Epidemiologic Survey of Bovine Diseases in Suriname[1]

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A seroepidemiologic survey of cattle diseases was undertaken in Suriname in 1985 to help assess the livestock disease situation in that country. The six diseases covered by the survey were bovine coronavirus infection, bovine rhinotracheitis, bovine virus diarrhea, brucellosis, parainfluenza-3 infection, and respiratory syncytial virus infection.

The results indicated relatively low prevalences of these diseases compared to the prevalences found in most developed countries. The reasons for this are uncertain, but the finding suggests that the cattle population in Suriname could lack extensive exposure to these diseases and so could be highly susceptible to them. In addition, the evident need for more thoroughgoing survey data points up the need to establish a continuous animal data health monitoring system in Suriname—as well as in other developing countries where there is a need to objectively assess the livestock disease picture.

A nimal diseases have a major impact on livestock production, economics, and public health, especially in nonindustrial countries. Furthermore, most developing countries have limited resources available for animal health programs. As a result, how these resources are used becomes crucial.

Unfortunately, program priorities are often assigned subjectively, due to a lack of objective information on livestock disease, livestock production, and economics. Suriname found itself confronting a situation of this kind in the early 1980s,

when a decision was made to increase the emphasis placed on agriculture and livestock. At that time the primary sources of information on livestock disease and production were personal impressions and data derived from a subjective questionnaire used to obtain census information (1). Therefore, an animal disease survey was planned to help the Government gain an objective view of the matter. It was felt that this would be the first step toward selecting programs in accordance with sound data on prevailing disease patterns combined with cost-benefit assessment of various possible interventions.

This article reports the results of the bovine seroepidemiologic portion of that survey. The work reported, which dealt with bovine coronavirus infection, bovine virus diarrhea, brucellosis, infectious bovine rhinotracheitis, parainfluenza-3 infection, and respiratory syncytial virus, was part of a broader survey that included other disease agents (ar-

thropods, bacteria, helminths, protozoa, and noninfectious environmental factors) and other livestock species. The undertaking was a collaborative effort supported by the Pan American Health Organization, Suriname's Ministry of Agriculture, Animal Husbandry, and Fisheries, and North Carolina State University's College of Veterinary Medicine.

The diseases cited above were selected for the survey because of their potential economic impact and their association with patterns of respiratory disease, reproductive inefficiency, and neonatal mortality observed in Suriname. It was also felt that the information obtained could prove of interest to other countries finding themselves in situations similar to Suriname's.

MATERIALS AND METHODS

The Suriname Region, consisting of four districts (Brokopondo, Para, Saramacca, and Suriname—see Figure 1), was
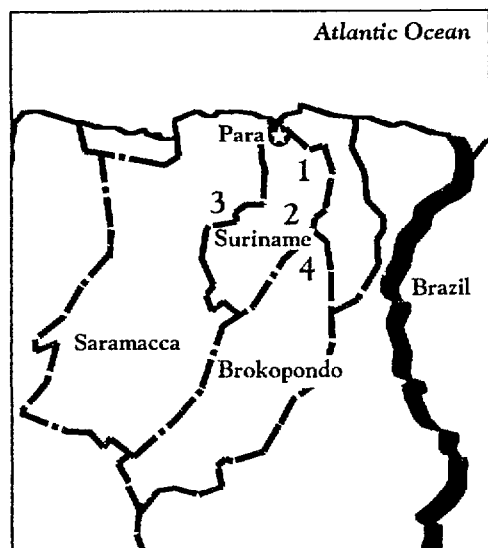
Figure 1. A map of Northeast Suriname showing the locations of (1) the state-run abattoir, (2) the Suralco dairy farm, (3) Tibiti, and (4) Baboenhol.

chosen for the survey, partly because the animals in this area (comprising 59.3% of the country's cattle) were deemed fairly representative of the approximately 52,938 animals in the national cattle population. The study included 478 animals and was conducted from June to August 1985.

Four sites within this region were chosen for sampling. Two were private beef farms named Baboenhol and Tibiti, one was a private dairy farm, and one was a state-run abattoir. The Baboenhol farm began operating about 10 years before the survey on land cleared in the tropical rain forest. At the time of our study it had 958 Brahman crossbred cattle (about two cattle per hectare), bred cows throughout the year, and rotated its pastures—in the process developing special grasses (mainly Signal, African Star, and Coebiti). The Tibiti farm was somewhat similar but smaller, with 503 Brahman crossbred cattle. The dairy farm had 80 animals and was run by Suralco, an aluminum company.

