Kansas Agricultural Experiment Station Research Reports

Volume 7
Issue 10 *Animal Feed and Pet Food Research Report*

Article 14

2021

Assessment of Soy-Based Imports into the US and Associated Foreign Animal Disease Status

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Recommended Citation

Blomme, Allison K.; Jones, Cassandra K.; Gebhardt, Jordan T.; Woodworth, Jason C.; and Paulk, Chad B. (2021) "Assessment of Soy-Based Imports into the US and Associated Foreign Animal Disease Status," *Kansas Agricultural Experiment Station Research Reports*: Vol. 7: Iss. 10. https://doi.org/10.4148/2378-5977.8152

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Cover Page Footnote

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K-STATE Research and Extension

2021 ANIMAL FEED AND PET FOOD RESEARCH

Assessment of Soy-Based Imports into the US and Associated Foreign Animal Disease Status[1]

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Summary

Soy-based products are known to pose a viable risk to US swine herds because of their ability to harbor and transmit virus. This study evaluated soy imports into the US as a whole and from foreign animal disease positive (FAD+) countries to determine which products are being imported in the highest quantities and observe potential trends in imports from FAD+ countries. Import data were accessed through the United States International Trade Commission website (USITC DataWeb) and summarized using R (version 4.0.2, R core team, Vienna, Austria). Twenty-one different Harmonized Tariff Schedule (HTS) codes were queried to determine quantities (US tons, T) and breakdown of different soy product types being imported into the US from 2015 to 2020. A total of 78 different countries exported soy products to the US in 2019 and 2020, with top contributors being Canada (602,377 T and 530,759 T, respectively), India (438,563 T and 474,678 T, respectively), and Argentina (134,610 T and 87,602 T, respectively). In 2020, soy oilcake (641,846 T) was imported in the largest quantities, followed by organic soybeans (297,838 T) and soy oil (148,190 T). Of the 78 countries, 46 had cases of FAD reported through the World Organization for Animal Health (OIE) World Animal Health Information Database (WAHIS). Top exporters of soy products to the US from FAD+ countries in 2019 and 2020 were India (438,563 T and 474,678 T, respectively), Argentina (134,610 T in 2019), and Ukraine (44,415 T and 62,162 T, respectively). A system to monitor the sourcing of these products into the US and the end usage would allow for a greater understanding of the risk of these products to domestic swine herds.

Introduction

Feed has been linked to the US porcine epidemic diarrhea virus (PEDV) outbreak, and African swine fever virus (ASFV) contaminated feed has been shown to cause

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infection in pigs as well.[4,5] Several viruses have been shown to survive shipping models in a variety of feed ingredients including soy products, such as soybean meal and soy oilcake.[6] Several viruses included in this study such as ASFV, classical swine fever virus (CSFV), Ajueszky's disease (pseudorabies), and foot and mouth disease (FMDV) are foreign animal diseases in the US and of direct interest to the swine industry. With this knowledge, it is critical to understand what feed ingredients are being imported to the US and where they originated, so the risk level of foreign animal disease introduction can be evaluated. Of particular interest are soybean meal and soy oil because of their likelihood of being added to swine diets. Soy products are the main area of concern due to their increased ability to harbor viable virus when compared to other ingredients, and the idea that most soy-based imports to the US are likely organic or non-GMO.[7] Some work has been done to prove an analytical approach to quantify soy imports into the US but the analysis was focused only on ASFV-positive countries and not on total imports of soy products regardless of FAD status.[8] The objectives of this paper were 1) to evaluate annual soy imports into the US by product type and determine the portion coming from countries with foreign animal disease (FAD), and 2) track soy import trends in regard to imports from FAD+ countries.

Materials and Methods

This work looked at the past five years of imports with a particular focus on 2019 and 2020. Product classification, quantity, country of origin, and year were obtained through the International Trade Commission Harmonized Tariff Schedule website (DataWeb). Product categories are identified by unique 10-digit Harmonized Tariff Schedule (HTS) codes. The 21 HTS codes associated with soy products that have potential to be used in animal feed were used to query the database. Several products, such as lecithins or butter substitutes, were included that may be in byproducts fed to animals. Data were exported to R (version 4.0.2, R core team, Vienna, Austria) and they were refined to total imports from each country by year and product type. Each HTS code was assigned a shortened description to improve data manipulation and reporting. Because of the low import rate of organic soy flour and meal; soy flour and meal; and soy flour and meal, not elsewhere specified or indicated (NESOI), these three HTS product categories were combined into one group in this report (Table 1). All soy oils, regardless of refinement level, were combined into one "soy oil" category because of the low volume of imports in each subsection. High-risk countries were identified

[4] Dee, S., Clement, T., Schelkopf, A., Nerem, J., Knudsen, D., Christopher-Hennings, J., & Nelson, E. (2014). An evaluation of contaminated complete feed as a vehicle for porcine epidemic diarrhea virus infection of naïve pigs following consumption via natural feeding behavior: proof of concept. BMC Veterinary Research, 10(1), 176. doi:10.1186/s12917-014-0176-9.

