**ADAP Animal Health Survey**
**ADAP 2000-27 • December 2000**

# Swine Disease Survey in the Federated States of Micronesia 1995 - 1997

## Results and Recommendations

(Chuuk, Kosrae, Yap, Pohnpei)

ADAP PROJECT
Agricultural Development in the American Pacific
Pacific Land Grant Programs

**Swine Disease Survey in the Federated States of Micronesia 1995 - 1997**
**Results and Recommendations (Chuuk, Kosrae, Yap, Pohnpei)**

Swine rearing in the Federated States of Micronesia (FSM) is an integral part of custom and tradition, and is considered to be a cultural obligation by many Micronesians. For this reason, a majority of the nation's households and extended families are involved, to some degree, in raising pigs. Farms vary in size from small backyard piggeries to 50 sow operations. The result of this situation is an estimated nationwide population of 40 to 50 thousand pigs. Considering that the resident human population of the FSM is approximately 100,000, this roughly equates to one pig for every two people living in the FSM

Prepared by:

James R. Simms, DVM
DIrector, COllege of Micronesia
Agricultural Experiment Station
Kolonia, Pohnpei
1997 (Original publishing date)

Printed December 2000

ISBN 1-931435-02-02

**For Further Information:**
American Samoa Community College (684) 699-1575 - fax (684) 699-5011
College of Micronesia (691) 320-2462 - fax (691) 320-2726
College of Micronesia (FSM) (691) 320-2480 - fax (691) 320-2479
College of the Marshall Islands (692) 625-3236 - fax (692) 625-4699
Palau Community College (680) 488-2746 - fax (680) 488-3307
Northern Marianas College (670) 234-9023 - fax (670) 234-0054
University of Guam (671) 735-2002 - fax (671) 734-5600
University of Hawaii (808) 956-8140 - fax (808) 956-6967

Funded by the United States Department of Agriculture Cooperative State Research, Education and Extension Service Grant 99-38826-7854
ADAP Home Office - College of Tropical Agriculture and Human Resources
3050 Maile Way, Gilmore Hall 213, University of Hawaii at Manoa
Honolulu, HI 96822 USA www.adap.hawaii.edu/adap - adap@hawaii.edu
The Pacific Land Grants and the U.S.D.A. are Equal Opportunity/ Affirmative Action Institutions

## Abstract

The animal disease status of the Federated States of Micronesia (FSM) is classified within a restrictive quarantine category by the United States Department of Agriculture (USDA) and the Office International des Epizooties (OIE). This restrictive classification represents an obstacle to the evolution of a more productive domestic livestock industry and is largely based on the absence of current information concerning the presence of animal diseases in FSM.

A swine disease survey was conducted in the FSM from November, 1995 through March, 1997. The objective of the survey was to document the swine disease status of the FSM for the protection and development of the nation's swine industry.

Swine, and to a lesser extent poultry, are the primary domestic food animals produced in the FSM. Due to climate, land limitations and cultural preferences, cattle and goats are few in number and represent an insignificant part of the livestock population. Although a developing poultry industry is emerging, swine represent the only economically significant food animal species produced in the FSM. For this reason, this disease survey was limited to the collection and testing of porcine blood samples only. The survey included the main islands of Chuuk, Kosrae, Pohnpei and Yap states, along with the Pohnpei state outer islands, Sapwuaphik, Nukuoro, Kapingamarangi, and Mwokilloa.

During the course of the survey, 794 porcine serum samples were collected from within the FSM. Test results indicate that a very narrow spectrum of swine diseases currently exists in the FSM. This finding underscores the need for the FSM to ensure that animal quarantine laws are relevant to the disease status of the country. Current quarantine laws are based on OIE regulations, and are not comprehensive enough to prevent the introduction of new swine diseases.

## Acknowledgments

I gratefully acknowledge the assistance of the following governmental departments, diagnostic laboratories, international aid organizations, and persons whose efforts and support made the Swine Disease Survey possible.

Department of Resources and Development, Government of the Federated States of Micronesia.

Divisions of Agriculture, Kosrae, Pohnpei, Chuuk, and Yap States.

Kosrae, Pohnpei, Chuuk, and Yap, State Agricultural Extension Agents, who provided liaisons with the farmers.

Food and Agricultural Organization (FAO), United Nations.

United Nations Livestock Development Program.

Donation of services for Leptospirosis testing and identification by the Laboratory of Microbiology and Pathology, a WHO Collaborating Centre for Reference and Research on Leptospirosis, Brisbane, Australia.

Veterinary Pathology Laboratory, Koronovia Research Station, Nausori, Fiji. Donation of Brucellosis and Parvovirus testing.

Donation Trichinellosis testing, Agricultural Research Service, Parasite Biology and Epidemiology Laboratory, Beltsville, Maryland, and Dr. H. Gamble.

South Pacific Commission (SPC), and Dr. Peter Saville, Animal Health Advisor for SPC.

Dr. Jonas Mundogo, United Nations Volunteer, Swine Disease Survey, Co-Principal Investigator.

Mr. Neville Stallman, Director Emeritus, Laboratory of Microbiology and Pathology, Brisbane, Australia.

Mr. Lee Smythe, Director, Laboratory of Microbiology and Pathology, Brisbane, Australia.

Mr. Engly Ioanis, College of Micronesia-FSM, Animal Scientist, Chief Research Assistant.

Mr. Linus Soumetau, Quarantine officer, Department of R&D, FSM, Research Assistant.

*Agricultural Experiment Station, College of Micronesia P.O. Box 1179 Kolonia, Pohnpei FSM 96041. Dr. James R. Simms, Director. The Agricultural Experiment Station follows a nondiscriminatory policy on programs and employment.*

## Table of Contents

**Page**

## Introduction

Swine rearing in the Federated States of Micronesia (FSM) is an integral part of custom and tradition, and is considered to be a cultural obligation by many Micronesians. For this reason, a majority of the nation's households and extended families are involved, to some degree, in raising pigs. Farms vary in size from small backyard piggeries to 50 sow operations. The result of this situation is an estimated nationwide population of from 40 to 50 thousand pigs. Considering that the resident human population of the FSM is approximately 100,000, this roughly equates to one pig for every two people living in the FSM.

