

# China's Grain Security toward 2030

## 1. Background

There has been periodically and recursively growing concern over China's grain security by scholars, national leaders and the public since middle 1990s. For example, when China's grain price rose in the middle 1990s, some observers predicted massive food shortfalls in China in the early 21<sup>st</sup> Century. However, large grain import did not occur in the past 10 years. Instead, China struggled to fight its over grain supply and falling grain prices in 1996-2002. Its net export of cereal reached 9 million tons annually in 1997-2003, reached the highest (19 million tons) in 2003.

After 6-year successive grain price fell, grain price increased in late 2003 and spring of 2004. Many agricultural officials and scholars claimed that China's grain supply is facing great challenge and predicted that China will encounter grain crises in the coming years. In response to this concern, the government recently launched several policies to promote grain production. An income transfer scheme with more than 100 billion yuan was implemented through a "Grain direct subsidy" program that distributes cash to farmers in grain production areas in 2004. Much stricter control of non-agricultural land use seems underway. Maize export subsidies were completely eliminated in April 2004. New contracts to import grain were signed in the late 2003 and early 2004 despite of higher world cereal prices than the domestic ones. The "Grain for Green" program was scaled down substantially in 2004.

Academics have expressed different opinions and views on the current policies and the concern on grain security. Several questions have been raised. Is China's grain supply a serious problem? What is the likely situation regarding China's grain security in the next 3 decades? What are the key determinants of China's future grain security? Can China rely on long-term productivity growth for grain security? This policy brief tries to summarize the answers to these questions based on our recent CHINAGRO study. Methodologies, scenarios and assumptions underlined the projections are summarized in other documents of this project.

## 2. Scenarios and Assumptions

In projecting China's grain economy, several alternative scenarios are formulated and run by CHINAGRO model. Each of them embodies key assumptions on the shifters of demand, supply and external economy. In this policy brief, we summarized the results from three scenarios we examined: a baseline run, a high agricultural R&D investment scenario, and a rapid economic growth scenario.

The assumptions under baseline scenario present the most plausible future trends of important population, urbanization, income growth, trade liberalization, technology changes, and environmental factors related to land and water resources. The population will increase from 1.275 billion in 2000 to 1.429 billion in 2020, and 1.459 billion in 2030. Share of urban population will rise from 34% in 2000 to 50% in 2020 and 58% in 2030. The baseline assumes that economic growth will decline from more than 8 percent in 2001-2005 to about 6.2 percent in the 2010s and 4.9 percent in

2020s. WTO accession is incorporated in the baseline because China already joined WTO in December 2001. The growth in agricultural R&D investment in recent 10 years will be continued in the next 30 years. The assumptions on cultivated land changes and water resource uses are reported in the other policy brief of this project.

The high agricultural R&D investment scenario assumes that, on the top of baseline, an extra 0.5% annual productivity growth in cropping and extra 0.2% in livestock output efficiency are added. The high growth scenario assumes average annual growth rates of about 7.9% in the first decade of 21<sup>st</sup> century, and down to 6.7% in 2010s and 6.0% in 2020s. Because high total economic growth is often associated with high urbanization, a light higher population growth, and high investment, therefore, under this scenario, we also assume that total population and urban population shares will reach 1.462 billion and 64% in 2030. Extra technical progress is also assumed (half the amounts of gains from the high agricultural investment scenario).

It is worth to note that any projections, including those presented below, are under certain assumptions that may change over time. However, the projections under different scenarios may help us to understand the trends and major driving forces of the grain economy in the future. It should be noted that it is not possible to predict any real world, including the grain economy in China, in the future.

### **3. Grain Demand, Supply and Trade Projection toward 2030**

While our projections cover nearly all crops and animals, this brief focuses on three major cereals only. They are rice, wheat and maize. In order to have a consistent measurement across production, consumption and trade, all rice data are reported in paddy form instead of milled rice. Total demand includes private food consumption, feed and industrial demand, seed use, and waste and losses in the post-harvest. In the following discussions, the term of private food consumption is equivalent to food demand, which distinguishes the rest of total demand.

