The risk of plant-based feed and feed ingredients as vehicles for virus transport and transmission.

Experimental Evidence and Industry Needs

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Topics

Literature review: PEDV & ASFV

- Current & pending publications

Industry response

- Actions & needs

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PEDV: Experimental evidence

Transmission through feed
- Dee et al, BMC Vet Res, 2014

Minimum infectious dose in feed
- Schumacher et al, AJVR, 2016

Feed ingredient survival
- Dee et al, BMC Vet Res, 2015

Transboundary survival in feed
- Dee et al, BMC Vet Res, 2016

Feed mill (pilot scale) contamination
- Schumacher et al, PLOS ONE 2017

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ASFV: Experimental evidence

Transboundary survival in feed

- Dee et al, PLOS ONE, 2018

Transmission through feed and water

- Niederwerder et al, EID, 2019

Minimum infectious dose in feed and water

- Niederwerder et al, EID, 2019

Viral half-life in feed ingredients

- Niederwerder et al, EID, 2019

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In addition:

SVA detected in Brazilian feed and ingredients
- Leme et al, Transbound Emerg Dis 2019

PRV and CSFV survival using transboundary model
- Niederwerder et al, publication pending

FMDV survival and transmission in feed
- Artz et al, publication pending

Feed-risk literature reviews
- Gordon et al, Front Vet Sci, 2019
- Jones et al, publication pending
- Dee et al, publication pending

Seaport risk
- Patterson et al, publication pending

"There is a growing body of evidence..."

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Port of Entry (POE) soy risk

It is well-documented that a significant number of viruses survive for extended periods in soy-based products.

- Pipestone, KSU, SDSU, Plum Island, UMN, UEL Brazil.

Example queries:

- How much soy-based product did the US import from ASFV positive countries in 2018?
- What are the primary POE and trends over time?

Methods:

- US Gov't Tariff schedule
- Microsoft Excel pivot tables (Patterson)

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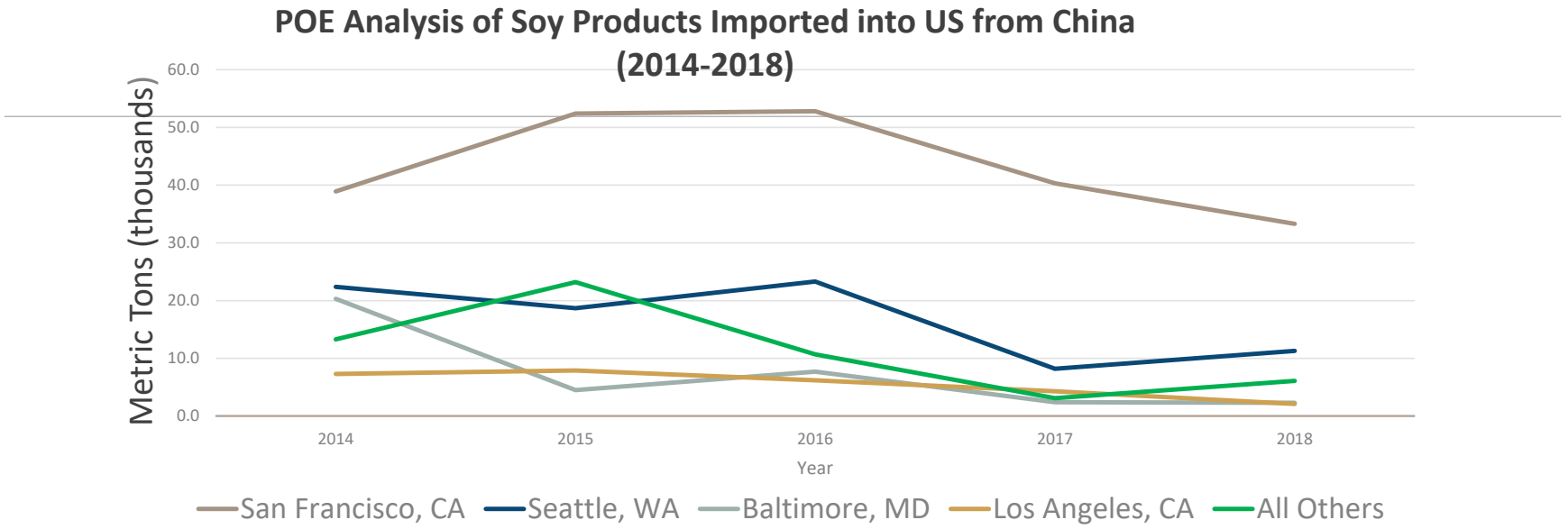
Total Volume and Country of Origin of Soy-based Imports in 2018		
Country of Origin	2018 (Metric Tons)	% of Total
China	55,101	52.6%
Ukraine	44,776	42.8%
Russia	3,396	3.2%
Uganda	990	0.9%
Taiwan	273	0.3%
Belgium	143	0.1%
Togo	223	0.0%
Vietnam	3	0.0%
Thailand	2	0.0%
Grand Total	104,707	100.0%


