon the data of vaccination being notified at least five days in advance, to enable the veterinary officer to select the checkers, according to circumstances and in view of the fact that total control of vaccinations would require a personnel more numerous than is available. The responsibility of registering the vaccination with the local FMD Combat Committee lies with the owner of the stock.

In Brazil, generally speaking, the rural guards collect the information

about vaccinations made by cattlemen or by license vaccinators, and in some cases personally checks that this has been done.

In Uruguay, the owners of the animals undertake to file notice of vaccinations with the Neighborhood Committees or the DILPA offices for registry.

These countries and the others that entrust vaccination to the private sector, use the invoices for purchases of vaccine as a means of checking whether the work has been properly done.

11. Health controls

All the countries have legislated on health controls, especially with regard to the movement of livestock and by-products of animal origin. Between countries, numerous agreements have also been concluded bilaterally and multilaterally, in which rules are set up with the object of avoiding the danger of spreading diseases or introducing their etiological agents and this without hampering international trade.

There exist, nevertheless, some aspects which have a negative influence on the benefit obtainable from these health controls.

Among the most important may be mentioned the following:

- a) Little knowledge of displacement of susceptible livestock for reason of marketing or farm management.
- b) Deficiency or delay in applying prophylactic measures to primary foci (enclosure or isolation, ring vaccination or slaughter in free zones).
- c) Deficient working of the system or epidemiological surveillance, occasioning delay in communicating the appearance of cases.

- d) Difficulty in applying health measures that cause temporary obstruction of trade, owing to low hierarchical status of Animal Health Administrative Services (e.g. closing of marketing centers and/or other points of cattle concentration and transit).
- e) Inadequate cooperation of other public authorities concerned with the surveillance and control of movement of livestock, vehicles and persons (Police, Army, Customs Authorities).
- f) Failure to enforce or comply with certain international agreements and/or revision of same in order to make their terms more effective.

As an example of the necessity and importance of effective health controls, attention should be drawn to the agreement signed by the governments of Venezuela and Brazil on the importation of Brazilian zebu cattle by Venezuela. In this case, the Pan American Foot-and-Mouth Disease Center developed a method, based on the present knowledge of the survival of foot-and-mouth disease in bovine carriers, with the object of minimizing the dangers of introducing into Venezuela the virus type C Waldmann and subtypes of virus O and A Vallée, existing in Brazil. Under this control, from 1968 through 1971 five shipments totaling about 900 head of cattle went through without raising problems.

Likewise, in January 1970 health authorities of Argentina, Chile and Peru met to draw up the rules of health control to be followed when Argentina cattle is imported over Chilean territory on the way to Peru.

Bi- and multilateral agreements are dealt with in Chapter V.

12. Health education and dissemination

From the point of view of health education as a necessary element of

support for the development of plans of campaign, it is licit and advisable to consider the application thereof at the executive or central level, and the receptive or community level.

Within the structures at present set up for fighting foot-and-mouth disease in South America, unfortunately such activity as there is to be seen in the field of health education is not enough to cover the requirements in this respect, except in the case of Chile. Paraguay has specific units, but they have not yet been developed to the extent needed to integrally perform their function.

There can be no doubt that on the foot-and-mouth disease programs and on the performance of other tasks likewise of foremost importance such as epidemiological surveillance, keeping of statistics and evaluation of situations.

Summarizing, it may be said that in general the action taken in the last 5 years in the field of health education on the levels defined above covers the following:

- 1) On the executive or central level: training courses, generally short and including various subjects, with the exception of those held at the Pan American Foot-and-Mouth Disease Center laboratory technicians, and that conducted in Buenos Aires to train veterinarians in animal health planning.
- 2) On the receptive or community level: talks on the level of stock-raiser's organizations, distribution of posters and pamphlets, a few mass communication broadcasts (radio and TV), many of them, however, lacking in continuity and penetration, and not based on

properly programmed arrangements. Great progress though, was made in this direction during the 1967-1971 five year period by Uruguay, a country which from the outset of its national campaign has assigned top priority to community development through the creation of neighborhood committees, cooperating with DILFA, and technical information centers set up in rural grade schools. The school children, in turn, attend classes on animal health topics. These committees constitute the mainstays of the campaign in Uruguay. Emphasis should likewise be laid on the value of the specific health education units organized during the period under review in Chile and Paraguay - countries in which the activities pursued are building up steady support over a wide front for their respective National Foot-and-Mouth Disease Combat Programs.

B. SITUATION BY COUNTRIES

Tables 13 to 22 contains statistical information, for each country, on coverage of the activities in the fight against foot-and-mouth disease and the resources used in the five years from 1967 through 1971.

1. Argentina

The General Animal Health Directorate of the Ministry of Agriculture and Livestock, Secretariat of State, acting through the Health Combat Service (Servicio de Luchas Sanitarias - SELSA), in 1963 maintained unaltered the Organization and structures of the national Foot-and-Mouth Disease program started in 1960 with the establishment of a national advisory commission for

eradicating the disease (CANEFA - Comisión Asesora Nacional para la Erradicación de la Píebre Aftosa), and by 1967 the whole of the territory was being covered.

To fulfill its commitment, SEISA has four services, namely: Laboratory, Field, Planning and Special Services.

The Laboratory has charge of virus diagnosis and quality control of vaccine. While the degree of positive results in typing samples of outbreaks is high, the number of samples collected is below standard, for it is estimated that three-quarters of the total outbreaks are not sampled to identify the causative agent.

Ever since the start of foot-and-mouth disease combat activities, Argentina has been self-sufficient in the production of the vaccine needed, and has even been in a position to export some to other countries on the continent. The vaccine is made by 12 private laboratories, controlled by SEISA. The strength of the product approximates to 50% of the total doses. In this connection, studies are being made to enforce a system that will ensure that all vaccine supplied for consumption is the best possible quality.

The field service carries out the directives of SEISA through the Local Combat Committees at the county level (partido or departamento) in the various provinces. These Committees, presided over by the Local Veterinary Officer, and composed of 4 representatives of the stockraisers' associations - rural societies and cooperatives - assisted by a secretary, are responsible for managing the campaign. Their main duties consist in detecting outbreaks of foot-and-mouth disease, receiving notifications of existence of the disease, controlling and registering vaccinations, supervising the sale of vaccines,

controlling auction fairs, and movements of livestock, extension work and documentation of infractions of the regulations.

The program is based on compulsory vaccination every 120 days of all cattle of any age, and every 180 days of all sheep more than 3 months old, at the north of the Colorado and Barrancas rivers. Compulsory vaccination of sheep, which was ordered in 1968, is the only change in the methodology of fighting the disease.

From the strategic point of view, that same year the province of Santa Cruz and the national territory of Tierra del Fuego¹ were recognized disease-free areas, as was the province of Chubut the following year, in accordance with the International Animal Health Code. To the north of the latter lie the provinces of Neuquén and Rio Negro, considered as disease-free and therefore not subject to systematic vaccinations.

In 1969, the Inter-American Development Bank approved a loan in the value of US\$ 10,500,000 to back a SELSA project designed reinforce the national foot-and-mouth disease combat program by building and equipping a new control and reference library, quarantine stockyards, check points for livestock in transit and truck washing, equipment of field work groups, personnel training and hiring advisers. Local budget problems prevented the project from getting under way, and studies are now being made on how best to reformulate it so as to ensure implementation.

¹ The national territory of Tierra del Fuego had lost its disease-free status on account of an outbreak which occurred towards the end of 1966.

In 1970, SEISA prepared a Basic Document on the Foot-and-Mouth Disease Control Program and a Plan of Activities for 1971. This work is the first attempt to regulate fighting the disease along the lines of the methodology preconized on this continent by PAHO/PAPMC. The main objectives of the campaign are set forth as follows:

- a) Lessen the number of foci of foot-and-mouth disease in the country.
- b) Increase the number of controls of anti-FMD vaccination.
- c) Devise a Plan for permanently ascertaining the incidence of foot-and-mouth disease.
- d) Preserve free from the disease the zones declared disease-free.
- e) Enlarge and protect the existing disease-free zones, incorporating the Andean to the extent that they comply with the precepts of the International Zoosanitarian Code.
- f) Maintain supervision and evaluation of the controlled anti-FMD vaccination zones.
- g) Control the handling of anti-FMD vaccines within the area of controlled vaccination.
- h) Compile the corresponding statistics, and draft conclusions at the end of the experiment.
- i) Compell all transporters of livestock susceptible to foot-and-mouth disease to present their means of transportation in a perfect state of cleanliness and disinfection before the animales are taken on board.

- 3) Produce the information relative to the epizootiological situation throughout the country.

With the purpose of devising more efficient means of speeding up the control of foot-and-mouth disease, at the end of 1970 the Secretariat of State for Agriculture and Livestock, by Resolution N° 1374 (Oct. 28, 1970) set up the Joint Commission for the Fight against Foot-and-Mouth Disease, composed of the Health Combat Service (SELSA), the National Crop and Livestock Technology Institute (INTA), the Faculty of Agronomy and Veterinary Medicine of Buenos Aires, the Faculty of Veterinary Medicine of Buenos Aires, the Faculty of Veterinary Science of La Plata, and the Argentine Foundation for Eradicating Foot-and-Mouth Disease (PADEFA), the latter being an institution that groups the organization of stockraisers, meat packers and livestock consignees. The Commission started work in 1971 and the first result achieved was a pilot plan for analysing the efficiency of the current standard practices for control of the disease.

Additional data are presented on Table 13.

2. Bolivia

The country does not yet have a national foot-and-mouth disease combat program. With financial aid from the IDB, a private firm is now engaged on the corresponding feasibility study, including therein rabies and brucellosis. It is calculated that the complete project will involve a loan of about US\$ 3,000,000 from the Bank.

Meanwhile, the Livestock Technical Service of the Ministry of Rural and Agricultural Affairs is using the available resources organize pilot plans

in Cochabamba and Santa Cruz de la Sierra. Furthermore, it encourages and gives advice on voluntary vaccination by stockraisers, intervening directly in the case of emergence of severe outbreaks.

The diagnosis of vesicular viruses and the production of anti-FMD vaccine is taken care of by the National Institute of Animal Biology. Both activities are far from sufficient to meet the country's requirements, as may be seen in Table 14. About three-quarters of the vaccine used by the stockraisers comes from Argentina.

On various occasions contact has been made with the Peruvian authorities with a view to joining forces to fight the disease in the border zone, but so far without concrete results.

The creation of an organization to be annexed to the Livestock Technical Service and placed in exclusive charge of foot-and-mouth disease matters throughout the country has been planned.

The present objectives, as of January 1971, for the organization of the fight against foot-and-mouth disease are the following:

- a) To organize the bases of a technical, administrative and juridical structure, on which to carry out the campaign.
- b) To vaccinate 250,000 cattle with inactivated O, A and C trivalent vaccine in 1972.
- c) To establish a central system for collecting epizootiological data whereby the reports sent in by the Departments and the Foot-and-Mouth Disease laboratory can be assembled and organized.

- d) To produce 750,000 doses of inactivated OAC trivalent vaccine - 500,000 by the Frankel method and 250,000 BHK in 1972.
- e) To increase the number of diagnostics.
- f) To train the indispensable personnel for the campaign in the calendar year.
- g) To reinforce the system of controlling imports of vaccine.
- h) To prepare a health agreement with Brazil and Peru.
- i) To take steps to encourage the communities to joint in the campaign.

In 1963, the Ministry of Agriculture prepared the First Plan for Fighting Foot-and-Mouth Disease (Project 104/63 of the Federal Crop and Livestock Fund), which failed to be put into operating for lack of resources, but served as a basis for future planning and as a source of information for perfecting an understanding of the scope of the problem.

3. Brazil

By Decree Nº 52,344 of August 9, 1963, the government created the Campaign Against Foot-and-Mouth Disease (Campanha Contra a Febre Aftosa -CCFA), attached to the Ministry of Agriculture, to be the organization in charge of the fight against the disease throughout the national territory. Under its orientation and stimulus, the states of Rio Grande do Sul and Santa Catarina established compulsory combat against foot-and-mouth disease in 1965 and 1966 respectively.

In 1968, the Ministry of Agriculture submitted to the Inter-American Development Bank, the project of National Foot-and-Mouth Disease Combat Plan, to be carried out in four stages:

- a) First stage (1971-1974). Calls for compulsory vaccination, systematic, repeated and controlled, of cattle more than four months of age in the states of Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Minas Gerais, Bahia and Espírito Santo, in pre-established proportions⁽¹⁾ and application of complementary health measures, including expansion of the installations of anti-FMD control laboratories and network of serological diagnosis laboratories, setting up various border quarantine stations and border check points to control interstate and international cattle traffic, and intensive training for technical personnel.
- b) Second stage (1974-1977). Vaccination will be gradually extended to cover all cattle of more than four months of age in the seven states included in the first stage, and started in the states of Mato Grosso, Rio de Janeiro, Goiás and Sergipe.
- c) Third stage (1978-1981). Vaccination and control of the disease will cover all the herds of cattle in the states in the Northeastern region and south of Paraná, as well as the stockraising zone that is being formed alongside the Belém-Brasília Highway and will extend integrally to all the territory of the states where the program was started in the second stage.
- d) Fourth stage (1982-1985). The project will cover the whole cattle population of the country, with simultaneous consolidation of the results obtained in the the three previous stages.

