

Research on the Significance and Countermeasures of Expanding Grain Production in Main Grain-Consuming Areas: A Case Study of Zhejiang, China

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Abstract: This paper examines the current state of grain production in main grain-consuming areas in China starting from the background of food security and regional differences in grain production and consumption in China. It points out that expanding grain production in these areas has significance in maintaining regional fairness, ensuring food supply security, and fulfilling international responsibilities. Based on the research, taking Zhejiang as an example, the article analyses the significance and countermeasures of expanding grain production in the main grain-consuming areas, and proposes policy recommendations such as reducing the occupation of high-quality cultivated land, supporting the development of mountainous urban areas, increasing high-quality cultivated land through ecological reclamation, driving grain production through technological progress, and cultivating new types of professional farmers, in the hope of helping improve food security issues in China.

1. Introduction

1.1. A Surge in Food Security Pressure Due to Rapidly Increasing Grain Demand

Ensuring food security in the context of globalization is a challenge and a tool of social resilience.^[1] China's rural population has declined significantly, with less arable land in the south and more arable land in the north. China's food security may have regional, structural and technical crises.^[2] As the economy develops, the consumption of meat by Chinese residents has greatly increased, which has in turn driven the consumption of grain. In 2001, the per capita grain consumption in China was only 363 kilograms, which increased to 460 kilograms in 2010 and further increased to 560 kilograms in 2020^[3]. Although China's grain production has been abundant since 2005, grain output has only increased by 3.5% from 2015 to 2020. China's cultivated land is rapidly decreasing, and the potential for increasing grain production through technology and management alone is limited. The growth rate of residents' grain consumption is much faster than the increase in grain production, so the gap can only be filled by increasing imports. Moreover, the process of urbanization and industrialization in China is far from over, and a large amount of cultivated land will be occupied for a long time to come.

1.2. Over-Reliance on the Global Market Will Pose a Threat to China's Food Security

Moderately relying on the global market to address food shortages is an important component of China's food security strategy, but over-reliance on it poses significant risks, as food can be used as an economic sanction. The uncertainty of China-US relations, which influence the global food market, and that of its allies, poses a potential threat to China's national food security in the future. Furthermore, sudden events such as pandemics and wars also pose threats to China's food security. Since the outbreak of COVID-19 in 2020, international food prices have experienced a sharp increase, and the February 2022 Russia-Ukraine conflict will reinforce this trend.

1.3. As a Responsible Major Power, China Should Be Responsible for International Food Security

China, as the world's second-largest economy, can import sufficient food to meet its demand. India and Brazil are major food exporting countries, but malnutrition among their populations is widespread due to their lack of industrial production capacity, forcing them to export food in exchange for foreign exchange. However, the world's food production capacity is limited, and excessive purchasing can cause rapid international food price increases, which is detrimental to developing countries. As a responsible major power, China should take on the responsibility of food security. With only 9% of cultivated land, China has managed to feed 1.4 billion people, earning high praise. Therefore, China should develop a food export plan that reflects its responsibilities as a major power and helps solve the world's food problems.

2. The Important Significance of the Main Grain-Consuming Areas Is to Assume the Responsibility of Grain Security and Expanding Grain Production.

2.1. The Grain Production Potential of The Main Grain-Producing Areas in China Has Been Exhausted and Overwhelmed

In 2001, China implemented the reform of the grain circulation system, which divided the 31 provinces (regions and municipalities) into three major functional areas: grain-producing areas, areas with balanced production and consumption, and major grain-consuming areas, based on the overall characteristics of grain production and consumption in each province, and considering factors such as differences in resource endowments and historical traditions of grain production. With the development of the economy and society, many grain-producing areas are also facing a reduction in cultivated land and increasing difficulty in grain production. Currently, only five provinces in the grain-producing areas can stably export grain, and many provinces have become grain-deficient provinces. Therefore, ensuring food security cannot only consider economic benefits. Grain production is not only the responsibility of the grain-producing areas, but the main grain-consuming areas also need to consider the overall grain security situation, stabilize grain production, and maintain the necessary self-sufficiency rate. This approach can not only enhance their level of food security, but also help alleviate the pressure on grain supply in the grain-producing areas, ease the resource and environmental pressures in those areas, allow their land and resources to recuperate, and promote sustainable development of grain production^[4].

