

Chapter 3

The Livestock Revolution and Feed Demand in China

Li Xianglin¹

Abstract

Demand for meat and milk in developing countries will more than double by 2020. This massive increase in demand for food of animal origin is fueling the next food revolution – the Livestock Revolution. As the world’s largest meat producer, China has been leading this oncoming Revolution. A great increase in demand for livestock food products leads to a drastic increase in demand for feed in China. Natural pastures, which used to be an important livestock feed resource in China, are subjected to serious degradation as livestock numbers exceed carrying capacity. In China, per capita cereal consumption for food is declining, while that for feed is increasing. Projected per capita demand for cereals is 180 kg for food and 200 kg for feed, and the aggregate annual cereal demand will range from 570 to 610 million tons by 2030, of which 8%-9% may need to be imported. There is also a deficit of 30 to 50 million tons in the supply of feed crude protein, the most limiting nutrient in China. Thus, it is not suitable for China to adopt widespread use of a high-concentrate feed diet as in developed countries, but appropriate “grain-saving” livestock systems are of great importance.

Introduction

The combined per capita consumption of meat, eggs and milk in developing countries grew by about 50% during the period from the early 1970s to the early 1990s (Delgado *et al.* 1999). Looking forward to 2020, there will be a further increase in global demand for food of animal origin, with virtually all the increased demand coming from developing countries. This increase in demand will arise from a combination of population increase - an extra 2.5 billion people to feed by 2020---and changes in the diet of millions of people. Increasing urbanization - more than half the people in developing countries will live in towns and cities - and growth in people’s incomes will drive the change (ILRI 2000).

China has been leading the Livestock Revolution. Per capita production and consumption of meats have been increasing by nearly 10% per year, and of egg and milk by nearly 12%. China thus became the world’s largest meat producer in 1985 and the world’s largest egg producer in 1990, respectively. These have been achieved as the population grew at an annual average rate of 1.2%. With increased production and consumption of meats, milk and eggs, demand for animal feed in China has been ever-increasing.

¹ Liaison Scientist for China, International Livestock Research Institute (ILRI), ILRI-Beijing Office, c/o Chinese Academy of Agricultural Sciences, 12 Zhong-Guan-Cun South Avenue, Beijing 100081 China

Since the early 1990s, the agriculture of China has come into a new phase of development, shifting its focus from providing enough quantity of food to feed the huge population, to providing higher quality products to meet the demand of the domestic and overseas markets, as well as to substantially increase the income of the rural population.

These changes are transforming traditional farming systems and cropping patterns in the rural areas of China.

Keeping pace with these changes requires that farmers keep abreast of new technologies and incorporate new information in order to take the opportunities in the market economy. This paper discusses the Livestock Revolution and its implications for the demand and supply of feed in China in next 30 years.

The Livestock Revolution

Population growth, urbanization, income growth and changes in diets of people in developing countries are fueling a massive demand for food of animal origin. This massive increase in demand for food of animal origin is termed “Livestock Revolution” by a team of researcher from the International Food Policy Research Institute (IFPRI), The United Nations Food and Agricultural Organization of (FAO), and the Livestock Research Institute (ILRI) (Delgado *et al.* 1999). As in the case of the well known Green Revolution in the 1970s, the term summarizes a complex series of interrelated processes and outcomes in production, consumption and economic growth. However, the two revolutions differ in one fundamental respect: the Green Revolution was supply-driven, whereas the Livestock Revolution is demand-driven. Yet, just like the well-known Green Revolution, developing countries will be participating on a large scale as they experience transformation that had previously occurred mostly in developed countries. The Livestock Revolution is leading to a global transformation of the livestock sector, from one that mobilizes surplus and waste resources to one that actively seeks new resources for production of livestock foods.

The Livestock Revolution can benefit the smallholders and rural development by increasing income of the rural poor, making efficient use of common-property resources and crop by-products and wastes, improving the nutrition and health of the poor, providing opportunities for the poor to enter the market economy, and protecting the farmland through increased nutrient recycling via livestock and improved nitrogen economy from forage legumes. On the other hand, the Livestock Revolution also presents many challenges to smallholder livestock keepers: increased degradation of grazing lands, insufficient supply of quality feeds, unresponsive policy environments, lack of access to markets and information, and loss of livestock and forage biodiversity.

