Review of swine production in China

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China has a long history in swine production and rich resources of swine breeds. Historically, swine production in China has occurred for some 6,000 years.

There are over 120 pig breeds in China, 66 of which are described in the book 'Records of Swine Breeds of China', including 48 local breeds, 12 newly selected breeds and six foreign breeds.

According to FAO, the output of pork was 42.40 million tons in 2001, accounting for 46.1% of the world total. Thus, China is the largest pig producer in the world.

Live pig production

In 1949, the output of pork meat in China was only 1.70 million tons. With the fast development of the national economy and continuous improvement in people's living standard, the demand for meat, especially pork is growing day by day.

Live pig production in China has made great progress over the last 20 years and the number of slaughter pigs has increased steadily since 1985. The figures for live pig production during 1986-1995 and 1996-2004 are shown in Table 1 and Table 2 respectively.

According to FAO, the number of pigs in China accounted for 44.3% of the world total, and slaughter pigs for 33.6% in 1990.

In 2004, China produced 608 million slaughter pigs with a marketing rate of 127.4%.

Year	No. of pigs (million)	Change (%)	No. slaughtered (million)	Change (%)	Marketing rate (%)
1986	337.19	1.75	257.22	7.74	77.6
1987	327.73	-2.80	261.77	1.77	77.6
1988	342.22	4.42	275.70	5.32	84.1
1989	352.81	3.09	290.23	5.27	84.8
1990	362.41	2.72	309.91	6.78	87.8
1991	369.65	2.00	328.97	6.15	90.8
1992	384.21	3.94	351.70	6.91	95.1
1993	393.00	2.29	378.24	7.55	98.4
1994	414.62	5.50	421.03	11.3	107.1
1995	441.27	6.43	479.91	14.0	116.0

Table 1. Swine production in China (1986-1995).

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004
No. of pigs (100 million)	3.63	4.00	4.23	4.31	4.47	4.54	4.62	4.66	4.72
No. slaughtered (100 million)	4.12	4.65	5.02	5.07	5.27	5.49	5.66	5.92	6.08
Marketing rate (%)	113.5	116.3	118.7	117.6	122.9	120.1	122.5	124.6	127.4

Table 2. Swine production in China (1996-2004).

From Table 2, it can be seen that the average increase rate of live pigs is 3-4% from 1997 to 2004.

Pork production

According to FAO, the amount of pork produced in China in 1990 was 18.92 million tons, accounting for 32.6% of the world total. In 1995 pork production amounted to 29.7 million tons, which shows an annual increase rate of 12%.

The amount of pork per capita was 32.93kg and 31.46kg in 1996 and 1999 respectively, in comparison with world figures of 14.87kg and 14.79kg.

The total pork production in 1999 ranked first in world pork production.

The output of pork in China in 2004 was 47.45 million tons with over 42% being produced in the five provinces of Sichuan, Henan, Hubei, Shandong and Hebei.

Table 3 shows Chinese pork production over the past 25 years.

Year	Output of pork (million tons)	Average carcase weight (kg/per pig)	% of world pork total	Pork owned per capita (kg)
1979-1981	11.079	-	21.0	-
1989-1991	22.854	73.8	33.0	20.4
2000	40.314	77.6	45.0	32.5
2001	41.845	76.2	46.8	32.7
2002	43.266	77.0	47.4	34.3
2003	45.565	77.7	47	35.2
2004	47.45	79.1	-	

Table 3. Output of pork meat production in China (1979-2004).

Pig performance

With the development of technology in swine production, pig performance has increased gradually since 1950 (Table 4).

Average daily gain was only 500-600g in 1950-1979, but rose to 700-800g in 1990-1998.

Nowadays, FCR keeps reducing and the lean percentage in the pig carcases is increasing very significantly.

Phase	1950-1979	1980-1989	1990-1998	1999-now
Daily gain (g)	500-600	600-700	700-800	>800
Feed/gain	3.5-4.5	3.2-3.8	3.0-3.2	-
Lean percentage (%)	40-50	50-60	58-64	-

Table 4. The change in commercial pig production performance in China (Xiong, 1998).

