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Development Status and Countermeasures of Potato Industry in Zaozhuang City

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Abstract The development status and problems of potato industry in Zaozhuang City are objectively analyzed and evaluated. For the current problems, it is proposed to actively innovate system and mechanism for promoting the development of potato industry, and focus on the promotion and application of high-tech facilities and fresh food processing varieties, farmers' cooperatives and other large-scale business models.

Key words Potato, Status quo, Countermeasure

1 Introduction

Potato is the fourth largest food crop in the world after wheat, rice and corn, and is native to the Andean Mountains of South America. It is produced and managed as food in China and vegetables in Shandong Province. Potato is rich in nutrition and can be used as both grain and vegetable. It can be used as grain, vegetable, feed and industrial raw materials. Potato is one of the most promising high-yield economic crops in China in the 21st century. The potato planting in Zaozhuang City can be traced back to the end of the 19th century, which has a history of more than 100 years. Zaozhuang is the largest two-season potato production area in China.

Zaozhuang has always attached great importance to the development of potato industry, and potato industry is taken as a pillar industry of agriculture. With the development of agricultural production, the adjustment of planting structure and the increase of market demand in recent years, the potato planting area has increased steadily, and per unit yield has gradually increased. The popularization rate of improved varieties and the application of virus-free potatoes have expanded rapidly, and the scientific and technological level has been continuously improved. A large number of specialized and large-scale production bases, professional townships and villages have been formed, which has become an effective way to realize the increase of agricultural efficiency and farmers' income.

2 Current situation of potato industry development

2.1 The planting area increasing steadily According to the statistics of agricultural sector, total plantation area of potato in Zaozhuang City in 2020 reached 5.51×10^4 ha, which increased

by 533.33 ha than 2019, with 1% of increase range. Divided by plantation season, spring planting area of potato was 4.3×10^4 ha, and autumn planting area was 1.21×10^4 ha. Divided by planting zone, potato planting area of Tengzhou City, Shanting District, Yicheng District, Xuecheng District, Taierzhuang District, Shizhong District, and High-tech District of Zaozhuang was respectively 4.37×10^4 , 0.4×10^4 , 0.373×10^4 , 0.24×10^4 , 0.107×10^4 , 0.04×10^4 and 133.33 ha. Divided by planting form, planting area of open field (containing plastic film mulching), small arch shed, and large and medium arch shed of potato was 2.67×10^4 , 2.47×10^4 and 0.367×10^4 ha. The main planting varieties are Netherlands 7, Netherlands 15, Luyin 1, Keshu 6, Zoadabai, and Nuolan. Spring and autumn planting area of potato in Tengzhou City was 4.37×10^4 ha, accounting for 1/4 of planting area in Shandong Province, 1/3 of total output, 1/2 of export volume. "Small potato" was turned into "big industry".

2.2 The output remaining at a high level Total output of potato in whole city in 2020 reached 252.6×10^4 t, and average yield was 45 871.5 kg/ha, which hit a record high. Among them, total yield of potato in Tengzhou City, Xuecheng District, Shanting District, Shizhong District, Yicheng District, Taierzhuang District, and High-tech District of Zaozhuang was 201×10^4 , 12×10^4 , 13.6×10^4 , 1.3×10^4 , 20.6×10^4 , 3.5×10^4 and 0.6×10^4 t. Total output of open field, small arch shed, large and medium arch shed of potato was 120.5×10^4 , 111.3×10^4 and 20.8×10^4 t. Zaozhuang potato is famous at home and abroad for its beautiful appearance, light yellow color, thin and smooth skin, yellow skin and yellow meat, high quality and delicious, rich nutrition, and suitable for eating.

2.3 Advanced planting mode and technology Zaozhuang City is a representative area of potato two-season cropping. All localities continue to explore and promote potato protected cultivation technology and high-efficiency intercropping and interplanting mode, and focus on the promotion of planting modes such as two potatoes and one grain (spring potato + summer corn + autumn potato), two potatoes and one vegetable, potato + grain + vegetable,

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and potato + vegetable + vegetable, and a variety of cultivation modes such as plastic film mulching, double-film arch shed, three-film arch shed and so on are formed. By taking protective measures, it is generally sown from first and middle of January to early March, and time-to-market is from middle and late of April to middle and late of June. In autumn, it is sown from late July to early August, and time-to-market is from late October to the Spring Festival. Tengzhou City pioneered the potato multi-film mulching cultivation technology in China, realizing potato appearing on the market in middle and late of April, 45 d earlier than open field cultivation, and seizing the market opportunity.

