

Food Security Problems and Solutions in China Based on the Strategy of Sustainable Agricultural Development

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Abstract China attaches great importance to food security. With the strong promotion of the government, China's grain output has achieved a great feat from "shortage" to "surplus in bumper years" and then to "rising steadily", achieving a record "increase for the tenth consecutive year". From the current balance of food supply and demand in China, the food security situation can be guaranteed on the whole. However, if we analyze the food security in China from the perspective of agricultural sustainable development strategy, there are some difficulties, such as the reduction of cultivated land area, the decline of cultivated land quality, the fragility of agricultural ecological environment, and the transformation of residents' consumption structure. This paper analyzes the difficulties faced by the development of food security in China under the strategy of sustainable agricultural development, and puts forward that to implement the strategy of sustainable agricultural development, it is necessary to realize the coordinated development of food security, science and technology, ecological environment, resources and society.

Key words Sustainable development, Food security, Ecological environment

1 Introduction

Under the old concept of food security to solve the problem of food and clothing, China has been pursuing the goal of maximizing the total grain output, which has caused pollution and destruction to the ecological environment. For these problems, we must achieve food security on the basis of sustainable agricultural development. The traditional concept of development only pays attention to the economic achievements already made. Under the control of this concept, people are often eager for quick success and short-term behavior, even at the expense of "killing the goose that lays the golden eggs". As for the adverse effects of such economic achievements on future development potential, little attention is paid to them.

Different from the traditional view of development, the strategy of sustainable development requires the change from focusing on development content to focusing on development ability. The concept of sustainable development organically unifies the present and the future to consider, not only seeing the immediate interests, but also taking into account the long-term interests; not only paying attention to the realization of economic achievements, but also focusing on the sustainability of social development in the future, so as to maintain the unlimited potential of development.

2 The sustainable development dilemma faced by China's food security

China is a big grain producer. In 2022, China's total grain output reached 686.53 million t (Fig. 1), and the per capita share of grain was 486 kg, ranking first among the top ten grain producers in the world. China's total grain output is 1.40 times and 1.97 times that of the United States and India, and the per

capita share of grain has exceeded the world average for many years. However, under the background of lack of resources and fragile agricultural ecological environment in China's agricultural production, with the improvement of people's living standards and the increase of rigid demand for food caused by industrialization and urbanization, China's food security is facing the dilemma of sustainable development, and the situation of food security is not encouraging.

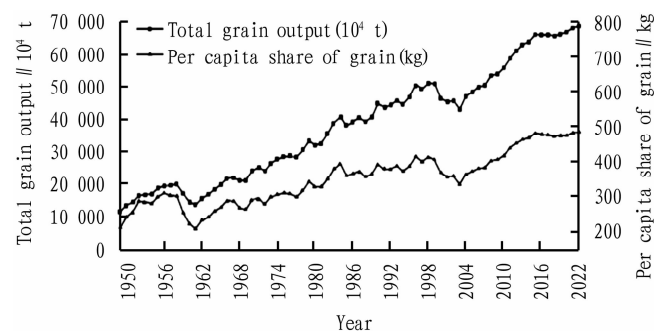


Fig.1 China's total grain output and per capita share of grain from 1949 to 2022

2.1 Large population base and transformation of residents' consumption structure constantly increasing food demand

The key to food security is the contradiction between food and population. China is a populous country in the world, and the impact of population on food consumption and food security should not be underestimated. Population problem has become a key factor related to the sustainable development of agriculture and food security in China.

With the continuous advancement of urbanization, a large rural population has poured into cities, and the proportion of urban population has continued to increase. Great changes have taken place in the consumption structure of residents. On the whole, urban residents often have higher requirements for food quality,

safety and nutrition. The trend of grain consumption structure in China has changed from simple satiation of need for rice, noodles and oil to balanced and healthy nutrition of meat, eggs and milk. It promotes the rapid development of breeding industry and grain processing industry. This has given rise to a large demand for basic raw grain, especially the increasing amount of feed grain, which brings a lot of practical pressure to food security.