[5] Niederwerder, M. C., Stoian, A. M. M., Rowland, R. R. R., Dritz, S. S., Petrovan, V., Constance, L. A., … Hefley, T. J. (2019). Infectious Dose of African Swine Fever Virus When Consumed Naturally in Liquid or Feed. *Emerging Infectious Diseases*, 25(5), 891–897. doi:10.3201/eid2505.181495.

[6] Stoian, A. M. M., Petrovan, V., Constance, L. A., Olcha, M., Dee, S., Diel, D. G., … Niederwerder, M. C. (2020). Stability of classical swine fever virus and pseudorabies virus in animal feed ingredients exposed to transpacific shipping conditions. Transboundary and Emerging Diseases, 67(4), 1623–1610.1111/tbed.13498.

[7] Dee, S. A., Bauermann, F. v., Niederwerder, M. C., Singrey, A., Clement, T., de Lima, M., … Diel, D. G. (2018). Survival of viral pathogens in animal feed ingredients under transboundary shipping models. PLoS ONE, 13(3), e0194509. doi:10.1371/journal.pone.0194509.

[8] Patterson, G., Niederwerder, M. C., Spronk, G., & Dee, S. A. (2020). Quantification of soya-based feed ingredient entry from ASFV-positive countries to the United States by ocean freight shipping and associated seaports. Transboundary and Emerging Diseases, n/a(n/a). doi:10.1111/tbed.13881.

for each year and based on reported cases in any country that the World Organization for Animal Health (OIE) identified as having ASFV, CSFV, FMDV, or pseudorabies cases during that year in their World Animal Health Information Database (WAHIS). Foreign animal disease status for each country by year was added to the import dataset.

Results and Discussion

The list of the top 10 countries exporting soy products to the US in 2019 was very similar to the 2020 list. Canada (602,377 T and 530,759 T, respectively), India (438,563 T and 474,678 T, respectively), and Argentina (134,610 T and 87,602 T, respectively) contributed the most to soy being imported into the US in both years (2019, Table 1; 2020, Table 2). Overall, soy oilcake (592,459 T and 641,846 T, respectively) was imported in the largest quantities, followed by organic soybeans (298,106 T and 297,838 T, respectively) and soy oil (187,085 T and 148,190 T, respectively). Soy flour and meal (6,479 T and 7,374 T, respectively) was the least commonly imported ingredient in both 2019 and 2020. Multiple countries (Argentina, China, India, Mexico, Moldova, Russia, Turkey, and Ukraine) within the top 10 exporters of soy to the US and several countries outside the top 10 had reported FAD cases in 2019 and/or 2020. The products these top FAD+ countries exported the most to the US were soy oilcake (381,471 T and 427,635 T, respectively) and organic soybeans (265,324 T and 175,313 T, respectively).

The current evaluation found organic soybean meal to be a very small portion of the imports into the US, with 7,374 T of organic and non-organic soybean meal being imported out of 1,360,818 T of total soy products in 2020. Less than a third of that soybean meal (2,384 T) was sourced from countries with FAD cases, which could be viewed as a low probability of disease introduction, but the severity and economic impact of disease introduction is still high. Even a small amount of virus in feed can still lead to infection in pigs because constant exposure to that low level may build up to an infectious level in their systems. Although organic SBM may not be a large contributor to US soy imports, soy oilcake is imported in large quantities. Soy oilcake is the byproduct of compressing soybeans to extract the soy oil. This oilcake can then be ground into soybean meal and included in swine diets. Soy oilcake made up 47% of soy imports in 2020, with 67% of the soy oilcake being imported from reported FAD+ countries. The largest contributor, overall and of reported FAD+ countries, of soy oilcake being imported into the US in 2020 was India (ASFV-positive) with 426,891 T. The current HTS codes do not differentiate between organic and non-organic soy oilcake; therefore, it was not possible to quantify the amount of this product that is organic using the USITC DataWeb.

From 2015 to 2020, imports from reported FAD+ countries increased from 526,691 T to 624,259 T (Figure 1). This increase was not consistent from year to year during this time period, with large increases in imports in 2017 and 2019 followed by a decrease in 2018 and 2020. The year that had the greatest quantity of soy imports from countries with FAD cases was 2019 with 725,114 T. India, China, and Ukraine were the top exporters of soy products to the US that had a consistently positive FAD status over these six years. Overall, imports from reported FAD+ countries contributed about 53% of the total soy imports in 2019 with India, Argentina, and Turkey being the largest individual contributors within this group. In 2020, approximately 46% of the total soy

imported was sourced from reported FAD+ countries. This high percentage is primarily due to reports of FAD in India and Argentina.

