Rethinking the uncertainty of African swine fever virus contamination in feed ingredients and risk of introduction into the United States

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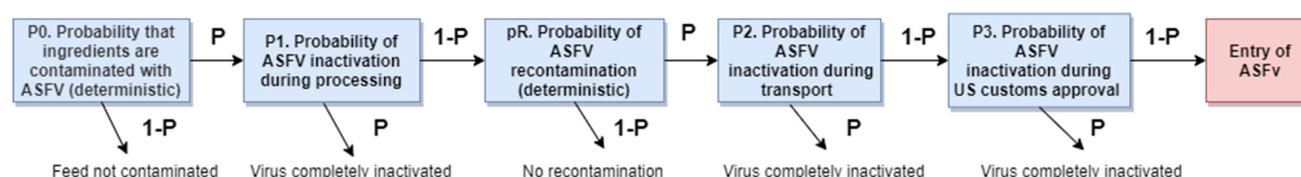
Key Points:
- We developed a quantitative risk assessment framework to estimate the risk of ASFV introduction into the U.S. from imported ASFV-contaminated corn and soybean meal produced by solvent extraction and extrusion.
- Current solvent extraction and extrusion processing conditions should be sufficient to inactivate ASFV in contaminated soybeans.
- Risk estimates were highly variable due to the uncertainty on the true values of the probabilities of contamination and recontamination and inactivation during transport, transport time, and the amount of imported ingredients and therefore research is urgently needed to estimate accurate values for those key parameters

ASFV has been shown to survive when experimentally inoculated in some feed ingredients under the environmental conditions in transoceanic transport models, generating concern that feed could be a source of introduction. Previous qualitative assessments have examined the risk of ASFV introduction from contaminated feed, but no quantitative assessments have been performed in the context of the United States.

We developed a quantitative risk assessment model to estimate the probability that one or more corn or soybean meal vessels (25,000 tonnes) contaminated with ASFV would be imported into the United States annually. The final probability estimate was conditionally based on five likelihoods (Figure 1). The probability of ASFV inactivation was modeled using corn and soybean (extruded or solvent extracted) processing conditions (times and temperatures), D-values (time to reduce 90% or 1-log) estimated from studies of ASFV thermal inactivation in pork serum (p1), and survival in feed ingredients during transoceanic transport (p2, p3). Because there is limited information available about contamination and recontamination of feed ingredients, p0 and pR were assumed to take alternative values (1, 10, 25, 50, 75, and 100%) to explore their impact on risk in different "what-if" scenarios.

The model estimated complete inactivation of ASFV after extrusion or solvent extraction processes regardless of the initial ASFV contamination probability assumed. The value of recontamination (ranging from 1-75%) was highly influential on the risk of one ASFV-contaminated soybean meal vessel entering the United States. Median risk estimates ranged from 0.064% (0.006-0.60%; 95% Probability Interval [PI]), assuming a pR of 1.0%, up to 4.67% (0.45-36.50% 95% PI) assuming a pR of 75.0%. This means that at least one vessel with ASFV-contaminated soybean meal would be imported once every 1,563 to 21 years, respectively. When all raw corn was assumed to be contaminated (p0=100%), and no recontamination was assumed to occur (pR=0%), the median probability of one vessel with ASFV-contaminated corn entering the United States was 2.02% (0.28-9.43% 95% PI) or once every 50 years. Values of initial contamination between 1-75% changed this risk from once every 5,000 (p0=1%) to 66 (p0=75%) years. Days of transport, virus survival during transport (D-value), and number of vessels shipped were the parameters most influential for increased likelihood of a vessel with ASFV-contaminated soybean meal or corn entering the United States. This risk assessment is a valuable advancement from previous qualitative assessments and can act as a framework for estimating the risk of ASFV introduction from other feed ingredients while being updated as new data are available to reduce uncertainty.

Figure 1. Scenario tree used to estimate the probability of at least one African swine fever virus (ASFV)-contaminated vessel of corn or soybean meal entering the United States.