Application of Intelligent Traceability Management System in the Production of Yongbei Golden Pear

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ABSTRACT

In recent years, frequent food issues have made more and more people pay attention to the quality and safety of food. The application of traceability system provides consumers with a quality assurance. The introduction of two-dimensional bar code technology enables consumers to understand the production and circulation process of food. It can track the whole process to ensure the quality and safety of agricultural products, and accelerate the popularization of food traceability technology in actual agricultural production. As Yongbei Golden Pear is a cash crop planted on a large scale, its quality and safety have become the top priority in the production process. In this paper, the application of two-dimensional code technology and RFID technology for traceability of agricultural products and foods is analyzed, and the implementation and application of intelligent traceability management system in Yongbei Golden Pear production are mainly introduced.

Keywords: Ttraceability system, Quality and safety of agricultural products, Yongbei Golden Pear, Two-dimensional bar code, Traceability system.

1. INTRODUCTION

The quality and safety of agricultural products refers to the reliability, usability and intrinsic value of agricultural products, including the nutrition, hazards and external characteristic factors formed and remained in the process of production, storage, circulation and use. It needs to meet not only the requirements of grade, specification and quality, but also the hazard level to human and environment [1]. With the development of science and technology and the frequent occurrence of food issues in recent years, the requirement of people for food have undergone a fundamental change, from full eating to safe eating, and the guarantee of food safety is to establish a sound intelligent traceability management system. The research on traceability system of agricultural products has been carried out earlier in developed countries [2]. At present, some developed countries have established relatively perfect food quality and safety management system. The research on traceability system in China is relatively late, and it is still in the initial stage of construction. Moreover, the research on traceability management system in China can not be separated from the strong support from the government.

2. RESEARCH BACKGROUND AND SIGNIFICANCE

Tianjin Aodong Fruit and Vegetable Planting Specialized Cooperative was established with the support of Municipal-level Assistance Funds and State-owned Assets Supervision and Administration Commission of Tianjin People's Government Assistance Funds. It was jointly organized by Aodong Village, Shigezhuang Town, Wuqing District. After on-the-spot investigation and related research, the Cooperative found that the Shangchanghe Golden Pear variety planted in Henan Province has a good development prospect, based on which, in 2015, Tianjin Municipal Committee approved the economic development plan of One Village, One Policy in Aodong Village, planting Shalite golden pear. Since its establishment, the Cooperative, supported by various parties, has made some achievements in the cultivation of Golden Pear, and registered the trademark of Yongbei Golden Pear. In order to dig into the brand connotation of products and further develop the deep processing of Yongbei Golden Pear, the Cooperative plans to increase the research and development of Golden Pear derivative products, such as pear vinegar, pear syrup and pear beer, and use new technologies to

create new Yongbei Golden Pear products. However, the premise of all these studies is to maximize the quality and safety of the agricultural products [3]. Food traceability system can better protect consumers according to the components of food safety and food quality, the internal defense and demand of the food chain, such as accurately locating recall objects, eliminating non-consumable food, and promoting the investigation of the causes of food safety problems [4].

With the development of rural economy and the popularization of agricultural technology in China, the supply pattern of agricultural products has undergone a fundamental change, and the variety and quantity are increasingly abundant. However, due to the relatively weak agricultural infrastructure, pesticide residues and pollution of agricultural products still exist. The information of agricultural products cannot be effectively transmitted, and the safety of agricultural products cannot be guaranteed, resulting in frequent incidents of agricultural product safety. The quality and safety of agricultural products is one of the social problems that people all over the world are most concerned about. The 13th Five-Year Plan clearly pointed out that it is essential to promote the construction of a healthy China, implement the food safety strategy, and form a strict and efficient food safety governance system with social co-governance. In recent years, although the quality and safety of agricultural products in China is improving, and major food safety incidents is decreasing year by year, the supervision mode is still the traditional post supervision and the supervision objectives are still relatively limited. Therefore, in order to ensure food quality and safety, China needs to establish a sound quality and safety traceability system.