(1) Between 95 and 100% in Rio Grande do Sul, Santa Catarina and Paraná; between 40 and 45% in São Paulo; and between 65 and 70% in Minas Gerais, Bahia and Espírito Santo.

In 1970, the Bank approved a loan of US\$ 13,000,000 for development of the first stage. Table 22 gives an idea of the coverage obtained by the seven states taking part in the plan and corresponding activities that the federal and state animal health services are furthering in the states of Goiás, Mato Grosso and Rio de Janeiro, and Roraima territory, in the last case, pursuant to international commitments with Guyana and Venezuela.

The Ministry of Agriculture is carrying out a plan through the intermediation of the Technical Team Coordinating the Anti-FMD Campaign (ETCCA), in collaboration with the Secretariats for Agriculture in the different states, which act through their respective Animal Health Services. Local coordination is delegated to Executive Groups, formed by representatives of the Federal government and state government.

Vaccine production is in the hands of 13 privately-owned laboratories and has been steadily increasing, as may be seen in Table 15, to keep pace with the requirements of the national plan. The CCFA controls the quality of the vaccine in three federal laboratories located in Minas Gerais, São Paulo and Rio Grande do Sul. As far as preparation of the vaccine is concerned, complete control is extended to the entire production. Efficiency control is now being set up.

4. Colombia

Since foot-and-mouth disease was introduced into Colombia in 1950, the Ministry of Agriculture, through its veterinary services, has been pursuing activities designed to fight the disease. In general, they are based on: virus diagnosis, vaccine production and distribution, control of voluntary vaccination by stockraisers and movements of livestock, and direct application of health measures in case of epidemics.

During the first half of the sixties, attempts were made to organize these activities on the national plan, but only the sectors corresponding to the border regions with Panama and Ecuador were implemented, pursuant to the corresponding international commitments.

In 1969, the Colombian Crop and Livestock Institute (Instituto Colombiano Agropecuario - ICA) was created as part of the Ministry of Agriculture and that same year work was started on a health project for fighting foot-and-mouth disease and brucellosis on a nation-wide scale. Towards the middle of 1971, financial aid in the amount of US\$ 7,300,00 was granted by the Inter-American Development Bank, and an immediate start was made on the Foot-and-Mouth Disease Combat Subproject.

The subproject is to be divided into two combat stages, the first to include only Zone 1, the "Atlantic Coast", composed of the Departments of Atlántico, Antioquia, Córdoba, Bolívar, Sucre, La Guajira, Magdalena, El César, Norte de Santander and part of Santander and Chocó. This zone contains approximately 9,179,000 head of cattle, i.e. 45% of the total population of the country.

The outset of the second stage of the Programs, which is to cover the rest of the country, has been scheduled for 1975.

The basic objectives as programmed in 1971 have been:

- a) Organization of the technical and administrative structure of the anti-FMD campaign (National), and Atlantic Coast).
- b) Training of campaign personnel.

- c) Immunization of the bovine population of the Atlantic coast.
- d) Control of vesicular outbreaks and establishment of a system of epidemiological surveillance on the Atlantic Coast.
- e) Coordination with other organisms.

The preventive program against foot-and-mouth disease in the north-western area of Chocó should be kept separate in view of its importance, since this zone marks the division of the disease-free area of the Americas from the affected area.

In this Panama-Colombia border area, where there are about 13,000 head of cattle, only one focus of foot-and-mouth disease has occurred and this was in August 1967. Since March 1966, vaccination has been effected every 4 months, a record of the bovine population has been kept up to date, as well as an epizootiological card index of the existing farms (550 in all), visits of inspection have been paid regularly to these farms and a regular control kept of the introduction of livestock. The system is now the object of studies and discussions, with a view to incorporating it in an international convention on prevention of foot-and-mouth disease, with the participation of disease-free American countries and the collaboration of international organizations sharing responsibility in providing a solution to the problem.

The only producer of anti-FMD vaccine in Colombia is the Colombian Livestock Products Enterprise (Empresa Colombiana de Productos Pecuarios -VECOL), an industrial and commercial unit attached to the Ministry of Agriculture.

Expansion of the foot-and-mouth disease unit is under study to meet the requirements indicated in the subproject. Quality control of the vaccine and diagnosis of the causative viruses in the field is the responsibility of the Médico-Veterinary Research Laboratory (Laboratorio de Investigaciones Médico-Veterinarias - LIMV) of the ICA. The construction and equipment of new installations is being planned to fill the needs of the subproject.

Additional data are presented on Table 16.

5. Chile

Up till 1965, the fight against foot-and-mouth disease followed more or less the same lines as those outlined in the opening paragraph on Colombia. That year the Ministry of Agriculture started work on a planning schedule that led to the presentation in 1968 of a project for a National Foot-and-Mouth Disease Control Plan.

The plan had been in execution since 1970 and is backed by a US\$ 2,300,000 loan from the Inter-American Development Bank. It is in the hands of the Animal Health Division of the Agricultural and Livestock Service (Servicio Agrícola Ganadero) of the Ministry of Agriculture, which conducts all the field operations directly. It also has to do with production of vaccine and, together with other state departments, sees to quality control and virus diagnosis. The output of virus is not enough for the needs of the plan and is supplemented by imports from other South American countries.

Integrated activities as specified in the Plan were started in the 1st Region, comprising the provinces of Valdivia, Osorno, Llanquihué and Chiloé, which contain some 33,000 livestock farms, raising in all more than 900,000

head of cattle. In 1971, the activities of the National Plan were extended to the 2nd Region, which includes the provinces of Cautín, Malleco, Bio-Bio, Arauco and Concepción, with a total of more than 850,000 head of cattle. It was planned to incorporate the 3rd and 4th Regions in 1972, thereby covering the whole of the country with the exception of the provinces of Tarapacá, Antofagasta and Atacama in Northern Chile, incorporation of which in the National Plan is not yet envisaged. The provinces of Magallanes and Aysén, being disease-free areas, will not be included in the vaccination program.

In general, the campaign in each region is organized as follows:

- (a) Regional Coordination is in the hands of Regional Coordinator who is a veterinarian, and is provided with a Biostatistical Office and a Health Education Bureau.
- (b) There are Provincial Units with a Veterinary Officer in charge, which include a team for the control of foci of foot-and-mouth disease, a statistics assistant, an administrative officer, a mechanic and intraprovincial work sectors, each with a vaccination team made up of an Inspector (an agricultural practitioner or technician) and two vaccinators.

Some of the objectives of the Plan, as set forth in the abstract of the basic document (December 1969) are the following:

- a) To create the National Foot-and-Mouth Disease Control Plan, attached to the Agriculture and Livestock Service (Servicio Agrícola y Ganadero-SAG) with full technical, administrative and financial autonomy.

- b) To immunize not less than 80% of the cattle population over 3 months old, three times a year, in all the provinces covered by the Plan.
- c) To prepare and carry out a project for the provinces in the Northern Zone (Tarapacá, Antofagasta and Atacama) with the object of eliminating sporadic outbreaks of foot-and-mouth disease.
- d) To keep the provinces of Magallanes and Aysén a zone free from foot-and-mouth disease.
- e) To study formulas whereby a fund can be set up with contributions from stockraisers, for seeing that strict attention is paid to sanitation in zones free from foot-and-mouth disease.
- f) To afford 100% assistance to farms attacked by foot-and-mouth disease in the provinces covered by the National Foot-and-Mouth Disease Control Plan.
- g) To provide the Health Control Department with the indispensable personnel and equipment for keeping a strict control over livestock transit and transportation.
- h) To increase vaccine production capacity to not less than 10 million trivalent doses a year.
- i) To thoroughly control (for sterility, innocuousness and efficacy) all the vaccines sold and applied in the country.
- j) To devise a Statistical Information Unit, by which in coordination with the Statistical Unit of the Department of Epizootiology of the Animal Health Subdivision, statistics on foot-and-mouth disease can be collected, tabulated, analyzed and published.

- k) To establish a system enabling parallel periodical evaluations to be made of what foot-and-mouth disease means to the country and the activities performed.
- l) To pursue the training of professional, technical and administrative personnel.
- m) To create a Unit of Health Education and Community Organization within the National Foot-and-Mouth Disease Control Plan.
- n) To determine the social and cultural values existing in farming communities and liable to be affected by foot-and-mouth disease.
- o) To arouse the awareness of the community to a comprehension of the foot-and-mouth disease problem, thereby causing it to adopt a favorable attitude toward control measures.

Additional data are presented on Table 17.

6. Ecuador

With the specific purpose of fighting foot-and-mouth disease, the Ecuadorian government created the Livestock Health Center (Centro de Salud Pecuaria), as an agency attached to the Ministry of Development, transformed successively into the Ministry of Agriculture and Stockraising and finally into the present Ministry of Production. Its original function was extended to the control of other diseases, now the overall responsibility of the Animal Health Section of the Livestock Promotion Department (Departamento de Fomento Pecuario) of that Ministry, excepting as regard virus diagnosis and the production and control of vaccine, which are performed by the veterinary laboratories, incorporated in 1971 in the National Hygiene Institute of the Ministry of Health.

Ever since the Livestock Health Institute was set up, a constant effort has been made to fight foot-and-mouth disease, though the activities deployed have varied in intensity and extent according to the fluctuations in the resources available.

In the period 1967 through 1971, the anti-FMD campaign activities were directed mainly towards emergency or preventive vaccination in the areas of the country where the incidence of the disease was the highest or else where the risk of infection was enhanced by proximity. The campaign also implied visiting the largest possible number of establishments where the presence of vesicular cases had been notified, in order to gather data on morbidity, take samples of epithelium for diagnosis and enforce health regulations.

With the object of proceeding to more stable and effective action, a National Foot-and-Mouth Disease Control Project was completed in 1971 and presented to the Inter-American Development Bank with an application for a loan of US\$ 2,800,000. At the same time, the financial aid of the United Nations Development Program was negotiated for purposes of building and fitting out new veterinary laboratories for the Ministry of Health.

The objectives outlined in the working plan for the foot-and-mouth disease control project, from 1971 on, are:

- a) Technical and administrative reinforcement so as to be able to carry out the campaign over a national range.
- b) Enactment of laws and regulations connected with the program.
- c) Perfection of a system of epidemiological surveillance.

- d) Establishment of a Biostatistics Unit.
- e) Vaccination of cattle in an endeavor to reach, and in some cases to surpass, 80% cover with inactivated A-O bivalent vaccine.
- f) Payment of closer attention to affected farms.
- g) Establishment of control and disinfection posts.
- h) Attainment of an annual production of 5,000,000 doses of inactivated A-O bivalent vaccine by 1974. Distribution of vaccine to subcenters and localities.
- i) Training of campaign and laboratory personnel in the period of 3 years.
- j) Community organization and education.
- k) Improvement of the evaluative system.
- l) Execution of border agreements.
- m) Publication of periodical bulletins and reports.

The data on Ecuador are listed in Table 18.

7. Paraguay

At the beginning of the period, generally speaking, the fight against foot-and-mouth disease consisted in voluntary sporadic vaccination by stock-raisers and the application of health measures by the Ministry of Agriculture when outbreaks of epidemic intensity occurred. The country had no laboratories for purposes of diagnosis or anti-FMD vaccine production. The vaccine needed was imported, generally from Argentina. In September 1967, the government

created the National Foot-and-Mouth Disease Combat Service (Servicio Nacional de Lucha contra la Fiebre Aftosa - SENALFA), an autonomous agency, to study and prepare a National Foot-and-Mouth Disease Combat Program. To put it into practice, a loan of US\$ 2,800,000 was obtained from the Inter-American Development Bank. Field work was begun in June 1968, when compulsory vaccination of all cattle was enforced in three farming districts in the south of country: Encarnación, Gambyretá and Capitán Miranda, comprising a total of 2,279 stockraisers and 21,522 head of cattle, figures that were raised in the second period, scheduled for October the same year, to 31 districts with 437,156 head of cattle and 15,217 owners.

SENALFA has continued to extend its range of action in the course of the last 3 years, and by the end of 1971, an area of 128,516 km² had been brought under health control with compulsory vaccination, thus covering 11 departments with 146 districts occupied by 86,032 stockraisers with 2,234,649 head of cattle.

Up till 1970 virus diagnosis was performed by the Pan American Foot-and-Mouth Disease Center and the vaccine imported from Argentina and Uruguay. The following year a private laboratory started up, and produced all the vaccine required for the country. At the same time, SENALFA began to undertake the work of virus diagnosis and quality control of the vaccine in provisionally equipped premises while the definitive laboratory was being built, completion being scheduled for 1972.

The main objectives figuring in the SENALFA combat program are the following:

- a) Extension of compulsory anti-FMD measures in the eastern zone to the banks of the Paraguay river.

