# CHINA'S GRAIN PRODUCTION AND FOOD SECURITY

## TREND REPORT

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# EXECUTIVE SUMMARY

China's grain production plays a critical role in ensuring national food security, given China's vast population and complex agricultural landscape. Over the decades, China has implemented various policies and technological advancements to enhance grain yield, stabilize supply chains, and reduce reliance on imports. However, the country continues to face significant challenges, including climate change, urbanization, declining arable land, and water scarcity, which threaten sustainable food production. This report examines the evolution of China's grain production, analyzing the policies that have shaped agricultural output and the factors that influence food security. It explores the government's interventions, such as subsidies, technological innovations, and land reforms, to ensure a stable grain supply. Furthermore, the paper discusses the impact of global trade, shifting dietary patterns, and climate change on China's agricultural sector.

To achieve long-term food security, China must adopt sustainable agricultural practices, invest in advanced farming technologies, and optimize resource management. Strengthening domestic production while balancing international trade partnerships will be crucial in addressing future challenges. This report underscores the importance of policy adaptability, environmental conservation, and technological progress in safeguarding China's food security.

If you are interested in learning more about China's agricultural policies and food security, please contact ICDK Shanghai.

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# INTRODUCTION

China's agricultural sector plays a critical role in sustaining its vast population, producing nearly a quarter of the world's grain with only a fraction of the planet's arable land. Over the past decades, China has made significant strides in increasing grain yields, improving food security, and advancing sustainable agricultural practices. However, challenges such as resource constraints, environmental pollution, and inefficiencies in grain storage and distribution continue to threaten long-term sustainability.

This report provides a comprehensive analysis of China's grain production, food security, and sustainability efforts. It examines the key challenges facing the agricultural sector, including food loss, environmental degradation, and regulatory barriers in food safety. Additionally, this report explores the policy frameworks and technological innovations shaping China's transition toward a more resilient and sustainable agricultural system. By evaluating both current strategies and future directions, this report aims to provide insights into the ongoing efforts to ensure food security while balancing economic and environmental sustainability.

# I. ANALYSIS OF THE CURRENT SITUATION OF GRAIN PRODUCTION IN CHINA

## 1.1 China's Grain Production Situation

In 2022, China's total grain production reached 687 million tons, an increase of 0.5%, exceeding 650 million tons for eight consecutive years, accounting for nearly 23% of the global grain production. Among them, wheat production is 137.72 million tons, rice production is 208.5 million tons, corn production is 277.2 million tons, legume production is 23.5 million tons, tubers production is 29.77 million tons, and other crops are about 10.31 million tons. China has achieved basic self-sufficiency in grains and food security (National Bureau of Statistics of China, 2024).

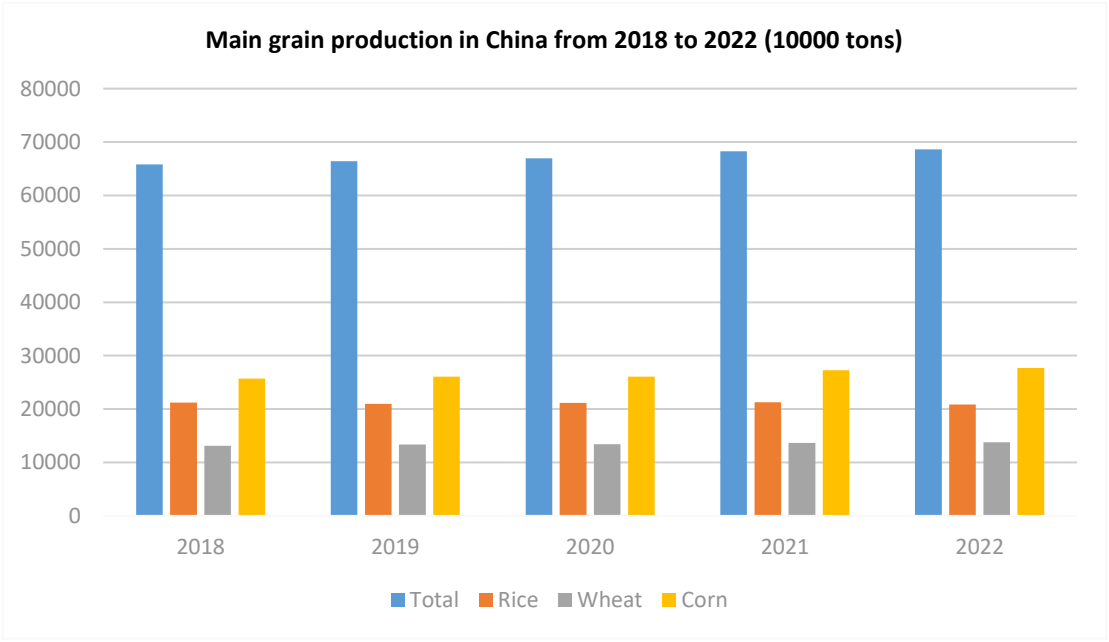


*Figure 1.1: China's Major Grain Production from 2018 to 2022 (10000 tons)*

Grains are the most important grain crop in China. In 2022, the sowing area of grains in China was 99268.8 thousand hectares, accounting for approximately 83.89% of the national grain crop sowing area; The sowing area of legume crops is second only to that of grains, but the yield is the lowest; In 2022, the sowing area of legumes in China was 11877.9 thousand hectares, accounting for approximately 10.04% of the national grain crop sowing area; tubers have the lowest sowing area, but their yield is higher than that of legumes. In 2022, the planting area of potato crops in China was 7185.4 thousand hectares, accounting for approximately 6.07% of the national grain crop planting area (National Bureau of Statistics of China, 2024).

## 1.3 The Main Grain Producing Areas in China

The five main grain producing areas in China are Heilongjiang Province, Henan Province, Shandong Province, Anhui Province, and Jilin Province, with their production accounting for approximately 41% of the national total. In 2022, Heilongjiang's grain production reached 77.63 million tons, accounting for 11.3% of the national total; Henan's grain production is 67.89 million tons, accounting for 9.9% of the national total; Shandong's grain production is 55.44 million tons, accounting for 8% of the national total; Anhui's grain production is 41 million tons, accounting for 6% of the national total; Jilin's grain production is 40.81 million tons, accounting for 5.9% of the national total (National Bureau of Statistics of China, 2024).

