Innovation of Supervision System for Quality and Safety of Edible Agricultural Products

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Abstract This paper elaborated multidimensional characteristics of quality and safety of agricultural products, introduced current situation of quality and safety supervision of edible agricultural products in China, analyzed existing problems of quality and safety supervision system and corresponding reasons, and finally came up with recommendations for innovation of supervision system for quality and safety of agricultural products.

Key words Edible agricultural products, Quality and safety, Supervision system, Innovation

With rapid development of China's rural economy, supply volume and diversity of edible agricultural products are increasing constantly. However, quality of edible agricultural products has hidden dangers and the existing situation is not optimistic. Quality and safety of edible agricultural products concern health of urban and rural residents, market competitiveness of agricultural products, and social harmony and stability. Therefore, how to produce safe and healthy agricultural products has become a hot spot. This is also fundamental purpose of production of edible agricultural products and basic requirement for market consumption of edible agricultural products. It becomes particularly important to constantly innovate upon the supervision system and raise quality and safety supervision level of agricultural products.

1 Current situation of quality and safety of edible agricultural products

1.1 Concept and characteristics of edible agricultural products Agricultural products come from primary products of agriculture, namely, plant, animal, microorganism and their products obtained in agricultural activities. Edible agricultural products refer to those agricultural products and their processed products that can be eaten, with the entire production and processing and terminal products passing strict test and all technical indicators and health indicators meeting national or related industrial standards.

Edible agricultural products and their safety and quality should be adjusted by the market. Nevertheless, due to multidimensionality (externality, publicity, information asymmetry, high regional mobility, disguise and occurrence of quality and safety, difference in supply and demand, irreversibility of event hazardous consequence) of edible agricultural products and risk measurement, varied reasons for different risks, hidden dangers of edible agricultural products are numerous and of high occurrence, and consequently quality and safety of edible agricultural products should not completely rely on market regulation, but need social supervision or government supervision entrusted by the society[1].

1.1.1 Information asymmetry of edible agricultural products. Information asymmetry of edible agricultural products is usually resulted from the fact that producers of edible agricultural products have more information about processing, environment and raw materials than supervision department and consumers, and the information is not public completely. Consumers know little about safety of edible agricultural products, so they would rather purchase products at lower price. As a result, inferior agricultural products drive out quality agricultural products. Information asymmetry between producers, supervision department and consumers is difficultly to be solved relying on market mechanism, but should make full use of supervision of government sectors.

1.1.2 Externality and public goods of edible agricultural products. At the beginning of the 20th century, Marshall and Pigou introduced the concept of externality. The externality is a loss or gain in the welfare of one party resulting from an activity of another party, without there being any compensation for the losing party. Externality includes positive and negative externality. For safety of agricultural products, it also has positive and negative externality, namely positive externality of formal agricultural product manufactures producing safe agricultural products on consumers and informal manufacturers, and negative externality of informal edible agricultural product manufacturers producing inferior and unsafe food on consumers and formal manufacturers[2]. Due to incompleteness and not transparency of edible agricultural product information, the negative externality on production of informal edible agricultural product manufacturers is greater than positive negative externality brought by formal agricultural product manufacturers. Therefore, government should implement supervision and punishment for production and operation of informal edible agricultural product manufacturers, to keep balanced development of market.

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A public good is a good that is both non-excludable and non-rivalrous in that individuals cannot be effectively excluded from use and where use by one individual does not reduce availability to others[2]. Edible agricultural products should be supervised by social public sectors and government departments. For individuals, even not providing any cost, they still can enjoy edible agricultural products. Public goods are extreme conditions of positive externalities. Thus, from these two characteristics, edible agricultural products need supervision of government department.

1.1.3 High regional mobility of edible agricultural products. Since production region of edible agricultural products is different, types of agricultural products are also varied. Now, with traffic and transport network becoming more and more convenient and developed, edible agricultural products have high mobility. This means that edible agricultural products can flow to different regions with certain distance to the place of production in a short time. In this situation, the problem of edible agricultural product is not solely the place of production, but also involves supervision of the region into which the edible agricultural product flows. Therefore, the problem of edible agricultural products is also the problem of public security, which needs coordination, communication and joint supervision of government sectors.

