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China, African Swine Fever

China and the African Swine Fever Epidemic

Government and Exports

China is a communist party-led state; the chief of state is President Xi Jinping. It has a very large population of 1,397,897,720 as of 2021. 914.25 million of those live in urban areas. The remaining 498.35 million live in rural areas. 54.7% of the land is for agricultural purposes as of 2018, and the largest crops are rice, corn, and wheat. 90% of China's food production is from these three crops. China's largest exports are broadcasting equipment, computers, integrated circuits, and office machinery and parts.

Farm and House Sizes

The average farm size in China is .5 hectare, or approximately 1.2 acres. The average Chinese family is 2-3 people per household. The Chinese government has placed a 1 child limit on families to reduce the population size. The average 80 square meter apartment in Shanghai's inner ring road sells for approximately 5,645,946.00 yuan, or 886,000 U.S dollars.

Traditional Diets

Traditionally, families eat low to moderate amounts of meat and fish with plenty of vegetables and starches such as rice and noodles. Instead of soft drinks, they drink tea. Dessert isn't common, but lots of fruit is served to aid in digestion.

Economy

Chinese have access to stores and supermarkets, however, as Covid-19 continues to be more of a problem there's less and less food available in stores. Rural Chinese are self-sufficient on their farms, although more of them are buying food in stores to contribute to the economy more. 10% of the jobs available are agricultural-related, while 45% is in manufacturing, and the other 45% is in the service industry. The national average wage is 97,379 yuan (15,281 USD), while in some places it is higher or lower than that. Beijing's average is 178,178 yuan (27,960 USD) and Henan's average is 70,239 yuan (11,022 USD). In 2020, 1.36 million people (more than 95% of the population) were covered by public health insurance. Private healthcare is rarely affordable by people with the country's national average wage. Everyone in China gets to go to school for 9 years, but if someone wants a better education or more of it, it costs more. The wealthier children go to the best schools and have after-school tutoring and extracurricular activities, which many of the average children don't get an option to do. Most people in urban areas have access to basic things such as clean water, toilets, electricity, telephones, roads, and local markets. Rural Chinese, however, are much worse off. They don't have access to a lot of those things. In recent years, organizations have gone to rural areas with financed projects to make it easier for the Chinese there. More people are gaining access to clean water and sanitation services. The largest and tallest barrier keeping Chinese families from earning a fair wage and getting access to nutritious food is the government. They aren't paying the people enough, and inflation is going up because of different events happening. China is importing more food because not enough people are farming and the farmers who are working aren't producing enough food to feed the entire country's population.

African Swine Fever Epidemiology

Viral Characteristics

ASF virus (ASFV) is the only member of the Asfviridae family. The genus is *Asfivirus*. ASFV is extremely resilient in most conditions, which is helpful for it to move across borders easily. Heat can inactivate it, but for complete inactivation the virus requires to be in temperatures of 60 degrees Celsius (140 degrees Fahrenheit) for 20 minutes or 56 degrees Celsius (132.8 degrees Fahrenheit) for 70 minutes. It can survive pH ranges of 3.9 to 11.5, and in dried blood on wooden boards in temperatures of 18-23 degrees Celsius (64.4-73.4 degrees Fahrenheit) for up to 70 days (Rademacher et al, par. 8). ASFV has been found living in dead wild hog carcasses for 15 weeks. Because hogs are omnivorous, this helps spread the disease. The virus can be deactivated by common disinfectants as long as organic material has been removed from the site. Most scientists are concerned about the virus's survivability in uncooked meat, mostly in cured hams and sausages. It can survive in most Spanish dry-cured meat products for 140 days and 112 days in loins. These cuts are often thrown away in the garbage or intentionally fed to hogs, which further spreads the virus. The cuts can also be carried by travelers and thrown away where wild hogs can get to them, which often results in a new infection, sometimes in a new country.

Clinical Signs, Symptoms, and Pathology

There is a large variety of clinical signs to observe in the hog herd and in postmortem procedures. After a 2-19 day incubation period, clinical signs start to appear. The incubation period differs depending on many things, including the strain of the virus, host hog characteristics, among others. Signs that can be observed after the incubation period are depression, anorexia, cyanosis (a bluish discoloration of the skin from poor circulation or lack of oxygenated blood) of ears and hind legs that can spread to other areas of the body, conjunctivitis (pink eye), watery/bloody diarrhea, increased respiration rate, abortion, and incoordination or paralysis of the hind limbs. The mortality rate of the hog herd commonly doesn't increase until weeks after the onset of the disease. Postmortem procedures are often performed at this point. Common pathological findings are cyanosis, hemorrhagic gastrohepatic and renal lymph nodes, splenomegaly, renal petechial, and edematous lungs (Rademacher et al, par. 12). Internal body temperatures of the host hog can exceed 40 degrees Celsius (104 degrees Fahrenheit) and can increase as the disease progresses. ASFV is transmitted through nose-to-nose contact with other hogs. The only way it is airborne is if it's in a close contact housing situation. It can also be spread through infected bodily fluids, so humans and small animals can also carry it. The virus can't affect these other species; it is strictly in swine. Because of this, biosecurity is very important in controlling this virus. Biosecurity is defined as procedures intended to protect humans or animals against disease or harmful biological agents. Since it is impossible to tell if a human has the virus on their clothes or shoes, they must be vigilant in having different clothes and shoes when they go to a hog site. It's very important that hog site managers watch the hogs vigilantly, so as not to miss a sick hog. ASFV looks very similar in terms of symptoms to other respiratory diseases, so if a hog looks suspicious, it's important to report the case.