2.4 High degree of standardized production Five systems such as agricultural product quality and safety responsibility system, law enforcement system, testing system, monitoring system and agricultural materials distribution system are actively constructed, and a law enforcement team for the quality and safety of agricultural products at the four levels of city, district (city), township and village has been established. Zaozhuang Agricultural Comprehensive Law Enforcement Detachment and Agricultural Product Quality and Safety Association were newly established, and it highlights the source supervision, prohibits high toxic and high residue pesticides, and ensures the quality and safety of potatoes. On July 2, 2013, Shandong provincial government held an on-site meeting on the quality and safety supervision of agricultural products and the construction of modern agricultural demonstration zone in Tengzhou of Zaozhuang City. It strives to do a good job in the certification of "three products and one standard", and rewards the certified organic, green and pollution-free famous and high-quality agricultural products every year. The technical specification for potato standardization was prepared and determined as the local standard of Shandong Province. At present, only Tengzhou has a number of well-known potato brands and trademarks, such as "Jinshuwang", "Tengyang", "Kunshengda", "Longhewan", *etc.* Tengzhou invested 20 million yuan to build a potato tissue culture center, with an annual production of 10 million potato virus-free test tube seedlings and 20 million original seeds. A 2 666.67 ha of virus-free potato seed breeding base was built in Inner Mongolia and Heilongjiang, and the popularization rate of virus-free improved varieties of potatoes reached 100%. A national standardized production base for green food raw materials covering an area of 1.33×10^4 ha, 25 processing and filing points for export enterprises, and a filing base covering an area of 0.467×10^4 ha have been built. Tengzhou potato has successively won the national geographical indication certification and geographical indication certification trademark, and was rated as the first top 100 public brand value of agricultural products in China. Tengzhou has been awarded the titles of "hometown of potato in China", "advanced county (city) for virus-free potato promotion" and "national agricultural standardization demonstration county (potato)".

2.5 Very obvious economic benefits It constantly accelerates the characteristic process of "one town, one industry" and "one village, one product" dominant by potatoes. Zaozhuang has devel-

oped 5 professional potato towns and 285 professional villages. The mechanization rate of potato production reached 85%, and the average yield of high-yield demonstration field was 67 260 kg/ha. The broad masses of farmers have achieved the goal of "producing 150 000 kg/ha of potato and 15 000 kg/ha of grain, with an income of more than 10 000 yuan". Remarkable achievements have been made in the establishment of high yield. In 2011, the highest yield of potato harvest in Fangling Village of Jiehe Town of Tengzhou City was 89 355 kg/ha, which set a national record. During 2012 – 2020, actual output in the village reached more than 75 000 kg/ha. Average benefit of potato in Tengzhou is more than 120 000 yuan/ha, and it is the county (city) with the largest planting area, the highest unit yield and the best benefit in two-season potato planting area of China. Jiehe Town, a special industrial town of potato, has an average household deposit of 200 000 yuan in 2020. Potato has become a golden bean for the people to "build a new house, marry a bride and go to a well-off society".

2.6 Strong market development and service It makes full use of China's transnational procurement center of agricultural and livestock products, national food safety testing center and special market, international potato expo and other platforms to actively explore the high-end market. The city's potato intermediary transportation and marketing organization has nearly 20 000 employees, and a production and marketing model of "market + transportation and marketing team + base" is formed, promoting potato sales in more than 20 provinces and cities, and exported to Hong Kong, Japan, Southeast Asia and other countries and regions. Tengzhou City has held China (Tengzhou) Potato Festival for 10 consecutive years. By visiting high-yield sites and holding industrial development forums, the advantageous agricultural product brand of "Tengzhou potato" is sounded, and potato sales is promoted. The provincial finance allocated 2 million yuan to implement the construction project of Tengzhou potato comprehensive information service platform. It has focused on building "two platforms and one hall" (Tengzhou potato online service trading platform, Tengzhou potato mobile phone smart portal platform and Tengzhou agricultural comprehensive service hall), built Tengzhou potato technology, brand, price, information and other comprehensive service platforms, and promoted the development of potato industry.