- b) Extension of compulsory anti-FMD measures to the whole of the Paraguayan Chaco Zone.
- c) Establishment of a system of epidemiological surveillance.
- d) Organization of a laboratory to perform the work of typing foot-and-mouth disease virus and controlling anti-FMD vaccines.
- e) Production of the necessary anti-FMD vaccine for vaccinating all the cattle in the country every 4 months.
- f) Control of cattle in transit and corresponding health inspection.
- g) Reorganization of the existing Statistical Service so as fully to perform the functions of a Biostatistics and Evaluation Unit.
- h) Organization of Commissions made up of personnel from the different departments, District Committees, rural associations and national authorities to support the anti-FMD campaign.
- i) Enforcement of the Bilateral Health Agreements on Foot-and-Mouth Disease.

Additional data are presented on Table 19.

8. Peru

In 1963, compulsory anti-FMD vaccination was established for cattle and in 1964 a start was made with a campaign for controlling the disease throughout the territory of the Republic. In 1965, the vaccination regulations still in force were issued. Since 1967, the campaign has been gradually intensified and the vaccination coverage increased.

Foot-and-mouth disease control was programmed bearing in mind the epidemiology of the disease in Peru, and is based on the following precepts:

- a) Health surveillance, so as to ensure early recognition of the appearance of any case of vesicular disease and determination of the diagnosis in the laboratory.
- b) Confinement of the detected focus and application of temporary quarantine until the infection is stamped out, so as to avoid or at least limit the possibilities of diffusion.
- c) Protection by vaccination with trivalent vaccine against O, A and C viruses in cattle and other species that develop immunity with application of the vaccine, in areas where such species have been seen to be important in spreading the disease.

In the areas that are the most exposed to infection, above all by the trade in livestock for fattening or consumption, and also in areas bordering international frontiers, vaccination of the cattle is performed every four months. This treatment is extended to cattle raised intensively, as in the case of the livestock in the coastal and inter-Andean valleys, especially the dairy herds, and also to cattle in the fattening centers and areas where trading is carried on in livestock on the hoof.

In places where the cattle is widely scattered, as on the higher levels of the Andes cordillera or in stockraising regions of the selva, vaccination tends to be performed every six months.

In Peru, for purposes of the Foot-and-Mouth Disease Control Campaign, validity is only accorded to vaccinations made by personnel of the Ministry of Agriculture or by veterinarians in private practice duly registered as vaccinators. For such vaccination to be considered as part of the campaign, veterinarians in private practice must issue vaccination certificates made out on official forms and send in monthly reports on the work done.

During the last four years the Campaign against Foot-and-Mouth Disease has brought about a significant reduction in the morbidity rate.

In Peru the vaccine used is prepared in the country by the Institute of Zoonosis and Livestock Research (Instituto de Zoonosis e Investigación Pecuaria) of the National Health Institutes of Ministry of Health, which is the official laboratory for research, diagnosis and preparation of biological products for health campaigns. Exceptionally, to meet an emergency, limited quantities of vaccine prepared in other countries have been imported.

The Foot-and-Mouth Disease Control Campaign is run by the Foot-and-Mouth Disease Combat Division (División de Lucha contra la Fiebre Aftosa), which is a dependency of the Subdirectorate of Livestock Health, which belongs to the Directorate of Livestock Promotion, which in turn is subordinated with the other Directorates to the General Directorate of Crop and Livestock Promotion of the Ministry of Agriculture.

For purposes of crop- and stockraising, Peru is divided into twelve Agrarian Zones, each in the charge of a Zonal Director. The Zonal Directorate has the responsibility of carrying out all the health campaigns within its jurisdiction, including the Campaign against Foot-and-Mouth Disease.

In January 1971, the Peruvian government made an application to the Inter-American Development Bank for a loan to partially finance a project for a Foot-and-Mouth Disease Control Program. The Program provides for a four-year outlay of US\$ 11,500,000, of which 4 million will be financed by the Bank.

The Program comprises the execution of three projects, namely:

- Project A. Operation and Equipment of the campaign of control in the field.
- Project B. Construction, equipment and operation of the Quarantine Stations and Animal Health Check Points.
- Project C. Construction, equipment and operation of the Central Diagnosis, Research and Vaccine Production Laboratory.

To summarize, the Foot-and-Mouth Disease Control Program proposes:

- a) To raise the annual number of vaccinations in cattle from 3,000,000 to 7,158,000. This means that, by the third year, systematic vaccination will cover 80% of the cattle population of the country.
- b) To install within 2 years the necessary infrastructure to control the entry of vesicular diseases (Quarantine Stations and Border Check Points), as well as their spread by movements and concentrations of cattle within the country (Inland Check Points).
- c) In the first year, to build and equip the new Research, Diagnosis and Vaccine Production Laboratory, with sufficient capacity to meet the needs of foot-and-mouth disease control for the next 14 years.
- d) To increase, within the first year, the capacity of the technical and administrative structure to keep pace with the development of the Program.

- e) To achieve by the end of the Program, control over foot-and-mouth disease to an extent such that the morbidity is not more than 2%, and the possibility can be considered of stamping the disease out entirely, concurrently with the progress made in other countries of South America, in which similar programs are being developed or going to be developed.

The application for financial aid is pendant on completion of the study of the project by the Bank.

Additional data are presented on Table 20.

9. Uruguay

At the end of 1961, the government of Uruguay declared the fight against foot-and-mouth disease compulsory throughout the country. With the object of providing the necessary organization, it created, four years later, the Foot-and-Mouth Disease Combat Directorate (Dirección de la Lucha contra la Fiebre Aftosa - DILFA), as a dependency of the Veterinary Services Coordination Directorate of the Ministry of Livestock and Agriculture, on the same level as the Animal Health Directorate and the Animal Industry Directorate.

In the first stage, DILFA assigned priority to the establishment of its laboratory for diagnosis and vaccine control. By the middle of 1968, quality control has been made effective over the entire production of vaccine, which was prepared by four private laboratories, it began the organization and supervision of four-monthly vaccination campaigns which have covered the whole territory since April 1969.

Vaccination is performed by the stockraisers, who collaborate with DILPA through Neighborhood Commissions, in charge of the promotion and registry of information. Furthermore, DILPA ensures a system of surveillance concentrating on the following activities:

- a) Encouragement of notification of the disease in every sector of the community (school children, stockraisers, police, drovers, rural workers, etc.).
- b) Surveillance of livestock in transit and places where livestock is concentrated.
- c) Laboratory research.
- d) Registration of foci, morbidity and mortality.
- e) Suspension of cattle shows in affected zones and prohibition of transit on roads near same.
- f) With the object of limiting the participation of carriers in outbursts of the disease, farmers are advised to isolate sick and possible contaminated cattle individually and only move them to slaughter.
- g) Attempts are being made to control the movement of livestock across the border so as to prevent the disease from spreading.

The control of livestock in transit by insistence upon presentation of a vaccination certificate is made by all the authorities (health officers, police, customs inspectors and the military), who supervise the transit of livestock on roads and at ranches, markets, packing-houses, slaughterhouses, etc.

At the present time, Uruguay is engaged in setting up a Biostatistics Unit for collecting and processing epidemiological data. In 1971, activities relating to the promotion of community organization and education by neighborhood committees have been intensified. DILFA controls more than 800 such committees and intends to lay special emphasis on field research, particularly in connection with the control of carriers.

The persistent low morbidity of foot-and-mouth disease recorded in the five-year period has aroused the interest of the authorities in studying the factors that intervene in the epidemiology of the disease, with the object of evaluating the feasibility of proceeding to a more advanced stage of combat and carrying it forward to possibly complete eradication.

Additional data are presented on Table 21.

10. Venezuela

Since the appearance of the disease in 1950, Venezuela has kept up a campaign against foot-and-mouth disease, concentrating above all on systematic twice-yearly vaccination in the affected states, transit control and quarantine, particularly when epidemic outbreaks occur. Up till 1956, the campaign was managed by an autonomous agency with the name of Foot-and-Mouth Disease Institute. The field duties of this Institute were transferred in 1956 to a Foot-and-Mouth Disease Department (Departamento de Pielre Aftosa) in the Animal Health Division of the Ministry of Agriculture and Livestock. Research, diagnosis and vaccine production remained in the hands of the Veterinary Research Center (Centro de Investigaciones Veterinarias - CIV) of that Ministry.

From 1967 on, a series of factors has raised serious problems. Among them may be noted the emergence of new subtypes of virus, maladjustments in the output of vaccines, scarcity of vehicles, lack of proper supervision of the vaccinating personnel owing to other official calls on the veterinary officer's time.

For the effects of foot-and-mouth disease control, the country is divided into two areas; a vaccination area where the disease is enzootic and a disease-free area or region where there have only occurred sporadic outbreaks, which were stamped out by slaughter up till 1970. In the second half of 1971, however, an epidemic wave started in the northwestern zone of the free area which could not be eliminated by slaughter on account of delay in notification and the rapid spread of infection.

In the vaccination zone, control is affected by:

- a) Compulsory periodical vaccination, free of charge, with modified live virus vaccines, almost entirely applied by official vaccinators.
- b) Control of all movement of livestock.
- c) Enforcement of isolation, quarantine and disinfection regulations in the affected zones.
- d) Disinfection of livestock transportation supplying the metropolitan area.

To remove the drawbacks mentioned, in 1970 the Ministry of Agriculture prepared a new National Program for the Control of Foot-and-Mouth Disease and Brucellosis, which has been approved by the Inter-American Development Bank for financing to the extent of US\$ 7,500,000. For the effects of this program, which is scheduled to start in 1972, the country is to be divided into 8 areas,

with a veterinarian officer as Regional Coordinator for each, and auxiliary personnel as required. Certain densely populated areas will be subdivided into sectors in the charge of heads of sectors.

The campaign is based on a gradual increase of vaccination, and as this goes ahead, steps will be taken to free the country of the disease progressively from east to west, dividing it into 7 sectors corresponding to 7 succeeding stages of liberation.

Compulsory vaccination on the basis of inactivated virus and modified live virus will be effected periodically free of charge by personnel of the Ministry of Agriculture and Stockraising (Ministerio de Agricultura y Cría - MAC). Special emphasis will be laid on statistical surveys of the epizootiological situation of the disease, and likewise on health education and spreading information about the campaign.

Finally mention should be made of the inauguration in February 1969 of the Paraguayan Quarantine Station, with a capacity of 140 head of cattle. Observation of imported animals and sentinel contacts is accompanied by a systematic study with the collaboration of the Pan American Foot-and-Mouth Disease Center and the Brazilian Government, for the purpose of detecting foot-and-mouth disease carriers in cattle by an examination of esophageal-pharyngeal material.

Additional data are presented on Table 22.

III. SPECIAL TECHNICAL PROBLEMS

A. VARIATION OF STRAINS

There are sound experimental and theoretical grounds for assuming that a large number of the subtypes of FMD virus existing in South America may be a consequence of the passages of the viruses in partially immune animals. Given the exceptional plasticity possessed by the foot-and-mouth disease virus, it cannot be disputed that the probabilities of the appearance of subtypes will depend in part on the quantity of virus in existence in the field. The use of controlled vaccines containing strains with a broad antigenic range in a correctly planned program of application ought to minimize these probabilities. Nevertheless, the existence of micro-populations with incomplete immunity, or none at all, will be hard to avoid, nor is it feasible to prevent the cohabitation of wild animals with this semiimmune population.

Therefore, although application of the national foot-and-mouth disease combat programs on the continental scale is likely to reduce the chances of new subtypes emerging, this variation remains an inherent possibility and the introduction of subtypes to the bovine population covered by vaccination programs may always occur either from the aforesaid subareas or from abroad.

Emphasis should be laid on the importance of the health control measures that must be taken to avoid this introduction and on the necessity of keeping a permanent surveillance of the actuating field strains through laboratory diagnosis of the greatest possible number of sick animals.

When a new subtype of virus appears, the significance it may have for the prophylaxis of the population as regards the possibility of using it in vaccine and likewise the degree of protection afforded by the vaccine already in use will depend on the level of immunological kinship of this strain to the other actuating strains in the field and to those utilized in the vaccine. A first guide to possible antigenic differences will be given (apart from the complement fixation test in routine use for diagnosis) by cross serum protection or serum neutralization tests. Finally, this relationship will have to be checked by cross immunity tests in cattle.

At the same time, priority must be assigned to the development of epidemiological studies designed to establish the effects and consequences this possible immunological variation may, or might, cause.

Early laboratory diagnosis associated with a permanent system of surveillance and epidemiological analysis should make it possible to identify the subtypes of possible epidemic transcendence soon enough in advance to avoid their spread to broad stockraising regions.

B. AVAILABILITY OF VACCINE

Given the epidemiological characteristics of foot-and-mouth disease in the countries of the continent, any campaign to control the disease will have to include, at least in the first stages, a vast program of immunization extending to the greatest possible number of susceptible animals.

While the availability of vaccine does not pose a problem the solution of which cannot be foreseen and attained, it is included in this chapter

owing to the wide range of variables that need to be ascertained and controlled unequivocally if an immunization program is to prove efficient.

The inactivated anti-FMD vaccine now available on the industrial level, even under optima conditions, only to induce an acceptable average immunity level if repeatedly inoculated at intervals of every 4 months. Each animal should therefore receive 3 doses of vaccine a year.