To select subjects at each site, techniques using random numbers were employed. However, logistics made these randomization techniques hard to apply, and only a quasi-random sampling was obtained. The main problem was that we were unable to restrain some of the selected animals on the three farms for sampling. In these cases, which accounted for approximately 15% of the original sample, the animals in question were dropped from the study and additional random numbers were used to select replacement animals.

Besides the selected animals, those cattle on the three farms suspected of being diseased were also tested. However, results obtained from these animals were not considered in estimating disease rates, being used only to indicate whether certain diseases were present or absent. The animals selected by use of

random numbers at Baboenhol (155), Tibiti (138), and the Suralco farm (43) constituted 16.2%, 27.4%, and 54%, respectively, of the cattle present at these sites.

The abattoir was used as a supplemental source of information. Data available on animals presented at the abattoir during the study included the owner's name and address and the animal's identification number, breed, and age. The farms providing animals slaughtered during our survey were plotted on a map in order to indicate what segment of the national cattle population these animals represented. Although it was assumed that this abattoir sampling would be skewed toward healthy animals, it was felt that subclinical or inapparent infections could be identified, which in turn would give an indication of the extent of the diseases involved. Moreover, we felt that comparing true disease prevalences at Baboenhol, Tibiti, and the Suralco dairy farm with the abattoir data would enhance our understanding of the animal disease situation in the Suriname Region. In all, we randomly selected and tested 142 (19.7%) of the 720 cattle presented at the abattoir.

Materials used to conduct indirect immunofluorescent antibody tests (2) for the six diseases surveyed, and also for bovine cytomegalovirus infection, were produced at North Carolina State University's College of Veterinary Medicine and transported to Suriname. Unfortunately, the serologic test for bovine cytomegalovirus was damaged in shipment, and so work on this disease was not performed.

Antigen slides for the various tests were produced as follows: Bovine turbinate cells were grown to confluency in 75 cm^2 tissue-culture flasks in a medium consisting of Dulbecco's Minimal Essential Medium (DMEM) and 10% bovine fetal serum (BFS). These cells were exposed to the appropriate virus for 90 minutes, rinsed, and then covered with DMEM containing 1% fetal calf serum. When the virus-infected cells exhibited cytopathic effects they were scraped from the flask and centrifuged at 1,000 RPM for five minutes. The resulting pellet of cells was then resuspended in approximately 0.5 ml of media, and eight drops of this cell suspension were placed on each test slide, air dried, and fixed in acetone for 10 minutes at room temperature. These slides were then stored frozen (at −70°C), were shipped to Suriname on dry ice, and upon arrival were maintained in a freezer at −70°C until used.

The tests were run as follows: Serum from each animal was diluted 1:20 in phosphate-buffered saline (PBS) and incubated at 37°C for 15 minutes. The slides were washed briefly in three changes of PBS, and the cells were overlayered with fluorescein isothiocyanate labeled rabbit anti-bovine immunoglobulin. The slides were then incubated again for 15 minutes at 37°C in a moist chamber, washed three times in PBS-tween 20, and allowed to dry. Coverslips were then placed over the slides, and all the test wells in each slide were examined for fluorescence using a Zeiss ultraviolet microscope. Positive and negative sera were tested on each slide evaluated. Specificity of these sera for the respective viruses was determined prior to use.