Agricultural product quality and safety traceability system can supervise the whole process of agricultural products from farm to table, which has been introduced by the Agricultural Product Quality and Safety Law and can solve the quality and safety problems to a certain extent. Traceability system of agricultural products enables regulators or consumers to trace all kinds of information of agricultural products according to bar codes. Once quality problems occur, supervisors can accurately determine the responsibility of individual operators who cause quality and safety accidents according to traceability management, so as to strengthen the safety awareness of production and business units. Traceability system of agricultural products makes every step of all links such as production, transportation and sales of agricultural products recorded, which can fundamentally guarantee the quality and safety of agricultural products and protect the rights and interests of consumers. Therefore, it is of great significance to construct the traceability system of agricultural product quality and safety for

realizing resource sharing and safety prevention and control of agriculture.

3. AGRICULTURAL PRODUCTS TRACEABILITY SYSTEM AT HOME AND ABROAD

Since 1990s, many countries and regions have started to establish traceability system of agricultural products to ensure the quality and safety of food. As the European Union, Japan and the United States started earlier, they already have sound and advanced food quality and safety management systems. Moreover, the traceability system characterized by prevention, control and traceability has been gradually established and implemented, which makes food safety production monitored throughout the whole process. Therefore, the construction of traceability system of agricultural products in developed agricultural countries is relatively mature. The development history of traceability system at home and abroad is shown in Figure 1.

Compared with Europe, Japan, the United States and other countries and regions, the research and establishment of agricultural product quality and safety traceability system started relatively late in China. With the continuous development of China's science and technology and economic strength, many domestic institutions and scholars have conducted in-depth research and discussion on food traceability system and made certain achievements [5].

At present, the construction of traceability management system of agricultural products quality and safety in China is still in the preliminary research stage, in which government departments such as Ministry of Agriculture, Food and Drug Administration, Ministry of Commerce, Ministry of Industry and Information Technology play an indispensable role.
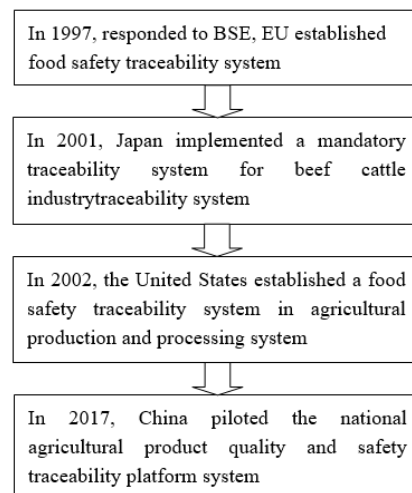

Figure 1 Development history of traceability system at home and abroad

Through in-depth research by some experts, scholars and institutions in China, China has made progress in the construction of traceability system for agricultural products quality and safety. In 2011, the Establishment and Demonstration of Electronic ID Card for Pollution-free Vegetables in Tianjin was launched, which provided technical support for ensuring safe vegetables. It mainly focused on facility agriculture and aquaculture [6]. Tianjin Aodong Fruit and Vegetable Planting Specialized Cooperative found that Golden Pear was adaptable and easy to cultivate, so it could be planted on a large scale. At the same time, Aodong Village is the main production area of Golden Pear in Tianjin, which is conducive to the implementation of monitoring management and standardized production scheme, and the establishment of quality and safety traceability system, so as to realize the tracking and tracing of the whole supply chain. The upstream and downstream traceability systems can be connected by the Internet to achieve information sharing. The information verification mechanism between upstream and downstream participants and the full participation of consumers, enterprises and governments will greatly improve the credibility of the tracked information [7].

On June 30th, 2017, the national agricultural product quality and safety traceability platform was put into trial operation in Shandong, Guangdong and Sichuan, which indicated that the national agricultural product quality and safety traceability platform was constantly improving and had entered the stage of popularization and application. The platform mainly includes four system: tracing, supervision, monitoring and law enforcement, and besides, it also includes command and dispatch center and supervision information network.

On January 1, 2018, the Credit Professional Committee of China Information Association, China Quality Certification Center, China Article Coding Center and China QR Code Registration Certification Center jointly initiated the establishment of China Traceability Service Industry Alliance, and released the first China Traceability Service Industry Development Report. It can be seen from its official website that it is dedicated to promoting the construction and pilot application of traceability system in important product fields, driving the formulation of China's unified traceability service technical standards and application standards and evaluation and certification system, setting up a traceability special domain name mechanism to establish a traceability credit system, building a national traceability service platform based on the traceability special domain name mechanism, accelerating the establishment of a sound traceability service industry ecological mechanism to promote the standardized development of industry, and leading enterprises to fulfill social responsibility in term of Healthy China, Poverty Alleviation, the Belt and Road Initiative [8]. The establishment of China Traceability

Service Industry Alliance can effectively promote the construction of China's important product traceability system, improve the credit environment, strengthen the overall competitiveness of the country, and promote the high-quality development of the national economy.