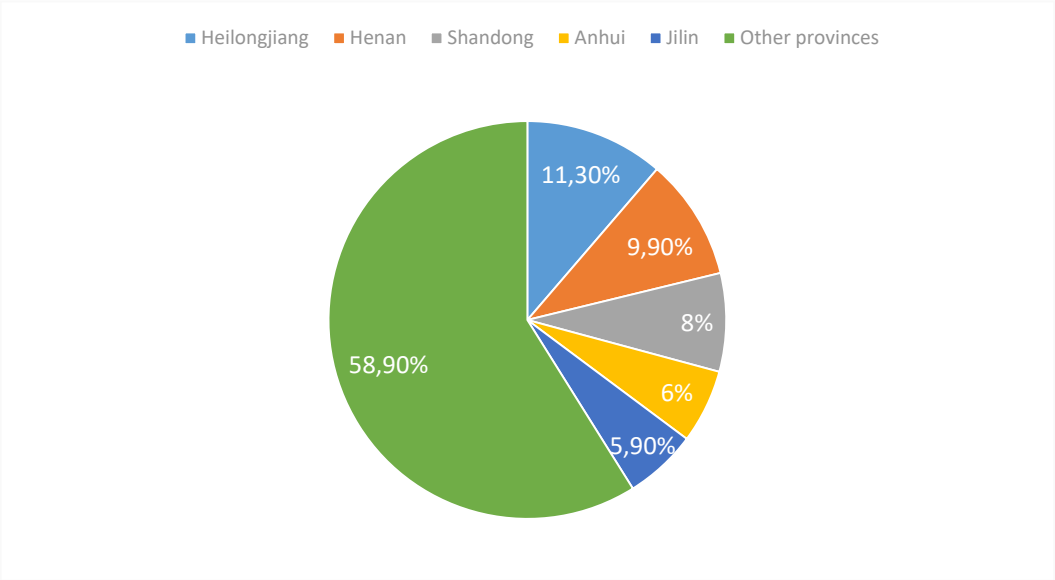


*Figure 1.3: Proportion of China's Five Major Production Areas in 2022*

## 1.4 China's Grain Loss Situation

### 1.4.1 Current situation of grain loss in China

The entire industrial chain of China's three major grain suffers from serious waste and losses. The *China Agricultural Industry Development Report 2023* shows that the loss rates of the entire industry chain for rice, wheat, and corn are 26.2%, 16.7%, and 18.1%, respectively, accounting for approximately 20.7% of the total production of the three major grain. Among them, the loss rate in harvesting, storage, processing, and consumption is relatively high. Taking rice as an example, due to excessive processing in China's rice industry, rice suffers the most losses in the processing process, with a loss rate of up to 10.95%. In 2020, the average rice yield rate of China's rice processing industry was 64.5%, while the rice yield rate level of advanced processing technology countries such as Japan was generally around 70%. Therefore, it is urgent to strengthen the technical support for grain loss reduction (CAAS, IFPRI, 2024).

### 1.4.2 Challenges faced by China in reducing food losses

According to the 2020 research report of the Standing Committee of the Chinese People's Congress on cherishing food and opposing waste, the main challenges faced by China in reducing food losses are as follows:

The production process has high losses. In the process of grain cultivation in China, there are problems such as excessive seed consumption and the need to improve the seedling rate. According to a survey in Shandong Province, the annual grain consumption for wheat and corn seeds in the province is about 1.05 billion kilograms. If operated according to the requirements of precision sowing technology, the province can save about 300 million kilograms of planting grain. The seed germination rate in some areas of Shaanxi Province is only about 80%, and to ensure the emergence rate, it is necessary to increase the amount of seed application. There is a significant loss in field machinery harvesting. According to estimates in Hebei Province, the loss in the corn harvesting process in the province reached 690 million kilograms in 2019; The mechanical harvesting loss in Weinan City, Shaanxi Province is over 1.2%, and the damage rate is over 2%. Domestic harvesting machinery faces two major technical challenges: crop loss and damage, with a much higher harvesting loss rate than imported machinery.

The post-harvest losses of grain are prominent. There are shortcomings in the grain storage technology of farmers. After the autumn harvest in Heilongjiang Province, the grain needs to be stored in stages at the households of farmers. About 50% of the harvested grain is directly placed on the ground, and problems such as mold and germination are prominent; The mechanical drying capacity in Guangdong Province is only about 10%. In 2020, 26% of grain depots in Hebei Province were unable to implement mechanical ventilation, while only 3% achieved controlled atmosphere grain storage. The application of closed and specialized grain transportation vehicles and equipment in rural fields is insufficient, resulting in significant losses in grain transportation. At present, the majority of grain transportation in China still adopts traditional grain packaging transportation, which involves multiple packaging and disassembly, as well as high loss rates caused by scattering during loading, unloading, transportation, and leftover packaging materials.

## 1.5 Main Issues of Food Security in China

### 1.5.1 Resource constraints are becoming increasingly severe

The basic national condition of China is that there are more people, less land, and less water. The average annual occupation of newly added construction land in China is about 480,000 hectares (ha) of arable land, and the quality of supplementary arable land is not high. The pressure to maintain the red line of 120 million ha of arable land is increasing. The quality of cultivated land has declined, with prominent issues such as thinning of black soil layers, soil acidification, and shallower cultivation layers. From the perspective of regional distribution, there is a structural

imbalance between the focus of water resources and the focus of grain cultivation. The average annual water resources in the north account for 18.8% of the national total, while in the south they account for 81.2%. However, the focus of grain cultivation structure is shifting northward year by year. The effective utilization coefficient of irrigation water in farmland is 0.2 lower than the average level in developed countries, and groundwater overexploitation is severe in North China (National Bureau of Statistics of China, 2024).