1.1.4 High occurrence and disguise of quality and safety of edible agricultural products. Most edible agricultural products are produced in open natural geographical environment, while the natural environment contains toxic and harmful substances and the content is uncertain; primary agricultural products have long production period, in addition to agricultural input such as chemical fertilizer, pesticide, and feed, it is likely to result in quality of agricultural products[1]. Because the Hazard Analysis and Critical Control Point (HACCP) system is not implemented in production and circulation of China's edible agricultural products, the circulation field of edible agricultural products still has problem of abuse and illegal use of antistaling agent and preservative. Finally, in consumption process, even edible agricultural products are safe, there may be safety risk in non production chain. These indicate that the problem of edible agricultural products is of high occurrence from production, circulation to consumption. In addition, the quality of edible agricultural products has disguise and the quality and safety have potential risk. The disguise of quality of edible agricultural products means identification of composition needs certain testing devices, and hazard of harmful substances fails to be accurately measured and evaluated with existing testing devices[1]. In all, high occurrence and disguise of quality and safety of edible agricultural products provide possibility for different entities to reduce cost, manufacturing risk to obtain maximum short-term benefits.

1.1.5 Difference in supply and demand of edible agricultural products. The difference is shown in natural environment, economic, social and political factors of production and sales of edible agricultural products. In addition to difference in benefit goal of production and sales entities and their planting and breeding technology and information, the same type of edible agricultural product is different in quality and safety due to production region, season, and circulation channel. From the perspective of demand, the difference in quality and safety of edible agricultural products mainly lies in diet and consumption habits, cultural level, cognition level of brands of edible agricultural products, and income level of consumers. In all, the difference in supply and demand of edible agricultural products provides possible space for profit – seeking and illegal manufacturers to obtain personal benefit at the sacrifice of safety of public foods.

1.2 Current situation of quality and safety and supervision of edible agricultural products in China With rapid rural economic development, supply volume and diversity of edible agricultural products are increasing and there are both development opportunities and challenges in works related to edible agricultural products. Since 2009, overall situation of China's edible agricultural products is excellent. From 2008 to 2011, the overall acceptance of quality of edible agricultural products was higher than 96% for 4 consecutive years[3]; in 2012, in the routine monitoring of vegetable, livestock and poultry and aquatic products, the acceptance rate was 97.9%, 99.7% and 96.9% respectively[4]. The supervision of edible agricultural products was well in all provinces and cities. Taking Hubei Province as an example, since 2010, the overall acceptance rate of edible agricultural products was always higher than 96%[5]. Edible agricultural products are getting well and the overall situation is stable and becomes better and better.

To match software and hardware of supervision of edible agricultural products, keep in step with management technology, strengthen supervision over foods and drugs, and improve safety and quality of foods and drugs, China learned experience of developed countries. For example, China separately managed quality and safety of foods and edible agricultural products. At Second Plenary Session of the 18th Central Committee of the CPC and the first meeting of the 12th National People's Congress, *the Plan for the Institutional Reform and Functional Transformation of the State Council* was approved. It set up new organizations, including China Food and Drug Administration and National Health and Family Planning Commission. Besides, it reoriented division of labor of the Ministry of Agriculture, Ministry of Commerce, State Administration of Industry and Commerce, and State Administration of Quality Supervision, Inspection and Quarantine in supervision over quality and safety of foods.

The China Food and Drug Administration is mainly responsible for unified supervision over safety and effectiveness of food and drugs in production, circulation and consumption. In addition, it will formulate the regulations on food administrative licensing and supervise their implementation; establish food safety risk management mechanism, formulate annual plans for nation-wide inspection for food safety and programs for major control actions, and organize their implementation; establish the unified food safety information release system and release information on important food

safety issues; participate in formulating food safety risk monitoring plans and food safety standards, and undertake food safety risk monitoring thereon. Then, China has established unified food safety monitoring, inspection and testing technology supporting system[6], and realized unified management of food from production, processing, to consumption and eating.