Each of these doses of vaccine must have a high viral antigen content, on account of the low immunogenic capacity of the FMD virus. Production of this virus involves a delicate, costly process, for which an excellent industrial organization is required. The laboratory making the vaccine will often have to depend on third parties for supplies of the raw material for multiplication of the viral antigen; producers using the Frenkel method, for instance, can only produce vaccine when the slaughterhouses catering to domestic consumption, or meat packers for export, are operating, and supplying the laboratory with the necessary lingual epithelia.

On the other hand, vaccination only means immunization if the vaccine used is of good quality, well kept and properly applied. The only way of ensuring the necessary basic quality of the product prepared is by tests that warrant its efficacy. These tests must be made by an official institute of control, that is fully detached from the producing laboratories, whether official or private.

If it is considered that at present, when less than half of the cattle population of the affected area is covered by vaccination campaigns, not all countries impose an efficacy test on all vaccines batches produced; that the product obtained in many laboratories is admittedly below

standard; and that finally, several of the countries cannot rely on domestic laboratories to meet the demand, it is to be expected that, with the future expansion of the combat programs, the provision of enough high-grade vaccine will run into a series of difficulties that call for timely solution.

C. ECOLOGICAL AND STOCKRAISING FACTORS

1. Topography and vegetation

A basic objective common to all foot-and-mouth disease combat programs is to immunize the greatest possible number of animals. This objective, generally set at the vaccination of at least 80% of the existing cattle, is attainable in most of the stockraising regions of South America.

Nevertheless, there are areas where the conditions encountered make systematic vaccination difficult, even more so every four months. Mention may be made of the Chaco region in the Southern Cone, the Andean valleys and small mesas at the foot of the Andes, the llanos of Colombia and Venezuela, the Roraima savannas in Brazil, and in general, the Amazon region. In some cases, environmental and communication difficulties are combined with a very low animal density, which affects herding the cattle. In others, though the density is comparable to that of well-developed stockraising areas on the continent, for the most part the clusters are very small.

Foot-and-mouth disease may, and often does, occur in one or another of these localities, though very infrequently in the same one twice running. On the broad plains, whether arid, semiarid or with a marked contrast between the dry and rainy seasons, and consequently a widely varying availability of pasture, the low animal density causes the disease, when it does

emerge or is introduced, to spread slowly. For that very reason, if natural factors or the action of man do not interfere, it may persist for quite a long time. On the contrary, in small, isolated stockraising clusters, the disease flares up sporadically and does not last; it is generally started by the introduction of the virus from regions where the disease generally is endemic, most often in cases of epidemics.

The features outlined for these regions allow for a fairly adequate level of protection to be maintained without the need of such frequent vaccination as in the areas of intensive stockraising, above all if it is possible to rely on other preventive measures such as isolation, quarantine and control of the movement of, and trade in, livestock and by-products of animal origin.

However this may be, such regions should be subject to measures for control of the disease, inasmuch as the existence of virus there, though it emerges only sporadically, may eventually be a source of infection for other regions, although the latter are submitted to systematic vaccination. There is always a percentage of the cattle population which, on account of age, physiological reasons or failure to vaccinate, remains susceptible to the disease, and this is true of other species, sheep for instance and especially swine.

2. Wild life

Various species of wild animals living in South America are susceptible to foot-and-mouth disease, both experimentally and by natural infection. Among them may be mentioned the families of deer and rodents widely spread over extensive areas. There exists the possibility, not yet

proven, that some species of wild life can be afflicted with outbreaks of foot-and-mouth disease without any need of the presence of susceptible domestic animals, and could by themselves maintain a permanent source of virus. This possibility becomes all the more hazardous when it is realized that it is above all in the inhospitable areas aforesaid that the wild life population is the densest, and inhabits the region by keeping at times a close contact with domestic animals susceptible to foot-and-mouth disease.

In short, the presence of wild animals known to be susceptible to foot-and-mouth disease in areas of difficult access for purposes both of vaccination and epidemiological surveillance of the cattle, makes the risk that these areas represent for combat programs against the disease even more serious. This hypothetical problem deserves to be studied in due course.

3. Handling cattle

The pursuit of the activities pertinent to a foot-and-mouth disease combat campaign must, as in any other health campaign, be adapted to the socioeconomic characteristics of raising and marketing livestock. This means that, not only must the campaign be conducted in such a way as not to damage the stockraisers economically and to take advantage of the practices of handling cattle specific to each zone, but the limitations these practices impose on certain communities must also be borne in mind. There are ways of handling and marketing cattle that may or may not be the most efficient in a given economic system, by they have been adopted and are kept up by custom, tradition or rational analysis of economic benefits.

In any case, these practices (auction fairs, cyclic flows of livestock, non-cyclic multidirectional movements, cattle shows, rodeos, etc.) are not easily modified. What can be done (and this depends on the priority assigned to the combat program not only from a sanitarian but also from an economic point of view) is to interrupt some of such activities in times of hazard or emergency (closing auction fairs, prohibiting movements, etc.). The possibility of such interruptions should be measured by the resultant of the health risk involved in maintaining the normal flow of activities and the economic risk attached to interfering with it.

IV. RESEARCH

A. LABORATORY RESEARCH

The research being carried out in the countries on foot-and-mouth disease virus and laboratory disciplines has been concentrated on diagnosis, and on serological and immunological studies of field virus strains, and the production of inactivated or modified live virus vaccines. This research has always had an eminently practical character, the aim being above all to adapt or modify known techniques to the laboratories and environmental requirements of the continent.

A field to which some of the countries have been devoting particular attention is related to adaptation of the method used in evaluating the immunological power of vaccines. Progress of outstanding importance has been reached in certain countries, in particular Uruguay, the first to control all the batches of vaccine produced for use in the national campaign.

With regard to research on vaccines, attention should be drawn to that done in Venezuela with modified live virus vaccine and in Argentina on vaccine with oil adjuvant, produced with a technique similar to the one developed at the Plum Island Animal Disease Laboratories in the United States, and using the virus produced by the Frenkel method as the source of the antigen. In Brazil, impetus has been given in the past year to laboratory research relating to the preparation of inactivated vaccine with antigen produced in newborn rabbits.

Brazil and Venezuela have also been investigating the detection of bovine carriers of foot-and-mouth disease virus by using a methodology developed by the PANMDC in dealing with imports of zebu breed cattle from the former to the latter country.

Likewise some of the private laboratories in the various countries have been tackling research problems in connection with the production of vaccines. This participation of private enterprise in the problems specially related to research on the immunogenic capacity of the products they prepare is being encouraged in those countries where the vaccine for use in national campaigns is nearly all produced by such private enterprise.

It is interesting to stress the fact that in the last few years there has been a notable increase in technical personnel suitably trained in laboratory work. In 1971, for example, all of the countries were provided with skilled technicians qualified to conduct research on serological differences in FMD virus strains and subtype them accordingly. All the countries with national campaigns now have, or are setting up, laboratories with all the necessary facilities for doing practical research on vaccines, detecting carriers, controlling vaccines and effecting diagnoses.

The interest of the countries in laboratory research problems has been concentrating on obtaining vaccines capable of inducing sounder and more lasting immunity. Campaign costs will be considerably lowered if a vaccine can be obtained that need only be applied twice a year. Research is being made for cheaper sources for the production of antigens, new inactivants that afford a better guarantee of the harmlessness of the vaccines made, without impairing their immunogenic properties, and new adjuvants

enabling to obtain more powerful vaccines. In the course of the Center's 29th seminar, held in Brazil in December, 1971, the countries showed an interest in having the research done by each of them, coordinated so as to achieve the common goals more objectively and at less expenses. With the collaboration of the Pan American Foot-and-Mouth Disease Center and the support of its laboratories, a start will soon be made with the necessary negotiations to secure this coordination.

B. EPIDEMIOLOGICAL RESEARCH

Contrasting with what has been achieved in other fields of research in connection with the problems of foot-and-mouth disease, in particular as regards vaccines, practically no advance has been made on the continent in research on the epidemiology of the disease.

To the absence of multidisciplinary epidemiology units must be added the extreme and alarming scarcity of professionals - a scarcity not merely confined to specialists in epidemiology, but even to those only very slightly familiarized with it. This shortage extends to all the fields of medicine in Latin America, and in particular to the epidemiology of acute infectious diseases, of both man and animals.

At practically every level of the epidemiological chain of foot-and-mouth disease, pertinent studies need to be prepared. The lack of knowledge that ranges from the mere description and selection of epidemic indicators to the construction of hypotheses and distributional models, mathematical or not, hinders and considerably retards the determined efforts expended on National Foot-and-Mouth Disease Combat Programs.

Topmost priority should therefore be shared in the coming years by the development of field studies of the disease which include not only determination of the most suitable systems of surveillance for each zone, but also extend to special epidemiological research projects, such as the study of possible reservoirs in areas of endemic or sporadic appearance of the disease, in particular certain regions in the southern cone of South America.

RECOMMENDATIONS

It is recommended that the following actions be taken:

1. To continue the study of the epidemiology of the disease in the various zones of endemicity, sporadic appearance and absence.
2. To carry out special epidemiological studies in the southern cone of South America, in particular in the following countries: Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.
3. To continue the study of the epidemiology of the disease in the various zones of endemicity, sporadic appearance and absence.
4. To carry out special epidemiological studies in the southern cone of South America, in particular in the following countries: Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.
5. To continue the study of the epidemiology of the disease in the various zones of endemicity, sporadic appearance and absence.
6. To carry out special epidemiological studies in the southern cone of South America, in particular in the following countries: Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.

V. INTERNATIONAL COOPERATION

The planning and execution of National Foot-and-Mouth Disease Combat Programs in the 5-year period 1967-1971 has been a powerful factor for stimulating international cooperation, above all since the Inter-American Development Bank has been providing financial assistance. The Bank adopts a regional outlook to the problem and therefore conditions its aid, amongst other aspects, to that of sanitarian coordination between neighboring countries.

A. AGREEMENTS

There exist 17 agreements between countries and/or international organizations dealing with the fight against foot-and-mouth disease in South America, varying in nature and status. According to the parties thereto, they may be grouped into three categories for easier presentation:

1. Agreements between countries

The Ministries of Agriculture of the various countries have started negotiations, confirmed or brought into force agreements, to collaborate in the fight against foot-and-mouth disease in the following chronological order:

Colombia-Ecuador-Venezuela

On February 16, 1966, representatives from the three governments signed a Crop and Livestock Health agreement with the main purpose, of fighting together against plant and animal diseases, placing coordination in the hands of a Bolivarian Crop and Livestock Health Organization (Organización

Bolivariana de Sanidad Agropecuaria - OESA). This matter is mentioned because it originated basically in mutual action and contacts to fight foot-and-mouth disease. The agreement has not yet been implemented, pending the conclusion of the legal formalities.

Argentina-Paraguay

On April 30, 1968, the Directors of the Argentine Animal Health Service (SELSA) and the anti-FMD Combat Service (SENALFA) of Paraguay signed a technical cooperation agreement to fight against foot-and-mouth disease. Most of the articles refer to the quality guarantee of the Argentine vaccine that Paraguay had to import, and these clauses were adequately carried out. Measures provided to coordinate activities along the border, and the commitment to take steps to have the agreement approved by their respective governments, were not implemented.

Nevertheless the agreement is in force, inasmuch as no expiry date has been stipulated.

Argentina-Chile

On September 11, 1968, the Ministers of Agriculture of Chile and Argentina signed an animal health agreement on foot-and-mouth disease, of indefinite duration, for the purpose of coordinating their action to protect free zones, stamping out the disease in zones of sporadic outbreaks, and unifying the methods of control in enzootic zones. However, by the end of 1971, the Central Commission in charge of implementing the agreement had not yet been appointed.

Paraguay-Uruguay

On April 30, 1969, the Minister of Agriculture and Livestock of Paraguay and the Coordinator of Veterinary Services of the Ministry of Agriculture and Livestock of Uruguay accepted an agreement of technical cooperation on foot-and-mouth disease, similar to that between Paraguay and Argentina, mentioned above, and which likewise was only operative as regards quality control of the Uruguayan vaccine imported by Paraguay.

Brazil-Paraguay

On May 16, 1969, the Minister of Foreign Relations and the Minister of Agriculture, on behalf of the Brazilian government, and the President of the Superior Council of the National Foot-and-Mouth Disease Combat Service (SENALFA), representing the government of Paraguay, signed an agreement of cooperation in the fight against foot-and-mouth disease. The text is similar to that signed the year before between Argentina and Paraguay, including, besides, a clause covering the formation of a Joint Commission to execute the agreement. By the end of the five-year period, the corresponding action had not yet been taken.

Bolivia-Peru

Since 1965, a project has been the object of negotiations between the two member countries of PAHO for an agreement to develop a joint program of prevention and control of foot-and-mouth disease in the border region between Peru and Bolivia. For reasons extraneous to the strictly sanitarian aspects, this project is still under discussion.

Ecuador-Peru

This is a draft agreement similar to the foregoing, proposed in 1965, and no further advanced.

Argentina-Brazil

At the beginning of 1970, the Argentine animal health authorities submitted to the consideration of their Brazilian colleagues, a draft bilateral agreement on cooperation in the fight against foot-and-mouth disease. There are, however, still no resolutions enabling any headway to be made with the official negotiations.