### 1.5.2 Environmental pollution issues are prominent

In 2022, China's grain production accounted for approximately 23% of the world's total production, while the input of fertilizers and pesticides accounted for 31.3% and 43% respectively, with input intensity several times higher than the world average. Industrial pollution, domestic pollution, and other external pollutants are spreading to agriculture and rural areas. Heavy metals such as cadmium, mercury, and arsenic continue to infiltrate the environment of agricultural production areas, with a national soil major pollutant point exceeding standard rate of 16.1%. Agricultural endogenous pollution is severe, and the utilization rate of fertilizers and pesticides is low. The recovery rate of agricultural film and the effective treatment rate of livestock and poultry manure are insufficient. The problem of ocean eutrophication is prominent, with frequent occurrence of red tide and green tide, and ecological deterioration of fishing waters. Rural garbage and sewage treatment are severely inadequate. The increasing trend of environmental pollution in agriculture and rural areas directly affects the quality and safety of agricultural products (Chinese Academy of Engineering , 2025), (CNGOIC, u.d.)

### 1.5.3 Ecosystem degradation

The total area of soil erosion in China is 2.95 million square kilometers, with an average annual soil erosion of 4.5 billion tons. 1.73 million square kilometers of decertified land and 120000 square kilometers of rocky desertification. The high-intensity and extensive production methods have led to structural imbalance and functional degradation of agricultural ecosystems, and the establishment of a composite ecosystem of agriculture, forestry, and animal husbandry is urgently needed. The problem of grassland overloading and overgrazing is still prominent, and the overall deterioration of grassland ecology has not been fundamentally reversed. The area of lakes and wetlands has shrunk, and the ecological service functions have weakened the *National Agricultural Sustainable Development Plan (2015 – 2030)* (The State Council The People's Republic of China).

# II. KEY TASKS FOR SUSTAINABLE AGRICULTURE IN CHINA

Agriculture is the foundation of the national economy, and sustainable development of agriculture is the fundamental guarantee and priority area for China's sustainable development. China is a populous country that feeds 18% of the world's population with 7% of the world's arable land. Therefore, the Chinese government attaches great importance to sustainable agricultural development. *The No. 1 central document* has been issued for 20 consecutive years in response to agricultural problems, which involves sustainable agricultural development, green agriculture, etc (The State Council The Peoples Republic of China , 2022). This chapter mainly elaborates on the current situation and future key work in the field of sustainable agricultural development in China, based on national level plans such as the *National Agricultural Sustainable Development Plan (2015 – 2030)* (The State Council The People's Republic of China), (National Agricultural Green Development Plan (2021-2025), 2021), (The State Council The Peoples's Republic of China, 2021), and (The State Council The People's Republic of China, 2022) prepared by the Ministry of Agriculture and Rural Affairs, Ministry of Ecology, Ministry of Science and Technology, and other departments.

## 2.1 Current Status of Green and Sustainable Development of Agriculture in China

**The protection and utilization of agricultural resources have been strengthened:**

The farmland protection system is gradually improving, and the quality of farmland is steadily improving. The total amount of agricultural water use has been effectively controlled, and the efficiency of water resource utilization has been continuously improved. The effective utilization coefficient of irrigation water in farmland has reached 0.559. The contribution rate of agricultural technological progress has exceeded 60%, the coverage rate of excellent crop seed has remained stable at over 96%, and the comprehensive mechanization rate of cultivation and harvest has reached 71%.

**Environmental pollution has significantly improved:**

The comprehensive utilization rate of livestock and poultry manure has reached 76%, the comprehensive utilization rate of straw has reached 86%, and the recovery rate of agricultural film has reached 80%. The number of fertilizers and pesticides continues to decrease, achieving negative growth for four consecutive years. The level of resource utilization of agricultural waste has steadily improved, and the production environment has significantly improved.

**The green level of agricultural products has steadily improved:**

In 2021, the sales revenue of China's green food industry reached 497.47 billion DKK. The certified production of green vegetables in China is 19.9082 million tons; Green fresh fruits, with a production capacity of 16.0184 million

tons; Green rice, with a production capacity of 15.2124 million tons; A total of 46 highly toxic pesticides have been banned, and 20 pesticides have been banned on certain crops such as vegetables and fruits. A strict implementation of the designated management and real name purchase system for highly toxic pesticides has been implemented. The green prevention and control area of major crops is nearly 6.67 million ha, and the utilization rate of fertilizers and pesticides for rice, corn, and wheat has reached over 40%.

**The support and guarantee capabilities continue to strengthen:**

As of the end of 2020, 85 green food standards have been formulated and revised, 140 green food standards have been effectively used, and 212 green food production operation procedures have been organized and formulated. It has established a scientifically rigorous, standardized, efficient, fair and authoritative process for trademark licensing review, and improved five regulatory systems, including annual inspections, product sampling, market supervision, risk warning, and product announcements.

## 2.2 Key Tasks for China's Agricultural Circular Economy

According to the *Circular Economy Development Plan (2021-2025)* issued by the National Development and Reform Commission, it is proposed that by 2025, agricultural circular production methods will be fully promoted, green design and clean production will be widely promoted, the comprehensive utilization capacity of resources will be significantly improved, and a basic resource circular industrial system will be established (The State Council The Peoples's Republic of China, 2021).The following subsections provide a detailed explanation of these recommendations and the key tasks that will help achieve these goals.

### 2.2.1 Resource utilization of agricultural and forestry waste

Promote the efficient utilization of agricultural and forestry waste such as crop straw, livestock and poultry manure, forestry waste, and by-products of agricultural product processing.

Strengthen the comprehensive utilization of crop straw, increase the efforts of returning straw to the field, give full play to the function of farmland conservation, encourage the industrial utilization of straw off the field, develop new materials and products, and increase the added value of straw feed, fuel, raw materials, and other materials. Strengthen the construction of livestock and poultry manure treatment facilities, encourage the integration of planting and breeding, and promote the local return and utilization of agricultural organic fertilizers. Encourage the use of secondary fuelwood and forestry residues according to local conditions for composite board production, edible mushroom cultivation, and energy utilization, and promote the resource utilization of by-products from agricultural product processing.

#### 2.2.2 Strengthen the recycling and utilization of waste agricultural materials

Guide responsible parties such as large growers, farmer cooperatives, family farms, agricultural material enterprises, and waste material recycling enterprises to actively participate in recycling. Support the centralized construction of recycling facilities in townships, and improve the recycling system for waste agricultural materials such as agricultural films, fertilizers and pesticide packaging, irrigation equipment, agricultural machinery, and fishing nets. Construct regional facilities for centralized disposal and utilization of waste agricultural materials, and improve the level of scale and resource utilization.

