World Food Prize Teenager Leader Camp

Grain Import and Food Security

——a comprehensive analysis based on soybean data

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Abstract

Food security is a universally concerned issue in today's international context, especially for a large country like China with a significant population and limited arable land. How to reduce the high dependence on grain imports and ensure grain security is a crucial topic worthy of in-depth research. This article takes soybeans, which are of significant importance to grain security, as a sample and analyzes data related to China's soybean imports, production, consumption, and other aspects. It further examines the main hidden risks and their causes regarding grain security and presents corresponding policy recommendations.

The article argues that China's excessive reliance on foreign soybeans and the relatively concentrated sources of imports are prominent weaknesses in ensuring grain security. The high demand and inflexibility of soybean consumption in China, coupled with low soybean production and poor yields, are the main reasons for the high external dependence on soybeans. In the long run, China's heavy reliance on imported soybeans is expected to continue, with increasing implications for grain security. Therefore, the article systematically presents strategic recommendations from three perspectives: improving the level of soybean production and supply, enhancing international soybean trade, and promoting efficient utilization of soybeans.

Keywords: food security; external dependence; production chain; supply chain; trade chain.

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In recent years, global grain production, supply chains, and trade chians have faced increased risks due to multiple factors such as the COVID-19 pandemic, international dynamics, and policy changes in grain-exporting countries. Soybeans, as one of China's important grain crops, have become a weakness in ensuring food security due to their high external dependence and insufficient self-sufficiency, particularly in the context of a complex international trade environment. This issue has gained increasing attention from various sectors. This article selects data on China's soybean imports, production, consumption, and other aspects to analyze the factors contributing to the high external dependence on soybeans. The aim is to provide practical policy recommendations with practical significance.

1. China’s Soybean Imports and Food Security Status

1.1 Quantity and Proportion of Soybean Import in China has Consistently Remained High

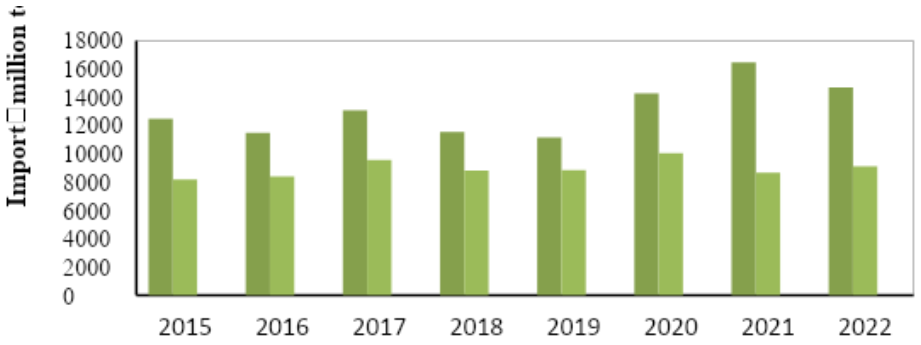

Figure 1. China's Grain and Soybean Import Situation since 2015

According to the customs data of China, the import quantity of grains and soybeans in 2015 was 125 million tons and 82 million tons, respectively. Soybean imports accounted for 65.5% of the total grain imports. In 2019, the import quantity of grains and soybeans was 111 million tons and 89 million tons, respectively, reaching a peak where soybean imports accounted for 79.4%. Subsequently, both the quantity and proportion of soybean imports have declined. In 2021, the import quantity was 97 million tons, accounting for 58.7%, and in 2022, it was 91 million tons, accounting for 62%. In terms of quantity, the average annual import volume of soybeans in China has reached 91 million tons since 2015, particularly in the three years since 2020, where imports have remained at the high level of nearly 100 million tons. In terms of structure, the proportion of soybean imports to the total grain imports in China has averaged around 69%, indicating that soybeans have consistently been a significant component of grain imports.

1.2 China's Excessive and Increasing Dependence on Soybean Imports

According to the basic criteria for national food security assessment proposed by the Food and Agriculture Organization of the United Nations, the most crucial indicator is the national self-sufficiency rate, which should strive to exceed 95% to ensure the security of food production. The higher the self-sufficiency rate, the lower the dependence on imports, and the higher the level of food security. Conversely, the higher the dependence on imports, the lower the level of food security. In 2015, China's soybean production was 12.367 million tons, while soybean imports during the same period reached 81.69 million tons, resulting in a dependence on imports of over 80%. Since then, the dependence on imports has shown a fluctuating upward trend. By 2021, soybean production had increased to 16.4 million tons, while imports amounted to 96.52 million tons, resulting in a dependence on imports of 88.4%. The

persistently high dependence on imports remains a significant hidden risk to food security.