It also should be noted that this information does not take into account that the products imported from FAD-negative countries may have been imported from somewhere else previously. The interconnectedness of the global economy makes it difficult to trace the original source of products in some cases. A deeper look into where a region's products are being sourced from would be beneficial in understanding the disease risk of the product more objectively. The end use is also an important consideration because a product that is used exclusively for human or industrial consumption also has a low disease risk, even if it is contaminated, because of its removal from interaction with swine herds.

Conclusion

Understanding the sources and intended uses of products being imported to the US is vital to determining the risk of FAD disease introduction. Biosecurity of feed in the US could improve when imports are analyzed to quantify the amounts and countries of origin for feed ingredients. While this quantification is beneficial, it should not be taken as a defining declaration of the risk of FAD introduction without a holistic view of the storage, transport, and usage of imported soy products. Monitoring FAD disease outbreaks and imports from countries could be useful for evaluating the risk of FAD introduction into US swine herds more readily.

Table 1. Top 10 exporters in 2019 of soy to US with products, quantities (US ton, T), and FAD status[a,b]

		Products (Tons)											
Country	Total	Non-organic soybeans	Organic soybeans	Soy oilcake	Soy flours and meals	Soy oil	Bran, midds, residues	Lecithins	Mayonnaise	Salad dressings	Butter and margarine	Soybean seeds	FAD present in country
Argentina	134,610	0.0	97,823	16,331	0.0	1,268	18,356	832	0.0	0.0	0.0	0.0	Yes
Canada	602,377	83,606	15,422	210,540	3,096	180,656	45,362	5,178	11,819	3,552	8,794	34,350	No
China	9,963	1,633	151	4,904	87	7.6	2,955	151	0.0	20	21	33	Yes
India	438,563	9,563	88,936	335,954	2,038	678	0.0	1,394	0.0	0.9	0.6	0.0	Yes
Kazakhstan	14,702	0.0	14,702	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	No
Mexico	22,964	3.5	2,403	0.0	282	3,856	0.0	0.0	756	12,410	3,254	0.0	Yes
Moldova	6,598	0.0	6,598	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Yes
Russia	24,248	0.0	22,775	0.0	0.0	0.0	0.0	1,173	293	0.0	6.8	0.0	Yes
Turkey	25,737	0.0	503	24,221	0.0	0.0	0.0	0.0	0.0	994	19	0.0	Yes
Ukraine	44,415	0.0	44,250	0.0	0.0	0.0	0.0	75	90	0.0	0.0	0.0	Yes
Others[c]	36,173	381	4,541	510	975	621	3,016	8,656	2,798	2,553	12,122	0.0	Yes
Grand total	1,360,350	95,187	298,106	592,459	6,479	187,085	69,689	17,458	15,756	19,530	24,217	34,383	NA

[a] Countries, products, and T were obtained from the United States International Trade and Tariff Database.

[b] Foreign animal disease status was determined based on presence of African swine fever virus, classical swine fever virus, foot and mouth disease, and/or pseudorabies virus in a country during 2019 as reported by the OIE WAHIS Disease Time Chart database.

[c] Countries included in others: Afghanistan, Australia, Austria, Bangladesh, Barbados, Belarus, Belgium, Brazil, Chile, Colombia, Costa Rica, Croatia, Denmark, Dominican Republic, Ecuador, El Salvador, Ethiopia, France, Germany, Ghana, Greece, Guatemala, Guyana, Haiti, Hungary, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Lithuania, Malaysia, Morocco, Netherlands, Nigeria, North Macedonia, Norway, Peru, Philippines, Poland, Portugal, Serbia, Slovenia, South Korea, Spain, Sweden, Switzerland, Syria, Taiwan, Thailand, Togo, Trinidad and Tobago, United Kingdom, Uruguay, and Vietnam.

Table 2. Top 10 exporters in 2020 of soy to US with products, quantities (US ton, T), and FAD status[a,b]