#### 2.2.3 Promoting the development model of circular agriculture

Promote the organic integration of planting and breeding, agriculture and animal husbandry, and the construction of breeding farms and farmland, and promote the coordinated development model of livestock, fish, grain, vegetables, fruits, and tea. Build a group of ecological farms and ecological circular agriculture industry consortia, and explore sustainable operation mechanisms. Promote the development and utilization of biomass energy in rural areas, and leverage the comprehensive benefits of clean energy supply and rural ecological environment governance. Build a forestry circular economy industry chain and promote the three-dimensional development industry model of forest, inter forest, and under forest. Promote the circular links of planting, breeding, agricultural product processing, biomass energy, tourism and health care.

### 2.3 Key Tasks for the Protection and Utilization of Agricultural Resources in China

#### 2.3.1 China's farmland resources protection and utilization project

Implement the strictest farmland protection system, stabilize the area of grain sowing, strictly control the occupation of new construction land, ensure that the amount of farmland is over 120 million ha, and ensure that the basic farmland is not less than 104 million ha. Implement a new round of high standard farmland construction plan, and carry out engineering construction such as land leveling, soil improvement, irrigation and drainage. By 2025, a total of 71.67 million ha of high standard farmland will be built, and by 2030, the basic fertility of arable land in China will be improved by more than one level.

**Black soil protection**

Black soil, also known as chernozem, is a highly fertile soil rich in organic matter, making it crucial for agriculture due to its nutrient content and moisture retention. In China, black soil is primarily found in the northeast and plays a vital role in food production. To protect and sustainably use black soil, China will implement the protection and utilization of 6.67 million hectares of black soil, focusing on preventing soil erosion, building agricultural infrastructure, and cultivating fertile soil layers. Additionally, China will carry out conservation tillage on 9.33

million hectares, using harvesters to return straw directly to fields and employing a no-till planter for seeding and fertilization. This approach reduces soil disturbance, preserves moisture, and ensures long-term soil health.

**Farmland restoration**

In areas with prominent acidification problems in southern farmland, concentrated and contiguous acid reduction and improvement measures will be carried out, while in areas with saline alkalization in northern farmland, soil improvement and fertilization will be implemented.

### 2.3.2 China agricultural water resources protection and utilization project

Implement water resource warning line management. Establish a warning line for the development and utilization of water resources, which remain at 372 billion cubic meters in 2020. By 2030, the national agricultural irrigation water consumption will be controlled at 373 billion cubic meters. Establish a warning line for water use efficiency control, and increase the effective utilization coefficient of irrigation water in farmland from 0.56 in 2020 to over 0.57 by 2025. By 2030, it will increase to above 0.6.

Promote water-saving irrigation technology. Promoting efficient and water-saving irrigation on a large scale in different regions, the effective irrigation rate of farmland reached 55% in 2020, and by 2025, 4 million ha of high-efficiency and water-saving irrigation farmland will be added. By 2030, the effective irrigation rates for farmland will reach 57% and the water-saving irrigation rate will reach 75%. Develop water-saving agriculture, increase the construction of water-saving irrigation projects in major grain producing areas, severely water deficient areas, and ecologically fragile areas, and promote water-saving irrigation technologies such as channel anti-seepage, pipeline water delivery, sprinkler irrigation, and micro irrigation.

### 2.3.3 China agricultural biological resources protection and utilization project

Conservation of agricultural species resources. Complete the third national survey of crop germplasm resources, livestock and poultry genetic resources, and the first survey of aquaculture germplasm resources from 2021 to 2025. Rescue rare, endangered, endemic resources and local varieties. Strengthen the construction of national germplasm resource banks for crops, livestock and poultry, freshwater fisheries, marine fisheries, microorganisms, and grass industries, build a number of germplasm resource banks (farms, districts, nurseries), and improve infrastructure for resource preservation, identification, and sharing. Prevention and control of invasive species from abroad. Establish a national level monitoring network and warning platform for invasive species from abroad, establish field monitoring stations, natural enemy breeding bases, and comprehensive prevention and control zones.

## 2.4 Key Tasks for Agricultural Pollution Control in China

### 2.4.1 Reduction and efficiency enhancement of fertilizer and pesticide utilization

Promote technologies such as formula fertilization by soil testing, integrated water and fertilizer, deep application of chemical fertilizer machinery, and increased application of organic fertilizer. Implement pilot projects to replace chemical fertilizers with organic fertilizers in key fruit, vegetable, and tea production areas, with a focus on promoting technical models such as compost returning to the field, commercial organic fertilizer application, biogas residue, and biogas slurry returning to the field. Key efforts will be made to promote green prevention and control, as well as physical and biological pesticide reduction technology models.

### 2.4.2 Green and circular agriculture

Promote intercropping and Rotation fallow techniques and models such as soybean and corn, and focus on innovating technologies and models such as comprehensive three-dimensional planting and breeding in rice fields, three-dimensional planting and breeding under forests, and comprehensive utilization of saline alkali land by fishermen and farmers. A new batch of national level demonstration zones for healthy breed and ecological breed will be established, integrating and promoting healthy breed models such as circular water breed, integrated rice and fishery breeding, and large-scale ecological fisheries.

### 2.4.3 Utilization and management of straw and agricultural film

Systematically promoting straw crushing and returning to the field, promoting straw feed conversion, and promoting straw fuel conversion. Developing straw raw material products such as artificial boards and packaging materials to enhance the added value of straw; Promote environmentally friendly biodegradable agricultural film, promote the processing and reuse of waste agricultural film, develop mechanized collection of waste agricultural film, build storage and processing sites for agricultural film, establish and improve monitoring points for residual agricultural film, and carry out regular and institutionalized monitoring and evaluation.

### 2.4.4 Key watershed agricultural pollution control

Focusing on the Yangtze River Economic Belt and the Yellow River Basin, we will build a number of key counties for agricultural non-point source pollution control, and implement projects such as agricultural non-point source pollution prevention and control, livestock and poultry breeding pollution control, aquaculture environment control, comprehensive utilization of crop straw, and agricultural film recycling according to local conditions.