2.7 Accelerating the cultivation of new business service subjects It actively guides industrial and commercial capital injection. Through land transfer and other means, the large-scale production of facility potatoes is developed, and more than 150 professional potato planting households with an area of more than 13.33 ha are cultivated, which plays a good demonstration and driving effect. Tengzhou Hengyu Food Co., Ltd. invested more than 10 million yuan to transfer more than 133.33 ha of land in Jiangtun Town and Jisuo Town, purchase advanced planting machinery, lay drip irrigation system, carry out facility cultivation according to export standards, and implement the five-unification management mode of "unified planting, unified medication, unified fertilization, unified water use and unified harvest", and the

planting area of surrounding farmers was driven to reach 1 333.33 ha. Tengzhou Tianhe Planting Professional Cooperative has built a 20 ha of facility potato planting base in Xigang Town, driving farmers to plant an area of more than 200 ha. The new potato production and marketing model of "leader + base + standard + brand + market" has been basically formed.

3 Current problems

The potato industry in Zaozhuang has a good momentum of development, but there are also some problems and potential risks.

3.1 Hidden dangers in quality and safety, urgent to strengthen supervision Potato planting is dominant by decentralized management by households, and there is a situation of fighting alone in medication and fertilization, which is difficult to realize household supervision, and the type and number of drug and fertilizer are difficult to control. In addition, some farmers have weak awareness of agricultural product safety and are vulnerable to economic interests, which brings great hidden dangers to potato quality and safety.

3.2 The sales market needing development comprehensive management and access control The products are mainly sold in the wholesale market in the form of fresh food, lack of intensive processing, with low agricultural added value. Leading enterprises of potato production and sales have small scale and weak driving ability, lack of private brands, with low degree of organization. It is suggested to strengthen local market supervision, establish an access system, and prohibit the sale of inferior seed potatoes in Zaozhuang while opening up foreign markets.

3.3 Lacking master plan, and area of protected cultivation less The potato industry lacks overall planning, and the cultivation area covered by three films is small. The ability to resist market risks in case of natural disasters such as strong spring cold in early spring or strong wind is insufficient, and freezing injury occurs almost every year, forming the contradiction between early sowing, appearing on the market and natural disasters.

3.4 Single variety, and risk in the development potential Main varieties of Zaozhuang City are the varieties of "Feiwuruita" series represented by "Luyin 1" and "Netherlands 15", and years of single planting is easy to bring natural disasters such as diseases. Moreover, they are all fresh varieties, limited by storage time and condition, and market prices fluctuate from time to time. It is of great significance to study how to introduce and study the combination of processing varieties, especially the varieties suitable for the processing and export, and could resist market risks.

4 Countermeasures and suggestions

The general idea of developing potato industry is to strengthen the organization, leadership, coordination and service role of governments at all levels, and adapt to the market demand based on the existing industrial advantages. By building industrial alliance, promoting scale operation, ensuring quality and safety, exploring

cultural connotation and other measures, it should constantly establish and improve virus-free seed potato breeding system, quality supervision system, processing and marketing system, so as to further expand and strengthen Zaozhuang potato industry.

4.1 Building industrial alliance

4.1.1 Establishing seed industry alliance. It should build long-term cooperation with domestic well-known potato seed production enterprises such as Xisen, Dafeng and Xuechuan. Through investigation and introduction, planting demonstration, product sampling and other measures, it provides seed source guarantee for high yield and good quality of potato in Zaozhuang City.

4.1.2 Establishing technology alliance. It should establish cooperative relations with countries such as the Netherlands and Canada, the Chinese Academy of Agricultural Sciences, Shandong Agricultural University, Shandong Academy of Agricultural Sciences and scientific research institutions in Tianjin, Heilongjiang, Inner Mongolia and Gansu, and actively introduce and promote new facility cultivation technologies such as formula fertilization, water-saving irrigation, mechanized planting, double-film and three-film arch shed, and autumn delayed cultivation. It has always been at the forefront of potato cultivation technology in two-season planting area and has become the pioneer of protected cultivation technology of vegetable potato in China.

4.1.3 Establishing sales alliance. It should actively carry out market development, from full flowering to key breakthrough, concentrate human, material and market resources, focus on developing high-end markets such as Shanghai, Nanjing and Guangzhou, establish long-term cooperative relations, build high-end special supply bases, unblock purchase and sales channels, and realize high quality and good price. Special support funds at all levels should be made good use of, and social capital investment should be actively attracted. It should build a potato online trading platform with high standards, and enable farmers in the city to realize "gold cleaned out from the soil and treasure bought from online" through online negotiation, online signing and online sales.