In spite of the abundance of pigs and piggeries in the FSM, significant barriers exist which prevent further development of the national swine industry. The absence of pork processing facilities and central marketing systems, combined with trade restrictions, results in erratic and unpredictable marketing opportunities for swine producers. In addition, high feed costs, inefficient husbandry techniques, and minimal herd health management incur high production costs.

Identification and resolution of animal health issues is a basic element in establishing a sound economic foundation for the nation's swine industry. Conducting a swine disease survey was determined to be the first step necessary to define the nature and scope of animal health issues in the FSM. The present survey involved visits to farms in each of the FSM island states in order to collect blood samples for disease testing, and to provide an opportunity to observe other factors that are integral to herd health such as management techniques and nutrition.

Individuals representing the following governments and institutions participated in the swine disease survey. Porcine serum samples were collected from the fall of 1995 until March 1997.

- College of Micronesia, Agricultural Experiment Station, a USDA Land Grant institution.
- National and state governments of the Federated States of Micronesia.
- Food and Agriculture Organization of the United Nations (FAO), through a United Nations Development Project.

Survey test results indicate that most swine diseases commonly found in the major swine producing areas of the world do not exist in the FSM. One obvious explanation for this is that the geographic isolation of this island nation provides an effective shield preventing the easy introduction of swine diseases. However, as economic development in the region spawns increased international air and sea traffic, the effectiveness of this shield will very likely diminish, and the risk of introducing new animal diseases shall magnify over time. The information provided in this report underscores the need for quarantine officials to develop quarantine laws that are uniquely applicable to the disease status of the FSM, and not to rely solely on the regulations of international regulatory organizations such as the OIE.

## Materials and Methods

*Study Location*
The following islands were included in the swine disease survey.

- Kosrae
- Chuuk Lagoon islands - Moen, Liman
- Yap main islands
- Pohnpei main island
- Pohnpei State Outer Islands - Mwokilloa, Sapwuaphik, Nukuoro, and Kapingamarangi

Collection of serum samples was made possible with the assistance of the agricultural extension agents representing the Kosrae, Pohnpei, Chuuk, and Yap state divisions of agriculture. The extension agents organized farm visits, provided introductions and served as interpreters.

*Determination of sampling locations:*
Swine management techniques as practiced in the FSM, do not include quarantine, so it is commonplace for producers to immediately co–mingle pigs from different sources. Due to geographic isolation and high transportation costs, pigs are rarely exposed to animals from other island states. More frequently, pigs that are introduced into a herd originate from within the village or municipality, and to a lesser extent other locations on the island. Because of the intimate contact of different herds within villages and municipalities, municipal boundaries were used to delineate sampling areas.

*Sampling Size*
The appropriate sampling size was determined by referring to the statistical table entitled, “Size of Sample for Surveys of Large Populations (infinite size)”. This table is included in the World Health Organization (WHO) publication, *Guidelines for the Control of Leptospirosis* (Faine, 1982). For the majority of locations, the number of blood samples collected were sufficient to detect a positive reactor within a 95% degree of confidence, at a 5% prevalence rate. In the case of the Southern outer islands of Pohnpei State, the field ship SS Micro Glory was the only means of transport to the islands of Sapwuaphik, Nukoro, and Kapingamarangi. Therefore, it was necessary for investigators to adjust sample collection according to the ships sailing schedule. Sample numbers fell short of the 95% confidence level on these islands because of this logistical problem.

*Collection Methods*
In each sampling, the location of pigs, was chosen randomly. Animals were humanely restrained with a hog snare and then were positioned to facilitate veni-puncture of the right brachiocephalic vein. The veni-puncture site was cleansed with 70% isopropyl alcohol. A Vacutainer™ blood collection apparatus was used with a 18 or 20 gauge, 11/2 inch needle, to collect 10 to 15 ml. of blood. Blood samples were placed in a cooler and transported to the lab for centrifugation and serum separation. Freshly harvested serum was then immediately frozen for storage.

Each animal sampled was categorized according to owner, breed, sex, age, and weight. Each farm was described according to municipality, and topographical location described as atoll, coastal, mid-upland, and upland. Depending on the serological test desired, frozen serum samples were transported to one of the following laboratories:

**Leptospirosis**
- Laboratory of Microbiology and Pathology, a WHO Collaborating Centre for Reference and Research on Leptospirosis, Brisbane, Queensland, Australia

**Hog Cholera, Porcine Parvovirus, Pseudorabies**
- Central Animal Health Laboratory, Upper Hutt, New Zealand

**Foot–and–Mouth Disease, Japanese Encephalitis Virus, Pseudorabies**
- Foreign Animal Disease Laboratory, Plum Island, New York, U.S.A.

**Swine Influenza, Transmissible Gastroenteritis, Porcine Reproductive Respiratory Syndrome, Pseudorabies**
- National Veterinary Services Laboratory, Ames, Iowa, U.S.A.

**Trichinellosis**
- Agricultural Research Service, Parasite Biology and Epidemiology Laboratory Beltsville, Maryland, U.S.A.

**Porcine Brucellosis, Porcine Parvovirus**
- Veterinary Pathology Laboratory, Koronivia Research Station, Nausori, Fiji

## Results and Discussion

**OIE List A Diseases:**

*Classical Swine Fever (Hog Cholera)*
In 1976, an outbreak of hog cholera occurred on the island of Kosrae. Fortunately, Kosrae was found to be the only island in the FSM to harbor the disease. Soon after the outbreak a hog cholera eradication program was instituted which eliminated clinical evidence of the disease from the island. Since the culmination of the eradication program over 20 years ago, there has been no serological proof that the disease was fully eradicated.

From January 1996 to October 1996, the swine disease survey submitted a nationwide total of 783 porcine serum samples for hog cholera testing. Using the Enzyme Linked Immunosorbent Assay (ELISA) test, all samples tested negative for hog cholera.

In the case of Kosrae, 145 serum samples tested negative for hog cholera indicating a 99% confidence level that the disease does not exist at a 3% prevalence rate. Considering the results of the current swine disease survey along with the lack of clinical evidence for hog cholera there is compelling evidence that hog cholera does not exist in the FSM.

