Strategic Analysis on Objectives of National Grain Security

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Abstract Price of global agricultural products rises with great fluctuation. China's food price also increases constantly. This leads to high concern of both at home and abroad for food and grain security. On the basis of making an overall analysis on current situation of grain security and making judgment on future grain security in China, this paper analyzed objectives, strategies and policies of national grain security in the new period. Finally, it came up with strategies and policy recommendations for improving agricultural production and guaranteeing national grain security.

Key words Grain security, Medium and long-term prediction, Strategic thinking

1 Introduction

Since 2006, rapid rise of global agricultural products has experienced two times of great fluctuation. In China, price of main agricultural products is also steadily rising. These have received high concern of both domestic and foreign scholars for grain security and food security. In international society, the term Food Security is often used. In China, this concept includes grain and other foods necessary for health of people (FAO, 1996). There is certain difference between the concept applied in China and in international society. In China, it is grain security in the narrow sense, mainly refers to domestic self-sufficiency of rice, wheat, corn, soybean and tuber crops. In 2007 – 2008, the price of global foods rose substantially, which was regarded as the largest global food crisis since the 1970s. Although global food crisis has not obviously spread to China, constant increase of agricultural products in China in recent years has become major factor for rise of CPI and domestic scholars also highly concern about the issue of grain security.

2 Judgment about current situation of China's grain security

2.1 Grain security in the broad sense is basically guaranteed

From individual, regional and national levels, food security of China is constantly improved in China in past thirty years. Firstly, from the perspective of micro food security of individuals and families, adequate food and clothing have been basically solved, and diversified consumption and food nutrition are constantly improved. Secondly, from the regional perspective, market integration and circulation condition between regions are constantly improved, and regional trade volume is significantly increased. These not only effectively solve the problem of regional food security due to uneven spatial distribution of resources, but also rapidly alleviate the impact of supply and demand of local agricultural products due to natural disasters, and promote significant improvement of food security level. Thirdly, from the perspective of national level, overall level of food security is highly guaranteed. In the Eleventh Five-Year Guideline period, food and feed trade volume of China kept net import. Since 2009, food and feed trade volume kept net import. In 2010, the net import of farming, animal husbandry and fishery was 153.5 billion yuan (deducting cotton import), with the self-sufficiency rate up to 97.6%. With acceleration of integration of global economy and constant improvement of China's economic opening degree, import and export trade structure of agricultural products is developing towards the direction favorable for bringing into play the comparative advantages. Import volume of farming intensive agricultural products (such as grain and oil crops) is constantly increasing, while export of labor and technology intensive agricultural products with high added value (such as vegetables, fruits and processed foods) is also increasing rapidly.

2.2 Grain security in the narrow sense has exceeded the national objective of self-sufficiency (95%)

According to definition of grain in China, grain crops include rice, wheat, corn, beans and tuber crops. In 2008, China's grain self-sufficiency has dropped below 95%; in 2009, it dropped to 92.5%; in 2010, it dropped to below 90.6%. Rigid growth of demand for feed grain and edible plant oil is the major factor contributing to drop of self-sufficiency of grain.

2.2.1 Security of soybean supply turns to international import from domestic production. After joining WTO, soybean import increases rapidly. In 2010, the annual import volume reached 54 million tons, accounting for 80% of total soybean demand. At the same time, China also imported about 2 million tons of soybean oil, equivalent to 10 million tons of soybean. The growth of soybean demand and restriction of domestic production resources and technologies are fundamental factors promoting raid growth of soybean import. The rapid increase of demand for feed and plant oils will continue to keep for a long period and the restriction of resources and technologies will be more and more prominent. For

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example, after the United States and Brazil adopted genetically modified soybeans in 1996, the planting area and per unit area yield of soybean in both countries increased rapidly. In 2009, the per unit area yield of soybean reached 2.7 ton/ha and 2.8 ton/ha in the United States and Brazil respectively, which are 70% higher than the level of China (1.6 ton/ha).

2.2.2 The security of corn supply is gradually changing from domestic production to international import. The year of 2010 is the turning point of China's corn trade volume changing from net export country to net import country. In the 1990s, the annual corm export of China was 5.5 million tons; in 2003, the export reached 16 million tons. Later, due to domestic demand growth higher than production growth, the corn export volume dropped about 2.6 million tons in 2004 – 2009. In 2010, China became a net importer of corn, the corn import volume reached 1.57 million tons, and China also imported 3.16 million tons of corn related materials to substitute domestic corn feed demand. With further growth of future livestock and poultry and aquatic product demands, even domestic corn yield keeps the annual growth rate of 2 – 3%, it is still difficult to change the situation of growth of annual import volume at 2 million tons.