2.2. Main Grain-Consuming Areas Should Fundamentally Curb the Trend of Continuous Decline in Grain Production and Assume the Responsibility for National Food Security

In the past, the failure of the main grain-producing areas to take on the specific task of grain

production has led to a steady decline in grain production in these regions, with a current shortfall of over 70 million tons of grain in China's seven major grain-producing areas. Zhejiang, as a main grain-producing area, illustrates this problem well: from 1953 to 1978, it achieved basic self-sufficiency in grain production with a surplus, and in 1984, grain production reached a historical high of 18.1715 million tons. Since then, grain production has shifted from surplus to insufficient^[5], and has continued to decline, hitting a record low of 5.6484 million tons in 2016. Zhejiang's grain production declines every few years by a million-ton level, and once it drops to the next level, it is difficult to return to the previous level except for a few rebound years. With the increase in population and changes in food consumption structure, grain demand continues to grow, and in 2021, Zhejiang's self-sufficiency rate for grain was only 23.7%. Currently, Zhejiang's annual grain shortfall is over 20 million tons. Zhejiang is located on the southeast coast of China, with good water and heat conditions, and the cultivated land can yield two or even three crops a year. In the increasingly severe situation of China's food security, if Zhejiang can take effective measures to expand grain production and continuously improve its self-sufficiency rate, it will make a significant contribution to China's food security. Other main grain-producing areas, especially Guangdong and Fujian, have natural and geographical environments similar to Zhejiang and good grain production conditions. If these areas can effectively expand grain production and continuously improve their self-sufficiency rate, it will be of great significance to ensure food security.

3. Research on the Countermeasures of Expanding Grain Production and Increasing Grain Self-Sufficiency Rate in Zhejiang

3.1. Strengthening the Source Control of Cultivated Land Protection and Minimizing the Occupation of High-Quality Cultivated Land

To ensure food security, it is essential to first protect cultivated land. In terms of cultivated land quality, the paddy fields in the coastal plains of Zhejiang are the highest quality for growing grains, with an annual yield of 1.2 to 1.5 tons per mu (1 mu is approximately 0.17 acres). However, in the rapid urbanization process, a large number of high-quality paddy fields have been occupied. Although Zhejiang has implemented strict policies on cultivated land occupation and compensation, the hillsides are not suitable for large-scale mechanized production, and the soil fertility and hydrothermal conditions are not as good as those in the plains. Therefore, after the high-quality paddy fields are converted to hillsides, they are unable to produce grains and are left fallow, which is an important reason for the significant decline in grain production in Zhejiang over the past four decades.

3.1.1. Not Occupying Cultivated Land or Occupying as Little Cultivated Land as Possible, Especially High-Quality Cultivated Land

Zhejiang's economy and society are still rapidly developing, which inevitably leads to urbanization and industrialization encroaching on cultivated land, but efforts should be made to minimize the encroachment on cultivated land. First, land use review should be strictly enforced. All types of land use standards should be strictly adhered to, and cultivated land, especially high-quality cultivated land, should not be taken or taken as little as possible. Second, factors should follow the project. Relevant mechanism reforms should be implemented to improve the level of conservation and intensive utilization. And to reduce unreasonable land use from the source. Third, efforts should be made to increase land inspection and law enforcement. Illegal and irregular occupation of cultivated land for non-agricultural construction and changing land use should be severely investigated and punished. Fourth, transportation and road construction should utilize

existing routes and stations as much as possible to minimize the occupation of cultivated land, especially high-quality paddy fields. Fifth, parks can be built by dint of mountains, forests, or river networks. Urban development inevitably requires the construction of parks, and to protect cultivated land, mountains, forests, or river networks adjacent to cities should be chosen as much as possible for park construction, which can greatly reduce the occupation of cultivated land, while also enriching the natural landscape, reducing the scale of greening, and saving costs.

3.1.2. Defining the Sequence of Land Protection by Law

China currently classifies land based on its price, but it can also be classified based on its function in terms of food production and ecological protection, as cultivated land, forests, grasslands, and tidal flats have different roles in these aspects. Zhejiang is located in the southern coastal region, with a warm and humid climate and less pressure on ecological protection compared to inland areas, but with significant pressure on food production. Therefore, land protection in Zhejiang should prioritize the protection of cultivated land, especially the protection of high-quality rice paddies in the coastal plain. Unless necessary, they should not be easily occupied. However, the reality is quite the opposite. Over the past forty years of reform and opening up, the most high-quality rice paddies in the coastal region of Zhejiang have been occupied not only by urbanization and industrialization, but also by conversion into forests, grasslands, lakes, and orchards, revealing inadequate protection to the high-quality cultivated land.

3.1.3. Supporting the Development of Mountain Cities to Reduce the Occupation of High-Quality Cultivated Land by Urbanization and Industrialization

Since the reform and opening-up policy, Zhejiang province has taken up a large amount of fertile coastal plain cultivated land in the process of rapid urbanization and industrialization. However, Zhejiang has a lack of land and an abundance of mountains, and the food production capacity of the mountainous areas is much weaker than that of the plains. Therefore, it is worth trying to develop mountainous urban areas as a new path for the urbanization and industrialization of Zhejiang, even though this may cause some damage to the ecological environment by increasing the use of mountainous land. It should be considered that in the past forty years, a large number of fertile coastal plains in Zhejiang have already been occupied, resulting in very few remaining paddy fields in Zhejiang.