## 2.5 Sustainable Science and Technology Work in Chinese Agriculture

Technological innovation plays a crucial role in improving agricultural production efficiency, resource utilization efficiency, and reducing environmental impact. The application of advanced agricultural technology helps to reduce the use of pesticides and fertilizers, increase yields, optimize water resource utilization, and reduce energy consumption, thereby promoting the development of agriculture towards a more sustainable direction. The Chinese government has always attached great importance to the supportive role of technology in agriculture, and the main agricultural science and technology work during the period of 2021-2025 is as follows:

### 2.5.1 Agricultural technology research and development work

Research and development efforts will focus on creating green and efficient agricultural inputs. This includes developing functional fertilizers, biological fertilizers, soil conditioners, and agricultural and veterinary drugs that are low in toxicity and residue. Additionally, there will be a focus on green and biodegradable inputs, such as biodegradable plastic films and efficient feed additives.

In terms of agricultural machinery, the development of energy-saving, low-consumption, and smart equipment will be prioritized. This includes promoting the use of plant protection drones, residual film recycling machines, and technologies for waste treatment. The goal is to accelerate the application of agricultural machinery that helps conserve resources such as water, energy, fertilizer, and pesticides. Research will also focus on technologies like rapid sorting, efficient pretreatment, and precise segmentation at sea. Furthermore, innovations in live seafood transport, energy-efficient marine preservation, and cold chain processing for aquatic products will be explored.

For livestock and poultry breeding, the focus will be on promoting technologies that enable efficient and healthy breeding. This includes the development of automatic monitoring systems for animal health, growth, and physiological conditions such as estrus and pregnancy. There will also be an emphasis on technologies to reduce emissions from feed and improve feed utilization. Efforts to break through physiological synchronization bottlenecks in animal herds will be key, as will innovations in environmental control systems for breeding facilities, as well as technologies to reduce greenhouse gases and ammonia odors. Additionally, research will focus on improving breed evaluation methods, providing precise feed nutrient supply, and scaling up healthy breeding technologies.

Finally, the goal is to improve the quality and efficiency of fishery production. Research will focus on sustainable and healthy aquaculture models, including land-based farming, marine and freshwater pond farming, deep-sea aquaculture, integrated rice and fish farming, and large-scale ecological fishing. Efforts will be made to improve seedling breeding and genetic breeding technologies to develop high-quality, efficient, and resilient aquatic

varieties. Additionally, research will focus on feed utilization technologies and the development of vaccines for disease control in aquaculture.

### 2.5.2 Smart agriculture construction work

According to the key tasks of the *Promotion of Agricultural and Rural Modernization Plan (2021-2025)*, China will build 100 national digital agriculture innovation and application bases nationwide, establish a smart agriculture integrated application system that connects information collection, analysis and decision-making, operation control, smart management and other links, improve the level of production and operation intelligence, and drive the construction of smart agriculture nationwide (The State Council The People's Republic of China, 2022).

**National Digital Planting Industry Innovation and Application Base:**

Utilize information technology to monitor the growth environment and crop body in real-time, promote precise operations such as tillage, seeding, fertilization, pesticide application, and harvesting, and build a smart farm management system.

**National Digital Facility Agriculture Innovation Application Base:**

Promote the application of intelligent seedling cultivation, automatic monitoring of growth environment and crop body, remote environmental control, precise management of water, fertilizer and medicine, intelligent plant protection, automatic harvesting and other technologies, and build a smart facility management system.

**National Digital Animal Husbandry Innovation Application Base:**

Promote the application of technologies such as intelligent monitoring of animal estrus, automated and precise environmental control, precise feeding, automatic monitoring and prevention of livestock and poultry diseases, automatic treatment of manure, and automatic collection of products, and build a smart ranch management system.

**National Digital Fisheries Innovation Application Base:**

Promote the application of technologies such as real-time environmental monitoring, automatic oxygenation, intelligent feeding of bait, circulating water, tail water treatment control, underwater robots, and remote disease diagnosis, and build a smart fishing ground management system.

**National Digital Seed Industry Innovation and Application Base:**

Transforming and upgrading intelligent information infrastructure, constructing efficient crop breeding information systems and data analysis systems for performance testing, genome selection, genetic evaluation, and other major livestock and poultry varieties.

# III. CHINESE FOOD SAFETY LAWS, REGULATIONS, AND MONITORING SYSTEM

## 3.1 Current Situation of Food Safety in China

The national food safety situation has maintained an overall stable and positive trend. From 2018 to 2022, the overall pass rate has been above 97% for five consecutive years. In 2022, the national market supervision department completed 6563388 batches of food safety supervision and inspection, and according to relevant national food safety standards, 187572 batches of unqualified samples were found. The supervision and inspection failure rate were 2.86%, an increase of 0.17 percentage points from 2021, and the overall pass rate was 97.14%. From the perspective of sampled food varieties, the five major categories of food with high consumption, including processed grain products, edible oils, fats and their products, meat products, egg products, etc., have supervision and sampling failure rates of 0.68%, 1.13%, 1.06%, 0.27%, 0.12%, respectively, which are lower than the overall sampling failure rate.

| | | 2022 | 2021 | 2020 | 2019 | 2018 |
|---|---|---|---|---|---|---|
| Number of spot checks | | 6563388 | 6954438 | 6387366 | 4736773 | 3355882 |
| Unqualified samples | | 187572 | 187368 | 147721 | 107064 | 81203 |
| Failure rate | | 2.86% | 2.69% | 2.31% | 2.26% | 2.3% |
| Main foods Failure rate | Grain processing products | 0.68% | 0.84% | 2.23% | 1.03% | 1.2% |
| | Edible oil | 1.13% | 1.35% | 1.18% | 1.1% | 2.4% |
| | fats and their products | 1.06% | 1.26% | 1.55% | 1.40% | |
| | meat products | 0.27% | 0.24% | 1.26% | 1.60% | 2.0% |
| | egg products | 0.12% | 0.13% | 0.29% | 0.27% | 0.5% |

*Table 3.1: Annual Food Safety Sampling in China from 2018 to 2022 (State Administration of Market Supervision and Administration , u.d.)*

From the category of detected unqualified items, in 2022, some unqualified samples accounted for the total number of sampled unqualified samples as follows: pesticide residues exceeded the standard by 33.31%, microbial contamination by 20.73%, organic pollution by 11.12%, excessive use of food additives by 9.65%, heavy metal pollution by 8.04%, veterinary drug residues exceeded the standard by 7.85%.

