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Influencing Factors on Farming System Development in Shandong Province

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Abstract The developmental situation of the farming system in Shandong Province is introduced. At present, Shandong Province is at the semi-intensive, semi-commercial and semi-sufficiency level of farming system. Eastern coast and central Shandong agricultural zones are moving in the direction of modern farming system, having formed a preliminary new pattern of the coordinated development of grain, feedstuff, economic and other crops. Influencing factors on the development of farming system in Shandong Province is analyzed, which are agricultural production condition and input level, population and food, policy measures, development of natural resources and regions, agricultural industrialization and urbanization level, and scientific and technological level. Total population will be within 100 million at the year 2020; per capita annual share of grain will be 475 kilograms; and there is great pressure on grain production. Therefore, we must change the pattern of agricultural development and accelerate the establishment of modern farming system. Agricultural machinery, water conservancy projects, and chemical fertilizer application have greatly affected the development of farming system. Improvement of production conditions has promoted the adjustment of agricultural structure, increased the planting ratio of winter wheat-summer maize, and improved multiple-cropping index. Development of agricultural industrialization has promoted the transfer of rural labor force and the establishment of modern farming system; while the unbalanced development of cities has restricted the establishment of modern farming system. Therefore, the appropriate policy, scientific and rational regional distribution, and advanced science and technology can help to set up the modern farming system in Shandong Province.

Key words Shandong Province, Structure adjustment, Regional development, Farming system, China

At present, there are quite a lot of running problems and a series of non-sustained constraints which can not be ignored in farming system. On the one hand, food production is low value-added; and gardening and high-value crops are lacked. On the other hand, both tertiary industry and secondary industry are weak, and the agricultural product processing industry is lacked. Therefore, it is urgent to find out a sustainable, efficient, high-quality, and environment-friendly road for agriculture[1-2]. Establishing a scientific and reasonable development of farming systems is the core of sustainable agriculture[3]. But there are large differences among provinces due to the unbalanced regional development, the difficult labor transfer, the inadequate social service system in rural areas, the incomplete agricultural infrastructure and other restricting factors. Studying on the influencing factors on farming system of Shandong Province helps to provide a theoretical basis for the sound and orderly development of future farming system.

1 Development status of farming system in Shandong Province

In the early days of the foundation of China, farming system in Shandong Province has changed from one crop a year or three crops two years into two crops a year. In the 1960s – 1970s, implementation of cultivation theories, such as the Double Cropping System of Winter Wheat and Maize and the Double Cropping System of Wheat-Cotton Intercropping, has effectively promoted the development of grain and cash crop production. In the early period of 1980, many researchers focused on the further improvement of utilization efficiency for solar energy and the crop-producing potential, which provides a theoretical basis for the multiple cropping system. In the 1990s, theory and practice of farmland development reaches a climax, with new crop varieties as the basis, intercropping and multiple cropping as the main bodies, supplemented by fine cultivation and plastic film mulching. The *China's Agenda* 21 points out that sustainable agriculture is the basic direction of the development of modern agriculture. After entering the 21st century, food security, peasants' income increase, market-oriented management, resources and environment protection and improvement, and coordinated development of urban and rural areas have become the requirements of agricultural development. At present, Shandong Province is at the semi-intensive, semi-commercial and semi-sufficiency level of farming system. Eastern coast and central Shandong agricultural zones are moving in the direction of modern farming system, having formed a preliminary new pattern of the coordinated development of grain, feedstuff, economic and other crops.

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2 Influencing factors on the development of farming system