2.2.3 Security level of grain ration is highly guaranteed. The security of core grain really threatening political and social stability has been fully guaranteed. Rice and wheat are major grain ration. Their self-sufficiency keeps 100% in the Eleventh Five-Year Guideline period, mainly giving the credit to change of resident consumption structure. With increase of residents' income level and advance of urbanization, the proportion of livestock products, aquatic products and vegetables and fruits to food consumption gradually rises, while the consumption of rice and wheat per capita takes on decline trend. In 1990, per capita annual rice consumption of China was 88 kg; in 2000, it dropped to 75 kg; in 2009, it dropped to 60 kg. For wheat, it is similar. In 1990, per capita annual wheat consumption was 73 kg; in 2000, it dropped to 65 kg; in 2009, it dropped to 50 kg. It is predicted that such rigid decline of demand will last for a long period.

2.3 Challenges and opportunities of grain security in the new period In the new period, China's grain security faces a series of challenges. From the perspective of grain production, farmland area is reducing, the pressure of resource and environment is increasing, labor cost is rising, and agricultural technological progress slows down. From the perspective of demand, with rise of income level, per capita meat consumption and demand for feed will increase substantially. From the perspective of international market, price of grain and agricultural products will still rise with fluctuation, and the price at international market will significantly influence stability of domestic market. At present, China's grain security also faces favorable factors and development opportunities. (i) China's population size growth rate obviously slows down, and per capita consumption of wheat and rice and total demand is declining. In 2000 – 2009, annual drop of total rice demand is about 0.7%, total demand of wheat drops 0.3% annually. In future, wheat and rice consumption demand will continue to decline. (ii) With reform and development of thirty years, both government finance and residents' income level have realized considerable growth. Foreign exchange reserve rose from 160 billion USD in the 1990s to 2800 billion USD in 2010, which strengthens China's capacity of supplying agricultural products through import. (iii) China's international political and trade negotiation conditions are obviously improved. China has established excellent cooperation relationship with North American countries, European countries, Russia, Brazil, and Argentina, and some South American countries. The establishment of WTO mechanism significantly improves international trade environment and corn and soybean trade volume at international market keep constant and stable growth.

3 Prediction of China's grain supply and demand balance and grain security level in a medium and long term

Global Trade Analysis Project (GTAP) is a global network of researchers (mostly from universities, international organizations, or the economic ministries of governments) who conduct quantitative analysis of international economic policy issues, especially trade policy. Using GTAP model and China Agriculture Policy Simulation model (CAPSIM), we made prediction of changes of supply and demand of grain and the grain security level in 2020. We set following three simulation schemes.

3.1 Simulation results of benchmark scheme The growth of China's grain demand will be higher than the supply growth in future 10 years and the self-sufficiency of grain constantly declines. In the condition of existing agricultural production resources, policies, technological progress and demand changes, China's grain yield will reach 575 million tons in 2020 with annual growth rate of 0.52%. However, grain demand will reach 663 million tons in 2020 with annual growth rate of 1.1%. This indicates that the growth rate of demand will be higher than production, and China's grain self-sufficiency will constantly decline. From 2009 to 2020, the self-sufficiency of grain will drop from 92.5% to 87%, annual decline rate near to 0.5 percentage points. Nevertheless, there is distinctive difference in supply and demand situation and self-sufficiency of different grain crops. In future 10 years, China's rice will be able to support China completely and there will be slightly surplus for export. Simulation results indicate that China's net import of rice in 2020 will reach 3.15 million tons and self-sufficiency of rice will keep at 102% approximately. The self-sufficiency of wheat will have slight decline, but it will still keep high level at about 98%. The self-sufficiency of corn will significantly decline. The corn yield will reach 210 million tons in 2020, while its demand will reach 230 million tons, so the gap is about 20 million tons, the self-sufficiency will drop to 91%. The insufficiency of soybean supply-demand will further increase. In 2020, China's soybean import volume will be up to 72 million tons and the self-sufficiency will drop to 18%.