Geographical distribution

There are four main regions of swine production in China:

- Changjiang River Area (including provinces of Sichuan, Chongqing, Anhui, Hunan, Jiangxi, Jiangsu, Zhejiang, Hubei).
- North China (including provinces of Hebei, Shandong, Henan).
- Northeast China (including provinces of Liaoning, Jiling, Helongjiang).
- Southeast China (including provinces of Fujian, Guangdong, Guangxi, Hainan).

Changjiang River Area and North China are the main regions of pork production and supply. Northeast China is becoming a new region.

The top 10 provinces for pork production during 2000 and 2002 are shown in Table 5 overleaf.

The provinces, which each produced over 30 million finisher pigs during the period from January to September of 2004 were Sichuan (54.67), Hunan (51.42), Henan (46.46), Shandong (32.06) and Hebei (30.60).

Patterns of production

There are three main patterns of swine production in China.

The first is individual family farming with each family feeding one to five pigs. Swine production is only a side occupation in order to use the manure as fertiliser on the farm and to produce meat for the farmer's own consumption. Grain byproducts, vegetables, forages and food residues are the main feed sources for the pigs in this sector. Commercial concentrates and feed

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Province	Pork production (million tons) 2000	Province	Pork production (million tons) 2002
Sichuan	5.512	Sichuan	4.589
Hunan	3.718	Hunan	3.969
Henan	3.229	Henan	3.665
Shandong	2.859	Shandong	3.148
Hebei	2.428	Hebei	2.652
Guangxi	2.068	Guangdong	2.258
Jiangsu	2.057	Jiangsu	2.174
Hubei	1.935	Hubei	2.188
Anhui	1.848	Anhui	2.012
Jiangxi	1.435	Yunnan	1.959

Table 5. The top 10 provinces for pork production in 2000 and 2002.

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additives are sometimes used by some farmers. Although the productivity is low for this pattern, the total number of pigs produced accounts for 70% of the national total.

The second pattern is specialised pig producers. Each producer produces 100-3,000 finisher pigs annually. Some 25% of slaughter pigs in China are from this method.

Commercial complete feeds and concentrates are the major feed sources in this sector.

The third pattern is intensive pig farming with farm sizes of generally over 5,000 pigs. Hybrid crosses are predominantly fed for meat. Pig feeds are complete feeds from feed manufacturers. Pig performance is close to international standards.

The number of these large pig farms is increasing gradually (see Table 7).

The swine breeds

There are many swine breeds in China. Farmers usually utilise local breeds or two-way crossbreeds of local and foreign breeds. Specialised pig producers feed two-way or three-way crossbreeds. The largest pig farms use three-way crossbreeds or specified commercial lines.

There are many local swine breeds in China, which are classified geographically into northern types, central types, coastal types, southern types, southwest types and plateau types.

The native Chinese breeds have some excellent characteristics. The first outstanding characteristic is their high reproductivity.

For example, Meishan sows can deliver 13 piglets at first farrowing and around 16 pigs at each subsequent one. For this reason, Meishan sows are used worldwide.

The second feature is high meat quality. Chinese local pigs are characterised by tenderness, juiciness, slender muscle fibre, marbling, and fragrance for the meat. PSE occurs rarely. The third advantage is their high resistance to adverse circumstances. After a long time of natural and artificial selection, Chinese local pigs have a higher ability to resist cold or hot environments, to tolerate poor nutrition, and to digest feeds of high fibre content.

However, Chinese local pigs have significant disadvantages, such as low growth rate, poor feed utilisation and low lean percentage.

Foreign or import breeds, including Landrace, Yorkshire (Large White) and Duroc, are mainly used to crossbreed with local pigs to improve growing-finishing performance.

Many new varieties or specified lines are successfully selected such as Shanghai White, Harbin White, Sanjiang White, Hubei White, Zhejiang White and Beijing Black.

They are characterised by faster growth, better feed conversion and higher lean percentage compared to pure local breeds.

However, China is now extending hybrids of foreign breeds. In particular, Duroc x Landrace x Yorkshire (DLY) is the first preference for meat production for large farms.

Region	Proportion of pork output to national total (%)
Changjiang River Area	43.8
North China	21.6
Northeast China	6.3
Southeast China	13.2

Table 6. Geographical distribution of swine production in China.

Under current feeds and feeding systems, DLY pigs are able to reach 100kg liveweight at about 165 days of age with 2.8kg feed consumed per kg bodyweight gain and 62% lean in carcase.