4. APPLICATION OF QR CODE, RFID AND OTHER TECHNOLOGIES IN THE TRACEABILITY MANAGEMENT SYSTEM OF YONGBEI GOLDEN PEAR

In today's competitive economy, traceability is a key concept across all products and all types of supply chains. The core supporting technology for traceability is the Automatic Identification and Data Capture (AIDC) technology [9]. With the progress of science and technology and the development of economy, Internet of Things technologies such as radio frequency identification (RFID) technology, sensor technology, cognitive computing and intelligent control technology, nanotechnology and network convergence technology have developed rapidly [10]. It is because of the R & D and promotion of these key technologies that the intelligent development of traceability system has strong technical support. The compilation of traceability codes of origin, type, grade and production date of agricultural products is based on the characteristics of regionality, freshness and variety of agricultural products. At present, the mainstream traceability codes of intelligent traceability system are based on two-dimensional barcode and radio frequency identification technology, which take product identification as information carrier [11].

RFID technology plays an important role in agricultural product traceability system. It is a kind of radio frequency technology. Compared with traditional bar codes, it has the following advantages: it does not need visual reading, and it can be identified at a long distance; It can be identified regardless of the motion state of the article; Multiple tags can be identified at the same time; it can store more information. The characteristic of RFID in food traceability is that it exists like an ID card, giving each item a unique ID number in the world. Therefore, the information of each item can be collected independently, so as to achieve the goals of anti-counterfeiting, and quality traceability.

However, because the unit value of RFID is high, the unit packaging cost of agricultural products using RFID is high, which is not suitable for large-scale use. Two-dimensional code technology, however, provides a solution to this problem. Compared with radio frequency identification technology, QR code has a novel and effective tracing method while transferring RFID data seamlessly.

Two-dimensional code refers to a basic management information system consisting of a group of regularly

arranged bars, spaces and numbers. It can quickly obtain accurate information of products to prevent unqualified and substandard products from entering the market. A unique two-dimensional code belonging to the smallest package is drawn up, which is equivalent to establishing the ID card of the smallest package product. Then the information of the product can be tracked. The two-dimensional code is created from the beginning of agricultural product planting to the farmers scanning the code to select the relevant planting information before each work, such as sowing, fertilization, weeding, picking and recording the relevant time and person in charge. At the same time, the technology of the Internet of Things in agriculture is applied to the intelligent traceability management system. The staff can obtain the parameters of plant growth such as temperature, humidity, light intensity and plant nutrient content by wireless network, and realize the acquisition, management, display, analysis and processing of all base test point information, so as to automatically control and manage the operation of agricultural parks, and record real product information. The advantages of two-dimensional bar code in traceability are shown in Table 1.

Based on the discussion above, the current operation principle of Yongbei Golden Pear Intelligent Traceability System in Tianjin Aodong Fruit and Vegetable Planting Specialized Cooperative is mainly reflected in the application of two-dimensional code. Farmers can record and manage production operations by scanning code, which not only saves the tedious and troublesome paper records, but also strictly controls the production process of Golden Pear, thus achieving the goal of improving product quality and safety. In addition, consumers can scan the two-dimensional code on the package on the terminal. The information in the code covers not only the basic information such as the name and origin of Golden Pear, but also the relevant information from the field to the dining table such as planting records. After understanding the whole production process of Golden Pear, consumers can safely eat Golden Pear produced in this village. The implementation of traceability system, on the one hand,

facilitates consumers to inquire about the information of Golden Pear. On the other hand, it helps to improve the influence of the Cooperative and establish its brand image, enabling Aodong Golden Pear to gain a higher market share among many homogeneous products and become a characteristic product of Aodong Village [12].

At the same time, the intelligent traceability system of Yongbei Golden Pear integrates the information of automatic monitoring sensors such as field environment information, carriage environment of transportation vehicles, GPS, real-time video monitoring, etc. Through GPS positioning and two-dimensional code recognition technology, each tree seedling and each planting plot are positioned and numbered. The information of field operations such as planting, irrigation, fertilization, weed control, pollination, fruit thinning, bagging, pest control, picking and harvesting is recorded by mobile phone automatically, which replaces the traditional manual recording and input operation. With the help of digital content records such as pictures and videos, every field operation can be traced. Traceability information of the whole planting process is linked to the traceability management of customized information such as order, packaging and shipment, so that consumers can see the whole process from production to sales by scanning code and QR code on their mobile phones.