***Foot–and–Mouth Disease***
No clinical evidence of Foot–and–mouth disease has been observed in the FSM. However, because this is a disease of major significance in the international trade of livestock and livestock products, it was determined that it was important to document the incidence of this disease in the FSM.

A total of 231 serum samples collected from the islands of Kosrae, Pohnpei, Chuuk, and Yap were submitted to the USDA-APHIS, Foreign Animal Disease Laboratory, Greenport, New York. All samples tested negative for Foot–and–mouth Disease using the virus infection associated antigen (VIAA) test.

**OIE List B Diseases:**

***Pseudorabies*** *(Aujeszky's Disease)*
The ELISA test was used to screen for the presence of pseudorabies in the FSM. A combined total of 783 porcine serum samples were tested from the FSM. The following islands tested negative for pseudorabies:

- Kosrae
- Chuuk
- Yap
- Outer Islands Pohnpei State
- Mwokilloa
- Kapingamarangi
- Nukuoro
- Sapwuahfik

Initial testing for pseudorabies on the main island of Pohnpei revealed 10 positive results out of 250 serum samples tested. The 10 positive samples were from pigs located in Kitti municipality. All other municipalities of Pohnpei tested negative.

Positive reactors were found in the following villages, located in Kitti municipality:

- Kitti Pohrasapw 1 positive
- Kitti Marahu 1 positive
- Lewetik 1 positive
- Kipar 1 positive
- Peil 3 positive
- Poahs 1 positive
- Pohsoail 2 positive

In March 1996 and February 1997 additional serum samples were collected to further investigate the pseudorabies status of the villages mentioned above. The March 1996 sample collection included all but one of the farms with positive reactors in the initial testing. Nineteen re-test samples were collected and submitted to the Central Animal Health Laboratory (CAHL), in New Zealand. The results from CAHL indicated eight positive reactors to the pseudorabies ELISA test, however; it was also determined that a sample identification error had occurred. Because of the serum identification error, 18 of the original 19 re-test samples were resubmitted to the USDA Foreign Animal Disease Labora-

tory (FADL) in March 1997. FADL used the latex agglutination test for pseudorabies and confirmed that all of the eight positive results obtained earlier from CAHL testing came from Piel village in Kitti municipality on the main island of Pohnpei.

In March 1997, 18 serum samples were submitted to the National Veterinary Services Laboratory (NVSL) in Ames, Iowa for pseudorabies testing. Ten of the samples were collected in February 1997 from one farm located in Peil. This farm had previously been tested twice and had positive reactors in both samplings. The remaining eight samples were from the Pohnpei State outer island of Kapingamarangi.

All 18 samples submitted to NVSL were tested for pseudorabies by ELISA, Latex Agglutination (LA), and Serum Neutralization (SN) tests. Four of the 10 samples from Peil tested positive by latex agglutination and serum neutralization, but negative by ELISA. The remaining six samples from Peil and eight samples from Kapingamarangi tested negative for pseudorabies.

Clinically, pseudorabies appears to have minimal impact on the herds containing positive reactors. Owners were asked if clinical signs typical of swine pseudorabies had been observed in their herds. In some cases, due to language barriers, small herd size, and lack of record keeping, the owners were not able to provide useful information. Overall, however, there were no reports of serious problems.

The Peil farm was the most frequently examined herd in the disease survey due to the large size of the herd, and the number of positive reactors. The herdsman reported that he had not observed any problems of reproductive, respiratory, or neurological nature. As with most pig farms on Pohnpei, the Peil farm is well endowed with resident dogs and cats. As with the herd, there were also no reports of neurological problems in these animals as well.

The results of the serological testing and analysis of the available clinical history suggest that a rather avirulent form of pseudorabies virus appears to be present in localized areas of Kitti municipality. However, at the present time, there has been no opportunity which would allow a virus isolation attempt.

***Japanese Encephalitis Virus***

Japanese Encephalitis virus (JE), is a mosquito-borne viral disease that affects humans and a wide variety of animals. JE infections in humans are manifested by encephalitis with varying degrees of severity and abortion in women. Some infected individuals only experience mild symptoms, while others, particularly children, may develop severe symptoms which can result in death.

JE in swine is subclinical with the only signs of infection being reproductive disorders in breeding animals. Boars may develop testicular infections resulting in infertility, and affected females frequently produce mummified or stillborn piglets. The most important consequence of JE infection in swine is that pigs serve as a reservoir host to the virus, thereby increasing the likelihood of the spread of virus to human populations.

The geographic distribution of JE is currently limited to the Pacific Rim countries, South East Asia, an some islands of the Western Pacific. Because the FSM is located in close proximity to the geographic range of the virus, documentation of the incidence of JE in the swine population of the FSM is of major significance to public health.

Porcine serum samples collected in the FSM were tested for JE by the USDA, Foreign Animal Disease Laboratory. Twenty serum samples were tested from Yap State, 25 from Chuuk state, 26 from Kosrae, and 38 from Pohnpei State. All test results for the virus were negative.

***Brucellosis***

Brucellosis is a disease caused by bacteria belonging to the genus, *Brucella.* There are six species of *Brucella* organisms which cause disease in a broad range of host animals including humans. Generally, brucellosis is responsible for reproductive problems in animals, and can severely affect the profitability of a livestock enterprise. Once established in a herd, brucellosis can only be eradicated by removal of infected animals. *Brucella suis*, causes brucellosis in pigs, and also causes the most severe form of brucellosis infection in humans. Humans can become infected by handling or eating pork, or by handling aborted piglets and associated afterbirth.

Seven hundred eighty three porcine serum samples collected in the FSM were tested for brucellosis caused by *Brucella suis* . Testing was conducted at the Veterinary Pathology laboratory, Koronovia Research Station, Fiji using the Rose Bengal Caps Test (RBT). The laboratory reported that all samples tested negative for porcine brucellosis.

***Leptospirosis***

Leptospirosis is a disease that infects both animals and humans, and has significant public health ramifications. The disease has a worldwide distribution, but is most prevalent in the warm, humid semi-tropical and tropical regions of the world. There are over 200 different types of leptospirosis organisms that can infect humans and animals. Serological testing conducted in this study, as well as in other studies, have confirmed the presence of this disease in the FSM, and the other nations of Micronesia, Melanesia, and Polynesia.