#### **Baseline Scenario**

According to our analyses, average per capita total demand for three major cereals (rice, wheat and maize) reached historical high at about 360 kg in recent year and will fall by about 3-4 kg in the next 2 decades. By 2030, we project that per capita total demand will fall to 348 kg. The fall in average per capita cereal demand will occur when food demand per capita falls while feed demand increases in next 30 years. These changing trends are output of simultaneous impacts of several factors.

Income and urbanization are 2 primary determinants of grain demand. Although income elasticities of demand for food grain will become negative over most years of projection periods in urban and will approach zero soon in rural, rising income will have substantial impact on per capita demand for meat. China's consumers will more than double their consumption of meat and egg by 2030, from 28 kg per capita in 1997 to 58 kg in 2030. The projected rise in meat demand will stimulate feed grain demand. For example, we project that per capita indirect demand for maize (feed

demand derived from meat consumption) will rise from 68 kg in 1997 to more than 85 kg after 2020. Rural meat demand will grow at the similar rate of overall demand, but urbanization trends will shift more people into the higher-consuming urban areas (urban resident consumed about 2.5 times of meat and egg than his/her rural counterpart), which, therefore, will increase feed demand for average Chinese consumers. However, the positive impact of urbanization on feed demand will be offset by its negative impacts on cereal food consumption (urban resident consumed less than half of cereal than his/her rural counterpart).

When considered with the projected population growth in rural and urban, aggregate annual demand for rice, wheat and maize will rise from 425 million tons in 1997 to 486 million tons in 2010 and 512 million tons in 2020, but fall to 507 million tons in 2030, with average annual growth rate of 0.8% in 1997-2020 and -0.1% in 2020-2030. Falling demand in 2020s is results of decline in per capita consumption, slower growth of population, and rising urban population shares. Income elasticities of demand for all cereals will be negative and population growth will virtually approach zero in the late projection periods. While urbanization will continue to increase meat and feed demand, the growth rate of meat consumption will slowdown as income elasticity of demand for meat also falls with income increase. On cereal food demand, urbanization negatively impacts on per capita consumption of average Chinese consumer.

Baseline projections of the supply of grain show that China's producing sector gradually falls behind the increases in demand. Aggregate rice, wheat and maize supply will attain the highest level (491 million thons) in 2020, increased from 363 million tons in 2003 (or 428 million tons in 1997). The production will fall slightly in 2020s and be about 487 million tons in 2030. Of three cereals, rice, wheat and maize make up about 47%, 29% and 24%, respectively. This projection implies a rise in three cereals output of only about 14% in 1997-2030 or 34% in 2003-2030.

Under the projected baseline scenario, the gap between the forecast production and demand implies a rising deficit. China is expected to import about 13 million tons of cereals in 2010, which will increase to 21 million tons in 2020 and 25 million tons in 2030. Nearly all these imports will be feed grains such as maize. Increase in domestic rice and wheat production will be about its rise in demand. Less than 2 million tons of rice export is also projected under baseline in the coming years, but future export will be minimal if there would be no significant liberalization of rice markets in the borders of Fareast Asian countries. Increasing domestic quality wheat production has been substituting for the imported wheat since the middle 1990s, no significant wheat import is forecasted in the future in our projections.

We project that China will achieve more than 95% of grain self-sufficiency and self-sufficiency in food grain (rice and wheat) in the coming 3 decades. We project that maize imports will increase significantly in the coming decade and its self-sufficiency level will fall from current more than 100% to 90% in 2010, 85% in 2020, and a slight more than 80% in 2030. Although the nation will be a net importer of maize, this will not threaten China's food security and social as well as political stability. Maize is mainly used as feed. Food maize is not a staple food in urban areas. In rural areas, as incomes increase per capita food consumption of maize has

declined significantly from more than 30 kg in the late 1970s to less than 10 kg recently. Increasing import of maize will promote China's livestock development, facilitate domestic agricultural structure changes and therefore increase farmers' income.

