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Establishment of Quality-Safety Traceability System for Navel Orange

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Abstract

Traceability system has been an import means in food quality and safety management. Governments in many countries are putting increasing emphasis on establishment of food traceability systems. According to production, processing, storage and distribution of the feature agricultural products---navel orange in the central mountain area of China, this article proposes the technology line and the main result of the research of traceability for quality safety of navel orange.

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Keywords: feature agricultural products; navel orange; trace of quality; traceability

1. Introduction

Navel orange is a kind of feature agricultural products in the central mountain area of China. It mainly distributes in the Gannan area of Jiangxi province. Gannan navel orange is the most special product in Jiangxi citrus production and has been an import means in increasing income of peasants. But, the quality safety incidents of navel orange in recent years have dealt a blow to navel orange's reputation and cause great

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economic loss. For example, the “dyedorange “incident made the navel orange of the 70% of Hong Kong market share reduce to zero in 2004;the “Bactrocera” incident in Sichuan Gung Yuan area was a great blow to the south citrus production in 2008.Market rate was below production cost. The bid of a part production was only 20% of production cost. The peasants suffered heavily loss.Typical of agricultural products of Central Mountain Gannan navel orange as the research object, we explore the monitor points of full traceability of quality and safety of the typical ofagricultural products in our country, and the retrospective business processes, relative standards and key technologies applied to safety and quality of typical of agricultural products in our country.

Because of efficient risk control, food traceability systems receive muchattention by many countries. Food traceability systems mainly apply in animal husbandry in developed countries at present, and gradually cover into vegetables、 fruit and so on.The United States issued the regulation for food safety, demanded all the companies which involve in food transportation、 food distribution and food import establish and save the whole records about the food distribution indecember,2003(2). In 2008, the Canadian federal government reached an ambitious goal.The country has achieved tracing back 80 percent of agricultural products to its source, supporting the "Brand Canada strategy"(7).The Japanese Government has passed new legislations required meat processors to collect and save time in the slaughter of livestock per head DNA samples (9).

In the past decade, a series of traceability system for quality and safety of agricultural products came into being, quality and safety monitored traceable system for chicken safety and quality production (YunfengBai, ChanghuaLu, 2005), quality tracking and traceability information system for the entire process of beef production in quality and safety (ShusenZan,TongchaoZheng, 2005) , Origin Digital System for Factory Pork Production Safety (ChanghuaLu, JufangXie, 2006), the main grain and oil product quality and traceability system (ShihongLiu, HuoguoZheng, etc., 2008), are all highly representative of the research results.

2. Methods And System Design

2.1. Methods

The use of modern informationtechnology, the entire process of traceable digital management, fast tracking and traceability of product quality and safety, traceability application support and rapid traceability across the network platform construction and other major breakthroughs in key technologies help to construct a number of software and hardware platform of independent intellectual property rights, and achieve demonstration and application in the mountains of central China to explore retrospective method for the quality of the typical of agricultural products suitable for China's national conditions.

2.2. System Design

Quality and safety of Orange tracking and tracing technology decompose the overall architecture from three levels of the information collection, information processingand information services. In the information collection layer, through sorting out process from planting to harvesting and the process of production of the navel orange product, we investigate their business processes, analysis hazards, explore and determine factors which affects the quality and safety of navel orange, and get product processing, quality inspection, logistics and marketing and other aspects of quality and safety information which basedon processing and production of enterprises, build traceability data center of navel orange, and provide data support to achieve the ultimate traceability. In the information processing layer, using HACCP(1)and other quality management methods and tools toanalyze and determine key factors of the quality and safety indicators of navel orange. Using the encoding information technology, information exchange, management and hardware R & D of digital

technology, we can complete traceable information portal of quality and safety of navel orange and research the technologies. In the information services layer, information services of quality and safety of orange could be provided to consumers, business managers and regulators through the network platform, supermarket touch screen, original mobile terminals and other methods. Overall system framework is shown in Figure 1. The traceability data centered original solution is shown in Figure 2.

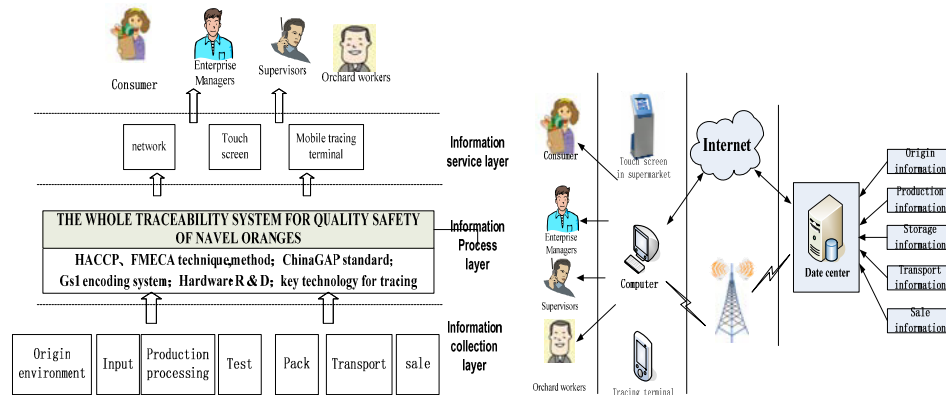


Figure 1. System architecture diagram Figure 2: Data-center retrospective programs at the core