Leptospirosis is an animal disease with cycles of infection being perpetuated in various domestic and wild species. Humans are not considered natural hosts of leptospirosis and become infected accidentally through contact with infected animals. Due to the high prevalence of leptospirosis in the region and its significant impact on public health, a separate report documenting the microbiological and serological features of the disease in the FSM is presently being prepared by the Agricultural Experiment Station of the College of Micronesia.

The Microscopic Agglutination Test (MAT) is considered the benchmark serological test for leptospirosis. Porcine, canine, and rodent serum were collected for MAT testing at the WHO, Participating Leptospirosis Reference Laboratory in Brisbane, Australia. The number of positive reactors defined as samples possessing IGg antibodies ≥100 are as follows:

Table _____

| Island | Number porcine serum samples tested | Number positives |
|---|---|---|
| Kosrae | 140 | 40 |
| Chuuk | 143 | 60 |
| Yap | 135 | 50 |
| Pohnpei | 256 | 81 |
| Mwoakilloa | 65 | 13 |
| Sapwuahfik | 9 | 7 |
| Nukuro | 15 | 4 |
| Kapingamarangi | 20 | 6 |

***Trichinellosis***

Trichinellosis is a disease caused by the parasite, *Trichinella spiralis*. All mammalian species are considered susceptible to infection by this organism. Pigs and bears are natural hosts of *Trichinella*, and humans are considered incidental hosts. Trichinellosis can be a serious disease in humans, while pigs are usually minimally affected. The disease is most common in temperate climate zones, and is found less frequently in the tropics.

The L1 larval stage of the Trichinella parasite forms cysts in the skeletal muscle tissue of the host. Humans become infected by eating under–cooked pork or other meat containing the larval cyst.

Serologic detection of *T. spiralis* is accomplished using the ELISA test for *Trichinella* specific antigens. Two hundred twenty porcine serum samples from Pohnpei were tested for *Trichinella* using the ELISA testing method. Analysis of test results indicated that all samples were negative. Testing for Trichinellosis was conducted at the United States Agricultural Research Service Parasite Biology and Epidemiology Laboratory, Beltsville, Maryland. Dr. H. Ray Gamble conducted the tests and assisted with interpretation of the results.

***Transmissible Gastroenteritis***

Transmissible Gastroenteritis (TGE) is a serious viral disease that can affect pigs of all ages. The symptoms include vomiting, bloody diarrhea, and dehydration. TGE is among the group of diseases that are usually suspected when diarrhea occurs in pre-weaning and weaning pigs. The pre-weaning age group is most severely affected and death losses usually approach 100 percent. Serum samples from all collection sites in the FSM were tested for TGE using the serum neutralization test. Testing was conducted by the National Veterinary Services Laboratory in Ames Iowa, and all samples tested negative.

**Additional Diseases not listed by OIE**

***Swine Influenza***

Swine influenza is a highly contagious, acute respiratory disease caused by an influenza type A virus. Upon introduction to a swine herd, almost all pigs are infected simultaneously. Clinical symp-

toms consist of inactivity, lack of appetite, coughing, nasal discharge, sneezing, and fever. Other symptoms may be labored and open mouth breathing. The disease is found in most of the major swine producing regions of the world and is responsible for great economic losses within these areas. Serum samples from all sampling locations in the FSM were submitted to the National Veterinary Services Laboratory in Ames, Iowa. All samples submitted tested negative to swine influenza using the Haemagglutination Inhibition test (HI).

***Porcine Reproductive and Respiratory Syndrome***

Porcine Reproductive and Respiratory Syndrome (PRRS), was first recognized in 1987-88. Over the last 10 years the disease has spread throughout the world. Animal health professionals in Hawaii have recently reported that the disease is causing considerable economic losses to swine producers in that state.

The symptoms of the disease are varied, with the most significant losses occurring due to reproductive failure of the breeding sows and gilts. Conception and farrowing rates are reduced and late term abortions occur at a high frequency. In addition, young pigs are severely affected with respiratory disease, causing significant mortality and poor feed performance.

Serum samples from all collection sites within the FSM were tested for PRRS by the National Veterinary Services Laboratory using the immunofluorescence antibody test. All serum samples tested negative.

The survey indicates that PRRS has probably not yet penetrated swine populations in the FSM. Current regulations do not require PRRS testing for the importation of swine to the FSM. Given the potential impacts of the introduction of this disease into the country, it is recommended that national and state quarantine officials sponsor an initiative to change current quarantine laws to include PRRS testing in their screening procedures.

***Porcine Parvovirus***

Porcine parvovirus is ubiquitous and is considered to be present in most swine herds throughout the world. The disease is manifested by reproductive failure primarily in gilts or sows that are not immune to the virus. The nature of the reproductive disorder is related to the phase of pregnancy in the infected dam when exposure to the virus occurs. Female pigs may be slow to conceive, abort, or produce increased numbers of still born and mummified fetuses.

Testing has revealed the presence of parvovirus infection in the FSM, as in other swine producing areas of the world. Swine serum samples collected from the main islands of Kosrae, Chuuk, and Yap were tested at the Central Animal Health Laboratory in New Zealand using the HI. Serum samples from Pohnpei were tested at the Veterinary Pathology Laboratory at the Koronovia Research Station in Fiji, using the ELISA test. The results reflect that parvovirus is endemic in FSM swine herds.

**Conclusions**

Survey results indicate that there are no swine diseases of major international importance with respect to trade of livestock, and livestock products, in the FSM. However, positive test results do confirm the presence of three diseases (leptospirosis, porcine parvovirus and pseudorabies) in the

FSM. While these diseases are capable of causing significant economic losses, they are also commonly found throughout the world which reduces their importance relative to international quarantine issues.

Of the three diseases detected by the swine disease survey, leptospirosis is the most damaging to human and animal health within the FSM. Animals are the source of leptospirosis organisms for human infections, and the prevalence of leptospirosis in swine, rats, and dogs is universally high in all of the states of the FSM. For this reason, residents of each state may face a significant risk of acquiring the disease. Evidence of the level of this risk is found in the hospital records of the island states of Kosrae and Pohnpei. Cases of human leptospirosis infection are frequently diagnosed, and there are reports of human fatalities due to leptospirosis as well. In addition to human suffering, a case of advanced leptospirosis is costly to treat and sometimes requires medical evacuation of patients. Leptospirosis also impacts animal health by reducing reproductive performance in breeding animals which results in economic losses to swine producers.