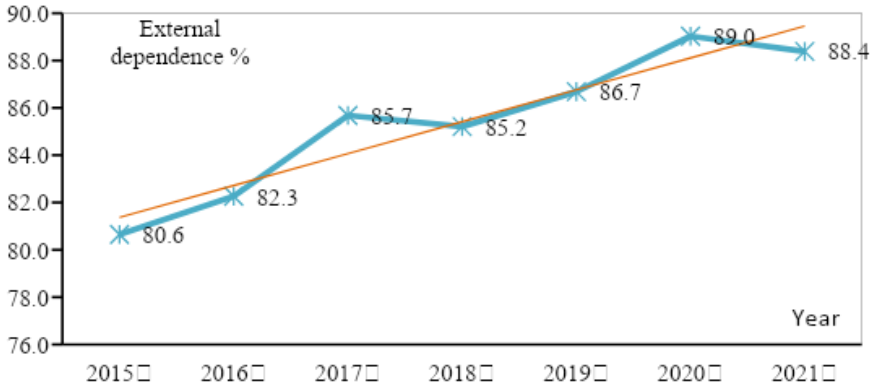

Figure 2. China's Soybean External Dependence in 2015 - 2021

1.3 Relatively Concentrated Sources of China's Soybean Imports

According to the data in Table 1, from 2012 to 2017, China imported soybeans mainly from Brazil, the United States, and Argentina, with average proportions of 47.31%, 38.58%, and 9.36% respectively. This indicates that China's soybean imports are highly concentrated in these three countries. The combined import volume from Brazil, the United States, and Argentina consistently accounted for over 94% of the total imports, with an average of 95.24%. China heavily relies on soybean imports, and the import dependency is excessively concentrated on these three countries (Brazil, the United States, and Argentina), which has been a prominent weakness in ensuring long-term food security. When comparing the data, the United States was the leading soybean importing country for China in 2012. However, there was a shift in the import pattern in 2013 when Brazil surpassed the United States and has maintained the position since then. Particularly, after 2018, China's soybean imports from the United States further declined. In 2019, China imported a total of 57.675 million tons of soybeans from Brazil and 16.944 million tons from the United States, accounting for 65.1% and 19.1% respectively.

Table 1. China's Soybean Import Source Table

Unit%

Country	2012	2013	2014	2015	2016	2017	Average
Brazil	40.92	50.19	44.82	49.06	45.53	53.31	47.31
USA	44.418	35.09	42.06	34.78	40.72	34.39	38.58
Argentina	10.1	9.66	8.41	11.55	9.55	6.89	9.36
Uruguay	3.26	3.63	3.42	2.84	1.98	2.69	2.97
Canada	1.08	1.32	1.21	1.31	1.74	2.14	1.47
Russia	0.16	0.11	0.08	0.46	0.48	0.53	0.30

Top 3 Sum	95.44	94.94	95.29	95.39	95.80	94.59	95.24

2. The Main Reasons for China High Dependency on Imported Soybeans

2.1 Quantity and Proportion of Soybean Import in China has Consistently Remained High

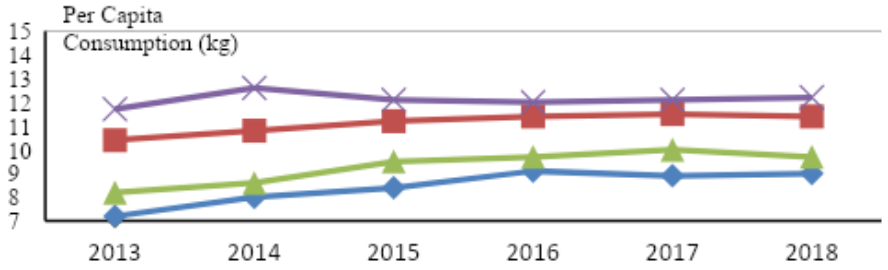

Figure 3. Changes in Chinese Residents' Consumption from 2013 to 2021

In recent years, the consumption of soybeans in China has been growing rapidly, making it the world's largest consumer of soybeans, with an annual demand exceeding 110 million tons. In terms of demand, traditional soybean products such as tofu, bean sprouts, dried bean curd, and soy milk mainly rely on domestically produced soybeans, while imported soybeans are primarily used for crushing and feed processing. Soybean oil is the largest edible vegetable oil in China, and soybean meal is an important source of protein feed for poultry, livestock, and aquatic products. Looking at the consumption data of Chinese residents from 2013 to 2021, the growth trends in poultry, livestock, aquatic products, and dairy products are all very apparent, and the rapid increase in soybean consumption resulting from the production of feed protein such as soybean meal has led to a high volume of soybean imports in China.