TALK ABOUT REGIONAL PRODUCTION, CONSUMPTION AND TRADE IN ONE PARA

### **Alternative Scenarios**

Our high investment scenario shows that China could achieve more than full self-sufficiency in grain (including feed grain) in the entire projection period. China could export more than 10% of its rice to world market after 2020 if the rest of the world would open their markets to China. By the late projection period, we also project surplus of wheat in China under high agricultural R&D investment scenario. Boosting in maize productivity is projected to turn China from a net importing feed country to nearly self-sufficient one. The results of this analysis imply that one of major effective ways China can improve its future grain security at nation's aggregate level is to invest heavily in agricultural technology. Although China's cereal yields are already high, rice yield is still about 15-20% lower than those in USA and Australia. China's wheat's yield in 2002 was about 70% of that in Mexico and 50% in France. The potential increase in maize yield is also high. China produced 5.06 tons maize per hectare in 2002, the corresponding figure was 8.01 tons in USA in the same year. The other conducive measure is to increase the efficiency of water use in agriculture (see the other report of this project).

The impacts of a rapid economic growth scenario on cereal production, consumption and trade are complicated. Cereal production will increase by about 17% in 2003-2030 (or 38% in 1997-2030). The impact of higher income growth on total grain demand is mixed. Higher income growth and rapid urbanization lead to higher meat consumption and feed demand, but food consumption decline with higher income and higher urban population shares because income elasticity will turn to negative in the late period of projection and the large gap of per capita cereal consumption between rural and urban will continue in the future. Although we find that China could achieve a slight higher grain self-sufficient rate under high growth scenario, the improvement in crop productivity (this is embodied in high growth scenario) is the key factor that will help China to balance its grain demand and supply. On the other words, if high growth scenario would accompany with a higher investment scheme, food deficit pressure could rise over time.

### **4. Concluding Remarks and Policy Implications**

China's effort and success in increasing food and fiber supply to meet its growing population in the past 50 years has been well recognized. China has shifted from a food net importer to net exporter since the early 1980s and became one of the developing countries with the highest food and grain self-sufficiency, which contributes significantly to world food security. In the coming decades, China would not have a critical grain security problem. Importing 5% or even 10% of grain (mainly feed) is feasible for China and should not be considered as a threat to national grain security. Even 10 percent (or 50 million tons) of China's grain demand is equivalent

to less than 2% of the world's total cereal production and less than 10% of international grain trade in 2030. This level of imports will not have a great impact on national grain security nor be a fatal threat. The major way China can protect its future grain security is to invest heavily in agricultural technology, increase the efficiency of water use in agriculture (see the results other reports of this project) and promote poverty reduction programs that will provide the poorest of China's households with a way to procure higher quantities of grain and other foods.

Major policy implications from this study and recommendations are summarized below.

1) Shift in emphasis of grain security from all grain to food grain

In order to maintain the spirit of China's rain security policies without imposing excessively costly and ineffective restrictions, the national government should redefine its grain security goals in terms of rice and wheat, the two major food grains; this would provide considerable protection against any external economic threat while being attainable without causing major distortions.

2) Emphasizing long term productivity growth instead of short term subsidy program

China's grain security will depend mostly on raising long-run productivity. Subsidy programs such as the "Grain direct subsidy program" that was implemented in early 2004 will be very costly, will not be appreciated by households in the long run, will reduce the government's fiscal resources for public services, and have much less effect on national grain security than investment in R&D and other public service. China should not follow other countries and should build a productive, undistorted agriculture that raises the income levels of its producers and provides the nation with a high degree of food security.

3) Promoting regional specialization of grain production

With the projected changing patterns of cereal production across regions, great efforts should be taken to ensure that investment policies do not impede the regional specialization of grain production. New policies should be design to promote the regional production consistent with its comparative advantage of productions. With rising regional specialization and trade, investment on market infrastructure is also critical.