Porcine parvovirus infection, is widespread in the FSM, and should be considered a threat to optimum reproductive performance in swine herds. Fortunately, the adverse effects of the disease can be easily and adequately controlled by herd vaccination.

Serological evidence of pseudorabies was fortunately limited to one municipality on the island of Pohnpei. However, the pattern of positive reactors does suggest that the virus is slowly spreading. For this reason steps should be taken to further investigate the epidemiological aspects of the disease on Pohnpei. The remainder of the FSM appears to be free of pseudorabies at this time.

During the course of the swine disease survey there was an opportunity to observe clinical cases with symptoms suggestive of other commonly found swine diseases, although no serological testing was performed. Other diseases observed included:

- Erysipelas infection
- Rota virus diarrhea
- E. coli infection (diarrhea)
- Arthritis- Streptococcal
- Exudative epidermitis

Fecal, physical and post mortem examinations conducted during the survey indicated the presence of the following internal and external parasites:

- Lungworm - *Metastrongylus spp.*
- Red stomach worm - *Hyostrongylus rubidus*
- Large roundworm - *Ascaris suum*
- Whip worm - *Trichuris suis*
- Kidney worm - *Stephanurus dentatus*
- Sarcoptic mange - *Sarcoptes scabei var. suis*

In comparison to other swine producing nations, the FSM is fortunate to be affected by a very narrow spectrum of swine diseases. However, the production efficiency of most swine operations in the FSM is very low. It is easy to blame a particular disease process for low production, but it is important to realize that many factors, in addition to a specific disease agent, contribute to poor herd

performance. The following section of this report contains a brief summary of recommendations offered in light of the information provided by the swine disease survey. These suggestions are made with the goal of improving production efficiency. For more information and assistance contact the College of Micronesia, Agricultural Experiment Station animal health extension agents.

## Recommendations

The following recommendations include considerations that are of interest to the appropriate governmental departments which are responsible for state and national animal quarantine policy, as well as recommendations designed for the benefit of local swine producers. These suggestions are offered in light of the unique situations found in the FSM, although they should also be applicable in similar environments within the region.

One of the challenges faced by swine producers in the FSM is limited availability of veterinary services, vaccines, supplies, and medications. For this reason, the suggestions are based on the minimal use of such services and products. Any mention of a commercial veterinary supply businesses is made for informational purposes only, and should not be interpreted as an endorsement by the College of Micronesia Agricultural Experiment Station.

### Suggestions for Appropriate Governmental Departments

*Reducing the Spread of Leptospirosis*
Leptospirosis infects a wide range of domestic and wild animals and is, therefore, considered to be a disease that can be controlled but not eradicated.

- Vaccination of domestic animals, including dogs, for leptospirosis reduces the overall numbers of pathogens which would normally cycle through animal populations. This practice also reduces the risk of human infection and mitigates the economic losses caused by the presence of leptospirosis in swine. In order for vaccination to successfully control leptospirosis, the vaccine must contain the specific types of leptospirosis organisms that are responsible for animal and human infections in the area.

- Rodents are widely suspected as being principle agents in perpetuating the transference of Leptospirosis to other animals and humans. Therefore, reducing rodent populations is an effective method in controlling the rate of transmission.

- Information on the epidemiology, symptoms, and beneficial effects of early treatment should be common knowledge to all residents and visitors of the FSM. Public information distributed through television and radio stations, as well as by billboards, posters and other written literature, has the potential of saving lives. Because it is reasonable to assume that last years three human deaths due to leptospirosis might have been avoided through public education, the time to act is now.

- Due to the public health hazard created by leptospirosis, human lives will continue to be lost, and many others will suffer from the disease until there is a program to reduce the threat of leptospirosis to residents and visitors of the FSM. It is hoped that the College of Micronesia, FSM Division of Health Services, and FSM Division of Resources and Development, will immediately collaborate with state governments to develop an effective program.

**Reducing the risk of the introduction of new diseases**
Because the FSM has no diseases of international significance, immediate steps should be taken to strengthen national quarantine laws. The best approach is not to allow the importation of live pigs into to the country for any reason. Any introduction of new genetic material into the FSM for herd improvement should be done by using artificial insemination, with certified disease free semen. If it becomes necessary to import live animals, they should be certified to be free of OIE listed diseases, and other diseases as well, such as Porcine Reproductive and Respiratory Syndrome (PRRS).

The FSM is located relatively close to Pacific Rim countries which harbor serious diseases of international significance, such as foot–and–mouth disease and hog cholera. These diseases may be introduced into the FSM, not only by direct contact with live animals, but also through contact with animal products such as meat. The hog cholera outbreak on Kosrae in 1976 was caused by the exposure of pigs to infected meat that was included in the garbage of a foreign ship. Port surveillance should include monitoring the practices of foreign fishing and cargo vessels that anchor in FSM ports and lagoons.

**Maintain disease surveillance:**
To remove the restrictive status placed on the FSM concerning export of animal products, and diagnostic lab specimens, ongoing disease surveillance must be implemented. The first step in improving the animal disease classification status was to document the presence or absence of swine diseases in the FSM. This has been accomplished through the completion of this study. The second step consists of organizing a surveillance program. Such a program will require the services of a professional veterinarian. Should a commitment to secure a full time veterinarian not be practical for the FSM at this time there are alternatives. Given limited budgetary means, it may be feasible to obtain a veterinarian on a part time basis. If a veterinarian could be secured only for biannual surveillance visits of a month's duration rather than a years contract, significant budgetary savings could be realized. Inbetween veterinary surveillance visits, a non-veterinarian livestock surveillance officer could maintain a liaison with animal producers and organize the biannual disease surveillance visits. Funding assistance for implementation of such a program could be explored through some of the international aid institutions, such as the SPC, UNDP, as well as through foreign embassies.

