Current Situations of Edible Fungus Production in Lianyungang City and Development Countermeasures

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Abstract On the basis of characteristics of edible fungus production in Lianyungang City, we analyzed its advantages and disadvantages and put forward suggestions and countermeasures for development of edible fungus industry, mainly including strengthening guidance and leadership of government, introducing professional personnel, and developing the edible fungus industry through science and technology.

Key words Edible fungus, Current production situations, Existing problems, Development countermeasures

In recent years, with constant deepening of rural reform, adjustment of industrial structure, as well as constant improvement of people's living conditions, both rural and urban residents have higher and higher demand for edible fungus. In this situation, the edible fungus production develops rapidly in Lianyungang City, both production and marketing thrive, and it becomes the highlight in the growth of farmers' economic income.

1 Current situations of edible fungus industry in Lianyungang City

Edible fungus has a long cultivation history in Lianyungang City. With several years of effort, the edible fungus industry has taken shape. It mainly has the following characteristics.

1.1 Regional production distribution At present, Lianyungang City has four edible fungus production areas in total, namely, the fragrant mushroom planting area in Shanzuokou Township of Donghai County, the button mushroom planting area in Xinba Township of Haizhou District, Enoki mushroom planting area in Xin'an Township of Guannan County, and Auricularia polytric planting area of Xiaoyi Township in Guanyun County. In addition, there is also *Pleurotus ostreatus*, *Coprinus comatus*, *Pleurotus eryngii*, *Pleurotus nebrodensis*, and *Pleurotus sajor-caju* on a small scale in suburbs and four counties.

1.2 Large scale planting in quantity and factory planting in technology According to our survey, Fenghe Company of Shanzuokou Township in Donghai County has invested more than 20 million yuan in building over 500 big canopies for planting fragrant mushroom; Fankou Mushroom Demonstration Park of Xinba Township in Haizhou District has builted more than 500 standard mushroom houses and over 20 000 ground canopies; Xin'an Township Agricultural Park in Guannan County has nearly 10 Enoki mushroom factories, each of which has an investment higher than 10 million yuan.

1.3 Diversified marketing modes In Lianyungang City, it mainly adopts the marketing mode of " company + base + farmer household" or cooperative of edible fungus, to strengthen the ability of resisting market risks.

1.4 Constant improvement of cultivation methods and technologies In Liayungang City, it mainly adopts stereoscopic tier rack type high-efficient cultivation mode. In the situation of increasingly tense land resource, this is indeed a practical and feasible way to help people get rich, for example, the standard mushroom houses in Xinban Township of Haizhou District and Enoki mushroom factories in Xin'an Township of Guannan County. In cultivation technologies, it adopts special-purpose mushroom fertilizer, secondary fermentation and standard production technologies, to ensure improvement in quality, increase in yield and benefit of edible fungus products.

1.5 Single variety developing to diversified varieties Before 2000, the edible fungus production was simple and single in variety, mainly *Pleurotus ostreatus* and fragrant mushroom, and little Enoki mushroom. In recent years, Lianyungang City introduced blackfungus, *Pleurotus eryngii*, *Pleurotus nebrodensis*, and *Pleurotus sajor-caju*, *etc*. With increase in benefit of rare mushroom varieties, their planting area is expanding, and there are many new ways of mushroom planting, such as using caves, air-raid shelters, constant temperature warehouses, and modern cold stores. Through these, it is able to produce button mushroom, *Coprinus comatus*, *Pleurotus eryngii*, *Pleurotus nebrodensis*, and *Pleurotus sajor-caju* in improper seasons, filling the gap of no fresh mushroom in summer and winter.

1.6 Diversified cultivation modes With many years of

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practice, Lianyungang City has accumulated rich experience in cultivation modes. Firstly, it is family cultivation mode. In this mode, idle houses and animal building are transformed into mushroom rooms. Secondly, it is organization cultivation mode. In this mode, original staple food control office, schools, and warehouses are reconstructed into mushroom rooms. Thirdly, basement, air-raid shelters, and constant temperature warehouses are used to cultivate mushroom in improper seasons. Fourthly, old vegetable sheds are built into mushroom canopies. Fifthly, forest land is used for arc shed planting. Shihu Forest Farm of Donghai County carried out integrated production of forest and edible fungus in an area of 70 hm^2. It can increase for 20 000 yuan in one mu annually. Sixthly, it has built high standard tier rack automatic cultivation mushroom house to realize standard production throughout the year. For example, a good many high standard mushroom houses has been built in Xin'an Township of Guannan County.