2.2 Urbanization leading to a decrease in grain production factors

With the improvement of economic development and the acceleration of industrialization and urbanization, a large quantity of land resources are needed. Especially the occupation of cultivated land resources in the suburbs of cities makes the cultivated land area needed for grain production decrease continuously. Although China adopts the policy of requisition-compensation balance in the occupation of cultivated land resources, in practice, there are phenomena of cultivated land in mountains, forests and rivers, lakes and beaches, high-quality and high-yield cultivated land is passively replaced, and the production capacity of cultivated land is constantly weakening. The threat brought by the occupation of high-quality cultivated land to grain production cannot be ignored.

2.3 Fragile ecological environment and lack of water resources increasingly restricting food production

Although China has a vast land area, there is an imbalance between available cultivated land resources and population. The utilization of grain production resources is becoming more and more tense. Under such a premise, only by continuously pursuing the improvement of grain yield, can cultivated land resources be maximized. The use of chemical fertilizers, pesticides and plastic films in China is increasing year by year. Pesticide residues and rural industrial pollution are the main agricultural pollution sources. Excessive application of pesticides and fertilizers, over-exploitation of groundwater and other non-sustainable production methods have caused erosion and pollution to a large area of farmland for grain planting in China, resulting in insufficient input of organic fertilizer into cultivated land, degradation of cultivated land, shallower tillage layer, and decline of water and fertilizer conservation capacity. Moreover, it is easy to increase silt in reservoirs, riverbeds and lakes, reduce reservoir capacity, raise riverbeds and aggravate flood threats.

3 Solutions for ensuring food security under the strategy of sustainable agricultural development

3.1 Developing large-scale grain production In the process of long-term agricultural development in China, influenced by the national conditions of more people and less land, China has long adopted decentralized small-scale extensive agricultural planting for grain production. This production mode makes China's grain production unable to be managed in a large-scale system, which is also one of the important factors affecting food security. Therefore, we can implement the rural land classification and circulation system, and ensure the basic food production by promoting the large-scale management of land and realizing the large-scale planting of cultivated land. For the long-term abandoned land, the village collective can recover it according to the actual situation, re-contract it, and transfer it to major planters with planting ability, which can not only improve the scale effect, but also improve the

land use efficiency.

3.2 Strictly implementing the cultivated land protection system to ensure the sustainable production capacity of cultivated land

Cultivated land is the lifeline of food production and ensuring food security. Therefore, governments at all levels must strictly implement the capital farmland protection system, do a good job in general survey and regular inspection of basic farmland, sign a letter of responsibility for farmland protection objectives with relevant responsible persons, and stick to the "red line" that capital farmland does not decrease. They must strictly implement the land use control system, appropriately raise the threshold conditions for occupying cultivated land according to the local actual situation, and realize the cultivated land protection system of "who occupies, who compensates" when it is really necessary to occupy land, so as to put an end to the phenomenon of "occupying the superior but compensating with the inferior".

3.3 Improving the scientific and technological level of production

Under the premise that grain production resources are constrained, the potential of increasing grain production in China in the future will mainly depend on the improvement of scientific and technological innovation ability. Therefore, it is necessary to give full play to the great role of science and technology in ensuring food security, and deeply realize that implementing the project of "increasing grain through science and technology", promoting the continuous innovation of grain production science and technology, and improving the comprehensive grain production capacity are the fundamental requirements for implementing the national food security strategy. Science and technology is an important means for the development of agricultural modernization. It is necessary to rely on scientific and technological progress and innovation to cultivate high-quality seeds and improve the scale and mechanization of grain production. It is necessary to establish smart agriculture, green agriculture and smart granary.

3.4 Actively promoting grain saving and loss reduction and advocating green catering

It is necessary to properly restrain people's food waste by establishing policies and regulations, and urge people to be diligent and thrifty and cherish food. It is necessary to promote scientific and civilized food and beverage consumption, avoid waste of food materials, guide consumers to form a civilized and thrifty concept, and strengthen the management of food in various links to reduce food loss and waste. At the same time, the government should also intensify the publicity of the concept of saving food, advocate the catering industry to change its business philosophy, develop green catering, actively guide consumers to order food in moderation, prohibit setting minimum consumption, increase food saving slogans, and take the initiative to help pack after meals, so as to strengthen the cultivation of people's awareness of saving.