It is widely believed that economic development in mountainous urban areas is difficult and unsuitable for human habitation. However, as a famous mountain city, Chongqing has accelerated its economic development in recent years due to proper planning and accurate positioning, serving as a model for the development of central and western China. An increase in the use of mountainous land for urbanization and industrialization development can reduce the occupation of coastal plain paddy fields and leave cultivated land for future generations. At the same time, the development of mountainous urban areas can radiate to surrounding areas, promote the development of mountainous and semi-mountainous areas, and help Zhejiang achieve common prosperity.

3.2. Effective Measures Should Be Taken to Offset the Negative Effects of Cultivated Land Reduction on Grain Production

The rapid pace of urbanization and industrialization has resulted in the significant occupation of cultivated land, and the expansion of non-food crops has further reduced the area available for food crop planting. This cultivated land constraint has become a major challenge to food security in Zhejiang. The area of cultivated land used for food crop planting has also decreased from 3472.20 thousand hectares in 1978 to 951.36 thousand hectares in 2016 ^[6]. Given that Zhejiang is still in a

period of rapid economic development, the need for urbanization and industrialization continues to consume precious cultivated land resources. Without concrete measures, the prospects for food production in Zhejiang are concerning.

To address these challenges, effective measures need to be taken to increase the arability of cultivated land and soil fertility. And to explore the potential of existing cultivated land resources to increase the multiple crop index and yields. First, it is necessary to adhere to the principle of “maintaining the best and supplementing the weak” to prevent the decline in both the quantity and quality of cultivated land. Second, it is important to improve the sustainable utilization of cultivated land resources by taking measures such as soil conditioning and improvement, optimizing fertilizer resources, to promote a balance between the use and maintenance of cultivated land and optimizing the allocation of fertilizer resources to protect and improve soil fertility. In addition, cultivated land rotation and fallow should be carried out in an orderly manner to promote the recovery and restoration of cultivated land and enhance the sustainable utilization capacity of cultivated land resources. Thirdly, land consolidation should be carried out to improve the arability of cultivated land. The land consolidation in mountainous and semi-mountainous areas should be strengthened to make the cultivated land more suitable for mechanized operations.

3.3. Doing Everything Possible to Increase the Area Sown with Grain

3.3.1. Optimizing Agricultural Planting Structure and Preventing Cultivated Land from Non-Grain Growing

In the past few years, the government has been encouraging the consolidation of agricultural land through land circulation. And also inspiring industrial and commercial capital to invest in rural areas to improve the economic efficiency of agricultural production. Driven by market interests, the cultivation of non-grain crops on cultivated land has become more profitable, leading to an increasingly severe trend of non-grain cultivation in China and a continuous decline in the proportion of grain crops. Therefore, it is essential for relevant government departments to comprehensively intervene in land management. Firstly, stricter supervision of land circulation is needed, including setting reasonable land circulation fees, emphasizing the use of land in the circulation contract to prevent non-grain cultivation during the land circulation, and increasing supervision of land use before and after circulation to prevent non-grain cultivation during the land circulation. Secondly, stronger supervision and punishment measures need to be implemented for non-grain cultivation on cultivated land, involving strictly regulating the use of cultivated land and emphasizing that permanent basic farmland should mainly be used for grain production, while high-standard farmland should also primarily be used for grain production.

3.3.2. Restoring Agricultural Production Function of Cultivated Land in Mountainous and Mid-Level Areas

Zhejiang province, with its thick and fertile soil in mountains and mid-levels and warm and humid climate suitable for cultivation, has a large amount of cultivated land left barren due to the policy of encouraging residents to move to urban areas since the reform and opening-up policy. In the current situation where food security is extremely severe, effective measures can be taken to restore the agricultural production function in some mountainous areas. To achieve this, the local government of Zhejiang Province should select villages with favorable conditions in mountainous areas for pilot projects. Building high-grade rural roads to ensure traffic safety, providing full coverage of information networks for quick communication in the mountainous areas, strengthening water and power facilities, enhancing the appearance, improving services, and developing tourism

to attract population clusters are all necessary measures.

Once the mountainous villages have attracted a certain population, efforts can be made to restore agricultural production. As the situation of cultivated land in mountainous areas is complex, agricultural production work should be tailored to local conditions. As the single-season rice in mountainous areas has excellent quality and a good reputation among the locals, local governments can organize or commission cooperatives to operate in a unified manner and improve the economic benefits of growing rice in mountainous areas through high-quality and high-price approaches.

