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# Research on Food Science and Technology Innovation Based on National Food Security: A Case Study of Hubei Province

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**Abstract** Based on the background of national food security, this paper analyzes the current situation of food production in Hubei Province that except food yields, overall production situation is not good. Through the food production, storage and circulation, this paper describes the role of food science and technology innovation in food security, and further points out the problems of food science and technology innovation system in Hubei Province, such as disconnection between food science and technology innovation research and food production as well as economic development, backward management system failing to adapt to the needs of agricultural transformation, and low conversion rate of food scientific and technological innovation. Based on this, this paper sets forth the recommendations for food security in Hubei Province.

**Key words** Food security, in Hubei Province, Food science and technology, Innovation system

## 1 Introduction

According to statistics in 2014, the contribution rate of food science and technology reached 56 percent, making a significant contribution to China's grain production. Hubei is not only one of the thirteen major grain producing areas, but also one of the nine major commodity grain production bases, playing a very important role in ensuring a stable supply of food. However, with the rapid development of the industrialization, modernization and urbanization, huge loss of labor, and increasingly serious phenomenon of idle land, the province's food production is facing great challenges, and food science and technology innovation has become the only way to solve the problem of food security in the province.

## 2 The status of food production in Hubei Province and the entire country

**2.1 Increasing total food production but declining proportion** In recent years, China and Hubei Province have introduced a number of favorable policies to stimulate farmers' enthusiasm for grain production. In 2014, China's grain yield achieved dramatic increase and Hubei's grain yield maintained a sustained trend. According to relevant statistics, Hubei's grain output has maintained a steady growth trend since 2003, with an average increase of about 2.8%, and the average growth rate of the country's grain output is about 3.2%. However, the proportion of Hubei's total grain output to China's total grain output was obviously volatile, and the proportion fell from 5.5% in 1990 to 4.1% in 2014.

**2.2 High level of grain yield for a long time** Hubei's grain yields have remained at a high level. The province's rice yield is still ranked first in the country, with rosy situation. The province's

grain yields have risen since 1978. In 1994, it took the lead into the 5000kg/ha level, while the national grain yield reached this level in 2011. In 2014, national grain yield reached 5385 kg/ha, while the province's grain yield reached 5913 kg/ha. The province's grain yield is expected the next year into the 6000 kg/ha level. These data show that long-term grain yields of Hubei Province are at a high level.

### 2.3 Decreasing sown area of three major grain crops

Wheat, rice and corn are the main food crops in Hubei Province, and their production accounts for a large proportion of the province's total grain output. In 1990, wheat sown area was 1.3521 million ha, and fell to 716200 ha in 2005. The sown area was 1.10 million ha in 2014, showing overall downward trend. Rice sown area fell from 2.64 million ha in 1990 to 2.10 million ha in 2014. Corn sown area shows a steady rising trend, which may be related to a significant increase in feed use industrial use of grain in recent years. However, the sown area of three crops, in the aggregate, still shows a slow downward trend.

**2.4 Unchanged ranking of Hubei's grain production** All along, Hubei's grain production occupies a very important position in China, and its status can not be underestimated (Table 1). Table 1 data show that the province's ranking remains unchanged in China, and it has been stable at around 10, indicating that Hubei has made a great contribution to China's grain production.

## 3 The role of food science and technology innovation in food security

### 3.1 Improving the level of security in food production

Food production is often affected by many factors, including seeds, cultivated land, cultivation techniques, environment, pests and diseases, the level of facilities and so on. Through innovation, food science and technology can be used to cultivate high-quality, high-yielding and low-consumption improved varieties and improve the breeding level. For example, rice has gone from general cultivation-dwarf varieties-hybrid rice series, then three-line,

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two-line successfully developed new hybrids. In recent years, Yuan Longping super rice research and development has also been carried out in some areas again. Food science and technology innovation is also reflected in the innovation of food cultivation techniques, irrigation technology, improved grain varieties, efficient

**Table 1** Hubei's ranking in terms of grain production

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Ranking	9	10	10	10	10	10	10	10	10	10	10	11	11	10

**3.2 Ensuring food storage security** Food storage security, which means that the grain distribution can be successfully guaranteed success and the country's reserve food can be effectively supplied to supplement the food supply gap, plays a very important role in stabilizing the grain market. Grain storage is typically in a closed, dry and cold conditions, but the water content of the food itself is the key to determining the quality of food, and too high or too low moisture content will lead to food deterioration, reducing the amount of food storage<sup>[1]</sup>. Food science and technology can be a good solution to this problem by analyzing the structure of molecules inside the food and developing targeted testing instruments and management equipments. These instruments can be used to provide timely and effective food quality temperature, humidity, moisture, pests and diseases reserve information to improve the ecological conditions of food and effectively protect the food storage safety.

**3.3 Promoting food security in the circulation** According to statistics, about 50 percent of China's total grain is for circulation, and it is necessary to ensure that every aspect of security in the area of food circulation is an important part of food security work<sup>[2]</sup>. In the advanced information age, traditional food logistics has also experienced rapid development, and gradually become a modern science and technology to support the modernization of logistics model. In the food distribution process, by using food science and technology innovation, it can always monitor and control the entire process of grain circulation, including quality, health conditions, quantity, space, efficiency and services, and make timely feedback and handling. Meanwhile, grain logistics facilities can be transformed through technological innovation to meet the ever-changing market requirements. We can say that scientific and technological innovation can improve the management level and has the ability to control information in the field of grain circulation, and ultimately promote food safety in the circulation.