3.2 Simulation results of high economic growth scheme In the scheme of high economic growth, due to further increase of grain demand, China's grain self-sufficiency will further decline. According to prediction, in the high economic growth scheme, China's grain self-sufficiency will drop to 86% in 2020, the rice self-sufficiency will keep 101%, wheat self-sufficiency will keep 96%, corn self-sufficiency will drop to 89%, and soybean self-sufficiency will drop to 17%.

3.3 Simulation results of high technological progress scheme In this simulation scheme, due to rapid technological progress, per unit area grain yield and total yield of China will be higher than the benchmark scheme, and domestic grain self-sufficiency will significantly increase. According to prediction, in 2020, China's grain self-sufficiency will be 89%, and self-sufficiency of rice, wheat, corn and soybean will be 103%, 99%, 93% and 19% respectively.

4 Discussion about future grain and food security of China

4.1 Implications of international experience in food security for China International development experience indicates that focus and policy objective of a country for food security will be constantly adjusted along with changes of its economic development and international environment. Developed countries generally focus on stability of food nutrition and price. In countries with rich agricultural production resources per capita, there is no prominent problem of food quantity or supply security, and their concern is focused on stable food price and food security of poor people. By contrast, in developed countries with scarce agricultural production resources per capita, they focus on high self-sufficiency of key agricultural products, such as rice and potato and also focus on providing sufficient and diversified foods through international trade. However, with advance of international trade liberalization, both such countries turn their focus from majority of agricultural products to core agricultural products. With changes of international political and economic environment and development of domestic social economy, it is necessary to closely look at China's grain security from a broad viewpoint. Firstly, with increase of residents' income, consumers have higher and higher demands for food diversity and nutrition. Therefore, it is required to provide diversified and nutritive foods for consumers from the entirety of foods. Secondly, international political environment and trade environment faced by China are different and significantly improved compared with the 1990s. Thirdly, great growth of overall national strength provides fund guarantee for sufficient supply for consumers using domestic and foreign market. Fourthly, due to restriction of WTO rules, the space is limited for China safeguarding grain security through trade protection. In addition, due to restriction of domestic scarce land and water resources, it will greatly increase the cost for continuing implementing the policy of 95% grain self-sufficiency. In all, in new historical condition, it is necessary to discuss whether it is necessary for China to keep this objective of grain self-sufficiency.

4.2 Import of livestock and poultry products and feeds The pressure on China's future import of agricultural products is mainly coming from growth of consumers' demands for animal products. In 2009, per capita annual consumption of livestock and poultry products was about 53 kg (including meat, egg and milk). By 2020, this figure will rise to 70 kg. Trade volume of livestock and poultry products has changed from net export in the end of twentieth century to net import. The net import volume rose from 60 million USD in 2000 to 4910 million USD in 2010. And such growth will continue. Among livestock and poultry products, the net import volume of pork and milk products increases rapidly. In 2010, the net import volume of pork and milk powder was 0.7 million tons and 0.41 million tons separately (Ministry of Agriculture, 2011). Although China can satisfy growth of domestic consumption demand through directly importing livestock and poultry products, it may be more feasible and effective through importing feeds. Firstly, international trade potential of meat products is limited. Due to concern for disease of livestock and poultry and product quality and security, all countries have formulated strict quarantine and inspection standard, so the trade cost of meat products is relatively high. In 2009, international trade volume of global meat products was only 41 million approximately. Secondly, international trade of meat products has high market risk. International trade data in the past 20 years indicate that international trade volume of meat products fluctuates in years. Outburst of livestock and poultry disease will cause sharp drop of international trade volume of meat products. Therefore, it is not proper to rely highly on international market. Thirdly, selecting feeds to increase supply of domestic livestock and poultry products can keep value adding part of breeding within domestic area, which is favorable for promoting domestic employment and increasing farmers' income. From experience of EU, Japan and South Korea and other developed countries, all of them adopt strategy of importing feed grain.