The supervision of quality and safety of edible agricultural products is handed over to agricultural department, including the process from planting and breeding to flowing to wholesale and retailing, and production and processing enterprises, as well as supervision of quality and use of pesticide and chemical fertilizer. Furthermore, agricultural department is also responsible for supervision over quality and safety of livestock and poultry slaughtering and fresh milk purchasing process. However, after edible agricultural products flow to wholesale and retailing market or production and processing enterprises, the responsibility should be taken by food and drug administration[7].

The supervision over production and operating tools, packaging materials and containers for production and circulation of foods and edible agricultural products should be undertaken by administration of quality supervision, inspection and quarantine. Administrative department for industry and commerce should be responsible for monitoring and inspection of food and drug advertisement, to avoid food accident due to false advertising. The Ministry of Commerce is responsible for formulating plans and policies for drug circulation, catering service and wine circulation and development[7]. For cases breaking laws related to food safety or constituting crime of food or drug, the Ministry of Public Security should take charge of investigation, affix legal liability and strike at lawless persons.

The safety risk evaluation and standard formulation from production to market circulation of food and edible agricultural products will be undertaken by the newly-found National Health and Family Planning Commission[7]. These 7 departments are coordinated by the Food Safety Committee of the State Council, and the office of Food Safety Committee is located at the China Food and Drug Administration.

Compared with construction of edible agricultural product supervision system in the United States, Japan and European Union, China started later, but the supervision ability is rapidly increasing in grass roots areas. In 2012, the Ministry of Agriculture gave the top priority to construction of township supervision organizations. In the whole country, about 94% agriculture-related towns set up supervision service organizations, supervising and serving more than 50 000 people. Besides, with construction of first phase plan of quality testing system, the quality testing of agricultural products has certain foundation from provinces to counties and townships. The second phase plan for construction of quality testing system of edible agricultural products (2011 – 2015) has been formally approved and started implementation[8]. In the whole country, quality testing organizations of agricultural system has reached 2 235, testing personnel reached 23 000, and it has basically established an edible agricultural product supervision system with comprehensive functions of supervision, testing, and law enforcement[4].

2 Existing problems in edible agricultural product supervision system

2.1 Lacking incentive policy, replacing high quality edible agricultural products with inferior ones The production cost of high quality edible agricultural products is much higher than that of inferior edible agricultural products. China's edible agricultural products are characterized by small scale and separate production. As a result, buyer and seller of high quality edible agricultural products fail to play repeated game and then fall into prisoner's dilemma, and consequently leading to loss of incentive function of social credit mechanism for producers of high quality agricultural products. In this situation, government department provides producers with no incentive policy for improving quality of edible agricultural products, leading to market failure and finally "inferior agricultural products driving out safe agricultural products".

2.2 High regional mobility of edible agricultural products, wide range and great difficulty in supervision With constant development of traffic and transport facilities, edible agricultural products can flow to different regions in short time. However, once there is problem, it will lead to trans-regional safety accident. Thus, supervision range of edible agricultural products expands to accident occurrence regions, and consequently it increases difficulty in supervision. Besides, edible agricultural products are raw materials of many foods, and can be used by different industrial chain in downstream of food processing industry. Once there is problem of such raw material, it will involve the processing chain of many foods, then it will extend the supervision chain and increase the supervision difficulty.

2.3 Separate production and operation of edible agricultural products leading to high occurrence of quality and safety accidents Compared with western developed countries, China's edible agricultural products are separate in production and operation, low in organizational operation, and poor in standardized production condition. Most producers lack knowledge of safe production of edible agricultural products. In circulation field, it is also mainly separate individual operation. Especially, operators after products flowing to wholesale market are also mainly family operation, so it is low in scale and specialization degree. In storage and sales of agricultural products, they fail to make different storage and sales according to physical properties of edible agricultural products. In consequence, it leads to high occurrence of quality and safety accidents of edible agricultural products.