Central and provincial levels of Pig Performance Test Station systems have been established to test and improve pig performance.

At present, 70-80% of the total national pork production is from two-way hybrids between local and import breed, and about 20% from DLY three-way crosses.

Pork consumption in China

China is a large country not only in pork production, but also in pork consumption. In the world, about 98% of the pork yield of China is

No. of pigs per year	50-99	100-499	500-2,999	3,000-9,999	10-50,000	>50,000	Total
1999							
No. of farms	637434	154650	16814	2368	629	12	811907
Proportion (%)	78.5	19.0	2.1	0.3	0.1	0	100
2000							
No. of farms	685802	165462	21437	2867	669	13	876250
Proportion (%)	78.3	18.9	2.4	0.3	0.1	0	100
2001							
No. of farms	703777	193450	22956	2798	747	16	923744
Proportion (%)	76.2	20.9	2.5	0.3	0.1	0	100

Table 7. The size of pig farms in China.

consumed by the Chinese. The amount of pork per capita was elevated by 206.2% during the period from 1981-1990 and by 455.21% from 1990- 2000 compared to the period from 1949-1960.

In 2000, the total amount of national pork consumption was 41.6 million tons, 19.45kg per capita.

Per capita consumption was 20.18kg in 2001 and 20.04kg in 2002. It is predicted that China will consume 63 million tons of pork meat in 2010!

Pork consumption ranks top in total meat consumption in China although the proportion is gradually decreasing (Table 7).

There are three kinds of live pig markets, Hong Kong and Macao market, interprovincial market and intraprovincial market.

Hong Kong and the Macao have a large demand for pork. Only 4% of the total demand is self-produced, 96% is imported from mainland China.

Because of the rapid progress in the economy, the high increase in the population and the high income of the citizens, huge cities such as Beijing, Shanghai, Guangzhou, Shenzhen, Tianjin, Wuhan have a large demand for lean meat.

The amount of pork produced here can not meet their needs, so 30-50% of the total demand is imported from other provinces. These cities are the main interprovincial market.

The intraprovincial market is the major market for pork. About 50-80% pork is consumed locally. Due to the great variations of pig productivity and citizen income, pork quality and consumption customs vary considerably. For example, the local market consumes large amount of fat pork and internal organs of pigs.

The way pigs are slaughtered has also changed. The government monopolised the slaughtering and pork trade before 1985. Private slaughterhouses developed from 1985-1992 and since 1992, the slaughtering admission system was established.

Pig slaughter can only be allowed at the sites approved by governments. At present, there are 40,000 approved slaughter houses in China with the majority being small scale and a few being moderate plants.

There are 3,000-4,000 meat processing enterprises in China at present. The total yield of processed meat in 2001 was about 3.5 million tons, which accounts for 8.4% of total pork production.

Products include pickle meat, sausage and ham cuts, and are sold to supermarkets in major cities such as Beijing and Shanghai.

All over the country there are about 500 production lines to produce ham sausage. Some enterprises have the capability to produce more than 100 tons per day.

	1996	1997	1998	1999	2000	2001	2002	2003
Ratio of pork (%)	66.9	66.6	65.8	65.8	64.5	64.1	-	62.2

Table 8. The ratio of pork consumption to total meat consumption.

Year	Export (ten thousand tons)	Import (ten thousand tons)
1998	16.4	3.2
1999	11.9	8.0
2000	11.0	12.0
2001	33.5	49.8
2002	29.3	19.8
2003	31.2	30.7
2004 (1-6)	18.0	14.6

Table 9. Export and import of pork in China.

Year	Frozen pork (10^4 tons)		Processed pork (10^4 tons)		Offal (10^4 tons)		Live pigs (10^4 head)	
	export	import	export	import	export	import	export	import
2004 (1-6)	12.42	4.37	5.46	15.75			93.77	
2003	21.35	14.91	9.15	61.06	0.033	16.28		187.8

Table 10. The structure of pork export and import in China.

Pork export

In 1999, the amount of pork export was 80,700 tons, 1.57% of the total amount of the world. Although the amount increased slightly in 2002 (293,200 tons), the ratio to the total amount of the world was only 3.77%.

The ratio of exported pork to the total yield of China was only 0.68%. Pork is only exported to adjacent countries or regions, such as Hong Kong, Macao and Russia. The situation of pork imports and exports in China is shown in Table 9.