4 Conclusions and recommendations

Food security under the strategy of sustainable agricultural development not only emphasizes the largest realistic quantity of food at a certain point, but also emphasizes realization of strong realistic and potential comprehensive food production capacity in a

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- [13] YE HT, LUO SQ, YANG ZN, *et al.* Endophytic fungi stimulate the concentration of medicinal secondary metabolites in *Houttuynia cordata* thumb. [J]. *Plant Signaling & Behavior*, 2021, 16(9): 1929731.
- [14] JIANG Y, WANG X, ZHAO Y, *et al.* Effects of biochar application on enzyme activities in tea garden soil[J]. *Frontiers in Bioengineering and Biotechnology*, 2021: 9.
- [15] ASLAM MN, MUKHTAR T, HUSSAIN MA, *et al.* Assessment of resistance to bacterial wilt incited by *Ralstonia solanacearum* in tomato germplasm[J]. *Journal of Plant Diseases and Protection*, 2017, 124(6): 585–590.
- [16] GERLIN L, ESCOURROU A, CASSAN C, *et al.* Unravelling physiological signatures of tomato bacterial wilt and xylem metabolites exploited by *Ralstonia solanacearum*[J]. *Environmental Microbiology*, 2021, 23(10): 5962–5978.
- [17] GROSCHE R, LOTTMANN J, REHN VNC, *et al.* Analysis of antagonistic interactions between *Trichoderma* isolates from Brazilian weeds and the soil-borne pathogen *Rhizoctonia solani*[J]. *Journal of plant diseases and protection* (2006), 2007, 114(4): 167–175.
- [18] YOUNG S, KIRKBY K, ROSER S, *et al.* Method for estimating inoculum of the soilborne fungal pathogen *Verticillium dahliae* in Australian cotton soils[J]. *Crop & Pasture Science*, 2021, 72(2): 146–154.
- [19] LAMICHHANE JR, BARTOLI C. Plant pathogenic bacteria in open irrigation systems: What risk for crop health? [J]. *Plant Pathology*, 2015, 64(4): 757–766.
- [20] YOUNIS B A, MAHONEY L, SCHWEIGKOFER W, *et al.* Inactivation of plant pathogens in irrigation water runoff using a novel UV disinfection system[J]. *European Journal of Plant Pathology*, 2019, 153(3): 907–914.
- [21] VISWANATHAN R. Severe red rot epidemics in sugarcane in sub-tropical India: Role of aerial spread of the pathogen[J]. *Sugar Tech*, 2023(25): 1275–1277.
- [22] BABIN D. Microbial community analysis of soils under different soybean cropping regimes in the Argentinean south-eastern Humid Pampas (vol 97, fiab007, 2021)[J]. *Fems Microbiology Ecology*, 2022, 98(6).
- [23] DAI L, SINGH SKK, GONG H, *et al.* Rhizospheric microbial consortium of *Lilium lancifolium* Thunb. causes lily root rot under continuous cropping system[J]. *Frontiers in Microbiology*, 2022: 13.
- [24] SONG X, HUANG L, LI Y, *et al.* Characteristics of Soil Fungal Communities in Soybean Rotations[J]. *Frontiers in Plant Science*, 2022: 13.
- [25] YU P, HE X, BAER M, *et al.* Plant flavones enrich rhizosphere Oxalobacteraceae to improve maize performance under nitrogen deprivation [J]. *Nature Plants*, 2021, 7(4): 481–499.
- [26] ZHU F, FANG Y, WANG Z, *et al.* Salicylic acid remodeling of the rhizosphere microbiome induces watermelon root resistance against *Fusarium oxysporum* f. sp. *niveum* infection[J]. *Frontiers in Microbiology*, 2022(13): 1015038.
- [27] MA K, KOU J, KHASHI URM, *et al.* Palmitic acid mediated change of rhizosphere and alleviation of *Fusarium* wilt disease in watermelon[J]. *Saudi Journal of Biological Sciences*, 2021, 28(6): 3616–3623.
- [28] GE G, GAO H, ZHENG B. Multiple-time contamination of benzo(a)pyrene in soils inhibits soil enzymatic activities[J]. *Chemistry and Ecology*, 2018, 34(3): 272–287.
- [29] LU H, XU D, KONG T, *et al.* Characteristics of enzyme activities during phytoremediation of Cd-contaminated soil[J]. *Sustainability*, 2022, 14(15).
- [30] YANG D, TANG L, CUI Y, *et al.* Saline-alkali stress reduces soil bacterial community diversity and soil enzyme activities[J]. *Ecotoxicology*, 2022, 31(9): 1356–1368.
- [31] NURZHAN A, TIAN H, NURALYKYZY B, *et al.* Soil enzyme activities and enzyme activity indices in long-term Arsenic-contaminated soils [J]. *Eurasian Soil Science*, 2022, 55(10): 1425–1435.
- [32] KIM YH, LEE HS, KWAK SS. Differential responses of sweet potato peroxidases to heavy metals[J]. *Chemosphere*, 2010, 81(1): 79–85.
- [33] LI Y, ZHANG S, JIANG W, *et al.* Cadmium accumulation, activities of antioxidant enzymes, and malondialdehyde (MDA) content in *Pistia stratiotes* L. [J]. *Environmental Science and Pollution Research*, 2013, 20(2): 1117–1123.