Brazil-Guyana-Venezuela

Since 1967, the three countries have been taking sanitarian action coordinated on the technical level for the prevention and control of foot-and-mouth disease in the border region. The situation is evaluated at annual ordinary meetings and special meetings, whenever necessary, attended by the PAPMDC. Negotiations are under way to establish an agreement between the governments of the countries.

Colombia-Panama

Practically unceasing efforts have been made to establish a new international agreement for the prevention of foot-and-mouth disease in the border region of the two countries, to replace that in force between April 1964 and March 1966. In December 1969, a declaration of technical agreement between the Ministries of Agriculture of Colombia and Panama was arrived at, but so far it has not been implemented by an agreement between the two governments.

There can be no eluding the relatively poor results of inter-country agreements. Of the ten mentioned, six have not come to any concrete results, although in some cases the negotiations have dragged on for years. None of the four that were signed have been integrally enforced. Only the three to which Paraguay is a party are operative and then only insofar as supplies of vaccine are concerned.

Experience shows that the intervention of a third party unaffected by the agreements is advisable as promotor and to see that they are carried out. This role has been successfully filled by the Pan American Health Organization, on other occasions, and therefore the Pan American Foot-and-Mouth Disease Center is thinking of laying more emphasis on activities of this nature.

2. Agreements between the countries and the PAHO

Eight agreements have been concluded by countries with the Pan American Health Organization. The Inter-American Development Bank was a party to one of them. Two refer to the PAHO guaranty of technical assistance required by the Bank for it to lend financial assistance for the fight against foot-and-mouth disease. Three are related to specific projects of research or vaccination. Finally, three are connected with pilot plans and training on prevention and control of foot-and-mouth disease. They are the following:

Paraguay -PAHO

Endorsed by the Director of the Pan American Health Organization on September 9, 1969, an agreement between this organization and the Ministry of Agriculture and Livestock of Paraguay, represented by the Minister and the President of SENALFA, came into force with respect to a project of

technical advice in carrying out the national foot-and-mouth disease control plan in Paraguay. This type of agreement is one of the prerequisites to an IDB grant of financial aid for the countries to fight the disease.

Colombia-PAHO

On September 14, 1971, with the signature of the Ministers of Agriculture and Public Health, and that of the General Manager of the Colombian Crop and Livestock Institute, a charter of agreement was concluded with PAHO on the supply of technical advice by the Organization for the development of an animal health project comprising the combat against foot-and-mouth disease and brucellosis.

Ecuador-CPS

On December 31, 1968, the agreement established on August 29, 1963, between the Ecuadorian Ministry of Agriculture and Livestock and PAHO, renewed on September 12, 1966, expired; the subject of the agreement was a project of vaccination against foot-and-mouth disease in Ecuador.

Chile-PAHO

A similar project, entered into on February 13, 1964, expired on the same date as that mentioned in the previous paragraph, after being renewed on May 9, 1966.

Bolivia-PAHO

An agreement concluded between the two parties on April 13, 1964, for a pilot project of vaccination against foot-and-mouth disease in the department of Cochabamba, was renewed on April 20, 1967, to run until

December 31, 1968. After this date the vaccination project was pursued exclusively by the Bolivian Ministry of Agriculture.

Brazil-PAHO

On April 28, 1971, an agreement came into force for the establishment of an animal health program in the state of Rio Grande do Sul, with priority assigned to foot-and-mouth disease. The parties to it were the Federal government, the state government of Rio Grande do Sul and PAHO. It is to remain in force until December 31, 1975. A work group has been set up and has begun a study of how the agreement is to be applied, by taking steps to have a diagnosis prepared of the livestock health situation in the state.

Colombia-Ecuador-PAHO

On October 6, 1964, the three parties signed an agreement for developing a foot-and-mouth disease prevention and control program in the border region of Colombia and Ecuador. The agreement is automatically renewed each year and is dealing with activities related to notification of vesicular cases and coordinated vaccination campaigns.

Brazil-IDB-PAHO

On May 17, 1971, an agreement was signed between the two international organizations and the Brazilian Ministry of Agriculture for the establishment of a demonstration unit for the industrial production and control of inactivated vaccines against foot-and-mouth disease. The laboratory of the unit is being built on the land occupied by the PAFMDC and is scheduled for inauguration in 1972 and training to be started in 1973.

3. Agreements between the countries and the IDB

Their object is to establish the form and conditions of financial aid granted by the Bank for the development of foot-and-mouth disease combat programs in accordance with the technical bases agreed upon with PAHO in 1966.

Table 8 contains data on the situation of such agreements by the end of 1971. On this date the Bank had approved financial aid to six countries: Argentina, Brazil, Colombia, Chile, Paraguay and Venezuela. It should be mentioned that the negotiation and particularly the execution of these agreements has been a slow process. There are various factors to be recognized in the problem, and in this connection special care should be taken by the interested parties to provide suitable conditions for them to receive aid from the Bank.

B. ANIMAL HEALTH REGIONAL TECHNICAL COMMISSION
(COMISION TECNICA REGIONAL DE SANIDAD ANIMAL - COTERSA)

The Animal Health Regional Technical Commission, created by agreement between the Ministers of Agriculture of Argentina, Paraguay and Uruguay on June 27, 1964, and also including Bolivia, Brazil and Chile, which adhered later, has shown prior concern in the technical coordination of the fight against foot-and-mouth disease, appointing a specific subcommission of which the Center is a member.

The topics to which major attentions was paid are: diagnosis, notification and the study of subtypes of FMD virus; production, quality control and international marketing of vaccine; promotion, development, and international financing of programs of control for the disease;

coordination of these programs in border regions; epizootiological notification; and measures to prevent the introduction of exotic animal diseases into South America.

C. INTER-AMERICAN DEVELOPMENT BANK (IDB)

In 1965, the Inter-American Development Bank decided to participate in the fight against foot-and-mouth disease in South America by means of lending financial aid for programs of the various countries, in close cooperation with the Pan-American Foot-and-Mouth Disease Center. To provide a frame of reference for their participation, both institutions prepared a document the following year dealing with a scheme for drafting foot and mouth disease control projects, and another setting up criteria for the analysis and assessment of the corresponding applications for loans. This document was succeeded in 1968 by a draft guide-plan for evaluation of the results of the campaign against foot-and-mouth disease.

In earlier chapters reference has been made to the valuable collaboration furnished by the IDB. Table 8 summarizes its financial contributions until the end of 1971 and the investments for which they were intended. The impact and interest caused by them motivated the inclusion, in 1971, in the policy of developing stockraising, the support of animal health projects, the purpose of which is to reduce or eliminate the loss caused, not only by foot-and-mouth disease, but also by brucellosis, tuberculosis and other epizootiological and parasitary diseases which constitute a serious problem for the development of stockraising and a threat to human public health. Among the types of projects open to financing figures the establishment of basic infrastructures for animal health services.

D. UNITED NATIONS FOOD AND AGRICULTURE ORGANIZATION (FAO)

Since 1958 the United Nations Food and Agriculture Organization has been collaborating in the fight against foot-and-mouth disease in South America, recognizing the prior responsibility of the Pan American Foot-and-Mouth Disease Center therefor. FAO veterinarians serve as liaison agents in areas not covered by the local consultants of the Center and perform complementary work there whenever required. This work has been particularly outstanding in Bolivia and Ecuador.

In 1971, FAO put into execution a regional project for Latin America, which provided for the appointment of a veterinarian to perform functions ascribed to the Center in activities related to direct technical assistance to the countries in aspects of field operations such as: planning, notification, assessment and execution of anti-FMD vaccination campaigns, control of foci and health measures in general.

This project, which is backed by financing from the United Nations Development Program, envisages the incorporation of two more officers for the same purpose of furnishing technical assistance in other aspects related to the fight against foot-and-mouth disease in Latin America.

E. PAN AMERICAN HEALTH ORGANIZATION (PAHO)

The Pan American Health Organization, through its Pan American Foot-and-Mouth Disease Center, continues to broaden and intensify its functions as adviser to the countries on the development of combat and prevention programs for vesicular diseases. In 1958, the Center, up till then a technical project of the Organization of American States, was transformed

into a regular program of the Pan American Health Organization, financed by quotas directly contributed by the member governments. This change signified a larger budget and expansion of its professional staff, allowing for a marked increase in consultant, advisory and research actions, available for planning and carrying out national anti-FMD combat programs.

The activities pursued during the 5-year period 1967-1971 in fulfillment of these objectives may be summarized as follows:

1. Technical assistance
 - a) Advice on the preparation of national foot-and-mouth disease control programs, with partial IDB financing: Paraguay (approved in 1967), Chile (approved in 1969), Colombia and Venezuela (approved in 1971), Ecuador and Peru (submitted for approval), and Bolivia (in preparation).
 - b) Participation in the preparation of projects for the control of foot-and-mouth disease in pilot areas in Argentina and Paraguay, and a demonstration area in Rio Grande do Sul, Brazil, in 1971.
 - c) All the countries mentioned in subparagraph "a" received assistance from the Center on the preparation of credit applications to the IDB for financial aid for the programs mentioned.
 - d) In section A of this chapter the bi- and multilateral agreements and treaties concluded between the countries are summarized. In all of them the Pan American Foot-and-Mouth Disease Center intervened to a greater or lesser extent.

- e) Analysis of epidemiological trends, together with studies made in visits on the spot when special problems arise, enable the Center to maintain constant revision of the systems of control and prevention, and suitable parameters for evaluating them. In the latter connection, mention should be made of the collaboration of a short-term consultant contracted in 1971 on behalf of the IDB and the national authorities to evaluate the Paraguay campaign.
- f) Pursuant to Resolution XIV of RICA2-3, based on report RICA2-3/17, the program of epidemiological surveillance of foot-and-mouth disease on the continental level was intensified in the period 1970/71. In this way, it has been sought to permanently improve the system of notification and epidemiological research of vesicular diseases. Detailed information on the activities of this program has been reported annually to RICA2 (RICA2-3/17, RICA2-4/13 and RICA2-5/12).

2. Research

- a) It is a permanent function of the PAFMDC Diagnosis and Reference Laboratory to clear up the typing and subtyping problems that generally arise in countries with strains that cause outbreaks with unusual characteristics. In the five-year period under review, the samples of epithelium and sera sent in by the countries of South America were examined as listed by countries in Table 23.
- b) With regard to vaccines, lines of research have been pursued on: inactivators and adjuvants, cell cultures for obtaining antigens, modified live virus vaccines, duration of immunity, quality control,

etc. Immunity duration tests have enabled it to be determined that the vaccines now in use are capable of imparting lasting reliable immunity to sheep, and that new vaccines still in the experimental period show good prospects of being able to immunize hogs, a problem of great epidemiological importance that has not yet been satisfactorily solved.

- c) Antibody research was made at the request of the Argentine government in close to 5,000 sheep sera obtained in the course of a serological investigation in Tierra del Fuego. This work has enabled the Argentine authorities to make the declaration that the island has been free of the disease since the 1967 outbreak.
- d) Cross immunity tests on virus subtypes have served to give a precise indication of which of them should be used in the preparation of vaccines, according to the strains that affect or threaten stock-raising in the different countries or regions. Thus it has been possible to show that subtype C_3 , currently used by the countries, provides very good immunisation against C_4 ; that A_{24} is suitable for immunizing against A_{27} . This holds good too for different strains of virus subtype O_1 .
- e) Various countries have been given advice in the field by specialists from the Center, on drafting the plans for the construction of their respective laboratories for the production and control of vaccines, and also on the preparation of legislation regulating such activities.

f) On countless occasions different countries have applied for supplies of biological materials, specially virus strains adapted to the Frenkel method of culture, or modified, for local vaccine production, or have received vaccines in cases of emergency or pilot plans. In the 1967/71 5-year period, the supply of mono- and trivalent vaccines reached 276,076 doses, which made it possible to meet requests from Bolivia, Brazil, Colombia, Guyana, Paraguay and Venezuela (Table 24). The supply of hyperimmune sera for diagnosis of field samples amounted to 4,024 ml. These sera were supplied to the countries in the affected area, and also to laboratories of the Netherlands and the United States, and the World Reference Laboratory at Pirbright, England.

3. Training

- a) In the sphere of training technical personnel belonging to government services, in the course of the 1967-1971 5-year period, seven international seminars were successfully held, respectively in Rio de Janeiro (Brazil), Guayaquil (Ecuador), Maracay (Venezuela), Santiago (Chile), Montevideo (Uruguay), San José (Costa Rica) and again Rio de Janeiro (Brazil), with a total participation of 272 veterinarians from 27 countries.
- b) Center personnel organized or collaborated in national courses held in Asunción (Paraguay), Bahia, Porto Alegre, Curitiba and Brasília (Brazil), Medellín (Colombia) and Havana (Cuba), and likewise organized or participated in round tables at the Sixth Pan American Congress of Veterinary Medicine and Zootechnics (Santiago, Chile, 1970), Nineteenth World Congress of Veterinary Medicine (Mexico,

1971) and Fifth Latin American Congress of Microbiology (Punta del Este, Uruguay, 1971).