RESULTS

Table 1 shows the data obtained from the three farms and the abattoir. Because the cattle populations of Baboenhol, Tibiti, and the Suralco farm were well-defined by fencing, and also by knowledge of their pedigrees and management practices, reasonably accurate prevalence rates could be estimated from the subsample population data. These rates indicate the percentages of animals exposed to the various viruses studied, based
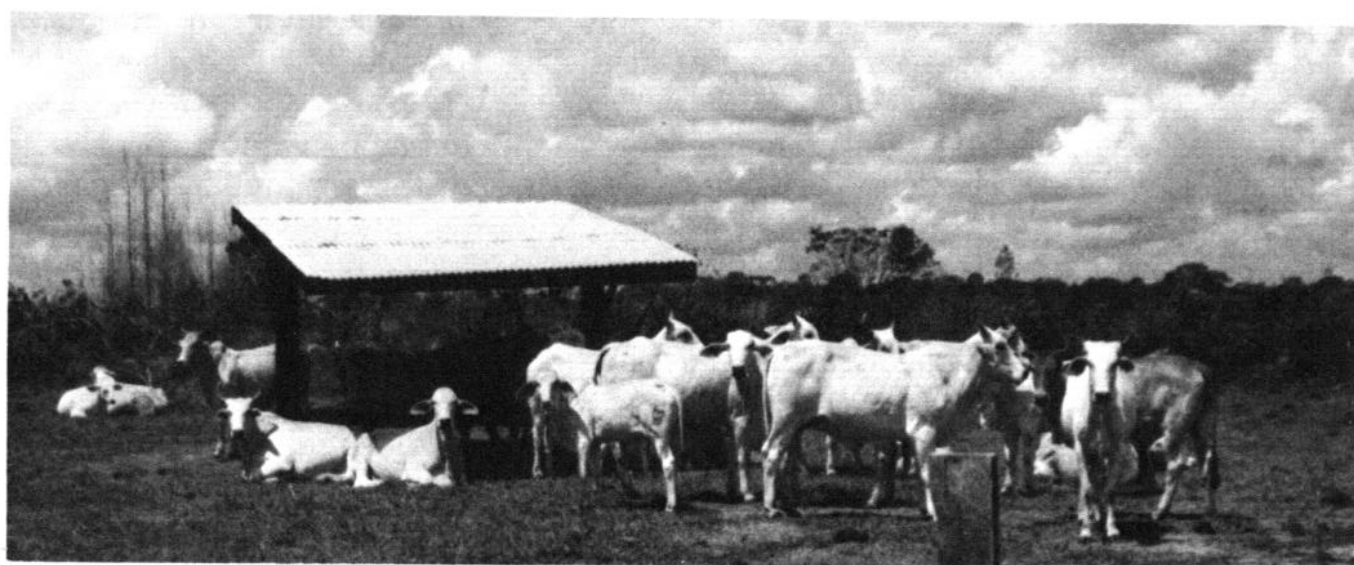
Cattle at Baboenhol (right) and Tibiti (above).
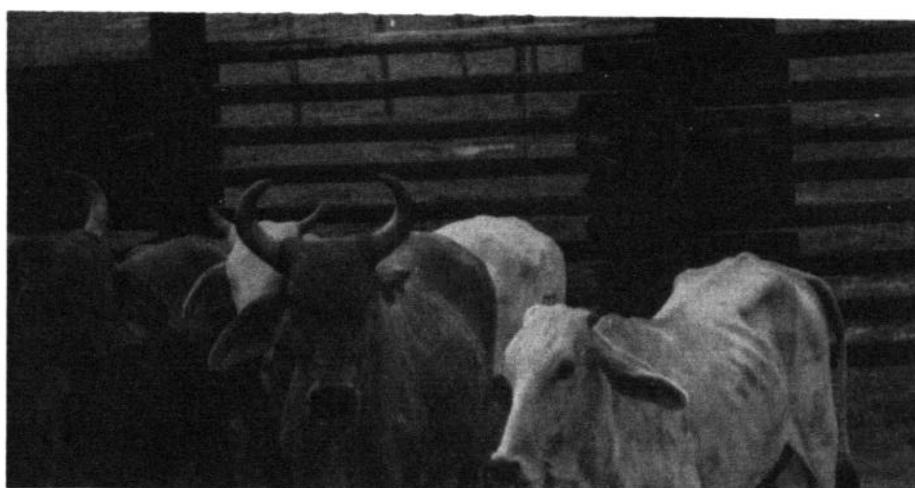
upon detection of serum antibodies against those viruses in the animals sampled.

In contrast, the "slaughterhouse rates" indicate nothing more than the percentages of slaughtered animals tested that yielded positive results. In this case the size of the original population at risk is unknown, and the data should merely be taken as providing a useful basis for comparison.

Basically, the data point to the presence of all six diseases covered except respiratory syncytial virus disease within the

Table 1. Percentages of cattle testing positive for exposure to the indicated diseases at each of the three farms studied and at the abattoir (BRUC = brucellosis, BVD = bovine viral diarrhea, PIV3 = parainfluenza-3, BCV = bovine coronavirus, IBR = infectious bovine rhinotracheitis, and RSV = respiratory syncytial virus).