2.1 Agricultural production condition and input level

Agricultural production condition is an important foundation for the realization of agricultural modernization. Since the year 1952, gross power of agronomic machinery has increased year by year. During this period, the years 1952 – 1970 are the accumulated stage of machinery power; the years 1971 – 1996 are the stage of stable development; and the years 1997 – 2007 are the stage of rapid development. In the year 1980, machine-ploughed area reaches its peak value for the first time. Then, it is relatively stable with little increase. In the year 2007, machine-ploughed area accounts for 91.2% of the total arable land area; effective irrigation area occupies 76.5% of the total arable land, which is the maximum value in the recent years. Moreover, both fertilizer application rate and electricity consumption in rural areas show a steady increase, which effectively promotes the development of agricultural production level (Fig. 1). Since the year 1952, proportion of assist-agriculture capital has decreased year by year, but the value of financial funds for agriculture has increased, especially after the year 1978. In the year 2006, absolute value of financial funds for agriculture is 10 800 million yuan, 26.9 times of that in the year 1978 (Fig. 2)[4]. Improvement of production condition has greatly promoted the adjustment of agricultural structure. Planting industry has gradually changed from three crops two years into two crops a year. Planting proportion of winter wheat-summer maize has a substantial increase and the multiple cropping index significantly increases[5]. Proportion of high value-added planting patterns further grows, such as grain-vegetable, grain-fruit, and fruit-vegetable. And the crops difficult to achieve mechanization decrease.

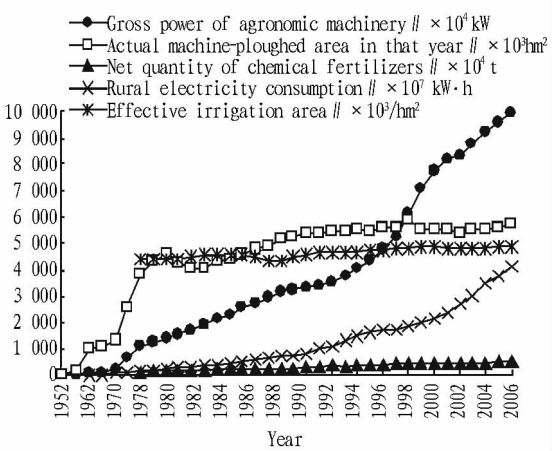

Fig. 1 Basic conditions for agricultural production in Shandong Province

2.2 Population and food

Table 1 reports the forecast result of grey correlation degree analysis by DPS software. Result shows that until the year 2020, arable land will be further reduced to 5 899 thousand hectares. And the unit yield will rise to 8 121 kilograms per hectare. Thus, product of the two is 479 00 million kilograms, increased by 5 billion kilograms compared with that at present. However, the 50 *Million Tons Increase of Grain Production Capacity in Shandong Province* (2009 – 2020) points out that we should work hard to realize the grain production capacity of 50 billion kilograms at the year 2020, which is 21 00 million kilograms more than the forecast result. At the same time, population will reach its peak value of about 100.9 million people in Shandong Province in 2020, which is basically consistent with the control target of total population within 100 million in the year 2020 formulated by the Population and Family Planning Commission of Shandong Province. Per capita annual share of grain will be 475 kilograms. Thus, a stable grain production is of great significance.

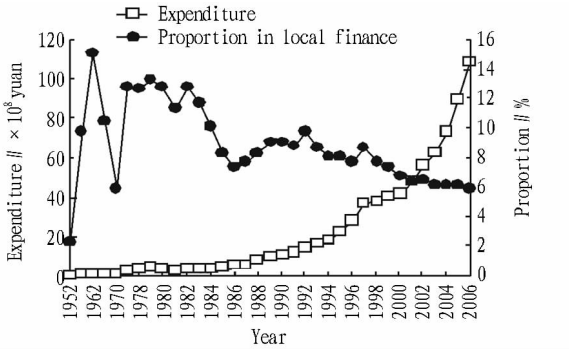

Fig. 2 Financial funds for agriculture in Shandong Province

Table 1 Grain production and population forecast in Shandong Province

Year	Area of arable land // ×10⁴ hm²	Total yield ×10⁴ t	Unit yield kg/hm²	Population ×10⁴
2010	608.3	4 328	7 115	9 740
2020	589.9	4 790	8 121	10 088

2.3 Policy measures

After the founding of new China, the party committees and governments in Shandong Province have carried out union movement according to the *Common Program*. In the year 1951, the Central Committee of the Communist Party of China adopted a resolution on mutual aid and co-operation in agricultural production (protocol). Based on this, Shandong Province released a situation report on mutual aid and co-operation in the year 1953, checking impetuosity and rash advance. In the year 1958, the Central Committee of the Communist Party of China released the *Suggestions on Integrating the Small Agricultural Cooperatives into Large Ones and the Resolution on Establishing the People's Communes in Rural Areas*. However, agricultural production fluctuated greatly due to the inappropriate policy guidance. In the year 1962, agriculture, forestry, animal husbandry and fishing gradually restored. But food production was affected by the "cultural revolution" to a certain degree[6]. Shandong Province implemented economic reform in rural areas in the year 1979, and allowed economic system with diverse modes of operation and different payment methods in the year 1980. In the 1980s, the Central Committee published a total of five documents No. 1 about agricultural problems (Table 2).