2.2 Long-term Low Domestic Soybean Production in China

While consumption has been rapidly increasing, domestic soybean production in China has remained stagnant, consistently staying between 10 million and 20 million tons. From 2015 to 2021, the average annual soybean production in China was 15.9 million tons, with most years below 16 million tons, accounting for only about 15% of total consumption. In recent years, the government has introduced a series of favorable policies, particularly subsidies provided to soybean growers, resulting in an increase in soybean planting areas. In 2019 and 2020, soybean production reached 18.09 million tons and 19.60 million tons, respectively, representing year-on-year growth of 13.36% and 8.35%. However, by 2022, this figure had

dropped to 16.40 million tons, returning to the production level of 2018. There has consistently been a significant gap between soybean production and demand.

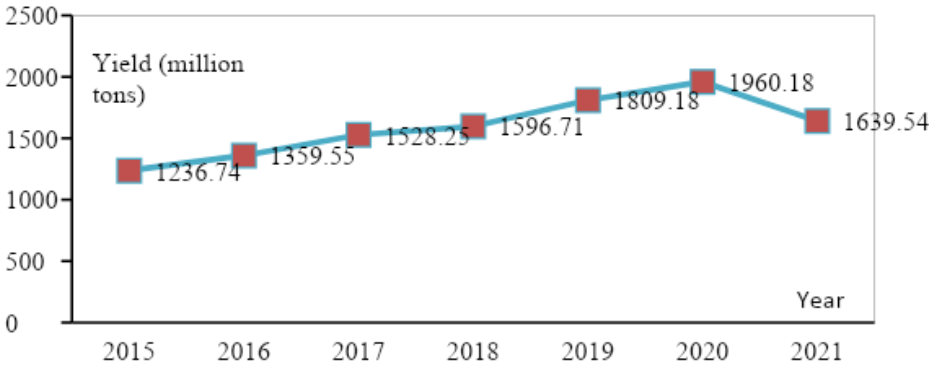

Figure 4. China Soybean Production in 2015 - 2021

2.3 Low Yield and Poor Efficiency of Soybean Planting in China

According to Table 2, in 2019, China's grain yield per mu (a Chinese unit of land area equal to 0.067 hectares) was 381 kilograms. Specifically, rice and corn yields were above 400 kilograms per mu, wheat yield was 375 kilograms per mu, and peanut yield was also above 250 kilograms per mu. In contrast, soybean yield was only 129 kilograms per mu. Compared to other crops, soybean has a lower yield per unit of land, coupled with the difficulties in field management and high labor intensity of soybean cultivation, which leads to a low willingness among farmers to plant soybeans. From an international perspective, the soybeans planted in China are non-genetically modified, with weak resistance to diseases and pests and lower yields. In contrast, internationally planted soybeans are mostly genetically modified, with high standardization of cultivation and much higher yields compared to China. Statistics show that the average soybean yield in the United States exceeds 350 kilograms per mu, nearly three times that of China's soybean yield. Additionally, genetically modified soybeans have higher oil extraction rates and are more suitable for crushing, giving international soybeans a significant advantage over domestically produced soybeans.

Table 2. China’s Grain Yield per Mu

Unit:kg/mu

Type	2013	2014	2015	2016	2017	2018	2019
Gain	363	363	370	369	374	375	381
Rice	448	454	459	458	461	468	471
Wheat	337	350	360	360	366	361	375
Corn	401	387	393	398	407	407	421
Soybean	117	119	121	119	124	127	129