		BRUC		BVD		PIV3		BCV		IBR		RSV	
	No.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Baboenhol	155	20	(13)	19	(12)	0	(0)	0	(0)	76	(49)	0	(0)
Suralco	43	0	(0)	11	(26)	0	(0)	0	(0)	6	(14)	0	(0)
Tibiti	138	3	(2)	0	(0)	16	(12)	7	(5)	10	(7)	0	(0)
Subtotal	336	23	(7)	30	(9)	16	(5)	7	(2)	96	(29)	0	(0)
Slaughterhouse	142	10	(7)	9	(6)	0	(0)	6	(4)	20	(14)	0	(0)

survey region. Noteworthy "exotic" animal diseases—including African swine fever, foot and mouth disease, malignant catarrhal fever, and rinderpest—were not covered by our survey, since Suriname had been declared free of these problems by organizations that routinely monitor them (e.g., the Pan American Health Organization, the International Office of Epizootics, etc.). However, the serum samples obtained have been used to establish a bovine serum bank in Suriname that could be used to address issues relating to such diseases.

DISCUSSION

The observed seroprevalences of the disease antibodies investigated in this study were low compared to those found by similar studies performed previously in the United States and Europe. For example, we detected no antibodies to respiratory syncytial virus in any of the serum samples tested, even though seroprevalences of 38–81% have been reported for this virus in the United States (3). Similarly, the seroprevalences of parainfluenza-3 and bovine viral diarrhea antibodies were low; in the United States and Europe, 50% to 90% of the cattle have antibodies to bovine viral diarrhea virus, and approximately 85% have antibodies to parainfluenza-3 (4, 5). An important implication of these findings is that Suriname may have a cattle population which is highly susceptible to these and perhaps other bovine viral diseases.

The reasons for the relatively low rates found are unclear. One circumstance that could provide a partial explanation is that cattle in Suriname are not routinely vaccinated as they are in the United States. This could account for our results with respect to bovine coronavirus, bovine viral diarrhea, and parainfluenza-3; however, it would not explain the low seroprevalence of respiratory syncytial virus

infection, since vaccines for this condition have only recently been introduced in the United States.

Conceivably, the low observed seroprevalence of bovine viral diarrhea could have arisen if there were a large population of persistently infected cattle in Suriname, a circumstance that can occur as a result of in utero infection (6). However, this appears very unlikely because mucosal disease, a sequela of this type of bovine viral diarrhea infection, was not observed during the survey (6).

In a more general vein, certain limitations of this study need to be clearly stated. To begin with, the data relate specifically to the Suriname Region. Although a few serum samples from ill animals in other regions were tested, the test results are not included in the data reported here, nor do they provide any basis for accurately assessing seroprevalences in those regions. The abattoir data were also specific to the Suriname Region, because three other slaughterhouses exist and handle animals from the other regions. Thus, focal problems existing in outlying regions would have been missed in this survey.

It is also true that the extreme western and eastern parts of Suriname differ topographically from the Suriname Region, a fact that could contribute to different disease patterns. However, travel between regions is frequent, so one would not expect major differences.

We did not sample "backyard" cattle operations. One might hypothesize that the management practices in these settings could result in more serious disease that we missed by not sampling. However, local Surinamese veterinarians working with these animals indicated that they had noted no unusual problems. In addition, an analysis of laboratory reports tabulated at the diagnostic laboratory in Paramaribo (Suriname Region) for such animals revealed no un-

usual disease or disease patterns that would indicate major deficiencies in the survey results.

The seasonality of this study is another limitation that needs to be considered. Suriname has four distinct seasons ("big wet," "little wet," " big dry," and "little dry"). Since disease patterns could vary with the season, it should be noted that we could have missed seasonal trends by taking all our samples during the major rainy season that typically lasts from June until the end of August.

CONCLUSIONS AND RECOMMENDATIONS

Although this survey accomplished its basic aim of determining the presence or absence of selected diseases and their relative frequency in the Suriname Region, it clearly was only a first step toward objective assessment of Suriname's food animal health situation. Indeed, it would be dangerous to make sweeping conclusions based upon a point prevalence epidemiologic survey such as this. What seems urgently needed, therefore, is an ongoing "Animal Health Data Monitoring System" especially designed to meet Suriname's requirements. Once established, such a system could make an integrated long-term contribution to both regional and national agricultural decision-making. The system could also serve to warn of emerging disease situations requiring national or international intervention.