After implementing the household contract responsibility system, a number of specialized households under contract appear in the field of aquaculture, planting industry and handicraft industry. Social service in rural areas is greatly developed, mainly in the form of the trade-industry-agriculture integration, market leading service, joint-equity cooperative service and so on. In general, there is a transversal community-based service system and a longitudinal professional service system. Grain output increase steadily in the 1980s – 1990s; structure of farming, forestry, animal husbandry and fishery is further optimized; and market economy plays an important role in agricultural production. However, good harvests for many years in succession have caused problems in grain selling, which reduces the peasants' enthusiasm for production. In the years 2000 – 2002, grain output decreases. In order to promote the healthy and stable development of agriculture, the Central Committee of the Communist Party of China has published five documents No. 1 (Table 3). Affected by these policies, grain output increases steadily in the years 2003 – 2008, and reaches 42 605 thousand tons in the year 2008.

Table 2 Documents No. 1 published by the Central Committee of the Communist Party of China in the 1980s

Year	Name of document	Main content
1982	Summary of Rural Working Conference in China	All-round responsibility system and fixing of farm output quotas for each household belong to the responsibility system of socialist production
1983	Current Issues of Rural Economic Policy	Household contract responsibility system is a great creation of farmers under the leadership of the Party, and a new development of Marxist agricultural cooperation theory in China
1984	Notice on Rural Work in 1984	Stabilize and improve the household contract responsibility system
1985	Ten Policies to Further Invigorate the Rural Economy	Cancel the unified purchasing of farm produce according to fixed quotes; adopt national planned purchase of a small number of important products
1986	Regulations on the Deployment of Rural Work in 1986	Confirm that the principles and policies of rural reform are correct

Table 3 Documents No. 1 published by the Central Committee of the Communist Party of China since the 21st century

Year	Name of document	Main content
2004	Suggestions of CPC Central Committee and the State Council on Several Policies about Increasing Peasants' Income	Increase farmers' income
2005	Suggestions of CPC Central Committee and the State Council on Further Strengthening the Rural Work and Improving the Overall Agricultural Production Capacity	Increase the overall production capacity of agriculture, adhere to the principle of "giving more, taking less and loosening control", stabilize and enhance agricultural support policies
2006	Suggestions of CPC Central Committee and the State Council on Pushing Forward the Construction of New Socialist Countryside	Promote the development of agriculture and rural area, enrich the peasants, and abolish agricultural taxes in China
2007	Suggestions of CPC Central Committee and the State Council on Actively Developing Modern Agriculture and Promoting the Construction of New Socialist Countryside	Strengthen the work of the "Three Agricultural Problems", actively develop modern agriculture, and push forward the construction of socialist new countryside
2008	Suggestions of CPC Central Committee and the State Council on Strengthening agricultural infrastructure construction and Further Promoting the Agricultural Development and Income Increase of Peasants	Strengthen the construction of agricultural infrastructure, promote the agricultural development, and increase peasants' income