		Products (Tons)											
Country	Total	Non-organic soybeans	Organic soybeans	Soy oilcake	Soy flours and meals	Soy oil	Bran, midds, residues	Lecithins	Mayonnaise	Salad dressings	Butter and margarine	Soybean seeds	FAD present in country[d]
Argentina	87,602	176.36976	72,640	8,318	0.0	250	5,665	552	0.0	0.0	0.9	0.0	No
Canada	530,759	77,147	21,014	167,692	3,989	136,138	47,303	4,227	13,215	1,823	8,170	50,037	No
China	3,691	1,332	169	516	36	0.0	1,399	205	11	24	0.0	0.0	Yes
India	474,678	4.5	42,007	426,891	1,927	2,375	0.0	1,474	0.0	0.0	0.9	0.0	Yes
Mexico	30,826	20	8,287	0.0	446	3,254	0.0	0.0	897	15,059	2,864	0.0	No
Netherlands	3,552	0.0	0.0	0.0	0.0	20	13	3,486	33	0.3	0.2	0.0	No
Russia	72,384	0.0	71,075	0.0	0.0	0.0	0.0	902	401	0.0	7.9	0.0	Yes
Togo	12,560	351	12,209	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	No
Turkey	44,663	0.0	0.0	37,783	0.0	4,306	26	0.0	869	1,668	13	0.0	No
Ukraine	62,162	0.0	61,832	0.0	0.0	0.0	0.0	205	125	0.0	0.0	0.0	Yes
Others[c]	37,940	1,840	8,606	648	976	1,849	1,563	4,880	3,533	2,564	11,484	0.0	Yes
Grand total	1,360,817	80,869	297,838	641,846	7,374	148,190	55,970	15,929	19,083	21,138	22,541	50,037	NA

[a] Countries, products, and T were obtained from the United States International Trade and Tariff Database.

[b] Foreign animal disease status was determined based on prevalence of African swine fever, classical swine fever, foot and mouth disease, and/or pseudorabies in a country during 2020 as reported by the OIE WAHIS Disease Time Chart database.

[c] Countries included in others: Afghanistan, Australia, Austria, Belgium, Benin, Brazil, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Ethiopia, France, Germany, Greece, Guatemala, Guyana, Haiti, Hungary, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Lithuania, Malaysia, Morocco, Nigeria, North Macedonia, Norway, Paraguay, Peru, Philippines, Poland, Portugal, Rwanda, Senegal, Serbia, Singapore, Slovenia, South Korea, Spain, Sweden, Switzerland, Syria, Taiwan, Thailand, Trinidad and Tobago, United Arab Emirates, United Kingdom, Uruguay, Venezuela, and Vietnam.

[d] Data for 2020 may be incomplete due to several countries not having reports available at the time of data collection.

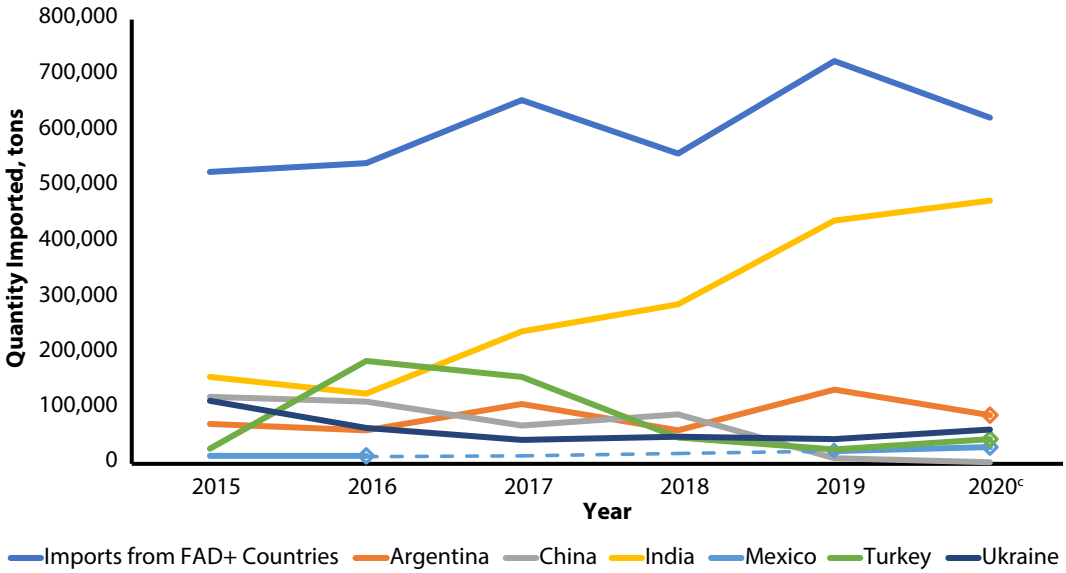

Figure 1. Imports from countries with foreign animal disease from 2015 to 2020 and the top 5 exporters of soy to the US by quantity (Tons)[a,b]

Dashed lines indicate years that a country did not have FAD status reported or there were no positive cases.

Diamond markers are the single year that a country had reported FAD cases.

Open diamond markers indicate the beginning of years that the country is FAD-negative or data was incomplete/not reported.

[a] Countries of origin and quantities (Ton) of soy imports were obtained from the United States International Trade and Tariff Database.

[b] Foreign animal disease status was determined based on presence of African swine fever virus, classical swine fever virus, foot and mouth disease, and/or pseudorabies in a country during each year as reported by the OIE WAHIS Quantitative Data database.

[c] No differentiation provided in figure between countries reporting no FAD cases and countries with no FAD data for 2020 in the OIE WAHIS Quantitative Database.