2 Advantages of Lianyungang City in developing the edible fungus industry

2.1 Superior natural conditions Lianyungang City (34°12′ to 35°07′ N, 118°24′ to 119°48′ E) is prefecture-level city in northeastern Jiangsu Province. It covers an area of 7 443.3 km^2 and belongs to part of North China Plain. Within the city, there is plain, hillock, water and mud flat. Land types are various, main type is plain. The land is smooth and connected together. In Lianyungang City, the soil is fertile and contains much potassium, so it is suitable for planting many varieties of crops, not only suitable for agriculture and forestry, but also suitable for stock raising and sideline production. Lianyungang City has humid monsoon climate at the south edge of temperate zone. It has four distinct seasons, temperate climate and sufficient sunshine. The annual average temperature is 13.2 to 14.0 ℃, the daily peak temperature is 40 ℃, and the lowest temperature is −21.7 ℃, and the frost-free period is up to 206 to 223 days. The annual precipitation is 910 to 980 mm (over 1 200 mm in highest rainfall year; and the least precipitation is less than 50 mm), and the rainfall is mainly between June and September. The above superior natural conditions provide gifted climatic conditions for developing edible fungus production.

2.2 Obvious regional advantages Lianyungang City borders Yancheng to its southeast, Huai'an and Suqian to its south, Xuzhou to its southwest, and the province of Shandong to its north. It is the eastern end of the New Eurasian Land Bridge and the proposed Northern East West Freight Corridor, is one of the first 14 Chinese coastal cities opening to the outside world, and is a rising centre of industry, foreign trade and tourism in east China. This port is located in the center of the coast, linking eastern sea routes with western land routes. Both Japan and the Republic of Korea in the east can be reached economically and conveniently from Lianyungang, which is also part of the worldwide network of sea transport. As well as this, the New Eurasia Continental Land Bridge and the railway networks in Western Europe continue by land, connecting Lianyungang with over 40 countries and regions in Europe, South Asia and the Middle East. These provide very convenient conditions for export of edible fungus products.

2.3 Rich raw materials and human resources As a national production base of commodity grain, Lianyungang City mainly produces rice, wheat and corn, providing rich high quality raw and auxiliary materials for manual cultivation of edible fungus. Besides, using straws to develop the edible fungus production in winter fallow field, it not only can take full advantage of sunshine and heat source in winter and land resources and increase the multiple crop index, but also can solve the problem of surplus labor in rural areas.

2.4 Certain mass foundation The edible fungus production starts early in Lianyungang City. With many years of practice and exploration, farmers have accumulated certain experience. They basically can operate independently in the whole process of edible fungus production. Many farmers get rich from developing edible fungus production. "To get rich, plant more mushrooms" having become a common understanding among citizens of Lianyungang City.

2.5 Broad development prospect In the first place, it has substantial economic benefit. The edible fungus industry belongs to a labor-intensive farming sideline, which has high rate of return on investment. According to our survey, using broadleaf tree saw-dust to produce mushroom, the production cost of one bag is about 1.2 yuan, and the mushroom output is 0.75 to 1 kg. Calculated at 4.0 yuan for one kilogram of fresh mushroom, the output value is 3 to 4 yuan, and the net profit is up to 2 to 3 yuan for each bag. The ratio of input to output is about 1∶3.5. In the second place, the capacity of market is high. With high protein and low fat, edible fungus products are new nutrition sources and also one of the ideal health foods, so its demand is increasingly growing day by day. Some American – European countries even take the per capita consumption of edible fungus as an important criterion of living standard. At present, there is a big market gap in many foreign countries, for example, Japan. In China, the situation is worse, the per capita consumption of edible fungus is less than 1 kg, so only in domestic areas, the potential for consumption of edible fungus is great[1].