5. THE BENEFITS BROUGHT BY THE ESTABLISHMENT OF INTELLIGENT TRACEABILITY MANAGEMENT SYSTEM FOR YONGBEI GOLDEN PEAR

In recent years, the quality and safety of agricultural products has aroused widespread concern in society. There is a higher demand for quality and safe agricultural products, which, however, is difficult to be guaranteed by market. Therefore, introducing traceability management into the production process of agricultural products is one of the effective ways to solve this problem. The construction of intelligent traceability management system of Yongbei Golden Pear can strengthen the docking and information sharing

Table 1. Advantages of two-dimensional bar code in traceability

Easy to use	Without cumbersome operation, the traceability query of product information can be completed by scanning the code on the mobile phone, which is convenient for consumers to look for product-related information
Integrate all circulation	Starting from the personal needs of each role in the product flow, the relevant links of the product flow are organically combined to form a real product solution
Widely used	It can be used for traceability product flow management of grain, oil, eggs, vegetables, cooked food, fruits, food semi-finished products and other products. It has a wide range of applications
High scalability	The whole process is in a complete chain, and each link is closely connected with each other, based on which, a variety of applications around the product identification QR code can be generated
Strong fault-tolerance	This makes it possible to read the two-dimensional bar code correctly when it is damaged partly due to perforation and contamination, and the information can still be recovered when the damaged area reaches 50%

of upstream and downstream traceability systems. When food safety incidents occur, problems and responsibilities can be quickly clarified through traceability management system, so as to identify the source of the incidents and put forward solutions in time. Therefore, the social benefits it brings cannot be ignored.

From many years of practical experience, the development trend of modern agriculture has gradually returned to its original source, from simply focusing on interests to paying equal attention to ecological benefits. Only by realizing sustainable development can we obtain lasting benefits. Reducing the use of pesticides, the amount of chemical fertilizer per unit of cultivated land and the effective irrigation rate can measure the ecological benefits. Yongbei Golden Pear traceability system records the whole process of planting, topdressing and picking. On the one hand, it realizes the intelligent management of the production process, on the other hand, it also plays an effective role in monitoring and ensuring the ecological environment of the planting area. As the production information is transparent and traceable on the traceability platform, producers need to take care of the top dressing, pesticide application and irrigation operations, so as to ensure the accuracy and credibility of the information, and avoid the damage to the land caused by the traditional extensive management. In modern agriculture, the use of chemical fertilizer can quickly and effectively improve the productivity of agriculture to obtain higher yield, but excessive use of chemical fertilizer will lead to soil hardening and environmental damage. The traceability system can determine the appropriate amount of chemical fertilizer according to the growth of each plant, so that it can achieve the highest yield with the least chemical fertilizer. Similarly, the traceability system of pesticide usage can still be controlled. During the growth of Golden Pear, it is necessary to replenish water in time. Therefore, the effective irrigation rate is very important. The traceability system of Yongbei Golden Pear can determine the irrigation ratio according to the planting area and other factors, so as to achieve effective irrigation rate and generate more ecological benefits.

6. CONCLUSION

Yongbei Golden Pear intelligent traceability management system is aimed at the whole production process of the Golden Pear from planting to consumption. In this paper, from the perspective of production demand of Yongbei Golden Pear, the relevant theories of agricultural product traceability and traceability code technology were expounded, and the application of agricultural product traceability management system at home and abroad was analyzed, and the following conclusions can be drawn:

(1) The intelligent traceability management system of Yongbei Golden Pear established by using two-dimensional code and other advanced technologies can fuse, query and monitor the information of Yongbei Golden Pear, so as to realize the purpose of safe production of Yongbei Golden Pear. .

(2) The establishment of Yongbei Golden Pear intelligent traceability management system can promote Yongbei Golden Pear to become the characteristic brand of cooperative agricultural products, and realize the purpose of cooperative agricultural products sales and brand image enhancement.

(3) The establishment of intelligent traceability system makes the whole process of agricultural products from planting to consumption traceable, and provides a channel for improving the overall added value of agriculture. It has a broad application prospect.

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