The Livestock Revolution cannot be stopped, but can help research harness it to benefit the poor. It offers hundreds of millions of poor farmers and their families new opportunities to enter the market economy. Then, livestock research needs to exploit the best of sciences to overcome constraints in animal agriculture, and to address emerging opportunities and challenges. Livestock research needs to increase the efficiency of

livestock enterprises, improve production levels while conserving natural resources and protecting the environment, and ensure that the poor benefit from Livestock Revolution, both as producers and consumers of livestock foods (ILRI 2000).

Consumption and production of livestock food products

About one-fourth (23 percent) of the world's population living in developed countries consumes three to four times the meat and fish, and five to six times of the milk per capita consumption in developing countries. But this pattern is changing. While demand for meat in the developed countries is projected to grow only marginally over the next 20 years, demand in developing countries is expected to grow at 2.8% per year (Delgado *et al.* 1999). This will increase the annual demand for meat in developing countries from 89 million tons in 1993 to 188 million tons by 2020. This means an additional 100 million tons of meat will be required every year to meet this demand. Two-thirds of the increased demand will be for pork and poultry meat.

At the regional level, the most dramatic increases in per capita consumption of animal food products took place in Asia, particularly in China (Table 1), where per capita meat and milk consumption doubled from 1983 to 1993. Throughout Asia, the share of calories and protein coming from animal food products increased, almost doubling in China, indicating that many consumers are increasing consumption of animal food products than of other foods such as cereals (Table 2).

However, there remains a great disparity between the per capita animal food consumed in developed and developing countries. National income is a determinant of this disparity. Generally, there is a positive relationship between income and consumption of animal food products: per capita animal food consumption increases with per capita income. Within this trend, countries differentiate themselves for cultural or other reasons. For example, Chinese people consume more meat than the trend level, reflecting the importance of pork in Chinese diets, and India consumes less meat than the trend level because of religious taboo against meat.

Production of animal food products grew most rapidly during the period from 1982 to 1992 in the same regions where consumption grew most rapidly (Table 3). The highest rate of growth in meat production occurred in Asia, especially in China where total meat production increased as much as 8.4% annually. In general, per capita meat and milk production from 1983 to 1993 increased in most regions in the world (Table 3).

The contribution of the livestock sector in China's gross agricultural production value rose from less than 15 percent in 1978 to over 28 percent in 1999, almost doubling over the last 20-year period, while that of crops declined from 80 percent to less than 58 percent in the same period (Figure 1). According to the experiences of developed countries, the rational share of the livestock sector in agricultural economy should be 40 to 50 percent. This means there is still a shortfall of 10 to 20 percent (30 to 60 billion Yuan) in livestock's contribution to gross agricultural production value for this rational level.

According to the statistics from the Chinese Ministry of Agriculture, China produced 64.5 million tons of meat, 22.2 million tons of eggs, and 11.5 million tons of milk in 2000, accounting for 27.6 percent, 40.8 percent and 2 percent of the world totals, respectively. Pork production accounts for 66.8% of national total meat production and 47% of the world total pork production. China's milk production is much lower as compared with meat and eggs, reflecting lower milk consumption of the Chinese people as affected by customs in food consumption. Even then, changes are currently taking place, making it reasonable to expect increases in milk consumption and production in China in next 10 years.

The projected annual growth rate of meat and milk consumption in China from 1993 to 2020 is 3 percent and 2.8 percent, respectively (Delgado *et al.* 1999), which means a total meat consumption of 85 million tons and a total milk consumption of 17 million tons by 2020. The projected meat and milk production in China by 2020 are 86 and 19 million tons, respectively (Delgado *et al.* 1999). Thus differences between current production (2000) and projected production in 2020 are 21.5 million tons for meat and 7.5 million tons for milk.