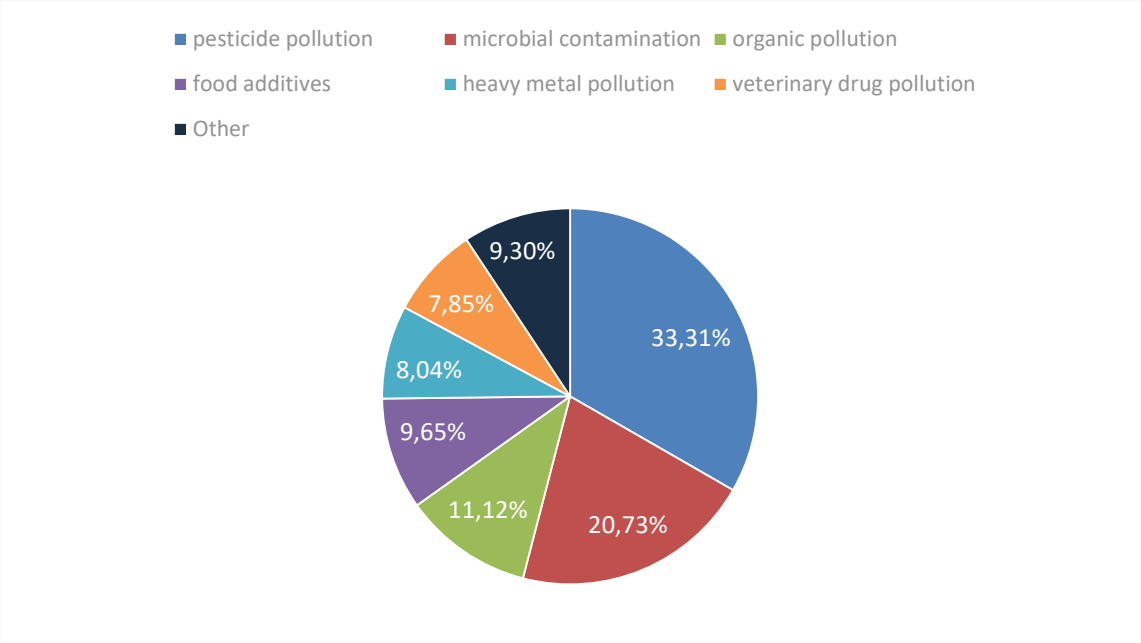


*Figure 3.1: The proportion of major unqualified factors in Chinese food in 2022*

## 3.2 Food Safety Legal and Regulatory System

Food safety is fundamental to the survival and development of a country. China's existing food safety legal and regulatory system is composed of the Food Safety Law, Product Quality Law，Agricultural Product Quality and Safety Law and others. These laws establish the governance concept of "*prevention first, risk assessment, full process control, and social governance*", establish multiple basic food safety supervision systems such as food safety risk monitoring system, food safety risk assessment system, food production and operation permit system, food recall system, and food safety information unified disclosure system, clarify the food safety supervision system, and provide legal system guarantees for achieving full process supervision, scientific supervision, improving regulatory effectiveness, and enhancing food safety level. The main laws and regulations are as follows:

| Name | Time |
|---|---|
| Food Safety Law | 2015 |
| Anti-Food Waste Law | 2021 |
| Product Quality Law | 2018 |
| Agricultural Product Quality and Safety Law | 2022 |
| Agricultural Law | 2012 |
| Standard Law of the People's Republic of China | 2017 |
| Regulations on the Implementation of the Food Safety Law | 2019 |
| Rules for the Implementation of the Law of the People's Republic of China on Standardization | 1990 |
| Regulations on the Safety Management of Agricultural Genetically Modified Organisms | 2017 |
| Regulations on the Administration of Pig Slaughtering | 2021 |
| Special Provisions on Strengthening Safety Supervision and Management of Food and Other Products | 2007 |
| Measures for the Supervision, Inspection and Management of Food Production and Operation | 2021 |
| Measures for the Administration of Food Production License | 2019 |
| Management Measures for Compulsory National Standards | 2019 |
| Measures for Investigating and Punishing Violations of Online Food Safety | 2021 |
| Measures for the Administration of Food Recalls | 2020 |
| Measures for the Administration of Food Business License | 2017 |
| Measures for Supervision and Management of Quantitative Packaging Commodity Measurement | 2023 |
| Regulations on Food Labeling Management | 2009 |
| Management Measures for Safety Review of New Food Raw Materials | 2013 |
| Management Measures for New Varieties of Food Additives | 2010 |
| Management Measures for National Food Safety Standards | 2010 |

*Table 3.2: Main Food Safety Laws, Regulations, and Rules in China*

## 3.3 Chinese Food Safety Regulatory Body

The market supervision bureau, health department, agricultural department, etc. exercise the power to supervise food safety risks. In collaborative governance, the government plays a leading role by closely linking the various entities involved in food safety risk regulation, making collaborative governance truly effective. By utilizing its authority and credibility, it enables food safety risk regulation to receive rights support and alleviates conflicts among various social entities in collaborative governance.

Although consumers and other regulatory entities do not have the enforcement power of government regulatory agencies, they each have their own roles. Consumers are a very large group that can discover many aspects that government regulatory agencies cannot regulate. Industry associations can teach businesses or enterprises to handle food safety risks in a timely manner when they discover them. Major media also play a very important role in guiding public opinion in various food safety risk supervision.

## 3.4 Chinese Food Safety Supervision System

### 3.4.1 Risk monitoring and evaluation system

Risk monitoring and assessment is the front-end of food safety supervision, which mainly focuses on risk prevention in food production and operation processes. China has established a food safety risk assessment system, which conducts risk assessments on biological, chemical, and physical hazards in food, food additives, and food related products based on food safety risk monitoring information, scientific data, and relevant information. The health administrative department of the State Council is responsible for organizing food safety risk assessment work and establishing a food safety risk assessment expert committee composed of experts in medicine, agriculture, food, nutrition, biology, environment, and other fields to conduct food safety risk assessment. The results of food safety risk assessment shall be announced by the health administrative department of the State Council.