2.3. System Function

The traceability system for quality safety of navel oranges focuses on the whole process of information management which in the production and processing of navel orange, and provides services that consumers can get the safety information of navel orange from online platform. Functional modules shown in Figure 3:

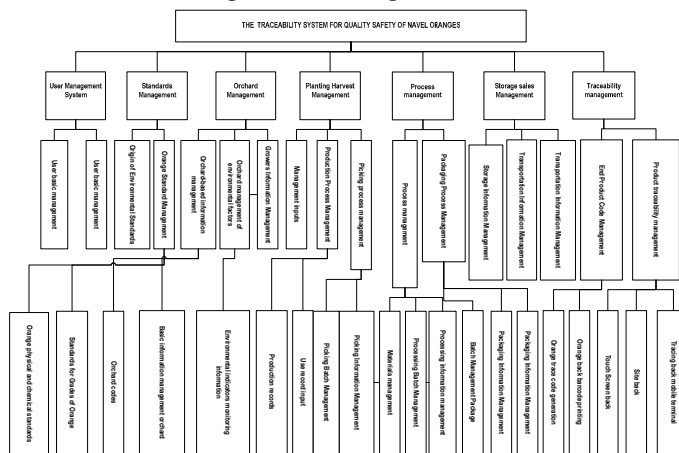


Figure3. The functional modules of traceability system for quality safety of navel orange

3. Results

3.1. System architecture diagram for traceability system

Using HACCP techniques, combined with China GAP, can analysis quality and safety of the navel orange chain trace. It can also raise the quality and safety of major hazard sources and analysis to determine the quality and safety indicators and critical control points in the various aspects of orange source trace chain. It can not only establish the traceability for quality and safety of navel orange indicator system, but also determine the key indicators of quality and safety orange. Navel orange elements of HACCP Hazard are shown in Table 1.

Table 1. Navel orange HACCP Hazard Analysis Table

Production Program	Safety hazards	Hazard is Significant or not	Judgments on the basis of the third column	Preventive measures	Whether the CCP
Parksite selection	Biological hazards	N			N
Application Management	Biological hazards	Y	Fertilizer Storage	Separate fertilizer and fruit	
Transportation	Biological hazards	Y	The breeding of pathogens during transport	Control of transport conditions&the environment	N
Sale	Biological hazards	N			N
	Chemical Hazards	N			N
	Physical hazards	N			N

3.2. Orange trace chain quality and safety control and controlling aspects of metadata elements standards

According the safety indicators and their critical control points which are introduced in the framework of navel orange safety system, we describe the navel orange back chain standardly. On this basis of description, metadata standards which in the navel orange back control and the navel orange control elements must be designed.

3.3. Orange retrospective coding system for quality and safety

Based on place of origin code, EAN / UCC standards, a quality tracking and tracing of Orange coding system, combined with internal production processes, has been studied and designed. This includes raw materials, origin code, the batch production at the core of all aspects of code orange, and final product quality and safety traceability code. It provides the basis support with forming a complete retrospective navel oranges.

3.4. Mobile Tracing Terminal

Adopting micro-electronic technology, we have developed Mobile traceability terminal hardware with ATmega128 microprocessor as the core and consisted by GPRS wireless communication module, LCD display, USB interface, random access memory, small keyboard, barcode scanning equipment and spare interface and so on. Meanwhile we have developed Data interactive software to communicate data with Mobile traceability terminal which is based on Windows Socket.

3.5. The Traceability System For Quality Safety Of Navel Orange

With navel oranges for object and with navel oranges' traceability chain for main, we have established a multi-level and multi-role traceability system for quality safety of navel oranges by information coding, multiple platform sources, hardware development and other technology. System functions include basic information management, standard management, orchard information management, processing process management, storing, transportation, marketing management and traceability management and so on, there not only realize the information management of quality and safety on production process, storage, and sales for enterprises, but also provide consumers and regulators with services by many kinds of ways such as network, supermarket touch screen, mobile traceability terminal and so on.

4. Discussion

1. Navel oranges in the central mountainous areas of agricultural production have the most representative features, which directly affect the quality and safety of agricultural products quality and safety of the entire region as a whole. Therefore, studying the traceability system for quality safety of navel oranges will have far-reaching social benefits.