The structure of pork exports in China has been improved. Table 10 shows the present structure.

In the 1990s, 2-3 million live pigs were exported per year. By the year 2003, total pork export was 306,900 tons and the total income of the foreign exchange was US$6.55 hundred millions.

From January to June of 2004, the export of pork was 179,700 tons with a relative increase of 9.36% compared to 2003. Import amount was 145,500 tons with an increase of 5.48% compared to 2003. About 2-3 million live pigs are exported to Hong Kong and Macao every year. In 2003, the total export of live pigs amounted to 1.87 million, of which 1.76 million went to Hong Kong and 0.12 million to Macao.

Frozen carcases are the main export product, accounting for 90% of all export products. The market for frozen carcases is mainly Hong Kong, Russia and North Korea.

Markets for processed pork products include Hong Kong, Japan and Malaysia. In 2003, China exported 29,500 tons to Hong Kong, 25,600 tons to Japan and 14,100 tons to Malaysia.

Pork imports

China also imports pork products – mainly pig offal including ears, feet, internal organs and tripe to satisfy eating habits. Some 70% of these products come from America. ■

This information was first presented at the Biomin World Nutrition Forum in Vienna in September 2006.

Developing trends in swine production

● Feeding systems.

Specialised middle size pig production will be promoted. Farmers feeding on a family basis will be joined into the format of company plus production base plus farmer. Two or three way crossbreeding pigs are mainly recommended to improve growth performance and lean percentage. Complete feeds and concentrates will be further popularised.

● Feed safety and pork quality.

The main problems for pork export are quality and safety issues. The key task is to eliminate residues of drugs, heavy metals and micro-organisms in the pork. It is expected that there will be more regulations and laws to ensure feed safety and pork quality. Growth promoters will be strictly controlled. Medication and feed quality control will be further perfected. HACCP systems will be applied to feed manufacturing, feeding processing and meat processing. New theory and technology in animal nutrition will play a more important role in swine production.

● Disease control.

Emphases will be put on highly effective swine disease prevention. Improvement of swine disease monitoring technology, development of effective vaccines against infectious diseases, and establishment of SPF programmes will be the main goals.

● Pig performance.

By applying comprehensive science and technologies of swine production, pig performance will be improved to a large extent. The goals to be attained by 2010 will be as follows.

- Each sow to provide 18-20 commercial pigs a year.
- Finisher pigs to reach 100kg bodyweight at 160-165 days of age.
- Feed conversion rate for growing-finishing pigs io be 2.8-3.0 and 3.2-3.4 for the whole farm.
- Lean meat percentage of carcase to be 62-64%.
- Marketing rate of fattened stock to be more than 160%.

Chinese diseases

Swine diseases have always been a big problem for the swine industry. The incidence of various diseases tends to increase and results in serious economic losses. The main diseases occurring in swine production in China include hog cholera, pasteurellosis of pigs, swine colibacillosis, porcine reproductive and respiratory syndrome (PRRS), enzootic pneumonia, piglet paratyphus, pig transmissible gastroenteritis (TGE), pig circovirus (PCV) and pseudorabies (Aujeszky's disease).

● Hog cholera (swine fever).

The number of pigs that died from various diseases in China is 8-10%. One third of death from diseases is caused by hog cholera.

Since China succeeded in developing lapinised hog cholera attenuated vaccine in the 1950s, hog cholera has been effectively controlled, but it has occasionally appeared in recent years, and the epidemic situation in some places is very complicated, and often coincides with piglet paratyphoid.

There are no effective drugs to treat hog cholera at present. Prevention by vaccine inoculation is the most important and effective means.

● Pasteurellosis of pigs.

This disease can occur throughout the year. Pasteurellosis vaccine is extensively applied all over the country, and accordingly this disease is well controlled in China. However, secondary infection of this disease is sometimes unavoidable, often coincident with hog cholera, swine enzootic pneumonia and swine erysipelas.

The basic measure to present this disease is to improve feeding management and environmental sanitation. Vaccination using aluminum hydroxide inactivated pasteurellosis vaccine is essential. Sick pigs should be isolated and dead pigs buried or burned.

● Porcine reproductive and respiratory syndrome (PRRS).