## Recommendations for Local Swine Producers

### Suggestions for a Farm Quarantine Plan

Quarantine should not only be a national consideration, but should also be included in the management policies of individual farms. The first consideration to prevent the spread of any disease is to avoid contact with the causative organism. The most effective management technique to prevent contact with disease is quarantine. A swine producer should consider his herd of animals as a closed system. All animals in the herd are in close contact with one another, and as a result have developed or acquired immunity to organisms which are present within the herd. Any pigs introduced from outside the herd should be considered to be a potential source of new disease organisms to which the herd has no protection. In addition to pigs, other sources of disease organisms should be considered. Wild or free roaming pigs and other animals such as dogs, cats, rats, poultry, and birds, may introduce new diseases into a herd. Humans can also act as disease vectors by transporting unwanted disease agents on their clothes, shoes, and vehicle tires.

With these considerations in mind, the following suggestions are made:

- Establish the location of the piggery in area that is as isolated as possible from road and foot traffic.

- Discourage unnecessary visitors to the pig raising area and provide a means of disinfection for workers and visitors that have to visit. Commercial disinfectants or diluted bleach solutions can used as an effective foot or shoe bath. Hosing off the shoes or feet of visitors, although not as effective as disinfectant, is better than nothing. Throw away plastic shoe and clothes covers are an even better alternative, and are commonly used in major swine producing countries.

- Keep all other types of animals away from the herd, such as chickens, dogs, cats, and rats.

- Any pigs that are to be introduced into the herd should be held in separate quarters as far away as possible from the herd for a period of 60 days. During that time, the new pig should be exposed to organisms already present in the herd by periodically feeding a small amount of the herds droppings mixed in with the food. If vaccination is practiced on the farm, the new pig should be vaccinated on arrival and treated for internal and external parasites.

### Avoiding Reproductive Failure

*Vaccination Program:*

Leptospirosis, porcine parvovirus, and pseudorabies all have the ability to cause abortion and increased numbers of weak or stillborn piglets. However, losses due to these diseases can be controlled by vaccination.

- One vaccine commonly used in many of the major swine producing areas may be of some value in the FSM. It is a combination vaccine that provides protection against porcine parvovirus, erysipelas, and leptospirosis. Use of this vaccine in the FSM may be expected to reduce the reproductive and performance problems associated with the presence of these diseases. Unfortunately, at the present time there is no vaccine available that contains all of the specific types of leptospirosis organisms found in the FSM. A vaccine that does not

include these specific leptospires is of no value in preventing leptospirosis. However, extensive serological testing for leptospirosis within the FSM has revealed that the predominate type affecting swine is serogroup Australis, serovar Leptospira bratislava. For this reason it is recommended that until there is a vaccine including all FSM serovars, the only combination vaccine with any effectiveness against leptospirosis must contain Leptospira bratislava .

- Erysipelas, parvovirus, and leptospirosis combination vaccines containing Leptospira bratislava are available commercially and may be ordered by mail or directly from Hawaii Veterinary Supplies in Honolulu, Hawaii. The combination vaccine should be administered to all breeding animals. Because porcine parvovirus primarily causes reproductive problems in young females, the vaccine will be especially valuable for immunizing gilts intended for breeding. Maternal immunity against parvovirus, which is passed from the mother pig to her offspring, interferes with vaccination and may still be present at 6 1/2 months of age. For this reason, gilts should not be vaccinated for parvovirus before 6 1/2 months. Another method to protect gilts from parvovirus is to periodically expose gilts to the fecal waste of the mature breeding sows. This method is not as effective as vaccination, but is of value because it attempts to expose the gilts to the virus before breeding. If a gilt is successfully exposed to parvovirus prior to breeding, she will then develop protective immunity before pregnancy and avoid a parvovirus induced abortion.

- Erysipelas is a bacterial disease that is commonly found among pigs, and the possibility for infection always exists. The disease inhibits performance and is potentially fatal. The combination vaccine is generally an effective agent in helping protect against this disease as well.

- Vaccination for pseudorabies is not advocated at this time because more epidemiological information is needed regarding the prevalence of the disease in the State of Pohnpei. Should a pseudorabies eradication program be developed in the future, vaccination at the present time could interfere with implementation of the program. The best insurance for local producers to prevent pseudorabies in their herds is testing and quarantine of any new pigs that are introduced from outside sources.

**Reducing Losses of Young Pigs**

Stress is an important factor in determining whether or not an animal will succumb to disease. Stress weakens animals and inhibits their ability to develop an adequate immune response towards infections. Animals of all ages are affected by stress, but the young and old are the most susceptible. The key to reducing losses of baby pigs is to provide an environment as free of stress as possible. The following examples consist of common stress situations experienced by pre-weaning and weaning pigs and solutions designed to minimize the stressful aspects of the animal’s environment:

**Reduced body temperature**

Newborn pigs are unable to consistently regulate their body temperature. Therefore, it is important to provide new born pigs with an area that is warm in order to permit them to maintain a stable body temperature. Baby pigs that are cold use up all of their energy reserves attempting to maintain their body temperature and thus become weak and less energetic in nursing. The cold pig then generally becomes malnourished and is in danger of succumbing to a downward weakening spiral, thus be-

coming more susceptible to disease.

**Solution**

- Setting up a proper area for sows to give birth (farrowing area) will pay dividends in numbers of healthy pigs weaned. A nursery or farrowing area should be planned to provide a clean, dry and warm environment for the newborn pigs. In addition, a creep area (sleeping area) that is properly designed to provide protection from the sow, will help to prevent unnecessary crushing deaths.

- Hog pens in the FSM vary considerably. However, a typical well fenced pen with a concrete floor can be adapted to become a suitable farrowing area easily and economically. Baby pigs born on cold, wet, dirty, and waste covered concrete floors are generally subject to unacceptable levels of stress and are susceptible to disease. A healthier environment can be provided with the use of a raised floor or platform made of expanded metal coated with a plastic or rubberized material. Such platforms can be purchased at a reasonable cost and cut to fit an existing pen. The platform will allow urine, waste, and other undesirable elements to pass through to the floor below thus keeping the sow and her babies in a clean, dry area.