- c) One of the most important activities in the sector is individual training, with fellowships financed by the Organization, which gives the professionals in public service, not only a wider range of knowledge, but also the technical skill to perform their functions with greater efficiency in their own countries. In the course of the last 5 years, this activity has provided 88 veterinarians from 10 countries with individual training (Table 25).
- d) In the informational field, 1969 marked the initial publication of the Epidemiological Report, which appeared monthly through 1970, but from January 1971 on has been distributed fortnightly to all the official services and agencies involved, providing them with the most up-to-date information obtainable on the dynamics of vesicular diseases on the continent.
- e) In 1971 a new bilingual Spanish-English quarterly, entitled Boletín del Centro Panamericano de Fiebre Aftosa, replaced the "Cuadernos". The new publication contains bibliographical information, summaries of works, translations, monographs and also accounts of some of the applied research work done at the Center. The circulation of this publication is 1,500 copies.

TABLE 1

OUTBREAKS, SAMPLES COLLECTED AND WITH VESICULAR SPICULITIS DIAGNOSIS
BY COUNTRY AND YEAR. SOUTH AMERICA. 1967 THROUGH 1971.

Country	Year	Number of outbreaks	S A M P L E S			
			Taken for diagnosis		With positive diagnosis	
			No.	%	No.	%
Argentina	1967	4 634	1 225	100	1 019	83
	1968	1 392	1 937	100	1 427	74
	1969	1 952	2 406	100	1 957	81
	1970	832	1 057	100	835	79
	1971	1 984	1 984	100	1 969	99
Bolivia	1967	...	17	100	8	47
	1968	...	...	...	48	...
	1969	...	56	100	49	88
	1970	...	49	100	37	76
	1971	196 ^{a/}	19 ^{a/}	100	15 ^{a/}	79
Brazil	1967	...	...	...	230	...
	1968	...	...	...	311	...
	1969	2 843	553	100	348	63
	1970	2 529	1 049	100	838	80
	1971	8 678	1 537	100	1 007	66
Colombia	1967	419	326	100	223 ^{b/}	68
	1968	362	362	100	242	67
	1969	284	397	100	299	75
	1970	223	274	100	218	80
	1971	400	363	100	246	68
Chile	1967	508	181	100	143	79
	1968	1 811	341	100	250	73
	1969	1 209	240	100	184	77
	1970	1 061	249	100	194	78
	1971	281	115	100	86	75

cont.

..... cont. Table 1

Country	Year	Number of outbreaks	S A M P L E S			
			Taken for diagnosis		With positive diagnosis	
			No.	%	No.	%
Ecuador	1967	...	111	100	81 ^{b/}	73
	1968	...	224	100	127	57
	1969	721	342	100	259	76
	1970	368	177	100	127	72
	1971	361	189	100	128	68
Paraguay	1967	...	-	-	-	-
	1968	75	84	100	53	63
	1969	268	210	100	149	71
	1970	64	68	100	52	76
	1971	87	71	100	42	59
Peru	1967	...	33	100	25	76
	1968	...	64	100	48	75
	1969	44	103	100	87	84
	1970	315	112	100	91	81
	1971	134	157	100	114	73
Uruguay	1967	52	12	100	9	75
	1968	20	26	100	9	35
	1969	52	69	100	44	64
	1970	208	184	100	122	66
	1971	375	176	100	129	73
Venezuela	1967	67	68	100	68	100
	1968	68	...	...	67	...
	1969	70	162	100	126	78
	1970	99	193	100	121	63
	1971	103	294	100	117	40

a/ Partial information.

b/ Only foot-and-mouth disease.

... No data available.

TABLE 2

SAMPLES ACCORDING TO FOOT-AND-MOUTH DISEASE VIRUS TYPING BY COUNTRY AND YEAR.
SOUTH AMERICA, 1967 THROUGH 1971.

Country	1967			1968			1969			1970			1971							
	Typing			Typing			Typing			Typing			Typing							
	O	A	C	O	A	C	O	A	C	O	A	C	O	A	C					
Argentina	369	116	34	206	329	1076	20	510	235	1145	577	449	110	530	195	222	1031	860	78	22
Bolivia ^{a/}	6	-	2	9	11	20	6	...	6	1	-	-	19	14	4	12	13	-	2	4
Brazil	147	57	26	...	189	83	40	...	145	72	76	...	462	203	173	211	376	161	74	169
Colombia	38	183	2	...	117	71	-	109	123	131	-	103	53	92	1	56	83	116	-	86
Chile	98	38	7	38	55	193	2	91	124	53	7	56	56	132	6	55	11	64	11	29
Ecuador	74	7	-	...	34	69	-	97	194	53	-	83	88	6	-	50	74	15	-	61
Paraguay	-	-	-	-	19	3	31	31	31	36	28	61	15	37	-	16	28	4	10	29
Peru	7	14	2	8	6	33	-	16	16	26	36	16	22	33	12	21	26	72	7	42
Uruguay	9	-	-	3	1	8	-	17	4	29	11	25	81	36	5	62	102	24	3	47
Venezuela	46	22	-	...	62	5	-	...	40	60	-	52	55	42	-	...	58	41	-	1
T o t a l	1294	437	73	264	823	1563	99	871	918	1606	735	845	961	1125	396	705	1802	1357	185	490

a/ Incomplete information for 1971.

... No data available.

TABLE 3

FOOT-AND-MOUTH DISEASE OUTBREAKS, CATTLE POPULATION AND SICK ANIMALS BY COUNTRY AND YEAR.

SOUTH AMERICA, 1967 THROUGH 1971.

COUNTRY	1967				1968				1969				1970				1971	
	No. of out- breaks	Cattle		No. of out- breaks	Cattle		No. of out- breaks	Cattle		No. of out- breaks	Cattle		No. of out- breaks	Cattle		No. of out- breaks	Cattle	
		Popula- tion	Sick		Popula- tion	Sick		Popula- tion	Sick		Popula- tion	Sick		Popula- tion	Sick		Popula- tion	Sick
Argentina	4 634	...	265 701	1 392	721 567	76 551	1 952	1 328 956	160 354	852	624 319	54 829	1 984	1 159 868	124 338			
Bolivia	-	-	-	-	-	-	-	-	-	-	-	-	196 ^a	5 110	4 536			
Brazil	...	...	8 615 ^b	...	...	20 863 ^b	2 843	586 259	90 220	2 529	...	74 485	8 678	3 177 573	365 292			
Colombia	419 95 261	...	7 630	362	37 928	4 850	284	69 604 ^c	7 483 ^c	223	46 843	5 260	400	98 165	12 933			
Chile	508 71 061	...	16 167	1 811	255 596	36 333	1 209	183 544	27 181	1 061	160 708	21 553	281	70 677	6 086			
Ecuador	...	...	...	...	...	...	721	97 183	28 790	368	28 847	7 898	361	79 544	30 151			
Paraguay	...	...	...	75	62 144	6 274	268	101 276	14 763	64	19 725	4 209	87	43 043	3 425			
Peru	...	...	...	...	...	...	44	70 885	4 814	315	33 350	5 791	134	39 314	8 278			
Uruguay	52	...	...	20	...	...	52	...	...	208	152 494	8 939	375	196 274	12 604			
Venezuela	67	...	...	68	15 041	2 238	70	11 177	1 840	99	19 140	4 415	103	14 655	3 608			

a/ Partial data.

b/ Corresponding to the State of Rio Grande do Sul.

c/ Includes vesicular stomatitis.

... No data available.

TABLE 4

GEOGRAPHIC COVERAGE ACCORDING TO THE SITUATION OF NATIONAL FOOT-AND-MOUTH DISEASE
PROGRAMS BY COUNTRY, SOUTH AMERICA, 1967 AND 1971

COUNTRY	AREA IN THOUSANDS OF F.E. ^a																
	TOTAL			1967				1971				UNDER VACCINATION			PROGRAMS IN PREPARATION		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
																	No.
Argentina	2 777	100	-	-	499	18	2 777	100	2 288	82	-	-	-	-	-	-	
Bolivia	1 099	100	-	-	-	-	-	-	-	-	-	1 099	100	1 099	100	100	
Brazil	8 512	100	-	-	-	-	202	2	673	8	...	...	7 839	92	92
Colombia	1 139	100	-	-	47	4	-	-	-	-	1 139	100	1 092	96	96		
Chile	757	100	132	17	236	31	-	-	127	17	625	83	394	52	52		
Ecuador	271	100	-	-	-	-	-	-	-	-	271	100	271	100	100		
Paraguay	407	100	-	-	-	-	-	-	179	32	407	100	278	68	68		
Peru	1 285	100	-	-	-	-	-	-	-	-	1 285	100	1 285	100	100		
Uruguay	187	100	-	-	-	-	-	-	187	100	187	100	-	-	-		
Venezuela	912	100	-	-	-	-	-	-	-	-	912	100	912	100	100		

a/ According to International Zoosanitary Code regulations.

b/ Excludes Antártida and South Atlantic Islands.

... No data available.

TABLE 5

CATTLE POPULATION COVERAGE ACCORDING TO FOOT-AND-MOUTH DISEASE PROGRAMS BY COUNTRY.

SOUTH AMERICA, 1967 AND 1971

COUNTRY	CATTLE POPULATION IN THOUSANDS															
	TOTAL CATTLE POPULATION				F E E B S ^a				UNDER VACCINATION				PROGRAMS IN PREPARATION			
	1967		1971		1967		1971		1967		1971		1967		1971	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Argentina	51 227	100	48 271 ^b	100	-	-	80 ^b	-	51 227	100	48 191 ^b	100	-	-	-	-
Bolivia	2 964	100	3 100 ^c	100	-	-	-	-	-	-	-	-	2 964	100	3 100 ^c	100
Brazil	89 896	100	101 972	100	-	-	-	-	9 300 ^d	10	19 917	20	80 596	90	82 054 ^e	80
Colombia	17 900	100	20 335	100	-	-	13 ^d	-	-	-	-	-	17 900	100	19 737 ^e	97
Chile	3 096	100	3 030	100	55 ^b	2	189 ^b	6	-	-	1 750	58	2 845	92	974	32
Ecuador	1 850	100	2 393	100	-	-	-	-	-	-	-	-	1 850	100	2 393	100
Paraguay	5 542	100	4 340	100	-	-	-	-	-	-	2 235	51	5 500	99	2 105	49
Peru	3 800	100	...	...	-	-	-	-	-	-	-	-	3 800	100	3 686	...
Uruguay	8 700	100	8 500	100	-	-	-	-	-	-	8 500	100	8 700	100	-	-
Venezuela	6 911	100	8 811	100	-	-	-	-	-	-	-	-	6 911	100	8 811	100

^a According to International Zoosanitary Code regulations.^b Last census, 1969.^c Data 1963.^d Estimated.^e Data 1970.

TABLE 6

TECHNICAL AND SUPPORT PERSONNEL AFFECTED TO VESICULAR DISEASE PROGRAMS
BY COUNTRY, SOUTH AMERICA, 1967 AND 1971.

COUNTRY	Technical Professional Personnel		Auxiliary and Administrative Personnel	
	1967	1971	1967	1971
Argentina ^{a/}	238	269	2 568 ^{b/}	2 646 ^{b/}
Bolivia ^{b/}	...	40	...	400
Brazil	...	482	...	6 194
Colombia	...	175	...	294
Chile	...	42	...	385
Ecuador	40	38	40	96
Paraguay	...	52	...	132
Peru	62	84	236	267
Uruguay	1	29	...	76
Venezuela	7	17	50	384

a/ Non exclusive for foot-and-mouth disease.

b/ Includes 2 304 "ad-honorem" personnel with expenditures compensations functioning as office clerks in local field commissions.

... No data available.

TABLE 7

FULL BUDGET OF THE FOOT-AND-MOUTH DISEASE PROGRAMS BY COUNTRY AND YEAR.
(IN THOUSANDS OF US\$). SOUTH AMERICA. 1967 THROUGH 1971.

Country	1967	1968	1969	1970	1971
Argentina	1 938	3 968	4 904	11 216	6 809
Bolivia	35	50	382 ^{a/}	185 ^{a/}	696 ^{a/}
Brazil	815 ^{b/}	879 ^{b/}	140 ^{b/}	1 301 ^{b/}	10 573
Colombia	400 ^{c/}	554 ^{a/}	2 353 ^{a/}	1 488 ^{a/}	2 629 ^{a/}
Chile	d/	d/	153	3 194	8 928
Ecuador	470	571	581 ^{c/}	500	260
Paraguay	d	168	1 090	2 087	529
Peru	475	200	202	255 ^c	92
Uruguay	d	452	312	132	238
Venezuela	2 133	1 948	2 085	2 250	...

^{a/} Non exclusive for vesicular diseases.

^{b/} Ministry of Agriculture.

^{c/} Approximated.

^{d/} Without specific budget.

... No data available.

TABLE 8

HISTORICAL OF FOOT-AND-MOUTH DISEASE PROGRAMS, SITUATION BY
COUNTRY IN SOUTH AMERICA, DECEMBER 1971.