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long period after the comprehensive action of various influencing factors, which requires the coordinated and sustainable development of food security, science and technology, society, resources and environment.

In a word, under the strategy of sustainable agricultural development, we should adhere to the concept of sustainable food security, not only pay attention to food quantity security, but also combine quantity security with quality security and ecological security to build an overall food security system.

References

- [1] TANG ZJ. Research on China's food security and development under the new economic normal[J]. *Quality and Market*, 2022(15): 163–165. (in Chinese).
- [2] MA YP. Analysis on the path of realizing food security in Henan Province under the sustainable development of agriculture[J]. *Shanxi Agricultural Economics*, 2022(17): 104–106. (in Chinese).
- [3] ZHU XK. National food security strategy from the perspective of modern agricultural development[J]. *National People's Congress of China*, 2012(15): 36–43. (in Chinese).
- [4] TANG HJ. China's food self-sufficiency strategy under the new situation [J]. *Agricultural Economic Issues*, 2014, 35(2): 4–10, 110. (in Chinese).
- [5] ZHAI YL, ZHOU B. Judgment of China's food security situation from the perspective of sustainable agricultural development [J]. *Agricultural Economy*, 2015(6): 3–5. (in Chinese).
- [6] SHAO YT, DUAN LL. New challenges and coping strategies for food security under the new normal[J]. *Journal of Tianjin University of Commerce*, 2020, 40(6): 60–67. (in Chinese).
- [7] YUAN H. Current situation and countermeasures of national food security [J]. *China High and New Technology*, 2020(21): 51–52. (in Chinese).
- [8] ZHANG Y, HAO YJ. Policy research on food security in China from the perspective of agricultural sustainable development[J]. *Journal of Hubei University of Economics (Humanities and Social Sciences Edition)*, 2022, 19(9): 33–37. (in Chinese).
- [9] ZHOU B, GUO HY. Study on the role of food security and the dilemma of sustainable development in Heilongjiang Province [J]. *Agricultural Economy*, 2023(4): 19–21. (in Chinese).
- [10] PAN Y. Challenges and countermeasures of China's sustainable development strategy[J]. *Journal of Huazhong University of Science and Technology (Social Science Edition)*, 2015, 29(4): 4–5. (in Chinese).
- [11] ZHOU B, ZHAI YL, QIAN W, *et al.* Analysis of influencing factors of China's food security from the perspective of sustainable agricultural development-empirical analysis based on structural equation model[J]. *Rural Economy*, 2015(11): 15–19. (in Chinese).
- [12] LIU X, WANG JM, WANG XD, *et al.* Study on the sustainable development strategy of grain crop industry[J]. *Engineering Science of China*, 2016, 18(1): 22–33. (in Chinese).
- [13] LI WH, CHENG SK, MEI XR, *et al.* Research on sustainable development strategy of agricultural resources and environment in China[J]. *China Engineering Sciences*, 2016, 18(1): 56–64. (in Chinese).
- [14] ZHONG Y, GAN LZ. Study on the path of ensuring food security in arid areas of northwest China under resource constraints [J]. *Zhongzhou Journal*, 2022(8): 42–50. (in Chinese).