3 Existing problems in edible fungus industry in Lianyungang City

3.1 Lack of production, marketing and processing talents Lack of talents leads to the weak scientific research forces and insufficient development stamina. There is neither specialized person nor professional institution engaged in research and development of edible fungus and its market management. The input in scientific research is low and introduction and popularization of scientific findings are weak and slow.

3.2 Immature market development of edible fungus products Market and production management system is not well established; information and service systems are not matching with each other; means of production is backward; it only focuses on output but neglects quality, and the brand awareness is

poor. In some townships and villages, there are problems of difficult loan granting, technology learning and information obtaining. In the aspect of supply of fungus strain, due to limitation of many factors, not strict management, and chaotic supply channel, there are problems of aging and degradation of strain, low biological conversion rate, *etc*.

3.3 Low organizational and standardization level Infection of plant diseases and insect pest is serious, probiotics organisms are few in fermented materials, and the yield per unit area is low and the benefit is minor. It fails to realize intensive planting in an organized way on a large scale, or form standard raw material base that has great development potential, let alone the scale merit.

3.4 Unbalanced development of facility-based edible fungus production At present, the total quantity of factory-based and facility-based edible fungus production is slightly low in Lianyungang City. Only the Enoki mushroom factory in Xin'an Township of Guannan County and the mushroom park in Xinba Township of Haizhou District adopt advanced process and technology. In other regions, edible fungus production adopts simple cultivation method, simple and crude facilities, backward process, small scale, and low quality.

3.5 Specialized production not coordinated with socialized support At present, the coordinated pattern of specialized production and socialized support is still not formed, which will seriously restrict the development speed. Such situation is resulted from two aspects. On the one hand, under influence of "fertilizer not spilled over to others' field", "large and comprehensive" and "small and comprehensive", many enterprises pursue self-established system, self-cycle and self-improvement. On the other hand, neither government nor related industries fully understands agricultural modernization and industrialization. Consequently, the input is not sufficient and factory-based development of edible fungus production.

3.6 Weak production supervision and failure to guarantee production safety and product quality In Lianyungang City, the edible fungus production is mainly simple production by farmers. These producers plant edible fungus in fragmented idle land, living and production happen in the same simple shed. As a result, accidents occur frequently, many producers lose money, some even go bankrupt, and the production safety fails to be guaranteed. No supervision results in failure to guarantee quality of raw materials and water. There is frequent occurrence of abuse of pesticides.

3.7 Failure to receive policy support in edible fungus production In the new round structural adjustment of agricultural planting industry, the edible fungus production develops rapidly with advantages of low investment, rapid effect and high benefit. Practice shows that the edible fungus production is a great project for realizing increase in farmers' income and solving problem of farmers' employment. However, edible fungus production often suffers a lot from natural disasters. The producers fail to receive subsidy for facility-based production development, and consequently, their enthusiasm for production will be dampened.

4 Suggestions and countermeasures for Lianyungang City in developing the edible fungus industry

4.1 Adhering to scientific planning and developing economic organizations with reasonable distribution Introduction of industrial leaders and establishment of risk and benefit sharing mechanism are key points of the development of edible fungus industry. On the one hand, it is suggested to introduce and cultivate a good many leading enterprises and establish production and demonstration base for edible fungus production. On the other hand, it is required to speed up developing rural cooperatives, bringing into play their intermediary function, and improving organizational level of farmers through establishing the industrial operation mode of "leading enterprises + cooperatives + farmer households" or "enterprises + base". At present, it is recommended to encourage and guide mushroom farmers to set up edible fungus association or other production and circulation cooperatives to effectively integrate raw material production and supply, product processing, and sales. Through establishing benefit affiliating mechanism, it is expected to form industrial chain, and to improve the overall level of edible fungus industry.

4.2 Strengthening organization leadership to form joint effort The edible fungus production is not only a labor intensive industry, but also a systematic project. It involves many aspects and requires strengthening leadership. (i) At the city level, it is required to set up leading team for edible fungus industry. Also, it should establish technical service stations at all levels, to provide service and guidance for planting farmers. (ii) It is required to establish the responsibility system, incorporate the edible fungus production into the indicators for annual performance assessment. (iii) Related functional departments should cooperate closely and make joint efforts in management of edible fungus industry, to build a large and strong edible fungus industry.