In November 2021, in order to further implement the risk monitoring and evaluation system, the National Health Commission issued the *Regulations on the Management of Food Safety Risk Monitoring*, which standardized the responsibilities of relevant departments and institutions, especially added requirements for responsibilities related to foodborne diseases, and added a working mechanism for consultation to ensure that responsibilities are implemented effectively (The State Council of the People's Republic of China, 2019).

### 3.4.2 Food safety standard system

Compared to other regulatory systems, the food safety standard system is one of the most important components of the food industry regulatory system. As of the end of 2022, China has issued a total of 1478 national food safety

standards. From the content perspective, food safety standards mainly include four categories: general standards, product standards, production and operation norms, and inspection methods, covering various major links in food production and processing. Among them, the most widely known and widely concerned among food industry practitioners is GB7718. Food safety standards, as a unified concept, first appeared in the 2009 Food Safety Law. Prior to this, China had multiple standard systems, including food hygiene standards, food quality standards, and industry standards. For the first time, the Food Safety Law stipulated that food safety standards were the only mandatory standards, and there were no other mandatory standards besides food safety standards. In addition to being mandatory food safety standards, China also has a large number of recommended standards from the perspective of effectiveness, usually marked as "/T" on their standard numbers. From the perspective of the main body of formulation, there are also industry standards, local standards, and enterprise standards.

### 3.4.3 Operational regulatory system

The Food Safety Law implements the concept of "*full process and all-round supervision*", extends the food related production and operation links that are included in the supervision, and refines the requirements for each subject in each link, with a particular emphasis on the construction of the enterprise's own system, record keeping, and self-inspection. It is worth noting that the Food Safety Law and its implementation regulations have incorporated and refined relevant regulations on food storage and transportation supervision, online food trading supervision, and sales management of edible agricultural products, continuously improving the scope of food production and operation supervision.

**License system:**

China implements a license system for the production and operation of food, food additives, and packaging materials that come into direct contact with food and other high-risk food related products. The producers and operators of these products need to obtain corresponding food production and operation licenses or industrial product production licenses. But according to Article 35 of the newly revised Food Safety Law in 2021, if selling edible agricultural products or only selling prepackaged food, no license is required. In the same year, the State Administration for Market Regulation required operators who only sold prepackaged food to complete registration before conducting sales activities (Hu Jintao, 2021).

**Traceability system:**

Article 42 of the Food Safety Law establishes a comprehensive traceability system for food safety. The food safety traceability system refers to the system in which food producers and operators record and store information from various stages of the food production and sales process for the purpose of responsibility traceability (Hu Jintao, 2021).

**Recall system:**

According to the *Food Recall Management Measures*, recalls are applicable to situations where food producers and operators discover that food does not meet food safety standards or there is evidence to prove that it may harm human health. Food producers and operators should take measures such as harmless treatment and destruction for recalled food, while food recalled due to non-compliance with food safety standards in labeling, labeling, or instructions is allowed to continue sales after remedial measures are taken (Ministry of Justice of the People's Republic o China, 2015).

### 3.4.4 Operator credit supervision system

**Food safety inspection:**

The Food Safety Law stipulates that food safety supervision and management departments at or above the county level shall conduct regular or irregular sampling inspections on food, and strictly prohibits exemption from inspection. On this basis, a series of legal norms have been passed, including the Food Inspection Work Standards, Measures for the Investigation and Punishment of Online Food Safety Violations, Measures for the Management of Food Safety Sampling Inspection, and Measures for the Supervision and Inspection of Food Production and Operation. Formally, it includes surprise inspections, random inspections, etc. At the same time, in response to the increasingly widespread online sales and the internet plus catering industry, regulatory authorities have also issued multiple special regulations, including them as one of the key points of food safety inspections (Hu Jintao, 2021).

**Credit supervision system:**

Article 113 of the Food Safety Law establishes a food safety credit file system for food producers and operators. The newly revised implementation regulations and relevant departments have successively issued documents such as Memorandum of Cooperation on Joint Punishing Serious Disruptors in Food and Drug Production and Operation, Guiding Opinions of the General Office of the State Council on Accelerating the Construction of a New Credit-Based Supervision Mechanism in the Social Credit System, Clearly establish a blacklist system for serious illegal producers and operators, and include food producers and operators who engage in dishonest behavior in the scope of joint punishment, and increase the severity of punishment (Hu Jintao, 2021).

### 3.4.5 Responsibility and punishment mechanism

**Responsibility subject:**

From the perspective of responsibility subjects, China has established corresponding food safety responsibilities for different entities such as food producers and operators, catering service providers, schools and other centralized dining units, and network platform operators. It is clear that food safety violations will be held

accountable to individuals, that is, not only production and operation enterprises should bear corresponding responsibilities, but directly responsible personnel will also be punished as responsible subjects. The State Administration for Market Regulation issued the Guidelines for Food Safety Responsibility of Food Sellers (Trial), Regulations on Supervision and Management of Enterprises Implementing Main Responsibilities for Food Safety, aiming to clarify the responsibilities of key positions such as the main person in charge of the enterprise, the food safety director, and the food safety officer, and form a unified and layered responsibility system for food safety (Hu Jintao, 2021).

**Responsibility types:**

In terms of nature, China's food safety responsibility currently spans three major categories: administrative responsibility, criminal responsibility, and civil responsibility.

In terms of civil responsibility, enterprises that produce and operate products that knowingly do not meet food safety standards should not only bear losses, but also bear compensation of ten times the consumer price or three times the loss amount. If the increase in compensation amount is less than 904 DKK, it is 904 DKK.

In terms of administrative responsibility, in addition to imposing personal punishment (restricting employment), a relatively rare high penalty system in other legal norms has been adopted. Serious violations will face a penalty of thirty times the maximum value of goods.