2.4 Development of natural resources and regions Shandong Province is located in warm temperate zone with semi-humid monsoon. It has the distinguishing features of cold and dry winter with scarcity of rain and snow, hot and dry summer with concentrated rainfall. According to the economic and natural conditions, Shandong Province has been divided for five times in history. In the year 1954, Shandong Province is divided into 5 agricultural zones of Jiaodong, southern Shandong, western Shandong, northern Shandong, and central Shandong. In the year 1957, it is divided into the mountain areas of south-central Shandong Province, the hilly area of Jiaodong, the piedmont alluvial soil irrigation area of central Shandong, and the Yellow River alluvial plain of northwestern Shandong. In the year 1961, it is divided into the Jiaodong hills, the mountain areas of south-central Shandong, piedmont alluvial plain of central Shandong, the Yellow River flood plain of northern Shandong, and the lake of western Shandong. In the year 1980, Shandong Province is divided into 8 areas, including the Jiaodong agriculture, forestry and fishing area, the Bohai agriculture, fishing and animal husbandry area, the northern Shandong agriculture, the forestry and animal husbandry area, the western Shandong agriculture, forestry and animal husbandry area, the east lake fishery and agriculture area, the Jiaoji agricultural area, the south-central Shandong agriculture, forestry and animal husbandry area, and the ocean fishing area. In the year 2008, Shandong Province is divided into 7 farming system areas, such as the low mountain and hilly agriculture, forestry, fruit and fishery area in coastal eastern Shandong, the Jiaoji Plain grain area, the mountain and hilly agriculture, forestry and animal husbandry area in south-central Shandong, the agriculture, forestry and fishery area of Hudong Plain, the agriculture, forestry and animal husbandry area of southwest Shandong plain, the agriculture, forestry and animal husbandry area of northern Shandong plain, the agriculture, fishery and animal husbandry area of Yellow River Delta. Therefore, it can be concluded that division of Shandong Province has changed from taking natural environment as the leading factor into the combination of nature and function. The evolution of division shows that based on the

local natural resources and the actual situation, connotation of farming system changes over time. Therefore, regional and large-scale development of farming system will effectively improve the utilization efficiency of agricultural resources and the agricultural commodity rate.

2.5 Agricultural industrialization and urbanization level Shandong Province is not only a major agricultural province in China, but also the cradle of the agricultural industrialization. The second-level government in Shandong Province spends more than 100 million yuan on the operation of agricultural industrialization. After drawing conclusions from their experiences, Shandong Province organically combine the industrialization management, the adjustment of agricultural and rural strategic economic structure, the development of modern agriculture, and the promotion of rural urbanization together, according to the general thought of " establishing the leading industry, implementing regional distribution, driven by leading enterprises, developing scale management" , in order to explore new development pattern. When implementing the operating modes such as " company + base + peasant household + standard" , a market-oriented organizational relationship led by company is formed with base as the vector and interests as the bond. At the end of the year 2005, number of agricultural industrialization organizations reaches 8 716 in Shandong Province. Development of agricultural industrialization plays an important role in forming the modern farming system, having distinctive characteristics of agricultural production area, standardization of agricultural production, and significant increase in peasants' income.

With the development of economy, Shandong Province has accelerated urban construction and has shown great changes in industrial structure. In the year 2005, population sampling survey reveals that the urbanization rate of Shandong is 45%, the agricultural population is 60 656 thousand, accounting for 65.8%. This indicates that the degree of non-agriculture is relatively low, and urbanization will be an important engine of economic development in the foreseeable future. However, the overall strength and competitiveness of western cities are significantly backward, which has weakened the radiation effect of cities on the vast rural hinterland, affected the cities' overall leading and radiation effect on economic and social development in Shandong Province. Fig. 3 illustrates that agriculture develops rapidly in recent years, but its proportion in the gross output value of industry and agriculture declines. Rural labor force transfers into cities and other industries. Proportion of employees in agriculture, forestry, fishery and animal husbandry has declined from 95% in 1952 to 50.5% in 2007, indicating that urbanization has cast significant effects on the adjustment of industrial structure, the regional distribution and modernization of agriculture, and the intensive agricultural production.

2.6 Scientific and technological level Agricultural production technology of Shandong Province can be divided into four stages. The first stage is the years 1949 – 1957. Organizational form, rules and regulations of agricultural techniques extension have played an important role in output increasing techniques of agriculture. The second stage is from the year 1958 to 1977. Agricultural production is greatly affected by the " Great Leap Forward" in the year 1958. In 1964, Shandong Province has established various types of model fields and high-yield plots, which promotes the agricultural production. After the year 1966, agricultural production technology has been greatly affected by the " cultural revolution" . The third stage is from the year 1978 to 1998. After the Third Plenary Session of the Eleventh Central Committee, agricultural science and technology has shown a leap-forward development. Establishment of the contract responsibility system of agricultural technology extension has greatly promoted the development of agricultural production. The fourth stage is from the year 1999 to 2008. Agricultural industrial structure has gradually tended to have the characteristics of standardization, industrialization and internationalization. Export of agricultural products in Shandong Province has taken the first place in China for many years.