Feed demand in China

One of the most important challenges created by the Livestock Revolution is the increased demand for feed. Feed and nutrition is the foundation of livestock production, and has long been the "bottleneck" of livestock development in China, where a huge population depends on very limited farmlands. Per capita arable land area is 0.1 ha in China, only half of the world average level, and much less than in most countries in the world. With increased demand for livestock products, animal feed and nutrition becomes more important to livestock production in China.

Grazing lands, mainly in the arid and semiarid areas in the North, Northwest and Qinghai-Tibetan Plateau, are traditionally the major feed resource of ruminants in China. However, most of the grazing lands presently are overgrazed and land degradation expands rapidly. The number of livestock has exceeded grassland carrying capacity almost wherever pastoralism is the prevailing production system. In most pastoral areas of China, there are no private land ownership rights and there has been little incentive for individual families to limit the size of their flocks and herds. As a result, livestock numbers have soared, and the increasing pressure on grazing lands leads to rapid desertification. Land degradation from overgrazing is taking a heavy economic toll in the form of losses in livestock productivity. In the early stages of overgrazing, the costs show up as lower land productivity, but, if the process continues, it destroys vegetation, leading to the erosion of soil and eventually, a wasteland develops. Currently, meat production from the vast pastoral area (over one-fourth of the total land area) only accounts for less than 5 percent of the national meat production. Apparently, natural pastures cannot support any more increased livestock grazing.

As the livestock sector developed and moved towards industrialization rapidly, cereal use for feed has been rapidly increasing as well in the past 20 years. This increasing trend is likely to continue in next 20 or 30 years. Various researchers made

projections on cereal demand for food and feed in China (Qureshi 1998; Fuller 1998; Schumann 1998; Huang and Zhang 1998; Wang 1998; Chen *et al.*, eds., 1998). The projections indicate that while the absolute demand for cereals will be increasing, the growth of cereal demand for food will be declining fast. Per capita demand for cereals for food is presently about 200 kg. This is projected to decline to 180 kg by 2030, while per capita demand for cereals for feed, which is presently around 100 kg, is expected to increase to 200 kg by 2030. Total cereal demand will be 380 kg per person per year in 20 to 30 years (Schumann 1998; Qureshi 1998). Then, the aggregate cereal demand by 2030 will be in the range of 570 to 610 million tons, with 270-290 million tons for food and 300-320 million tons for feed. The population then shall have reached 1.5 to 1.6 billions.

Given the above aggregate demand level, if China were to be fully sufficient in supply in 2030, its cereal production would need to grow at the rate of 1.4%-1.6% per year. However, this growth rate is not easily achievable because production growth in the future may be faced with more constraints in natural resources and technology (land, water, yield growth potential, and etc) than it did before. A commonly accepted view is that China may be a stable net importer of cereals of some 50 million tons (8 to 9 percent total consumption). If this is the case, China will still be likely to meet its demand of cereals for both food and feed in the new century.

From the viewpoint of feed nutrient composition, crude protein is the most limiting feed ingredient in China. A study on feed demand and resources (Zhang 1999) indicates that, if the dietary protein intake of Chinese people is to reach the world average 25 grams per day per person, the total annual demand for food protein of animal origin would be at least 12 million tons in 2000 and 16 million tons in 2030. If translated into feed crude protein based on the best feed conversion today, the demand for crude protein from feeds would be at least 60-80 million tons, if the above-indicated demand for food protein is to be achieved. However, the actual supply is only 30 million tons, leaving a deficit of 30-50 million tons. Exploitation of new feed protein resources and their efficient use now are the highest priorities of feed research and industry.

It is generally accepted that it is not possible for China to adopt widespread use of a high concentrate feed diet, similar to those in the United States. One alternative that has made significant progress in China is the "grain-saving" model which employs intensive feeding techniques based on formulated feed compounds that increase feed use efficiency. These technologies favor poultry, swine and aquaculture production rather than ruminant production because of their superior feed conversion. Although the technology improves feed use, it relies heavily on grain inputs so that it is still likely to lead to a rapid increase in feed grain consumption. Other scientists in China are advocating the development of feeding systems that exploit the potential of non-grain feed resources. For ruminants, these include the use of straw-treated with urea and specially grown forage crops. For non-ruminants, the substitution of fruit and food processing residues, forage, water plants and other materials (sweetpotatoes for example) for grain feeds in manufactured feed formulas has been suggested. While sweetpotatoes and other green feeds have long been staples in animal diets in China, their use in the production of nutritionally balanced feed concentrates is limited.