At present, Suriname and countries in its position sometimes have so-called numerator data (the numbers of animals with certain diagnosed diseases) generated by veterinarians, laboratories, universities, and international agencies. Numerator data without corresponding denominator data—the identifiable animal populations at risk for these diseases—have limited utility. However, if both numerator and denominator data were provided by an Animal Health Disease Monitoring System, it would be possible to establish disease rates, determine disease magnitudes and trends, assess the economic impact of the various diseases involved, and estimate the costs and benefits of intervention programs. Thus, the system could provide a basis for selecting cost-effective interventions.

This is something that cannot be accomplished adequately by the kind of study reported here, primarily for lack of economic data. Such data—relating to production income and expense—need to be included in any monitoring system so as to clearly delineate the impact of diseases on animal production. The data needed can be obtained through stratified sampling by species, type of production, and herd or flock size. It is essential that such sampling be random and include data from healthy as well as ill animals.

Another key feature of any sound surveillance system is a diagnostic laboratory that produces accurate results. Suriname has an advantage here, because it currently possesses a more than adequate microbiological laboratory with a very capable staff. During our survey, we trained several staff members to use various diagnostic techniques that were new to them. The training was accomplished quickly and the technicians' performance was good.

It appears, therefore, that Suriname has a facility able to provide the accurate diagnoses the surveillance system needs. However, certain reagents required to develop necessary tests are lacking—a major difficulty that could best be overcome through cooperative arrangements with outside institutions whereby these institutions supply reagents and various tests (notably tests for viral antigens) on a regular and consistent basis. It appears that

this could be accomplished in a practical and affordable manner.

In sum, Suriname needs to develop an animal disease surveillance system producing objective data with an economic component if the country is to increase its livestock output, meet its internal needs, and produce for export. Around the time our survey was completed, the attitudes of people in the Government and livestock industry appeared to make creation of such a system feasible. The task would depend upon coordination at the national level and might entail creation of an epidemiology division within the Ministry of Agriculture, Husbandry, and Fisheries; however, it seems clear that the country possesses the personnel and facilities needed to do the job. Furthermore, there is considerable incentive for establishing such a system—the success of which could make Suriname an attractive site for agricultural investment by major international institutions.

REFERENCES

1. Pan American Health Organization. *Diagnosis of Animal Health in the Americas.* PAHO Scientific Publication 452. Washington, D.C., 1983.

2. Potgieter, L. N. D, J. B. Jones, C. S. Patton, and T. A. Webb-Martin. Experimental parvovirus infection in dogs. *Can J Comp Med* 45:212–216, 1981.

3. Baker, J. C., T. R. Ames, and J. F. Markham. Serologic studies of bovine respiratory syncytial virus in Minnesota cattle. *Am J Vet Res* 46:891–892, 1985.

4. Ernst, P. B., J. D. Baird, and D. G. Butler. Bovine viral diarrhea: An update. *Compend Cont Educ Prac Vet* 5:5581–5589, 1983.

5. Potgieter, L. N. D. Current concepts on the role of viruses in respiratory tract diseases of cattle. *Bovine Practice* 12:75–81, 1977.

6. Brownlie, J., M. C. Clarke, and C. T. Howard. Experimental production of fatal mucosal disease in cattle. *Vet Rec* 114:535–536, 1984.

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AIDS Information Clearinghouse in Canada

The Canadian Public Health Association's AIDS Clearinghouse acts as a central source of information and documentation on AIDS education and prevention in Canada. It stocks distribution copies of some 75 different brochures, posters, videos, and pamphlets from sources throughout Canada and distributes them separately or assembled into kits. It also collects AIDS educational and promotional materials from around the world and makes them available for loan.

For further information, contact Ms. Patricia Shotton, Clearinghouse Manager, CPHA AIDS Education and Awareness Program, 1565 Carling Avenue, Suite 400, Ottawa, Ontario K1Z 8R1, Canada; telephone (613) 725-3769, fax (613) 725-9826.

Source: Gerald Dafoe, CPHA AIDS Education and Awareness Program Clearinghouse expands activities, *Can J Public Health* 80(4):234, 1989.