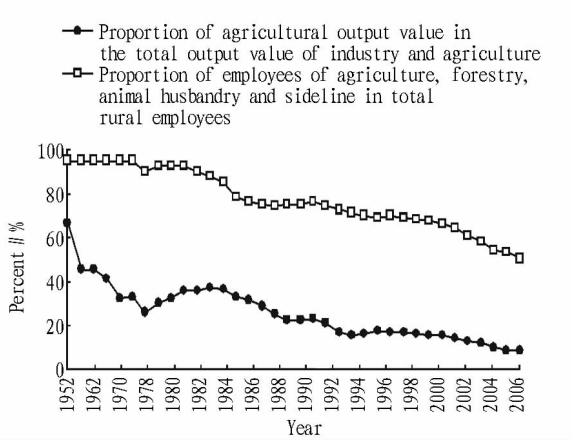

Fig. 3 Total output value of agriculture and its employees

3 Conclusion and discussion

Establishment of modern farming system in Shandong Province must fully consider the population, industrial structure, agricultural production conditions, urban construction and policies and so on. It should satisfy the requirements of urban industrial development for resources consumption and agricultural raw materials, as well as the requirements of urban and rural residents for safe and high-quality agricultural products. The fundamental driving forces of the constant adjustment of farming system are narrowing the income gap between urban resident and rural resident and increasing peasants' income. Improvement of agricultural production conditions and urban construction are usually accompanied by the adjustment of industrial structure. Shandong Province is now at the middle or later period of industrial development, which is a turning point for the optimization of farming system. The main objective of adjustment is to improve the competitiveness and market adaptability of agricultural industry, to enhance the benefits of agriculture, and to increase the peasants' income. The key to promote agricultural development and peasants' income is to rely on agriculture itself and other forces outside agriculture[7].

Making a long-term and stable agricultural development policy can help to promote the rapid development of agriculture. Therefore, we should increase investment and subsidies in agriculture, especially the subsidies for grain production, and gradually turns it into policy. The core of farming system reform and optimization is the high-quality variety improvement and high-yield farming and cultivation techniques. Promotion and application of future biotechnology, information technology, and new material technology will also have a huge effect on promoting the development of agriculture. Therefore, based on the actual situation of Shandong Province, we should develop modern agriculture, establish a scientific and rational farming system, and realize the sustainable development of agricultural production according to the influencing factors of population, agricultural production, urban development and natural conditions.

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In general, 3PLs enterprise is still in the initial stage in China. Management information system of agricultural supply chain is not perfect, which can not meet the current needs of the rapid development and agricultural products circulation in rural China. Thus, there is an urgent need to build a new mode of agricultural logistics, so as to reduce the process of sales turnover, to lower the production cost of 3PLs enterprises, to improve the circulation efficiency of agricultural products, and to expand the sales market of agricultural products.

3 Conclusion

Developing modern 3PLs is an inevitable trend of market development. Design and development of management information system based on 3PLs can bring spillover benefits to the producer, supplier and retailer of agricultural products. Under the current Internet environment, management information system of agricultural supply chain based on 3PLs must be established based on the specific characteristics of operation mode and the actual business situation of 3PLs enterprises, so as to establish a management information system suitable for a given enterprise. From the perspective of overall integration of resources, the network management information system of agricultural supply chain based on 3PLs established has connected the interests of different nodes in agricultural supply chain into an organic whole, has effectively eliminated the barriers to information flow, and has increased the profits of agriculture-related enterprises and farmers. At the same time, according to the characteristics of agricultural enterprises in China, a rational agricultural products logistics mode of internal and external integrated agricultural enterprise is established, which offers a reference for the management of agricultural supply chain in China.

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