History of African Swine Fever Worldwide

The African Swine Fever (ASF) was first discovered in Kenya in the early 1900s. It has been spreading into surrounding countries in Europe, Asia, Africa, and the Caribbean since 2018. The virus was first passed from a wild warthog to a domesticated swine herd and "caused 100% mortality", Rademacher and others explain. The first discovery of ASF outside of Africa was in 1957, in Lisbon, Portugal. At first, people thought it was contracted from the feeding of airline waste to hogs. The airline waste in question was strictly from flights from Africa. Between 1960 and 1986, genotype I of ASF was identified in Spain, France, Italy, Sardinia, Belgium, the Netherlands, the Caribbean, Cuba, the Dominican Republic, Haiti, and Brazil. The disease was eradicated in all countries, except Sardinia. Genotype II of ASF commonly is a more destructive viral sequence than genotype I. Genotype II was found in 2007 in the Republic of Georgia. It was most likely contracted from feeding waste to hogs from ships originating from East Africa. Because not much was done about it, the virus became common in wild hog herds. The wild hogs then gave it to domestic hog herds. Soon, ASF was spreading to neighboring countries to the north and west. Wild hog migration patterns and the illegal sale and transportation of domestic hogs easily allowed this. ASF was next found in Russia, Ukraine, and Belarus. In 2014, ASF was found in the European

Union on the Lithuanian and Belarus border. It has been in Estonia, Latvia, and Lithuania since 2014 and in the Czech Republic, Hungary, Romania, and Bulgaria since 2018. In 2018, ASF hit Asia hard, with the first case found in China. ASF spread to surrounding Asian countries in 2019. Vietnam in February, Cambodia in April, Hong Kong and North Korea in May, Laos in June, Myanmar in August, and the Philippines, South Korea, and Timor-Leste in September. The swine industry in these countries promptly were devastated. In 2020, Germany reported their first case, and in 2021 Italy reported theirs. Cases are primarily found in wild hog herds, with a few being in domestic herds. Also in 2021, ASF made its way back into the Americas, with cases being reported in the Dominican Republic and Haiti. Cases were thought to be from ship waste, similar to back in the 1960s-1980s. As of September 2021, “[98%] of the outbreaks have occurred in backyard pigs while 3 commercial pig operations have been infected” (Rademacher et al, par. 6).

African Swine Fever in China

Please note, China manages to downplay the catastrophic effects of ASF, so these numbers may not be accurate.

The first case of African Swine Fever in China was confirmed on August 3, 2018, in the Liaoning province. By the end of October of 2018, there were 45 cases and 3,841 dead hogs. (Shao et al, par. 1). It spread to all 32 provinces within the year (Rademacher et al, par. 4). As the disease spread throughout the country, it started to affect larger producers. Consequently, over a million hogs were culled to try and prevent this. The Chinese government responded with the following orders (MOA 2018a; MOA 2018b; Gao 2018):

1. Quarantine areas are set up within 3 km radii of the site affected. All hogs within the radius are to be euthanized, and no hogs or byproducts are to leave the radius. If after 6 weeks there are no further cases within the radius, the quarantine will be lifted.
2. Producers were originally compensated 800 RMB per head that was euthanized, but it was raised to 1200 per head.
3. If two or more prefectures in a province have confirmed ASF, hog products can't be shipped outside the province. Each province also has their own shipping restrictions.
4. Provinces with ASF can't ship outside their own province at all, for any reason.
5. Slaughter houses in confirmed ASF provinces are shut down. Live markets in confirmed ASF provinces and adjacent provinces are closed.
6. Feeding hogs with food waste has been banned across the country.

The second wave of ASF hit China early 2021, and not much information has been released about it. We do know that over 8 million hogs have been culled, and many more than that have been affected by the disease. The economy has been hit hard, as well as the country's pork supply. This has significantly driven up the imports to China, which means that other countries have had to crack down on their own biosecurity and make sure that ASFV doesn't go into more countries and cause more devastation.

The third wave of ASF hit Xinjiang in 2022. On February 23rd, the Chinese embassy notified the USDA of the first recurring case of ASF. According to USDA foreign animal service officials, 150 animals were susceptible and 16 were confirmed sick and died. All hogs in the radius around the site have been culled and disposed of. China is continuing to monitor the situation, and the World Organization for Animal Health (OIE) of the occurrence.