4.2 Promoting scale operation According to the principle of "stable area, improving per unit area yield, increasing total output, and scale management", the development of potato industry is guided. By promoting property right reform and land circulation, actively guiding a new type of business entity that understands technology, has capital and can operate to intensively transfer land in non main potato production areas, developing potato planting in arch shed, and constructing standardized production base with high standard, it strives to develop more than 300 large planting households with a planting area of more than 6.67 ha in the three years, and 4 – 5 bases with a potato planting area of more than 3 333.33 ha. In traditional main production area of potato such as Jiehe, Longyang, Jiangtun, Chengtuo, and Zhouying, it should sufficiently play advantage of industrial scale, and closely combine fine planting by family with highly specialized socialized services. By taking household management as main body, centralized input of improved potato varieties, fertilizers and facili-

ties materials should be increased. It should actively support and guide professional social service organizations, carry out unified technical guidance and centralized supply of agricultural materials. Vigorous implementation of specialized unified prevention and control of diseases and pests should be conducted, and organization level of potato production should be further improved, to realize upgradation of potato planting, cost saving and efficiency increase.

4.3 Strengthening quality supervision Quality safety is the fundamental guarantee for the development of potato industry. Based on the potato 10 billion industry, it should build a century old brand of potato, carefully maintain the quality reputation of potato, and create safety on the tip of the tongue. Moral concept should be used to promote mass awareness of quality, and it should enhance construction of "five systems" such as quality and safety responsibility system, law enforcement system, detection system, monitoring system and agricultural materials distribution system, and scientific mechanism should be used to do a good job in the quality supervision of agricultural products. According to the requirements of "implementing standard with standard and preparing standard without standard", it should carry out the construction of potato production technology system, and form technical specifications and standards covering the whole process of planting. By following technical specification and enhancing "two hands" in the supervision of agricultural inputs, it could realize that the whole process of potato production can be controlled, and the product quality and safety can be traced, thereby escorting the healthy and sustainable development of potato industry.

4.4 Exploring potato culture Brand building of potato enterprises should be carried out, and a number of famous and marketable independent brands of Zaozhuang potato enterprises should be cultivated, to improve product grade and increase product benefit.

The first exhibition hall with potato culture as the theme in China-Potato Culture Museum should be constructed well, and the *Potato Analects* should be selected. The *Potato Song* should be created, and Tengzhou Potato Theme Culture Park should be actively built. It should comprehensively publicize the communication origin, nutritional use, development history and achievements of potato, fully show potato vegetable culture, potato banquet tongue culture and potato planting culture created by the masses, truly combine potato history, products and culture, further improve the connotation of potato industry and build the birthplace of national potato culture.

4.5 Strengthening policy support Potato is a sunrise industry, a superior agricultural product with high yield and efficiency, and a good project for farmers to get rich and get well-off. As one of internationally recognized big crops, potato is not as good as rice, corn and wheat, which could obtain subsidies and preferential treatment for improved varieties. It is suggested to induce leaders at all levels attach great importance to it, strive to implement the subsidy policy for improved potato varieties, vigorously support and promote industrial development at the policy level.

4.6 Innovating management system Relying on the opportunity that Zaozhuang City is listed as national rural reform pilot zone, it should actively innovate system and mechanism for promoting the development of potato industry, and strive to make breakthroughs in the promotion and application of high-tech facilities and fresh food processing varieties, large-scale operation of farmers' cooperatives, product quality and safety supervision, product market development and marketing, financial support, *etc.* In particular, it should explore the internal fund mutual assistance mode of farmers' cooperatives, do a good job in top-level design, and promote the upgrading of Zaozhuang potato industry.

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develop the leading industries of the two sides as far as possible, and carry out financial investment cooperation between the two places to promote both sides. The cooperation of scientific and technological innovation and the use of talents has formed a bipolar linkage and common development.

The development situation of Shantou in the east of the Guangdong Coastal Economic Zone is similar to Zhanjiang. The construction process of the development pole index is expected to be suitable for Shantou, and there may be some differences in the conclusions and recommendations of the specific analysis process.

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