3.4. Increasing High-Quality Grain Fields Through Ecological Reclamation

The cultivated land is constantly occupied in the process of rapid urbanization and industrialization, and it seems inevitable that the quantity and quality of cultivated land will decrease. Yet, in the battle for farmland protection, we can not only retreat forever. But also take the initiative to attack.

Zhejiang has a winding coastline that is rich in tidal flat resources. In some areas, after long-term reclamation, artificial coastlines have been formed, which are straight and uniform. On the outer side of the coast, there is an endless and flat tidal flat, where the environment is relatively homogeneous and marine life is not abundant. Reclamation of the tidal flats outside Zhejiang's artificial coastline has the least impact on the marine ecology, and proper ecological reclamation will not cause a significant ecological impact on the waters of Zhejiang. The farmland obtained through ecological reclamation can be entrusted to agricultural cooperatives or large-scale farmers for large-scale mechanized cultivation.

3.5. Promoting Grain Production by Relying on Scientific and Technological Progress

To fundamentally increase grain production, the key lies in enhancing the yield per unit area. Zhejiang has the potential to increase its rice yield per unit area. There are several approaches to achieving this. Firstly, high-quality grain crops should be developed, and more funding should be allocated to promote modern seed industry development, while also continuously advancing in science and technology. Secondly, it is important to strengthen the introduction of products and advanced technologies, standardize the production process, and train farmers to master high-yield and efficient practices. Thirdly, the mechanization rate should be raised, and greater incentives for agricultural machinery should be provided. While exploring new technologies. Fourthly, disaster prevention and mitigation capabilities should be enhanced, with preventative measures against weather disasters, pests, and diseases. It is also important to strengthen basic infrastructure construction. Additionally, promoting contiguous planting of the same variety of grain crops, using drones for pest and disease control, improving prevention and control efficiency, and reducing production costs is also crucial.

3.6. Changing the Problem of Rural Labor Shortage and Training a New Type of Professional Farmers

Currently, the main workforce engaged in agricultural labor in rural areas consists of older farmers, as younger people are not willing to engage in agricultural labor, resulting in an extreme shortage of rural labor force. With the comprehensive modernization and mechanization of agricultural production, farmers are increasingly moving towards professional and technical personnel. Only highly qualified farmers can have modern agricultural production.

The cultivation of high-quality food producers requires local governments to increase the training of talent among farmers, while also changing public perceptions of agriculture, rural areas,

and farmers. Firstly, existing farmers' agricultural production skills need to be further improved. Local governments should cooperate with local cooperatives to provide free specialized production technology guidance and information technology training to farmers. Secondly, more attention should be paid to cultivating successors in rural areas. Efforts should be made to actively develop labor resources for young adults of appropriate age in rural areas, further increasing the scale of young and knowledgeable laborers in rural agriculture. Thirdly, the old perceptions of ordinary people towards agriculture, rural areas, and farmers need to be changed. In the past, it was generally believed that rural areas were backward, and people tended to avoid agriculture, rural areas, and farmers when it came to marriage, employment, and settlement. With the development of society and economy, most rural areas now have convenient transportation, easy information transmission, and greatly improved living environments. In particular, with the continuous implementation of policies such as the Beautiful Countryside Construction and Rural Revitalization in Zhejiang, the appearance and living conditions of villages have undergone fundamental changes, becoming more livable. Farmers' income has also greatly improved, and it is common for some large-scale grain growers to earn millions of yuan annually.

4. Conclusion

Due to the increasing population and changes in residents' dietary consumption structure, there is a significant increase in demand for grain in China. However, grain production has reached its limit, and growth is slow. Currently, only five out of the thirteen major grain-producing regions in China, such as Jilin and Heilongjiang, have stable grain exports, while provinces such as Sichuan and Liaoning have become grain-deficient areas. In this context, expanding grain production in the major grain-consuming areas is of particular importance to ensure national food security. This paper thus proposes strategies for expanding grain production in the major grain-consuming areas, using Zhejiang Province as an example, based on its geographic, historical, and economic characteristics.

While food security is a perennial issue, it holds different meanings for grain-consuming areas, grain-producing areas, and balanced areas. The notion of expanding food production in grain-consuming areas has been mentioned by scholars and journalists alike. But has yet to receive systematic exposition or be integrated into broader studies of food security. A wealth of research already exists on food production and problems in Zhejiang, and this study seeks to combine the two to examine the experience, significance, and strategies of expanding food production in grain-consuming areas, using Zhejiang as an example. Although this study relies heavily on experience and lacks micro-level empirical research, it nonetheless points to directions for future studies. Potential research topics include evaluating policy implementation for food production, assessing the interplay between policies, and examining the effectiveness of technologies and their dissemination for expanding food production.

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