China's rural population is losing their individual hog herds, which causes pork shortages country-wide. This shortage is forcing China to import more pork, and the price of domestic and foreign pork goes up. This will especially affect those who depend upon hogs as their income, as well as those who are poorer and struggle to afford good quality meat. This is also affecting the environment as people are dumping swill (kitchen wastes) into bodies of water. A law was recently passed making it illegal to feed swill to hogs, and the Chinese are struggling to find a way to get rid of all the extra waste.

Suggested Solutions

Due mostly to the complexity of the virus, traditional methods of live and inactivated viruses have been unsuccessful at killing the virus in the hog. “There is evidence that both antibody-mediated and cell-mediated responses are going to be required for vaccine efficacy” (Rademacher et al, par. 9). Different countries, including China, have been figuring out ways to keep ASF at bay. In 2021, China put into place a plan of action to slow the spread of ASF. The goal was to separate China into 5 sectors and ban the movement of breeding stock and piglets in and out of the sectors. This plan works well to stop live hogs from moving, but at the same time doesn’t stop small animals and humans from passing it around. This plan requires humans to be very careful about what they wear wherever they go, which is extremely difficult.

United States’ Plan

ASF is considered a foreign animal disease, and if we find it in the United States we must notify the World Organization for Animal Health. The virus would have detrimental impacts on our pork exports and economy, as we export 25% of our pork. Other countries that don’t have cases yet, such as the United States, have plans in place to take care of the hogs that are infected. The United States Department of Agriculture (USDA) has created the Red Books to refer to if it breaks out. The plan is loose and mainly controls the movement of hogs around the country. If a case is suspected anywhere in the United States, the first thing to do is to reach out to a state animal health official to start the process of a disease investigation. A foreign animal disease diagnostician will come to the site and collect samples for confirmation. Samples are taken in pairs and one set will go to a National Veterinary Services Laboratory (NVSL). The NVSL has two locations, one in Ames, IA, and the Foreign Animal Disease Diagnostic Laboratory in Plum Island, New York. If a sample is suspected to be positive for ASF, they’re sent to the Foreign Animal Disease Diagnostic Laboratory, which is moving to Manhattan, Kansas. The other set of samples will go to a local National Animal Health Laboratory Network diagnostic laboratory. The lab is certified by the USDA to conduct testing for ASF. If ASF is confirmed by the NVSL, they will refer back to the Red Books

Most states do have their own plans in place as well, including Iowa. Their plan has three steps. The first step is to halt all movements of hogs unless necessary (slaughter) at the discretion of the Iowa Department of Agriculture and Land Stewardship (IDALS). If this doesn’t work, IDALS will proceed to their second step, investigations and surveillance of both infected sites and contact sites will occur. Contact sites are sites in a close distance to the infected site that are close enough to contract the disease. The third step will be the mitigation of the disease. This includes quarantining infected sites, permitting movements of animals, establishing control areas, mass depopulation, carcass disposal, and cleaning and disinfection. Mass depopulation can take place using any of the four methods IDALS has approved: Carbon dioxide or other gasses, firearms, penetrative captive bolt, or ventilation shutdown.

Besides planning for the hit, scientists have been constantly working on developing a vaccine and cure. For example, “recently, a team from the USDA Plum Island Animal Disease Center developed a gene deletion candidate of the currently circulating genotype II Georgia 2007 ASFV-G strain” (Rademacher et al, par. 9). Some of the characteristics were low viremia titers, it showed no virus shedding, it developed a strong virus-specific antibody response, and protected vaccinated hogs when faced with the parental strain of ASFV-G.

The United States’ leading risk factor for importing ASF is through illegal pork smuggling. Since 2018, the risk of passengers smuggling pork products has increased 183%, and this can be centralized to 5 international airports in the US. US Customs and Border Protection responded by placing trained Beagles at all international airports to inspect luggage coming from international flyers (Rademacher et al, par. 10).

Russia’s Vaccine Plan

Some countries, like Russia, are working tirelessly to develop a vaccine for ASF that will be able to be used by many hog producers. Russian scientists are expecting a vaccination to be available to the public by 2024. The vaccine is planned to be given to wild hogs first, which are a leading cause of the spreading

of ASF. An issue that could most likely be expected is the virus to mutate after the release of the vaccine. Similar to other viruses, it will probably become antibiotic and vaccine-resistant, which could cause another outbreak of an even deadlier disease.

Personal Ideas

The plan set in place by IDALS is very ideal and realistically could prevent millions of swine deaths. In China, this plan could be very beneficial and do lots of good. The Ministry of Agriculture and Rural Affairs of the People's Republic of China could lead this and possibly get government funding. Local community members should be informed of this, and practice severe biosecurity measures to help protect swine herds across the country.

ASF is one of the greatest threats to the pork supply around the world. The spread of it is contributed to by human behavior and activity, so by staying informed and making sure that everyone knows how to safely slow the spread, we can work through this. The outbreak of ASF in China has been very hurtful to the economy and pork supply. However, by taking care to use good biosecurity precautions and working diligently to protect the swine herds across China, they can rebuild their swine herd. As China's population grows, it's imperative that they work to feed their population. This includes battling ASF with fierceness to make sure it's not an issue. This may take years or even decades to overcome, but it can be done.

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