The main characteristics of PRRS are poor reproductivity with features of early birth, stillbirth and high death rate (up to 40%) of baby pigs. If other diseases are infected together or secondarily, death rate would be even higher.

There are no effective drugs to treat PRRS at present. Vaccination is an important way to prevent PRRS. Piglets are usually vaccinated with attenuated vaccine, and boars and healthy pigs with inactivated vaccine.

● Circovirus disease (PCV).

At present there are several PCV2-related clinical symptoms in China, such as piglet multi-system wasting syndrome (PMWS), infectious congenital tremors (CT), pig dermatitis and nephropathy symptom (PDNS). The incidence and death rates are shown in Table 1. There is no effective way to control this disease. Prevention includes good feeding and management, clean environment, disinfection of equipment and the isolation of infected pigs.

● Enzootic pneumonia.

The incidence of the disease is 30-50% in China and the infection rate is up to more than 75%. The death rate is generally not high. Poor feeding management or disease infections can lead to death with up to 5-30% death rate.

Effective prevention is to vaccinate healthy pigs with attenuated or inactivated vaccines. Infected pigs must be isolated immediately.

Table 1. Incidence and death rates of PCV-related entities.

Clinical symptoms	Incidence (%)	Death rate (%)
PMWS	5-35	5-85
Congenital tremors	10-20	-
PDNS	-	10-20

● Swine colibacillosis.

● Piglet diarrhoea.

The incidence of diarrhoea is becoming higher in recent years than previously seen.

Piglet mortality is about 15%. E. coli. K88ac-LTB double gene vaccine, K88-K99 double gene vaccine and K88- K99-987P inactivated vaccine are available in China at present.

● Pig oedema disease.

In recent years, pig oedema disease is prevailing in some areas. Group incidence is up to 4% with mortality up to 98%. For some farms, incidence can be 10-14% for piglets and mortality, up to 100%.

Piglets should be intramuscularly injected with local bacterial strain vaccines or with local bacterial strain multivalent inactivated vaccines at 10-15 days old. Another way is to apply antibiotics or traditional Chinese medicine. ■

Chinese feeds

With the development of pig production, the feed industry of China has also made steady progress.

According to statistics from the Chinese Feed Industry Yearbook, total feed output increased from 68.73 million tons to 87.12 million tons with 6.11% of average annual increase rate from 1999-2003.

Commercial feeds are composed of 75% compound feeds, 22% concentrates and 3% premixes (see Table 1).

The structure of feed products is 35% swine feed, 50% poultry feed, 10% aquatic feed, and 3% ruminant feed and 2% other feed. The quantity of total feed output can only meet 20% feeds required to produce the current amount of animal products. It is predicted that total feed required will be 200 million tons by 2015. Therefore, there will be a potential for the feed industry to develop.

The total number of feed manufacturers with production capacity of over one ton per hour is around 13,000, among which CP, Xiwang, Liuhe, Tongwei and Wenshi are among the top ten. Guangdong, Shangdong and Sichuan are the top three provinces of feed manufacture.

● Energy sources.

Energy feedstuffs include corn, wheat, rice, sorghum, and so on. In China, 70-85% corn is mostly used for feed. In 2003, the amount of corn used for feed reached 98 million tons (Table 2). Experts predicted 123 million tons of corn would be consumed as animal feed in 2005. This figure is higher than the actual corn output of this year, indicating that corn import is inevitable.

China is a corn exporter. The amount of corn exported increased rapidly during the middle of 1980s. China exported 10.34 million tons of corn in 1992, accounting for 10.8% of total production and 14.0% of the world total corn trade. Since the domestic demand for corn is considerably enhanced these years, corn export decreases and will continuously decrease.

● Protein sources.

Protein resources are deficient in China. At present, protein resources mainly depend on importing from other countries, for example, 70% fish meal, soybean meal and synthesised amino acids for feeds are imported.

Soybean meal is the main protein source. Although soybean output has been increasing since 1996 In China, reaching a record level of 16.4 million tons in 2002, most soybean needed for feed is imported.

The amount of import was 13.94 million tons in 2001, and declined to 11.32 million tons in 2002 owning to Management Regulation of Trans-

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Year	Total corn output (million tons)	Amount for feed (million tons)	Proportion of amount for feed to output (%)
1999	128.09	79.00	69.7
2000	106.00	83.00	76.3
2001	114.09	87.00	71.3
2002	121.31	92.00	75.8
200	115.83	98.00	84.6

Table 2. Corn output and amount for feed in China (1999-2003).