**4 Problems in Hubei's food science and technology innovation system**

**4.1 Food science and technology innovation research and development is separated from food production and economic development** The aim of food science and technology innovation is mainly to improve food productivity, thus promoting social and economic development. At present, there are various research institutions in Hubei, and the scientific and technical exchanges and cooperation between various departments are unable to open. It

use of resources, and reduction of arable land pollution. At the same time, by using food science and technology innovation, it can ease the current situation of food production, reduce the risk of food production and improve food production quantity and quality and safety.

lacks complementation between research institutions and business, and there is a waste of scientific and technological resources. Meanwhile, there are considerable scientific researches in Hubei every year, but most of them are academic, and it is difficult to contribute to the food production and market economy. Under the influence of these factors, Hubei's food science and technology innovation is not closely linked up with food production and economic development. In grain breeding, the grain varieties are mixed, and cropping factor is not high, which is difficult to meet the demand for food production; in food production, there is agricultural and agronomic separation in food cultivation techniques and irrigation technology; in food processing, total food processing profit is still much lower than that of some other provinces.

**4.2 Food science and technology innovation management system is lagging behind and it is difficult to adapt to the needs of agricultural transformation** At present, Hubei's food science and technology innovation management system is still outmoded, and management organization in the provision is unreasonable. The decisions are inefficient and the specialization of the entire management team is not high. It lacks initiative and creativity in the technological innovation, distribution and research, and optimal allocation of resources, hampering the food science and technology innovation. Agricultural education, agricultural research and agricultural extension are fragmented due to the different management systems among the various departments, resulting in a lack of inter-departmental communication and cooperation, so it is difficult to achieve mutual learning purpose and provide real services for farmers in practice. In speeding up the process of agricultural modernization, it is faced with increasingly stringent requirements of food production, and the current food innovation management system can not meet the needs of agricultural transformation.

**4.3 Application of food science and technology is insufficient and the conversion rate is low** In speeding up the process of land transfer, more and more skilled management personnel are engaged in food production, and these farmers have become the main force in grain production<sup>[3]</sup>. These new farmers also encounter difficulties in seed selection, food storage and transportation, sales, and food processing. Although Hubei has made great efforts to build agricultural extension institution, it still lacks extension staff, and there are big differences in the food crop production technology and improper promotion methods, making innovative food science and technology difficult to become effective tool for major grain growers. So, backward food science and technology

information can not effectively solve the technical difficulties of these farmers. Meanwhile, the results of relevant research institutions are not efficiently applied, and extension services are difficult to produce new scientific and technological achievements. Under the traditional mode of extension, the technical problems encountered in the work are not timely fed back to the scientific research departments, resulting in low conversion rate of food science and technology information.

## 5 Recommendations

### 5.1 Vigorously promoting the production-learning-research cooperation model and promoting scientific research to be closely combined with economic development

There are a lot of researches annually on food production in Hubei, but they are rarely used in the actual production. Firstly, the research evaluation mechanism must be improved and innovated, and there is a need to attach importance to the actual ability to apply. Secondly, it is necessary to integrate and reasonably allocate the existing food science and technology resources, vigorously promote collaborative innovation model of production and research, strengthen mutual cooperation between universities or research institutions and enterprises, and fully improve benefit-sharing and risk-sharing awareness of universities, enterprises and research institutions, to closely combine scientific research with economic development.

### 5.2 Innovating food science and technology management system and guiding the direction of development of food science and technology

To guarantee the smooth progress of food science and technology innovation, we must improve and innovate the management mechanism of food science and technology, which is a prerequisite for promoting the effective implementation of food science and technology innovation. Firstly, since food science and technology personnel are the main subject of food of technological innovation, it is necessary to fully mobilize the enthusiasm of the food science and technology personnel to create a good working environment, stimulate their potential and innovate talent evaluation and incentive mechanism. Secondly, as a carrier of the whole management activities of food technological innovation, management organization plays a role in the integration and allocation of resources, as well as assignment of personnel<sup>[5]</sup>. It is necessary to optimize the management structure to improve decision-making efficiency, construction quality and professional management team. Finally, it is necessary to innovate food science and technology management system, and scientific research departments at all lev-

els need to cooperate with each other to coordinate and guide the rational flow of scientific and technological resources for food industry, and increase research funds to promote food science and technology innovation.

### 5.3 Increasing food science and technology promotion service platform and establishing diversified promotion body

Food science and technology promotion department, as an important support system of food science and technology innovation, needs to develop its platform. Firstly, it is necessary to make full use of technology to enhance service capability of food science and technology promotion department, and vigorously promote the rural construction. Secondly, it is necessary to strengthen the linking between various food innovation entities, increase scientific and technological exchanges and cooperation between researchers, industries, or regions, and provide technical guidance and information services, to promote food science and technology innovation. Finally, it is necessary to establish a diversified extension system in food science and technology promotion agencies. Cooperative organizations in rural areas, food research and education institutions, food associations and nonprofit organizations can be developed for the promotion of science and technology<sup>[6]</sup>. There is a need to increase efforts to promote food science and technology and strive to make every farmer enjoy the income from food science and technology innovation.

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