In terms of criminal responsibility, an important aspect that deserves attention is the mechanism of punishing individuals. In 2018, the State Food and Drug Administration and the Ministry of Public Security issued the *Provisions on Strengthening Law Enforcement on Food and Drug Safety and Strictly Implementing Punishments for Food and Drug Violations to Individuals*, which specifically clarifies the mechanism for linking administrative and criminal activities. It also stipulates that if a unit engages in food and drug violations, in addition to imposing penalties on the unit, it is also necessary to punish the directly responsible supervisors and other directly responsible personnel; which can be the production and operation management personnel of the unit, or the employees of the unit, including those hired or hired (Hu Jintao, 2021).

## 3.5 Issues Facing the Implementation of the Food Safety Law

### 3.5.1 Food contamination issues

Food pollution is one of the important challenges for the comprehensive implementation of the Food Safety Law, on the one hand, regulatory agencies need to invest more resources in testing, resulting in high enforcement costs. On the other hand, food pollution makes the supply chain opaque, making it difficult to track the source of food

and affecting regulatory agencies' monitoring of food quality. The State Council's Opinions on Deepening Reform and Strengthening Food Safety Work points out that the current food safety problems in China are mainly food pollution, including microbial and heavy metal pollution, pesticide and veterinary drug residues exceeding standards, non-standard use of additives, environmental pollution gradually showing its impact on food safety, and low illegal costs.

### 3.5.2 Food safety traceability issues

At the legal level, the Food Safety Law has officially fixed the food safety traceability system in legal form for the first time, but it has not made more clear provisions on how enterprises can establish a food safety traceability system (FSTS). Due to the lack of uniformity in regulations and rules across departments and regions, it is not possible to form a nationwide unified FSTS. At the national and local government levels, there are many entities involved in the construction of food safety traceability systems in China. Due to various departments implementing different traceability systems in different fields and regions through different channels, it is difficult to integrate and exchange traceability information, and effective sharing cannot be achieved. Unable to truly achieve full traceability from origin to consumers.

### 3.5.3 Weak regulatory foundation issues

The weak regulatory foundation is also one of the reasons why the Food Safety Law cannot be implemented. The *National Plan for Improving the Quality and Safety of Agricultural Products (2021-2025)* issued by the Ministry of Agriculture and Rural Affairs points out that China's regulatory foundation is still weak due to two main reasons: on the one hand, there is a common shortage of personnel, funds, and means in grassroots supervision, and some agricultural products have not yet been included in the scope of risk monitoring and supervision inspections; On the other hand, there are numerous small workshops, vendors, and restaurants in China, and the problems of numerous, small, scattered, and disorderly enterprises are more prominent, making supervision difficult (The People's Republic of China, 2021).

### 3.5.4 Inconsistent food supervision issues

Since 2015, some cities and counties have merged newly established food and drug regulatory departments with departments such as industry and commerce, quality inspection, and pricing to form a "multi in one" market supervision bureau. On the one hand, this is conducive to streamlining institutions and integrating administrative law enforcement forces, but on the other hand, some areas have weakened the function of food safety supervision. At the grassroots level, market supervision departments have been established, while at the higher level, there are still departments such as food and drug regulation, industry and commerce, and quality inspection. With multiple

directives from the higher authorities, the lower levels are struggling to cope, leading to a lack of coordination and other challenges. At the same time, issues such as inconsistent identification of regulatory agency names, inconsistent enforcement basis, inconsistent enforcement procedures, and inconsistent legal documents have affected the effectiveness of legal implementation.

### 3.5.5 Insufficient cold chain logistics capacity

On the one hand, cold chain logistics control food temperature, prevent bacterial growth, extend the Shelf Life of Food, ensure safe transportation and storage of food in the supply chain, and thus maintain food safety issues. On the other hand, cold chain logistics systems are usually equipped with advanced traceability technologies, such as temperature sensors and real-time monitoring systems, providing reliable data support for food traceability and law enforcement. According to the cold chain circulation public information service platform, the inventory of cold storage in China reached 52.24 million tons in 2021, with one refrigerated truck per 10000 people; According to the 2019 US cold storage capacity of 103 million tons, with an average of one refrigerated truck per thousand people. The per capita ownership of cold storage and refrigerated trucks in China is less than one tenth of that in the United States. From the perspective of cold chain circulation rate, the cold chain circulation rates of fruits and vegetables, meat, and aquatic products in China are only 22%, 34%, and 41%, while those in Europe and America are all above 95%, with meat products reaching 100%. Therefore, compared to the European and American markets, China's cold chain supply is insufficient (Zhang & Wang, 2023).

### 3.5.6 Insufficient ability to quickly detect food safety

The ability to quickly detect food safety is an important auxiliary means for the effective implementation of food safety laws. By quickly identifying risks, improving regulatory efficiency, and ensuring that food quality meets regulatory standards. After the revised version of the Food Safety Law was introduced in 2015, the market demand for fast food testing rapidly expanded due to the advantages of convenience, speed, and low cost of fast inspection products. However, currently, the market share of fast-food testing only accounts for about 10% of the entire food inspection market. Main reasons: The ability and scope of rapid food testing are limited, and the items and types of food that can be detected by food rapid testing boxes are limited; The specificity and accuracy of rapid food testing are not high.

# CONCLUSION

China's grain production forms the backbone of its national food security strategy. While historic efforts have significantly boosted yields and reduced dependence on imports, the country continues to face evolving challenges, including climate change, urbanization, and resource scarcity. These stressors not only affect production but also intensify issues related to food loss, environmental degradation, and water shortages. Sustainable farming practices, enhanced efficiency, and climate-resilient technologies are crucial to securing future food supply.

However, food security is not only a matter of quantity, but also quality and safety. As China’s food system becomes increasingly complex, robust food safety governance has emerged as a critical component. From contamination risks and insufficient cold chain infrastructure to challenges in traceability and regulatory enforcement, ensuring the safety of food throughout the supply chain is vital. Strengthening the legal and regulatory framework, improving rapid detection technologies, and addressing weak points in supervision will be key to restoring consumer confidence and safeguarding public health.

Going forward, China must continue integrating food safety with its broader agricultural policies. Coordinated investments in science and technology, sustainable resource management, and smart regulatory systems will help build a resilient agri-food system. Balancing domestic production with international trade partnerships, while upholding both food availability and quality, is essential to realizing long-term food security in the country.

# LIST OF FIGURES



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