- A few days before the sow is ready to farrow, the platform should be placed in her pen. An adequate number of cinder blocks should be positioned on the concrete floor in order to support the platform and weight of the sow. After the blocks are put into place, the platform is laid down on top of the blocks suspending the platform about a foot above the original floor. The platform must fit flush with the existing wall of the pen in order to prevent the baby pigs from falling through to the floor below.

- After the raised floor is in place, a corner of the pen should be modified to create a protective area for the piglets. Such an area is called a creep and serves many beneficial purposes. Creep areas offer protection to baby pigs, thus helping to prevent crushing deaths by the sow, and also provide a sleeping area so the piglets can pile up together to conserve heat. As weaning time approaches, the creep also serves as a supplemental feeding area for the piglets that is out of the sows reach. A suitable creep area is made by forming a roof over a corner of the pen with slats or a triangular shaped plywood sheet. The roof should be about 8 to 12 inches above the platform and constructed so that the height can be adjusted as the pigs grow larger. The size of the creep area should be no larger than what is adequate to house the litter when sleeping as excessive size will not conserve warmth.

If economic and space considerations permit, placing a farrowing crate in the pen is an additional precaution that may be used to prevent crushing deaths in baby pigs. However, with a suitable creep area, a farrowing crate is not absolutely necessary.

**Baby pig anemia**

It has been determined that sows are unable to provide their offspring with enough iron to maintain adequate numbers of red blood cells. With free roaming or pastured pigs this is less of a concern because the piglets have access to soil which is a source of supplemental iron. However, pigs raised in a confined environment do not have access to soil and need an additional source of iron. Baby

pigs that do not receive iron supplementation will become anemic and more susceptible to disease. It has been shown that use of iron supplementation in baby pigs can increase survival rates by 50%.

**Factors affecting sows milk supply**

A sow's ability to produce milk and their disposition to allow nursing can vary for a variety of reasons. In some cases, the lack of milk and/or the sow's reluctance to permit nursing can be prevented. Mastitis or infection of the mammary gland is a frequent reason for lack of milk supply. In addition, a sow that has infected or sore mammary glands is less willing to allow her piglets to nurse. One cause of mastitis is udder laceration which is caused by the needle teeth of baby pigs. These sharp teeth puncture the gland around the teat area and predispose the sow to infection.

**Solutions**

Baby pig processing is a collective term for a group of procedures performed on 3 to 7 day old pigs.

- Administer 1-2cc Iron Dextran injection, to insure the baby pig has enough iron to produce adequate numbers of red blood cells. If Iron Dextran injection is not available, then a second alternative is to provide the piglets with access to non-contaminated soil. Iron supplementation by the soil method may be helpful, but will not be as effective as iron injections.

- Trimming needle teeth removes the sharp points of these teeth that puncture the sows milk glands and induce her to be less willing to allow nursing. Non-trimmed needle teeth also promote cannibalism due to tail biting in litter mates.

- Castration at an early age is less traumatic to the pig than at older ages and the procedure is actually much easier to do on 3 to 7 day old pigs.

- Tail amputation at an early age will help prevent tail biting when pigs are older. Tail biting among pen mates should be discouraged because this activity can lead to health complications and actual loss of pigs.

- Ear notching is the most common identification practice. Use a system with litter and individual pig numbers or just the individual pig numbers. Use a single system to reduce uneccesary notches on the ear.

The procedures involved in baby pig processing are easy to perform. For further information contact the College of Micronesia-FSM Agricultural Experiment Station.

**Weaning stress**

When a piglet is weaned it encounters the most stressful time of its life and as a result, many piglets will sicken and possibly die during this time. Diarrhea is the most frequent illness affecting pigs of this age. At weaning age a pig's immune system is ill equipped to combat disease causing organisms. Immunity provided to piglets by sows milk generally diminishes and baby pigs' immune systems are not fully exposed to the disease causing elements in the environment. In addition, the digestive tract of weaning pigs are immature and adapted for milk digestion, not solid food diets. Weaning time in Micronesia usually means the pigs are removed from the sow and placed in a new

pen with other strange pigs and given a starter ration. In many cases this type of treatment to these vulnerable animals results in death losses, stunted pigs, and a poor beginning for the meat production cycle of their lives.

**Solution**

Provide a weaning procedure that considers the vulnerability of the piglet at this age. Avoid stressful surgical procedures such as castration, ear notching, and tail amputation. These procedures are the least stressful for the pig when done at an earlier age. Creep feeding should begin at 10 to 14 days of age, to help the digestive tract make the transition from a milk to a solid diet. If possible, the ideal diet for a pre-weaning, and weaning pig should be provided. These diets are generally called pre-starter diets and are solid feeds formulated from milk based products. This type of diet will be more digestible and will assist piglets' digestive systems in making the transition to solid feed. Unfortunately, these diets are a little more expensive, and are not available at local feed stores in the FSM. Perhaps a local importer/retailer should consider testing the market for a pre-starter feed. Finally, in all cases, it is the sow that should be moved from the farrowing pen, not the piglets. The platform should remain in place and the litter left in place without newcomers for a week or so until the stress of weaning subsides. About 10 days later, weaning piglets of similar size should be grouped together and treated for internal and external parasites.

The preceding discussion was intended to be an introduction to swine management techniques which are practical and cost effective methods for producers to improve the productivity of their swine herds. To implement these suggestions and obtain more comprehensive details contact the College of Micronesia Agricultural Experiment Station.