Table 1. Feed production in China from 1999-2003 (million tons).

Year	Output	Increase (%)	Compound feed	Increase (%)	Concentrate feed	Increase (%)	Premix	Increase (%)
1999	68.73		55.5		10.9		2.23	
2000	74.29	8.09	59.1	6.46	12.4	13.96	2.5	13.45
2001	78.06	5.07	60.8	2.96	14.1	13.61	3.0	18.97
2002	83.19	6.57	62.50	2.68	17.64	24.31	3.16	4.98
2003	87.12	4.71	64.97	3.95	18.88	7.03	3.25	2.85
Average		**6.1**		**4.01**		**11.73**		**10.06**

Time	Import amount (million tons)	Change compared with corresponding period in previous year (%)
2005 (January)	1.86	-6.1
2004 (December)	2.20	40.70
2004 (November)	2.50	223
2004 (October)	1.56	126.2
2004 (September)	1.45	-51.5
2004 (August)	1.67	-32

Table 3. Soybean imports over a six month period.

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genic Organisms becoming effective. Table 3 shows soybean imports over a six month period.

Fish meal is the most widely utilised animal protein. The total domestic output of fish meal is about 0.35-0.40 million tons each year, meeting one third of total consumption. Two third of fishmeal for animal feed is imported, amounting to 0.9-1 million tons each year (Table 4). Peru and Chile are the major suppliers.

Synthesised amino acids used widely include lysine, methionine, tryptophan and threonine. Although lysine output in China increases gradually with capacity being 0.35 million tons in 2005, about 0.7-0.8 million tons of lysine is imported each year (Table 5).

Major suppliers are USA and Korea. Other amino acids are almost entirely from foreign countries, mostly from Japan.

Byproduct feeds.

Plant byproducts produced in processing industries are used largely as feeds, including rice byproduct (rice bran, rice hull, rice bran meal, rough rice, broken rice), wheat byproduct (wheat bran, wheat middling and reddog), oil seed meals (rapeseed meal, cottonseed meal, sesame meal, peanut meal, sunflower meal, benne meal, rubber meal, coconut meal, palm meal), other byproducts (distillers dried grain, brewers dried grain, byproduct of corn starch, molasses, sugar beet lees, sugar cane lees).

Nutritive values vary considerably. Some may be regarded as energy feed, such as rice byproducts, wheat byproducts, molasses; some as protein feed, such as oilmeals; some as roughages. Plant byproducts are utilised either directly as animal rations or to be an ingredients of commercial compound feeds.

Byproducts of animal source mainly include blood meal, feather meal, leather meal, meat and bone meal, meat meal, which mainly produce in slaughter factories, leather industries. According to statistics in China, nearly 2.5 million tons of fresh animal blood each year can be used to produce 0.5 million tons of blood meal. The amount of raw materials to produce meat and bone meal reaches 0.3 million tons each year.

The stem, leaf and hull of plants are used for feed and include crops (paddy, corn, sorghum, legume, peanut), potato, vegetables (cabbage) and trees.

According to statistics in China, there are 700-800 million tons of straw of crop each year, one fifth of which is used for feed. Vine of sweet potato is rich, about 80 million tons fresh sweet potato vine each year, which can produce 10 million tons dry sweet potato vine meal.

Swine production in China in the next decade will be developed to be in harmony with Chinese social and economic development levels.

The number of pigs raised will be kept relatively stable, but productivity , pork quality and benefits will be the emphasis of future swine production. ■

Year	Import amount (million tons)
1992	0.64
1993	0.43
1994	0.66
1995	0.69
1996	0.63
1997	0.98
1998	0.41
1999	0.63
2000	0.12
2001	0.90
2002	0.96
2003	0.80
2004	1.12

Table 4. Fish meal imports.

Table 5. Lysine imports during the second half of 2004.

Month	Import amount during the month (tons)	Import sum during the year	Change compared with corresponding period in previous year
November	5,455	75,292	+117.25
October	5,868	69,837	+131.58
September	10,229	63,969	+126.86
August	8,328	53,741	+91.79
July	6,857	45,413	