2.4 Weak grass-roots force and low supervision efficiency At present, to a certain extent, supervision department pays little attention to quality and safety of edible agricultural products. The supervision ability is very different, and supervision work is difficultly to be implemented at grass-roots level. Some regions, espe-

cially testing organizations at or below county level, although have certain quantity of testing instrument, they just lay them aside due to lack of specialized testing person. Most regions do not have testing ability for high technologies, such as biological toxin quantitative detection, and GMO detection. These limitations result in low efficiency in supervision of edible agricultural products.

2.5 Inconsistency between detection technology and supervision demand, and supervision work having blind area Most edible agricultural products at market come from county-level or urban production base or farmer households, while most testing devices for agricultural products below the county level can be used for rapid detection only. Although the time is rapid, the detection technology has narrow scope, few indicators, and large error. Thus, detection results can not be taken as basis of punishment. Detection organizations at prefecture level or above mainly adopt quantitative detection. However, quantitative detection is characterized by slow speed, high requirement, high cost, and failure to issue detection results. Such inconsistency between detection technology and supervision demand easily leads to blind area of supervision work. What's worse, those edible agricultural products having problem will not be tracked down promptly and effectively, consequently leading to detection work failing to implement effectively.

3 Recommendations for innovation of edible agricultural product supervision system

3.1 Innovating upon production and operation mode, to realize driving through pilot projects Production of edible agricultural products in China is characterized by separate production, low scale operation, and poor standardized production condition. These are different from western developed countries. Thus, we should not blindly imitate developed countries. Instead, we should accord with our actual condition, bring into full play to advantages of high mobility and flexibility, and take the road of promoting the development of edible agricultural products through pilot projects. Because China is vast in territory, production and operation level of edible agricultural products are greatly different in all regions. Thus, uniform practice is not suitable. It is recommended to take administrative management department of cities at prefecture-level as backbone, take pilot administrative villages and leading enterprises as branches, and take separate households, large planting and breeding households, and production bases as leaves, to form the "tree" type production and operation mode, as shown in Fig. 1. Firstly, it is feasible to set up some city-level pilot projects. Secondly, according to actual situation of cities, some enterprises and pilot villages with high scientific and technological content, and bright market prospect can be taken as major supporting objects, to cultivate standardized production and scientific operation. Finally, those pilot villages can promote surrounding non-pilot villages and pilot cities can boost surrounding non-pilot cities. In actual implementation, according to Barrel Theory (Short Slab Theory), it is proposed to reject, constantly merge and optimize those enterprises and bases with low technological content, low production efficiency and low operating benefit, form "supplement and rejection" mechanism, and finally realize large scale, modern, scientific and standardized production and operation of edible agricultural products.