**Swine Disease Survey**

**of**

**The Federated States of Micronesia 1995 – 1992**

Test Result Tables

for

Chuuk
Kosrae
Yap
Pohnpei Main Island
Pohnpei Outer Islands

## List of Abbreviations

Tests:

| | |
|---|---|
| ELISA | Enzyme Linked Immunosorbent Assay |
| SN | Serum Neutralization |
| LA | Latex Agglutination |
| RBT | Rose Bengal Test |
| MAT | Microscopic Agglutination |
| HI | Haemagglutination Inhibition |
| IFA | Immunofluorescence Antibody |
| VIAA | Viral Infection Associated Antibody |

*Laboratories:*

| | |
|---|---|
| ARSPL, U.S.A. | Agricultural Research Service Parasite Biology Laboratory United States |
| CAHL, NZ | Central Animal Health Laboratory, New Zealand |
| FADL,U.S.A. | Foreign Animal Disease Laboratory, United States |
| NVSL,U.S.A. | National Veterinary Services Laboratory, United States |
| VPL, KRS, Fiji | Veterinary Pathology Laboratory, Koronivia Research Station, Fiji |
| WHO, LRL, Aus. | World Health Organization, Leptospirosis Reference Laboratory, Australia |

*Others*

| | |
|---|---|
| NT | No test performed for the respective disease |

## Swine Disease Survey Results
## Chuuk State, Federated States of Micronesia

| Sampling Fall 1996: CHUUK STATE | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 143 | 10,000 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 143 | |
| Japanese Encephalitis | Negative | HI | FADL, U.S.A. | 25 | |
| Foot–and–Mouth Disease | Negative | VIAA | FADL, U.S.A. | 60 | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 143 | |
| Leptospirosis | 57 Positive | MAT | WHO, LRL, Aus | 143 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 60 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 60 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 60 | |
| Porcine Parvovirus | 16 Positive | HI | CAHL, NZ | 34 | |

## Swine Disease Survey Results
## Kosrae, Federated States of Micronesia

| Sampling Fall 1996: KOSRAE STATE | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 145 | 10,000 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 145 | |
| Japanese Encephalitis | Negative | HI | FADL, U.S.A. | 26 | |
| Foot–and–Mouth Disease | Negative | VIAA | FADL, U.S.A. | 60 | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 145 | |
| Leptospirosis | 39 Positive | MAT | WHO, LRL, Aus | 140 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 60 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 60 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 60 | |
| Porcine Parvovirus | 7 Positive | HI | CAHL, NZ | 33 | |

## Swine Disease Survey Results
## Yap State, Federated States of Micronesia

| Sampling Fall 1996: YAP STATE | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 135 | 3,000 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 135 | |
| Japanese Encephalitis | Negative | HI | FADL, U.S.A. | 20 | |
| Foot–and–Mouth Disease | Negative | VIAA | FADL, U.S.A. | 50 | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 135 | |
| Leptospirosis | 52 Positive | MAT | WHO, LRL, Aus | 137 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 50 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 50 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 50 | |
| Porcine Parvovirus | 13 Positive | HI | CAHL, NZ | 33 | |

## Swine Disease Survey Results
## Pohnpei, Federated States of Micronesia

| Sampling: Fall 1995, Winter 1996: Main Island, Pohnpei | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 251 | 16,000 to 20,000 |
| Pseudorabies | 10 Positive | ELISA | CAHL, NZ | 251 | |
| Pseudorabies Retest | 8 Positive | ELISA | CAHL, NZ | 19 | |
| Pseudorabies Retest | 4 Positive | SN, LA | NVSL, U.S.A. | 18 | |
| Pseudorabies Retest | 8 Positive | LA | FADL, U.S.A. | 18 | |
| Japanese Encephalitis | Negative | HI | FADL, U.S.A. | 38 | |
| Foot–and–Mouth Disease | Negative | VIAA | FADL, U.S.A. | 61 | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 251 | |
| Leptospirosis | 81 Positive | MAT | WHO, LRL, Aus | 256 | |
| Trichinellosis | Negative | ELISA | ARSPL, U.S.A. | 220 | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 51 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 51 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 51 | |
| Porcine Parvovirus | 125 Positive | ELISA | VPL, KRS, Fiji | 249 | |

## Swine Disease Survey Results
## Mwokilloa, Federated States of Micronesia

| Sampling Fall 1996: Mwokilloa, Pohnpei State | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 65 | 200 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 65 | |
| Japanese Encephalitis | N/T | | | | |
| Foot–and–Mouth Disease | N/T | | | | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 65 | |
| Leptospirosis | 13 Positive | MAT | WHO, LRL, Aus | 63 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 65 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 65 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A. | 65 | |
| Porcine Parvovirus | N/T | | | | |

## Swine Disease Survey Results
## Kapingamarangi Outer Island, Pohnpei State FSM

| Sampling Fall 1996: Kapingamarangi, Pohnpei State | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 20 | 400 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 20 | |
| Pseudorabies | Negative | ELISA<br>SN, LA | NVSL, U.S.A<br>NVSL, U.S.A | 8 | |
| Japanese Encephalitis | N/T | | | | |
| Foot–and–Mouth Disease | N/T | | | | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 20 | |
| Leptospirosis | 6 Positive | MAT | WHO, LRL, Aus | 20 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 11 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 11 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 11 | |
| Porcine Parvovirus | N/T | | | | |

## Swine Disease Survey Results
## Nukuro Outer Island Pohnpei State, FSM

| Sampling Fall 1996: Nukuro, Pohnpei State | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 15 | 400 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 15 | |
| Japanese Encephalitis | N/T | | | | |
| Foot–and–Mouth Disease | N/T | | | | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 15 | |
| Leptospirosis | 4 Positive | MAT | WHO, LRL, Aus | 15 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 15 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 15 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 15 | |
| Porcine Parvovirus | N/T | | | | |

## Swine Disease Survey Results
## Sapwuahfik Outer Island Pohnpei State, FSM

| Sampling Fall 1996: Sapwuahfik, Pohnpei State | | | | | |
|---|---|---|---|---|---|
| **Disease** | **Result** | **Test type** | **Testing laboratory** | **Sample size** | **Est. pig population** |
| Hog Cholera | Negative | ELISA | CAHL, NZ | 9 | 500 |
| Pseudorabies | Negative | ELISA | CAHL, NZ | 9 | |
| Japanese Encephalitis | N/T | | | | |
| Foot–and–Mouth Disease | N/T | | | | |
| Brucellosis | Negative | RBT | VPL, KRS, Fiji | 9 | |
| Leptospirosis | 7 Positive | MAT | WHO, LRL, Aus | 9 | |
| Trichinellosis | N/T | | | | |
| Swine Influenza | Negative | HI | NVSL, U.S.A | 6 | |
| Transmissible Gastroenteritis | Negative | SN | NVSL, U.S.A | 6 | |
| Porcine Reproductive Respiratory Syndrome | Negative | IFA | NVSL, U.S.A | 6 | |
| Porcine Parvovirus | N/T | | | | |