COUNTRY OR STATE	Historical				Present situation cattle population coverage %
	Dates		Budget (US\$ million)		
	Start of activities ^{a/}	signature of agreement	Total	IDB contribution	
Argentina ^{b/}	1960	30-8-69	48,5	10,5	100
Bolivia ^{c/}	-	-	-	-	-
Brazil ^{d/}		1-12-70	67,0	13,0	
Bahia	1968				25
Espírito Santo	1971				18
Minas Gerais	1971				2
Paraná	1966				30
R. G. do Sul	1965				100
Santa Catarina	1967				100
São Paulo	1967				20
Colombia	-	-	16,7	7,3	-
Chile	1970	16-1-69	7,6	2,3	65
Ecuador ^{e/}	-	-	7,8	2,8	-
Paraguay	1968	17-12-68	7,6	2,8	50
Peru ^{f/}	1964	-	11,5	4,0	33
Uruguay	1968	-	-	-	100
Venezuela ^{f/}	1956	-	25,5	7,5	40

^{a/} Year in which organized combat against FMD started with local funds only or with the financial assistance of the IDB.

^{b/} Not disbursed.

^{c/} Program in preparation for FMD, brucellosis and rabies.

^{d/} Does not include funds from the states.

^{e/} Project in preparation.

^{f/} Project in course.

TABLE 9

FOOT-AND-MOUTH DISEASE VACCINE PRODUCTION LABORATORIES
AND VACCINE PRODUCTION BY COUNTRY, SOUTH AMERICA, 1971

Country	Laboratories			Vaccine production
	State	Private	Total	
Argentina	-	12	12	175 173
Bolivia	1	-	1	220
Brazil	1	11	12	127 326
Colombia	1	-	1	15 549
Chile	1	-	1	981
Ecuador	1	-	1	968
Paraguay	-	1	1	7 033
Peru	1	-	1	3 630
Uruguay	-	4	4	30 060
Venezuela	1	-	1	8 541
Total	7	28	35	369 481

TABLE 10

PRODUCTION OF FOOT-AND-MOUTH DISEASE VACCINE BY COUNTRY AND YEAR.

(IN THOUSANDS OF DOSES), SOUTH AMERICA, 1967 THROUGH 1971.

Country	1967	1968	1969	1970	1971	Total
Argentina	166 089	189 975	146 298	168 610	175 173	846 145
Bolivia	295	498	200	282	220	1 495
Brazil	60 900	80 000	91 524	113 100	127 326	472 850
Colombia	9 985	10 018	14 347	12 407	15 549	62 306
Chile	5 500	4 521	7 818	5 200	981	24 020
Ecuador	700	690	500	227	968	3 085
Paraguay	-	-	-	700	7 033	7 733
Peru	2 901	2 256	1 942	2 873	3 630	13 602
Uruguay	10 124	14 937	26 043	27 868	30 060	109 032
Venezuela	9 529 ^{a/}	8 500	8 369	5 946	8 541	40 885
Total	266 023	311 395	297 041	337 213	369 481	1 581 153

^{a/} Includes 3 721 thousand of bivalent doses. The rest are monovalent doses.
Excludes 43 thousand of experimental doses.

TABLE 11

FOOT-AND-MOUTH DISEASE VACCINATION ACCORDING TO CATTLE POPULATION,
 CATTLE FARMS AND DOSES INJECTED BY COUNTRY AND YEAR.
 SOUTH AMERICA, 1967 THROUGH 1971.

Country	CATTLE POPULATION			CATTLE FARMS			doses injected (thousands)
	Total Thousands	vaccinated		Total	assisted		
		No. (Thousands)	%		No.	%	
<u>Argentina</u>							
1967	51 227	44 595	87	354 600	315 316	89	133 785
1968	51 465	44 747	87	355 369	318 090	90	134 241
1969	48 271 ^a	45 062	93	365 110	311 415	85	135 187
1970	48 271 ^a	43 966	91	349 962	303 686	87	132 544
1971	48 271 ^a	45 516	94	335 239	305 629	91	136 549
<u>Brazil</u>							
1967	89 896	9 210	10	1 647 279	124 587	8	29 891
1968	92 939	...	...	1 647 279	...	...	...
1969	95 150	15 578	16	1 647 279	450 662	27	39 749
1970	97 864	23 647	24	1 647 279	656 446	40	94 457
1971	101 972	19 917	20	1 647 279	746 950	45	53 262
<u>Colombia</u>							
1967	17 900	3 630 ^b	20	440 320	...	...	8 900
1968	18 800	4 776 ^b	25	440 320	...	...	9 551
1969	19 133 ^b	4 330 ^b	23	440 320	...	...	8 661
1970	19 742 ^b	5 390 ^b	27	440 320	...	...	10 780
1971	20 335 ^b	7 508 ^b	37	440 320	...	...	15 159
<u>Chile</u>							
1967	2 896	...	...	168 564	...	...	...
1968	2 910	...	...	168 564	...	...	...
1969	2 954	...	...	168 564	...	...	...
1970	3 002	536	18	168 564	10 851	6	4 805
1971	2 870	2 255	79	168 564	75 056	45	6 003
<u>Ecuador</u>							
1967	1 850	...	...	...	...	...	1 104
1968	2 393	...	...	233 213	...	...	830
1969	1 839	...	...	233 213	...	...	1 181
1970	2 393	...	...	233 213	71 332	31	905
1971	2 393	...	...	233 213	89 166	38	961

Cont... ..

Cont. TABLE 11

Country	CATTLE POPULATION			CATTLE FARMS			doses injected (thousands)
	Total Thousands	vaccinated		Total	assisted		
		No. (Thousands)	%		No.	%	
<u>Paraguay</u>							
1967	5 542	-	-	-	-	-	-
1968	5 625	440	8	110 426	15 217	14	459
1969	5 529	1 184	21	110 426	19 444	18	2 680
1970	5 595	1 703	30	110 426	65 753	60	6 974
1971	4 340	2 185	50	110 426	84 252	76	5 966
<u>Peru</u>							
1967	3 800	2 164	57	1 401 240	...	...	2 681
1968	3 810	1 556	41	...	...	...	2 336
1969	4 060	1 742	43	1 533 605	...	...	2 949 ^{b/}
1970	4 130	1 000	24	1 565 062	...	...	3 221 ^{b/}
1971	4 130	1 500	36	...	...	...	4 428 ^{c/}
<u>Uruguay</u>							
1967	8 700	...	...	68 819	...	...	...
1968	8 188	...	...	68 819	...	...	4 500
1969	8 188	...	...	68 819	...	...	...
1970	8 188	...	...	68 819	...	...	20 338
1971	8 500	...	...	68 819	...	...	20 939
<u>Venezuela</u>							
1967	6 911	4 420	64	100 337	...	...	9 074
1968	7 000	3 680	53	100 337	...	...	7 368
1969	8 289	3 680	44	100 337	...	...	8 000
1970	8 299	2 710	33	100 337	...	...	6 174
1971	8 811	3 470	39	100 337	...	...	6 945

a/ Last census 1969.

b/ Estimated.

c/ Includes sheep, goats and pigs.

... No data available.

TABLE 12

APPLICATION OF FOOT-AND-MOUTH DISEASE VACCINE ACCORDING TO
RESPONSIBLE BY COUNTRY. SOUTH AMERICA. 1970.

Country	Vaccine applied by		
	State	Farmer	Vaccinator
Argentina	-	F	-
Bolivia	X	P	X
Brazil	-	P	X
Colombia	-	P	-
Chile	P	-	X
Ecuador	P	X	-
Paraguay	X	P	X
Peru	P	-	X
Uruguay	-	F	-
Venezuela	P	-	-

P - Predominant presence

X - Presence

- - Absence

TABLE 13

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN ARGENTINA.

1967 THROUGH 1971

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area 2 777 ^{a/}					
Free area	-	264	489	489	489
Area covered by program	2 777	2 777	2 777	2 777	2 777
2. Livestock population (in thousands)					
Cattle	51 227	51 465	48 271 ^{b/}	48 271 ^{b/}	48 271 ^{b/}
Sheep	49 000	...	44 307	...	...
Swine	3 000	...	4 097	...	...
Goats	5 280	...	...	...	...
Cattle in free area	-	...	80 ^{c/}	80 ^{c/}	80 ^{c/}
Cattle in area under program	51 227	51 465	48 271 ^{b/}	48 271 ^{b/}	48 271 ^{b/}
3. Notification of FMD					
No. of animals in foci	...	721 567	1 326 956	624 319	1 159 868
No. of sick animals	265 701	76 551	160 354	54 829	124 338
No. of outbreaks	4 634	1 392	1 952	832	1 984
4. Diagnosis of Vesicular Diseases					
No. of samples collected	1 225	1 937	2 406	1 057	1 984
No. of samples with positive diagnosis	1 019	1 427	1 957	835	1 969
5. FMD vaccination					
Doses produced (thousands)	166 089	189 975	146 298	168 610	175 173
Doses applied (thousands)	133 785	134 241	135 187	132 544	136 549
Vaccinated cattle (thousands)	44 595	44 747	45 062	43 966	45 516
6. Human resources					
No. of veterinarians	236	...	...	...	267
No. of auxiliaries	246	...	...	...	320
7. Financial resources (thousands)					
Global Budget ^{d/}	678 200	1 388 935	1 716 400	44 863	26 960

a/ Excluding Antártida and the South Atlantic islands.

b/ Last census, 1969.

c/ Approximately.

d/ National currency.

... No data available.

TABLE 14

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN BOLIVIA.
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	1 099				
Free area	-	-	-	-	-
Area covered by program	-	-	-	-	-
2. Livestock population (in thousands)					
Cattle	2 964	3 100	...	...	...
Sheep	...	...	...	...	...
Swine	...	...	...	...	...
Goats	...	...	...	...	...
Cattle in free area	-	-	-	-	-
Cattle in area under program	-	-	-	-	-
3. Notification of FMD					
No. of animals in foci	...	...	...	...	5 110
No. of sick animals	...	...	...	...	4 536
No. of outbreaks	...	...	...	...	196 ^{a/}
4. Diagnosis of Vesicular Diseases					
No. of samples collected	17	...	56	49	19 ^{b/}
No. of samples with positive diagnosis	8	48	49	37	15 ^{b/}
5. FMD vaccination					
Doses produced (thousands)	295	498	200	282	220
Doses applied (thousands)	...	...	...	109	215
Vaccinated cattle (thousands)	...	...	...	...	...
6. Human resources					
No. of veterinarians	...	...	...	...	...
No. of auxiliaries	...	...	...	...	...
7. Financial resources (thousands)					
Global Budget ^{c/}	...	...	4 545 000	2 201 500	...

^{a/} Partial datum.

^{b/} Up to September, 1971.

^{c/} National currency.

... No data available.

TABLE 15

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN BRAZIL,
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	8 511				
Free area	-	-	-	-	-
Area covered by program	202	301	351	559	673
2. Livestock population (in thousands)					
Cattle	89 896	92 939	95 150	97 864	101 972
Sheep	23 065	24 606	24 333	...	24 382
Swine	63 406	64 924	65 734	...	65 866
Goats	14 322	14 815	14 744	...	14 774
Cattle in free area	-	-	-	-	-
Cattle in area under program	9 300 ^{a/}	12 026	15 578	23 647	19 917
3. Notification of FMD					
No. of animals in foci	...	...	586 259	...	3 177 573
No. of sick animals	8 615 ^{b/}	20 863 ^{b/}	90 220	74 485	385 292
No. of outbreaks	...	...	2 843	2 529	6 678
4. Diagnosis of Vesicular Diseases					
No. of samples collected	...	...	553	1 049	1 537
No. of samples with positive diagnosis	230	311	348	838	1 007
5. FMD vaccination					
Doses produced (thousands)	60 900	80 000	91 524	113 100	127 326
Doses applied (thousands)	29 691	...	39 749	94 457	53 262
Vaccinated cattle (thousands)	9 210	...	15 578	23 647	19 917
6. Human resources					
No. of veterinarians	...	...	...	...	365
No. of auxiliaries	...	...	...	...	6 352
7. Financial resources (thousands)					
Global Budget ^{c/}	2 200 000 ^{d/}	2 814 185 ^{d/}	560 000 ^{d/}	5 894 500 ^{d/}	55 507 248

a/ Estimated.

b/ Correspond to the State of Rio Grande do Sul. mcy

c/ National currency.

d/ Ministry of Agriculture.

... No data available.

TABLE 16

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN COLOMBIA.
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	1 139				
Free area	-	47	47	47	47
Area covered by program	-	-	-	-	-
2. Livestock population (in thousands)					
Cattle	17 900	18 800	19 133	19 742	20 335
Sheep	1 746	...	...	...	1 650
Swine	2 643	...	...	...	3 850
Goats	845	...	...	...	900
Cattle in free area	-	13 ^{a/}	13 ^{a/}	13 ^{a/}	13 ^{a/}
Cattle in area under program	-	-	-	-	-
3. Notification of FMD					
No. of animals in foci	95 261	37 928	69 604 ^{b/}	46 843	98 165
No. of sick animals	7 630	4 850	7 485 ^{b/}	5 260	12 933
No. of outbreaks	419	362	284	223	400
4. Diagnosis of Vesicular Diseases					
No. of samples collected	326	362	397	274	363
No. of samples with positive diagnosis	225 ^{c/}	242	299	218	246
5. FMD vaccination					
Doses produced (thousands)	9 985	10 018	14 347	12 407	15 549
Doses applied (thousands)	8 900	9 551	8 661	10 780	15 159
Vaccinated cattle (thousands)	3 630	4 776	4 330	5 390	7 508
6. Human resources					
No. of veterinarians	...	...	...	...	186
No. of auxiliaries	...	...	...	...	283
7. Financial resources (thousands)					
Global Budget ^{d/ e/}	6 500	9 000	40 000	27 000	51 136

a/ Approximately.

b/ Includes vesicular stomatitis.

c/ Only foot-and-mouth disease.

d/ National currency.

e/ Not exclusive of FMD.