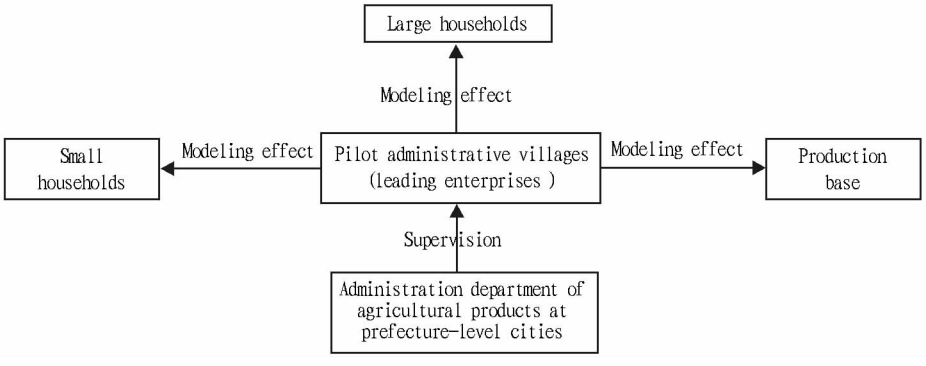

Fig. 1 "Tree" type production and operation mode

3.2 Trying to implement subsidy policy for edible agricultural products The subsidy policy for edible agricultural products is an oriented transfer payment directly or indirectly provided for production, circulation and trade of agricultural products by financial means, to realize support and protection for safe production of edible agricultural products. Agricultural products with higher quality standards require producers and operators adopt safer and more standardized technologies in agricultural production, processing and operation, and carry out production, processing and operation in strict accordance with related standards. In actual situation, it is recommended to implement standardized, normalized new technology and new process to improve quality of agricultural products, and ensure safe supply capacity. In addition, there is possible problem that "inferior agricultural products drive out safe and high quality agricultural products" at market. If producers and operators engaged in high quality edible agricultural products fail to obtain due economic benefits, they will not have enthusiasm for providing safe foods[9]. Therefore, we recommend government increases agricultural subsidy for producers and operators of high quality edible agricultural products, to encourage them

provide safe agricultural products.

3.3 Establishing regional edible agricultural product inspection center, to realize "supervision free of region" Inspection organizations should be established in accordance with geographical relationship, food production characteristics, consumption level, economic level, population flow and folk and custom factors, but not in accordance with administrative region and mandatory setup and staffing. The "supervision free of region" is a new management mode for supervising and radiating surrounding counties and cities and realizing high benefit and low cost supervision through breaking the original pattern of administrative division, taking cities as centers, and using convenient geographical condition. For example, Huanggang City, Huangshi City and Ezhou City of Hubei Province are close to each other (less than 30 minutes of driving). It is feasible to integrate project construction of these three cities together, build them into a regional and comprehensive inspection and supervision center. In this way, it not only saves cost, expands inspection team, but also increases resource utilization rate and supervision efficiency. For another example, Huangmei County and Wuxue City belong to Huanggang City, but both are long from Huanggang City (the driving distance is longer than 90 minutes). However, their distance to Jiujiang City of Jiangxi Province is less than 30 minutes. Therefore, it will cost less if quantitative inspection of edible agricultural products of Huangmei County and Wuxue City is carried out in Jiujiang City. It is thus obvious that inspection of edible agricultural products should set up "inspection free of region" from central to local areas.

3.4 Establishing information network for food quality and safety, and trying to implement territorial management system for agricultural products The information network for food quality and safety is specially used for issuing information and problems about food quality and safety in production, circulation and processing. Since edible agricultural products are a branch of foods, it is recommended to arrange a separate column for edible agricultural products. In this way, it is able to timely announce food safety information, prevent spread of rumors about food safety, and prevent social panic. Also it is able to disseminate knowledge related to food safety to consumers. Besides, it is expected to exert positive incentive effect on producers and operators of foods.

Therefore, establishment and improvement of food quality and safety information network will promote implementation of territorial management system of agricultural products. The territorial management system of agricultural products is a supervision system in which edible agricultural products will not be circulated and sold if they are not packaged with packing boxes or bags distributed by competent agricultural departments. Every packing box or bag has a unique bar code issued by agricultural department. Consumers can input or scan bar code information on website, then they can know information out territorial region and producer of corresponding product. This can facilitate tracing of agricultural products, standardize production and sales of edible agricultural products, further solve information asymmetry problem of food safety, and will be favorable for building healthy agricultural product market.

3.5 Trying to establish risk evaluation and certification system for edible agricultural products Supervision unit of each region should carry out routine monitoring, random inspection and special inspection for production and operation entities of edible agricultural products, and make classification according to inspection results. Different grades represent different risk levels. The evaluation shall be made once annually. According to risk certification level of organizations randomly inspected, the supervision department may determine the frequency of random inspection for food safety, to realize "equal probability and balanced" supervision of different size organizations, reduce burden of small organizations, and increase the supervision efficiency[10]. Inspection grading is carried out by government free of charge. Organizations with higher grading and higher disqualification rate will be downgraded and economic punishment will be imposed. With social development, quality and safety of edible agricultural products receive more and more attention. The call for green food and organic food is higher and higher. In this situation, a highly efficient food supervision system will be gradually established with greater concern for quality and safety of edible agricultural products and increase of input in quality and safety of edible agricultural products.

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