4.3 Developing the edible fungus industry through science and technology and striving for development advantages Scientific and technological progress is an essential requirement of revitalizing the edible fungus industry, and also a leading factor for speeding up development of edible fungus industry. For this, firstly, it is required to introduce specialized technical personnel, cooperate with scientific research institutes, colleges and universities, to combine production, learning and research. Secondly, it is proposed to hold training on a regular basis, to cultivate a good many production, processing, sales, and management personnel. The government at all levels should set up special team, take full advantage of specialized personnel of agricultural, sci-tech, Women's Federation organizations and rural practical talents, to impart high yield and high quality standard production technologies, prevention and control technologies for plant diseases and insect pests, storage and fresh-keeping and marketing technologies to mushroom farmers, to enhance market competitiveness of edible fungus products in Lianyungang City. Thirdly, it is proposed to conduct research of technique, reform in traditional and back-

ward edible fungus cultivation modes, and energetically promote advanced technologies. According to segments of edible fungus production, it can be divided into strain production base, standard production base of compost, standard production base of mushroom products, mobile intelligent mushroom house production base, and standard production base of nutrient soil, *etc.* Waste materials after picking up mushrooms can be treated in the mode of " straw – edible fungus – fungi residues – ecological organic fertilizer – market" , " straw – edible fungus – fungi residues – decomposition and fermentation – return to field" , or " straw – edible fungus – fungi residues – clean energy resource (marsh gas or gasified raw material)" [2].

4.4 Formulating preferential policies to increase support for edible fungus industry It is proposed to take the road of government guidance, mass participating, urban and rural linking. For example, Lianyungang City can popularize the mode of " government + experts + leading enterprises + trade society + bases + farmer households" , to achieve the scale merit as soon as possible. The edible fungus industry is a rising industry which can benefit thousands of households, so it is required to increase the support for this industry. Firstly, financial departments at all levels and comprehensive development departments of agriculture should allocate certain amount of fund for developing edible fungus production. Secondly, it is proposed to offer preference for edible fungus leading enterprises in project establishment, land expropriation, taxation, financial support, and credit support, *etc.* Thirdly, we suggest establishing incentive mechanism to reward leading enterprises, relevant organizations, big planting households, and big transport and marketing households that have made great contribution to the development of edible fungus industry, so as to create a favorable development environment for edible fungus industry.

4.5 Improving product grade and striving for brand benefit It is required to set up solid brand awareness. At the same time of holding tightly the edible fungus production, it is also necessary to register brand of relevant new variety of edible fungus, actively apply for certification of harmless, green and organic edible fungus, and conduct bar code registration and external packing, to constantly improve product grade[3].

4.6 Speeding up the expansion of scale of edible fungus industry to realize specialized intensive production Lianyungang City should accelerate building specialized, intensive, standard, high-efficient and market-oriented edible fungus production demonstration park. Traditionally, the planting happens in August and September. Every household has to carry out fermentation, sterilization, and production, so the labor intensity is high. The operation procedure is complex; the yield per unit area is low and not stable; the production cycle is long. Through specialized and intensive production, farmers can transport raw materials from fermentation material factory, put into mushroom houses, pick them and deliver to sales company. These not only eliminate heavy work of farmers, but also guarantee product sales.

4.7 Dealing with export barrier of agricultural products to promote standard production At the international market, export of agricultural products is faced with huge challenges. Many countries take the " Green Barrier" as major means of trade control. In this situation, it is required to energetically implement standard production and control quality from the source. Firstly, it is recommended to provide standard production knowledge training for production, processing and export workers, especially mushroom farmers. Secondly, it should bring into play functions of agricultural, hygiene and food security departments. For raw materials and environmental factors of edible fungus production, it is proposed to provide comprehensive and accurate information for guidance, control, inspection and declaration in advance. For intermediate products and end products, the most strict international inspection standard should be applied, to exploit both domestic and international market and build famous brand both at home and abroad[4].

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