Peanut	244	243	243	245	247	250	252

3. China’s Soybean Import Trends and Their Impact on Food Security

3.1 The High Dependence on Imported Soybeans in China is Expected to Continue

In the long run, as Chinese residents' incomes increase, consumption will further iterate and upgrade. The consumption of meat, eggs, milk, and aquatic products will continue to grow rapidly. As soybean meal is the main source of animal feed protein, its demand will also increase. At the same time, a large number of soybeans crushing enterprises in China have formed closely linked industrial chains around soybean imports, crushing, feed production, and poultry and livestock farming. Both the upstream and downstream sectors of this industrial chain have a strong dependence on imported soybeans. According to estimates by the U.S. Department of Agriculture, 79% of the global soybean demand growth in the next decade will come from China. It is projected that China's soybean imports will increase to 140.5 million tons by 2030, nearly 10 times the domestic soybean production. Therefore, the high dependence of China's soybean demand on imports is difficult to reverse, and the reliance on foreign trade may even increase further.

3.2 The Impact of China’s Soybean Imports on Food Security is Becoming Increasingly Evident

In the context of the 21st-century pandemic, trade protectionism is rampant, international trade frictions are intensifying, and the instability and uncertainty of the global food industry chain and supply chain are increasing. The excessive dependence on soybean imports has become an important hidden danger to China's food security. In particular, the combination of the China-U.S. trade friction and the Ukraine crisis has led to high international soybean prices. It is expected that in the short term, the international situation will be difficult to reverse significantly, and China's soybean imports will face increasingly severe challenges, with a growing impact on China's soybean trade. Meanwhile, constrained by arable land and other grain consumption, the potential for growth in China's soybean production is extremely limited. In 2021, China imported 96.52 million tons of soybeans. If this amount were to be produced domestically using a yield of 129 kilograms per mu, it would require 750 million mu of land, which is equivalent to the total arable land area of Northeast China and North China. In the face of increasing pressure on international soybean imports and the difficulty of effectively increasing domestic soybean supply, the impact of soybean imports on food security will gradually deepen.

3.3 Suggestions for addressing China's Soybean Import Issues

In recent years, China has implemented a series of policies to revitalize domestic soybean production. In 2019, the "Soybean Revitalization Plan Implementation Program" was issued, and in 2021, it was further proposed to expand soybean cultivation and provide subsidies for soybean intercropping. In 2022, adjustments were made to the planting structure and various measures were taken to expand soybean cultivation, effectively promoting an increase in soybean production. However, the high dependence on soybean imports cannot be resolved in the short term, and more powerful measures need to be taken from production, utilization, and foreign trade perspectives.

3.3.1 Improve soybean production and supply levels

First, expand the scope of soybean cultivation, especially targeting the issue of insufficient arable land. This can be achieved by expanding soybean-corn rotations, developing soybean cultivation on saline-alkali land, promoting soybean-corn intercropping, and other methods to tap the potential for increased soybean production and improve self-sufficiency. Second, establish a mechanism to ensure the income of soybean growers, stabilize subsidies for soybean producers, and increase subsidies for intercropping, ensuring reasonable returns for soybean farmers and stimulating their enthusiasm for soybean cultivation. Third, improve the level of industrialization by adopting a production and operation model of "leading enterprises + cooperatives + farmers." This will organize scattered small-scale farmers, promote large-scale and standardized soybean production, unify varieties, cultivation practices, and field management. At the same time, accelerate the digitization, intelligentization, and facility construction of soybean production, promoting stable production and increased income.

3.3.2 Improve international trade in soybeans

First, expand the range of trading partners for soybeans and diversify import channels to gradually achieve "buying globally and selling globally" in the agricultural field. Second, enhance the level of soybean import trade, dynamically assess changes in the international market situation, adjust soybean import strategies in a timely manner, grasp the quantity and pace of soybean imports, and ensure the high-quality development of soybean import trade. Third, enhance the ability to resist risks in soybean imports, increase soybean import reserves, take proactive measures, and guard against risks in soybean imports.

3.3.3 Improve the efficiency of soybean utilization

On the one hand, improve the overall efficiency of the soybean industry chain by vigorously

supporting and cultivating soybean processing enterprises, constructing a fully integrated industry chain operation model, promoting the coordinated development of the industrial chain, value chain, and supply chain, and improving the transformation and upgrading of the soybean industry to increase efficiency and profitability. On the other hand, improve the precise utilization of soybean protein feed, achieve higher feed conversion efficiency by strengthening low-protein diet technology in livestock and poultry production, increasing the proportion of high-conversion-rate livestock products (such as poultry and eggs), and comprehensively improving feed conversion efficiency to effectively reduce the pressure on soybean feed demand.

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