... No data available.

TABLE 17

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAM IN CHILE,
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	757				
Free area	132	132	132	132	236
Area covered by program	-	-	-	58	127
2. Livestock population (in thousands)					
Cattle	2 896	2 910	2 954	3 002	2 870
Sheep	7 600	6 675	...	...	6 690
Swine	1 022	1 120	1 197	1 105	999
Goats	925	...	...	...	933
Cattle in free area	55	55 ^{a/}	109	190	189 ^{b/}
Cattle in area under program	-	-	-	933	1 750
3. Notification of FMD					
No. of animals in foci	71 061	255 596	183 544	160 708	70 677
No. of sick animals	16 167	36 333	27 181	21 553	6 086
No. of outbreaks	508	1 811	1 209	1 061	281
4. Diagnosis of Vesicular Diseases					
No. of samples collected	181	341	340	249	115
No. of samples with positive diagnosis	143	250	184	194	86
5. FMD vaccination					
Doses produced (thousands)	5 500	4 521	7 818	5 200	981
Doses applied (thousands)	...	...	...	4 805	6 003
Vaccinated cattle (thousands)	...	...	...	536	2 255
6. Human resources					
No. of veterinarians	...	...	...	35	36
No. of auxiliaries	...	...	...	...	296
7. Financial resources (thousands)					
Global Budget ^{c/}	-	-	-	44 322	25 000

a/ Approximately.

b/ Last census, 1969.

c/ National currency.

... No data available.

TABLE 18

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN ECUADOR.

1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	271				
Free area	-	-	-	-	-
Area covered by program	-	-	-	-	-
2. Livestock population (in thousands)					
Cattle	1 850	2 393	1 839	2 393	2 393
Sheep	2 040	1 830	...	...	1 829
Swine	1 730	1 294	...	...	1 294
Goats	166	104	...	...	184
Cattle in free area	-	-	-	-	-
Cattle in area under program	-	-	-	-	-
3. Notification of FMD					
No. of animals in foci	...	...	97 183	28 847	79 544
No. of sick animals	...	...	28 790	7 898	30 151
No. of outbreaks	...	...	721	368	361
4. Diagnosis of Vesicular Diseases					
No. of samples collected	111	224	342	177	189
No. of samples with positive diagnosis	81 ^{a/}	127	259	127	128
5. FMD vaccination					
Doses produced (thousands)	700	690	500	227	968
Doses applied (thousands)	1 104	830	1 181	905	961
Vaccinated cattle (thousands)	...	...	...	...	...
6. Human resources					
No. of veterinarians	40	...	...	40	38
No. of auxiliaries	40	...	...	69	87
7. Financial resources (thousands)					
Global Budget ^{b/}	9 400	12 000	13 354	10 500	3 500

^{a/} Only foot-and-mouth disease.^{b/} National currency.

... No data available.

TABLE 19

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN PARAGUAY.
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	407				
Free area	-	-	-	-	-
Area covered by program	-	26	46	102	129
2. Livestock population (in thousands)					
Cattle	5 542	5 625	5 529	5 595	4 340
Sheep	...	...	362	...	324
Swine	...	...	441	...	500
Goats	...	...	59	...	59
Cattle in free area	-	-	-	-	-
Cattle in area under program	-	437	1 184	1 703	2 235
3. Notification of FMD					
No. of animals in foci	...	62 144	101 276	19 725	43 043
No. of sick animals	...	6 274	14 763	4 209	3 425
No. of outbreaks	...	75	268	64	67
4. Diagnosis of Vesicular Diseases					
No. of samples collected	-	84	210	68	71
No. of samples with positive diagnosis	-	53	149	52	42
5. FMD vaccination					
Doses produced (thousands)	-	-	-	700	7 033
Doses applied (thousands)	-	459	2 680	6 974	5 966
Vaccinated cattle (thousands)	-	440	1 184	1 703	2 185
6. Human resources					
No. of veterinarians	-	...	...	39	50
No. of auxiliaries	-	...	...	...	60
7. Financial resources (thousands)					
Global Budget ^{a/}	-	21 196	137 411	262 918	65 551

^{a/} National currency.

... No data available.

TABLE 20

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN PERU.

1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	1 285				
Free area	-	-	-	-	-
Area covered by program	-	-	-	-	-
2. Livestock population (in thousands)					
Cattle	3 800	3 810	4 060	4 130	4 130
Sheep	16 040	16 210	16 310	17 060	...
Swine	1 830	1 840	1 940	1 930	...
Goats	1 870	1 820	1 860	1 860	...
Cattle in free area	-	-	-	-	-
Cattle in area under program	3 710	3 810	4 060	4 130	...
3. Notification of FMD					
No. of animals in foci	...	...	70 885	33 350	39 314
No. of sick animals	...	...	4 814	5 791	8 278
No. of outbreaks	...	...	44	315	134
4. Diagnosis of Vesicular Diseases					
No. of samples collected	33	64	103	112	157
No. of samples with positive diagnosis	25	48	87	91	114
5. FMD vaccination					
Doses produced (thousands)	2 901	2 255	1 942	2 873	3 630
Doses applied (thousands)	2 681	2 336	2 949	3 221	4 428
Vaccinated cattle (thousands)	2 164	1 556	1 742	1 000	1 500
6. Human resources ^{a/}					
No. of veterinarians	62	...	...	62	84
No. of auxiliaries	236	...	...	...	261
7. Financial resources (thousands)					
Global Budget ^{b/}	12 740	...	8 844	11 055	-

^{a/} Not exclusive of FMD.^{b/} National currency.

... No data available.

TABLE 21

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAM IN URUGUAY.

1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area 187					
Free area	-	-	-	-	-
Area covered by program	-		187	187	187
2. Livestock population (in thousands)					
Cattle	8 700	8 188	8 188	8 188	8 500
Sheep	21 900	...	...	...	19 000
Swine	360	...	...	...	500
Goats	18	...	...	...	18
Cattle in free area	-	-	-	-	-
Cattle in area under program	-	...	8 188	8 188	8 500
3. Notification of FMD					
No. of animals in foci	...	...	...	152 494	196 274
No. of sick animals	...	...	...	8 939	12 604
No. of outbreaks	52	20	52	208	375
4. Diagnosis of Vesicular Diseases					
No. of samples collected	12	26	69	184	176
No. of samples with positive diagnosis	9	9	44	122	129
5. FMD vaccination					
Doses produced (thousands)	10 124	14 937	26 043	27 868	30 060
Doses applied (thousands)	...	4 500	...	20 338	20 939
Vaccinated cattle (thousands)	...	...	...	...	...
6. Human resources					
No. of veterinarians	-	...	...	28	29
No. of auxiliaries	-	...	...	...	22
7. Financial resources (thousands)					
Global Budget ^{a/}	-	108 000	78 063	32 914	59 570

^{a/} National currency.

... No data available.

TABLE 22

PROGRESS IN FOOT-AND-MOUTH DISEASE PROGRAMS IN VENEZUELA.
1967 THROUGH 1971.

	1967	1968	1969	1970	1971
1. Area in thousands of Km ²					
Total Area	912				
Free area	-	-	-	-	-
Area covered by program	-	-	-	-	-
2. Livestock population (in thousands)					
Cattle	6 911	7 000	8 269	8 299	8 811
Sheep	98	...	...	...	104
Swine	1 909	...	...	...	2 236
Goats	1 241	...	...	...	1 759
Cattle in free area	-	-	-	-	-
Cattle in area under program	-	-	-	-	-
3. Notification of FMD					
No. of animals in foci	...	15 041	11 177	19 140	14 655
No. of sick animals	...	2 238	1 840	4 415	3 608
No. of outbreaks	67	68	70	99	103
4. Diagnosis of Vesicular Diseases					
No. of samples collected	68	...	162	193	294
No. of samples with positive diagnosis	68	67	126	121	117
5. FMD vaccination					
Doses produced (thousands)	9 529	8 500	8 369	5 946	8 541
Doses applied (thousands)	9 074	7 368	8 000	6 174	6 945
Vaccinated cattle (thousands)	4 420	3 690	3 680	2 710	3 470
6. Human resources					
No. of veterinarians	7	...	...	1	15
No. of auxiliaries	46	...	...	...	372
7. Financial resources (thousands)					
Global Budget ^{a/}	9 598	8 767	9 382	11 008	11 008

^{a/} National currency.

... No data available.

TABLE 23

SAMPLES ACCORDING TO ORIGIN EXAMINED AT
THE PAN AMERICAN FOOT-AND-MOUTH DISEASE CENTER

BY COUNTRY AND YEAR, SOUTH AMERICA.

1967 THROUGH 1971.

Country	1967		1968		1969		1970		1971	
	Field samples	lab. samples	Field samples	lab. samples	Field samples	lab. samples	Field samples	lab. samples	Field samples	lab. samples
Argentina	122	18	53	6	93	23	19	10	81	40
Brazil	31	33	249	186	94	31	241	137	279	48
Bolivia	-	-	19	3	9	3	6	-	1	-
Colombia	29	6	4	-	7	9	9	-	12	14
Chile	-	12	-	-	5	5	54	12	50	11
Ecuador	9	-	37	-	48	-	-	2	14	4
Paraguay	-	-	84	-	232	-	70	69	10	5
Peru	10	1	8	6	14	6	12	3	31	5
Uruguay	-	26	-	6	2	9	5	24	5	4
Venezuela	-	7	2	-	11	4	9	-	36	6
Total	201	103	456	207	515	90	425	257	519	137

TABLE 24

SOUTH AMERICA. DISTRIBUTION OF FOOT AND MOUTH DISEASE VACCINES* ELABORATED BY THE PAN AMERICAN FOOT AND MOUTH DISEASE CENTER.

1967-1971

Year	Doses produced and type	Distribution			Total
		Country	Number of doses and type		
1967	34 400 trivalent 5 ml	Bolivia	19 080 trivalent 5 ml		30 680
		Brazil	11 600 trivalent 5 ml		
1968	27 800 trivalent 5 ml 7 600 C ₃ Resende 2 ml	Bolivia	24 200 trivalent 5 ml		41 400
		Brazil	9 600 trivalent 5 ml		
		Colombia	7 600 C ₃ Resende 2 ml		
1969	20 040 trivalent 5 ml 5 600 O ₁ Guyana 5 ml	Bolivia	10 000 trivalent 5 ml		25 160
		Brazil	9 560 trivalent 5 ml		
		Guyana	5 600 O ₁ Guyana 5 ml		
1970	40 276 O ₁ Campos 2 ml 25 000 C ₃ Resende 2 ml 16 000 C Paraguay 2 ml 12 500 A ₂₄ Cruz. 2 ml 3 040 O ₁ Guyana 5 ml	Brazil	10 000 O ₁ Campos 2 ml		52 040
		Brazil	10 000 C ₃ Resende 2 ml		
		Brazil	7 000 trivalent 5 ml		
		Colombia	4 000 C ₃ Resende 2 ml		
		Guyana	3 040 O ₁ Guyana 5 ml		
		Paraguay	16 000 C Paraguay 2 ml		
1971	29 500 O ₁ Campos 2 ml 24 000 C ₃ Resende 2 ml 20 000 A ₂₄ Cruz. 2 ml 11 000 A ₃₂ Venez. 2 ml	Brazil	9 660 trivalent 5 ml		35 660
		Colombia	8 000 C ₃ Resende 2 ml		
		Venezuela	9 000 bivalent O ₁ +A ₂₄ 4 ml		
		Venezuela	10 000 bivalent O ₁ +A ₃₂ 4 ml		

* Inactivated vaccines Frankel, with formalin, aluminium, hydroxide and sorbitol.

TABLE 25

NUMBER OF PROFESSIONALS TRAINED AT THE PAN AMERICAN FOOT-AND-MOUTH DISEASE CENTER
SOUTH AMERICA, 1967 THROUGH 1971.

Country	1967		1968		1969		1970		1971		Total	
	Indivi- dual	Course	Indivi- dual	Course	Indivi- dual	Course	Indivi- dual	Course	Indivi- dual	Course	Indivi- dual	Course
Argentina	-	-	-	-	2	-	-	2	3	-	5	2
Bolivia	-	-	-	-	1	1	-	-	2	-	3	1
Brazil	5	-	8	-	7	77	4	1	7	-	31	78
Colombia	-	-	-	-	1	2	2	1	3	-	6	3
Chile	-	-	1	-	3	1	-	5	-	-	4	6
Ecuador	-	-	1	-	1	7	2	1	2	-	6	8
Paraguay	2	-	4	35	2	1	6	47	4	-	18	83
Peru	-	-	-	-	1	1	1	-	-	-	2	1
Uruguay	-	-	1	-	-	1	2	2	1	-	4	3
Venezuela	2	-	2	-	3	5	1	1	1	-	9	6
Total	9	-	17	35	21	96	18	60	23	-	88	191