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Table 1. Per capita meat and milk consumption by region (1983 and 1993)

Region	Meat		Milk	
	1983	1993	1983	1993
	(kilograms)			
China	16	33	3	7
Other East Asia	22	44	15	16
India	4	4	46	58
Other South Asia	6	7	47	58
Southeast Asia	11	15	10	11
Latin America	40	46	93	100
West Asia and North Africa	20	20	86	62
Sub-Saharan Africa	10	9	32	23
Developing world	14	21	35	40
Developed world	74	76	195	192
United States	107	118	237	253
World	30	34	76	75

Source: Delgado, *et al.* 1999

Table 2. Proportion of calories and protein from animal products in the human diet (1983 and 1993)

Region	Calories from animal products		Protein from animal products	
	1983	1993	1983	1993
	(percent)		(percent)	
China	8	15	14	28
Other East Asia	11	15	29	38
India	6	7	14	15
Other South Asia	7	9	19	22
Southeast Asia	6	8	23	25
Latin America	17	18	42	46
West Asia and North Africa	11	9	25	22
Sub-Saharan Africa	7	7	23	20
Developing world	9	11	21	26
Developed world	28	27	57	56
World	15	16	34	36

Source: Delgado, *et al.* 1999

Table 3. Regional trends in the production of meat and milk (1982 and 1994)

Region	Annual growth rate of total meat production 1982-94 (percent)	Per capita meat production (kilograms)		Per capita milk production (kilograms)	
		1983	1993	1983	1993
China	8.4	16	33	3	6
Other East Asia	5.0	16	24	15	30
India	3.7	4	5	51	66
Other South Asia	4.8	6	8	50	62
Southeast Asia	5.7	11	16	2	3
Latin America	2.9	43	48	94	101
West Asia and North Africa	3.9	14	16	58	57
Sub-Saharan Africa	2.1	10	9	19	19
Developing world	5.4	15	21	32	39
Developed world	1.1	76	78	305	272
World	2.9	30	34	102	93

Source: Delgado, *et al.* 1999

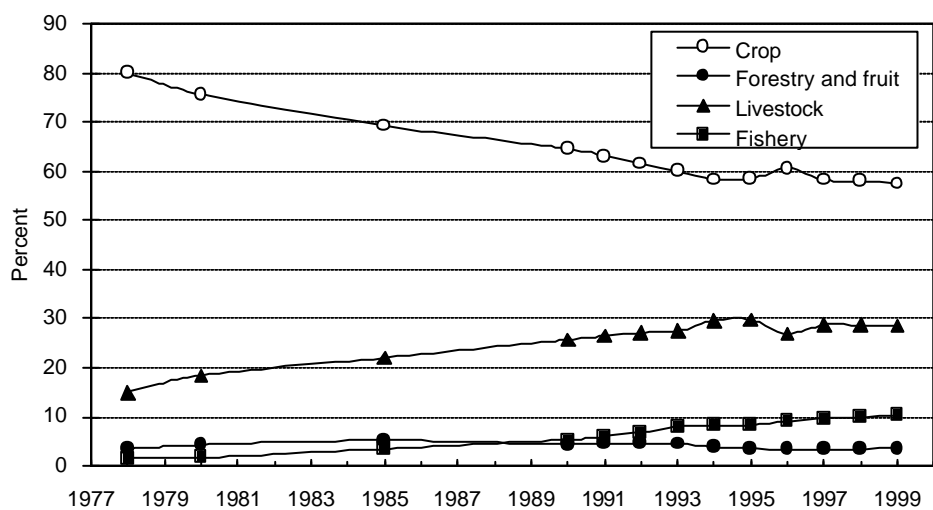


Figure 1. Share of crop, forestry and fruit, livestock and fishery in gross agriculture output value of China.

(Source: National Bureau of Statistics of China, 2000.)