POE Analysis of Soy Products Imported into US from China (2014-2018)
Metric Tons (thousands)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
2014
2015
2016
2017
2018
Year
San Francisco, CA
Seattle, WA
Baltimore, MD
Los Angeles, CA
All Others

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Industry actions

Feed additive risk mitigation.

- Work in progress.

“Responsible Imports”

- From vision to reality.

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Pipestone Responsible Imports (JAVMA 2019)

Objective: Develop a science-based plan to safely import essential ingredients from countries of high risk.

Principles

1. What is the ingredient and the country of origin?
2. Are there alternatives?
3. What is the virus of concern?
4. Do we know its T ½ in feed?
5. What is the transport time from the source country to the mill?
6. Has any mitigation been applied?
7. What is the storage period (time & temp)?

"Feed quarantine"

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Pipestone RI: China phase

- **Feed ingredient focused:** AAs and VTMs from China
- **Leadership:** Dr Arkin Wu
- **China:** Manufacturing plant and port warehouse oversight
  - Mechanical biosecurity protocols at both sites
    - Lines of separation, PPE, etc
  - One time use totes
  - Containers sealed at the plant, sealed until final US destination
  - **Audited 2x/year**

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Pipestone RI: US phase

Import warehouse, Leadership: Dr. Roger Cochrane

- Separate entry and exit points for people & products
- Sign in + product certification required upon entry
- Mechanical biosecurity protocols practiced throughout facility
- **Quarantine room**
  - Separate entry point and designated forklift
  - Designated holding time (minimum 30 days) & temp (20^0C)
  - True AIAO space
- **Storage area**
  - Products labeled with names and dates
  - Heated year-round
- **Audited 2x/year**

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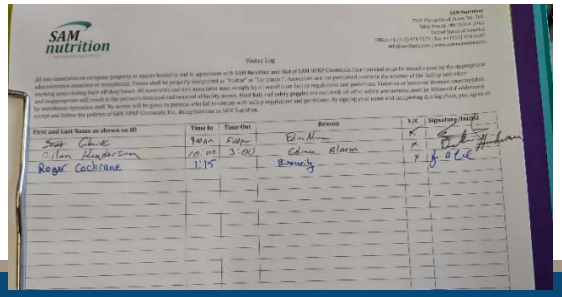
SAM nutrition

"Living on the ASFV edge"

Conclusions

There is a growing body of experimental evidence suggesting that feed and feed ingredients (soy-based products in particular) may serve as vehicles for the transport and transmission of FADs such as ASFV.

This ongoing work is the product of multiple research organizations over the past 5 years.

The application of Responsible Imports across the swine industry is driving change in the management of this risk.

A national ("CFIA-like") program, based on policy, is needed to unite these independent efforts.

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