4.3 Resource import and domestic production According to supply potential of China's farmland and water resources, importing feed grain not only conforms to China's economic benefits but also is the requirement for keeping sustainable agricultural development and agricultural resource security. Importing soybean saves large area of farmland and water resource for China. In 2010, China imported 54 million tons of soybean, calculated at 1.6 ton/ha per unit area yield, equivalent to saving 34 million hectare farmland, which is 28% of China's farmland area. Calculated at 4000 tons of water for one hectare soybean production, it saved 136 billion tons of water for China, which is about 37% of total agricultural water consumption in 2009, basically the water consumption of all industrial and urban and rural residents. Considering import of soybean oil, the volume of farmland and water resource saved is considerable. If we satisfy soybean demand completely relying on domestic production, it will inevitably compress planting area of other grain crops and cash crops, and seriously hinder adjustment of agricultural production structure and develop-

ment of agricultural comparative advantages. Our model analysis indicates that the deficiency of demand of soybean and corn of China in 2020 will reach 72 million tons and 20 million tons separately. At the current supply potential of existing farmland and water resources, it is impossible to realize such objective completely relying on domestic production. Suppose China's soybean yield in 2020 is 1.8 ton/ha and water consumption keeps 4000 ton/ha, importing 72 million tons of soybean means saving 40 million hectare farmland and 160 billion tons of water. Suppose corn yield is 6.8 ton/ha and water consumption keeps 4800 ton/ha, importing 20 million tons of corn means saving 2.94 million hectare farmland and 14.1 billion tons of water. Importing soybean and corn will save 429.4 billion hectare farmland and 174.1 billion tons of water for China, equivalent to 35% of farmland area and 47% of agricultural water consumption in 2009.

5 Strategies and policy recommendations for improving agricultural production and guaranteeing China's grain security

5.1 Establishing new national grain development strategies suitable for national conditions in the new period According to prediction and trend judgment of China's grain and agricultural product market, there will be significant change in demand structure of China's agricultural products. In the restriction of natural resources and production structure, it is recommended that central government formulate suitable strategies and policies for national grain security. It is recommended to implement three transformations and four objectives of new national food security strategies. Three transformations are transforming grain security to food security, grain security to grain ration security, and import of livestock and poultry products to import of feed grain. Four objectives are keeping self-sufficiency of grain above 95%, self-sufficiency of rice and wheat up to 100%, self-sufficiency of feed grain above 85%, and meat and egg products are basically self supported.

5.2 Laying solid foundation for grain production and raising integrated grain production capacity

5.2.1 Implementing national agricultural sci-tech innovation project. Agricultural sci-tech progress is technological guarantee for raising grain and food security. According to medium and long-term plan and twelfth five-year agricultural sci-tech development plan, at the same time of increasing input to agricultural science and technology, it is recommended to practically implement reform of agricultural scientific research and extension system, accelerate industrialization of GM technologies and modern biological technologies, create favorable market conditions to attract large enterprises to participate in agricultural sci-tech innovation, make them become major subjects of future sci-tech innovation, and make agricultural sci-tech progress become driving force for grain and other major agricultural products.

5.2.2 Implementing renovation and improvement projects for national agricultural infrastructure. Agricultural infrastructure is material foundation for guaranteeing security of grain and other agricultural products. It is recommended to increase input to agricultural production and market infrastructure, raise supply capacity of agricultural products, ability of resisting against natural disasters and keep stability of agricultural product market. At the same time of increasing input to capital construction of farmland water conservancy project and transformation of medium and low yield farmland, it is recommended to increase input to infrastructure of market logistics and food security supervision.

5.3 Improving international grain trade environment and building global and regional food security administration mechanism

5.3.1 Actively participating in construction of global and regional food security administration mechanism. For example, it is recommended to actively participate in and promote the proposal of FAO, G20, and APEC for establishing global and regional grain reserve system, grain security administration mechanism and forbidding grain embargo program. These programs require that major production and consumption countries of grain should establish certain level of grain reserve and release grain stock according to promised proportion when there is high rise of global grain price.

5.3.2 Promoting technological transfer between countries. It is recommended to promote developed countries to transfer agricultural production technologies to developing countries, to raise grain production capacity of developing countries.

5.3.3 Establishing and improving trade partnership with North and South American countries in corn and soybean. The United States, Brazil, and Argentina are major sources of China's corn and soybean import. Thus, on the basis of equality and mutual benefit, it is recommended to sign medium and long-term agreement with these countries on grain trade.

5.3.4 Actively promoting development of African grain production. Promoting development of African grain production is favorable for alleviating supply-demand market of international grain market and reducing international policy pressure of China's grain import. China should increase support for technologies and infrastructure construction for African grain production, improve grain security of African countries, and guarantee China's grain security.