2. The methods of the research, the development and application of the results of product demonstrations, will have a positive impact on fruit production quality management. R & D quality, safety traceability system and establish tracking and tracing information chain, largely to facilitate to the users of the products which are (anti) to the back.

3. Fruit production traceability system is applied to producing information and collecting real-time quality monitoring information, which will be difficult and key points of the tracing process.

References

- [1] Bao Dayue. Guide to implementation of HACCP. Chemical Industry press, 2007
- Chang Xiang. The food quality and safety traceability systems for Beijing Olympic games will be put into use in August. <http://www.chinanews.com.cn/> 2007.07.09
- [2] Cheng Hao. Animal product safety control and traceability technologies. Modern Agriculture science

and technology, 2007(13), 169-170

[3] Fan Hongping, FengZhongze, Yang Ling, RenAisheng. Appliance and Discussion of Traceability System in Food Chain. Ecological Economy. 2007, 17(4): 30-33

[4] General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China. GB/T 15425-2002, 2002

[5] Liu Shihong, ZhengHuoguo, Meng et al. Study of full-supply-chain quality and safety traceability systems for cereal and oil products. Springer ifip, USA, 2008

[6] Liu Yin, Chen Licheng. Traceability Production System of Beef in EU and USA, food science, 2003(8), 182-185

[7] Lu Changhua, Wang Changjiang, Hu Sinong etc. Identification and Traceability System for Animals and Animal Products. Chinese Agricultural science and technology press, 2007, 35-36

[8] Shanghai agricultural committee. Notification in carrying out animal identification in Shanghai. Shanghai agricultural committee (2001) NO:126, 2001-08-24

[9] Wang Lifang, Lu Changhua, XieJufang, Hu Yinong. Review of traceability system for domestic animals and livestock products. Transactions of the Chinese Society of Agricultural Engineering. 2005(07)

[10] Zhou Yingheng, GengXianhui. Application of Traceability in Food Safety. Research of Agricultural Modernization, 2002(06)

[11] Zhu Haipeng. Research and implementation on traceability system of key cereal enterprise. Chinese Academy of Agriculture Science, 2007, 10-11

[12] Hobbs J E. Information Asymmetry and the Role of Traceability Systems[J]. Agribusiness, 2004, 20(4): 397-415.

[13] Golan E, Krissoff B, Kuchler F, et al. Traceability in the U.S. food supply: economic theory and industries studies[R]. USDA: Agricultural Economic Report No.830, March 2004.

[14] Pettitt R G. Traceability in the food animal industry and supermarket chains[J]. Scientific and Technical Review, 2001, 20(2): 584-597.

[15] McKean J D. The importance of traceability for public health and consumer protection[J]. Scientific and Technical Review, 2001, 20(2): 363-371.

[16] Sharpe R, Barling D, Lang T. Ethical traceability in the UK wheat-flour- bread chain[M]. Ethical Traceability and Communicating Food (The International Library of Environmental, Agricultural and Food Ethics). Springer, 2008: 125-165.

[17] William H. Sperber. HACCP and transparency[J]. Food Control, 2005, 16(6): 505-509.

[18] Antoniol G, Caprile B, Potrich A, et al. Design-code traceability recovery: selecting the basic linkage properties[J]. Science of Computer Programming, 2001, 40(2-3): 213-234.

[19] EAN International and the Uniform Code Council. EANUCC, 2002, European Article Numbering Association[EB/OL]. <http://www.ean.ucc.org>.

[20] Sébastien Pouliot, Daniel A. Sumner. Traceability, liability, and incentives for food safety and quality[J]. American Journal of Agricultural Economics, 2008, 90(1): 15-27.

[21] Elise Golan, Barry Krissoff, Fred Kuchler, et al. Traceability in the U.S. food supply: economic theory and industry studies[R]. Washington: United States Department of Agriculture, 2004.

[22] Dimitris Folinas. Traceability data management for food chains[J]. British Food Journal, 2006, 108(8): 622-633.

[23] Shen Guangrong, Zhao Xiaodong, Huang Danfeng. Consideration of farm product safety system in China[Y]. Journal of Shanghai Jiaotong University (Agricultural Science), 2005, 23(1): 77-83.

[24] Yang Xinting, Sun Chuanlaeng, Qian Jianping, et al. Design and implementation of quality traceable label for farm products based on UCC/EAN-128 bar code[J]. Packaging Engineering, 2006, 6(27): 113-114.

[25] Yang Xinting, QianJianping, Sun Chuanheng,et al. Design and application of safe production and quality traceabilitysystem for vegetable[J].Transactions of the Chinese Society of Agricultural Engineering,2008,24(3):162-166.