On Necessity and Urgency of Environmental Cost Control in Jilin's Farming Industry

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Abstract

Relying on farming products as its major economic source, Jilin Province regards farming industry as its pillar one and has attached great importance to this industry's development in recent years. In my studies, however, it is realized that farming industry is a highly-polluted one, especially water pollution. In addition, Jilin has quite poor water resources as well as slow water metabolization caused by the special climate there. Therefore, without appropriate control on environmental cost while developing farming industry, deteriorating pollution will hinder the sustainable development of farming industry. This paper explores the necessity and urgency of environmental cost control in Jilin's farming industry, with a hope to give a warning to government as well as investors and producers of farming industry and to establish scientific development philosophy on Jilin's farming industry.

Keywords: Jilin of China, Farming industry, Environmental cost control, Necessity, Urgency

1. Analysis on the Necessity of Environmental Cost Control in Jilin's Farming Industry

1.1 Strategic Position of Farming Industry in Jilin Province

With its excellent climate including the average annual precipitation of 500-600 mm, annual sunshine duration of 2200-3000 hours, 120-160 days' frost-free season as well as some features of rainforest, Jilin has favorable natural conditions for a variety of farming products, especially grain, oil plants, beet, tobacco, hemp, potatoes, ginseng, medicinal materials, fruits and so on. Songliao Plain, with its fertile soil, is a significant grain production base in China as well as a famous corn-producing field all over the world.

As is shown in developed countries' experience, quantitative expansion mainly relying on primary products must be followed by a new era of processing industry. According to world agricultural development process, there will be a significant transition to farming produce processing with the per capita grain ownership of 800 kg. It is revealed in Table 2 that Jilin has had the per capita grain ownership over 800 kg in recent 5 years. In addition, there has also been rapid development in the output of other farming produces in recent years (shown in Table 3). Therefore, it is quite necessary to develop farming produce processing industry.

After so many years' construction, Jilin has formed a basic framework for its farming produce processing industry as a new pillar industry. By the end of 2008, there had been 3510 agricultural industrial operation organizations accomplishing 28,600,000,000 yuan worth's investment in fixed assets, a growth of 31.0%; grain processing output had reached 14,000,000 tons; 310,000,000 fowls had been butchered and processed; sales income from farming produce processing industry had reached 186,000,000.

1.2 Pollution in Farming Produce Processing Industry

In statistics 12 industries are related to farming produce processing industry, including food processing industry, food manufacturing industry, beverage manufacturing industry, tobacco processing industry, textile industry, garment and other fiber manufacturing industry, leather and feather processing industry, timber and rattan processing industry, furniture manufacturing industry, paper industry, printing industry and rubber processing industry. Serious pollution widely exists in these enterprises, forming the environmental cost for their development. Among these enterprises, corn deep-processing industry, paper industry, feather industry, textile industry and beverage manufacturing industry cause particularly serious environmental pollution.

Rapidly developing leather industry has brought about serious environmental pollution and ecological destruction. Sewage produced by this industry is one of the important pollution sources in China's water pollution. To be specific, among all the 20 industries with serious pollution, the leather industry ranks fifth. Annually, it produces around 120,000,000 tons of sewage which contains 250,000 tons of COD, 6000 tons of chromium, 10,000 tons of sulfides, 150,000 tons of suspended substance. With current leather manufacturing technology, it will exhaust 70-85 m³ water as well as a variety of chemicals weighing 600 to 700 kg to process 1 ton of raw material. In addition, 30% of collagen protein will be abandoned, hence causing a waste of resource as well.

Paper industry is a light industry with large output, large water consumption and serious pollution, causing particularly serious water pollution as well as exhaust gas, exhaust solid and noise. If sewage is drained into rivers without proper treatment, organic substance in it may consume the oxygen in the water in the process of fermentation, oxygenation and decomposition, causing fish and shellfish's death of oxygen lack; tiny fibers floating in water may choke fish's gill and cause their death; bark chips, wood chips, grass chips, rotten grass, slime pulp may be buried at the bottom and silt the riverbed and even produce poisonous and smelly gas; some substances hard to be fermented and decomposed may float in water, absorb sunlight, reduce sunlight's penetration into water and therefore hinder aquatic plants' photosynthesis; there are also some poisonous and harmful substances causing cancer, malformation mutation. In a word, sewage from paper industry has made rivers dirty, smelly, an ideal place for mosquitoes, flies and maggots instead of seaweeds, fish and shrimps, seriously threatening nearby people's health, such as dysentery, enteritis, scabies and so on as well as doing harm to irrigation and people and livestock's drinking water. The production of one ton of paper will discharge 60-220 tons of industrial sewage, has a BOD ranging from 3.6 to 30kg and has a COD ranging from 6 to 135kg.

In additional, some solid waste discharged by paper industry such as rotten size, tailings, bark, wood chips, grass roots, coal cinder may be fermented and discharge smelly gas. Once raining, poisonous smelly water may pollute surface water and underground water sources.

Exhaust gas, smoke and noise produced in the production process also seriously influence workers and nearby residents' health.

As for the industrial pollution caused by corn deep-processing enterprises, water and air pollution are serious. Because raw materials need to be soaked in sulphuric acid or sulphurous acid and hydrochloric acid and NaH₂PO_{4 are} employed in some techniques, a large amount of acid sewage with a lot of organisms will be discharged. Currently, sewage contains COD, NH₃-N and other main pollutants and has a PH value of 3 to 4. discharged without treatment, these water has no basic function at all. Exhaust gas mainly comes from some production processes and sewage treatment plants, including SO₂ and NH₃. They may harm people's health without proper treatment before discharged.

As a country with strong alcohol industry, China has increasing demands for alcohol with the development of social economy and the improvement of people's living standards. With water as its medium, alcohol production requires a large amount of fresh water and washing water. In the production process, only starch or sugar in the raw material is used while other ingredients may produce many kinds of amino acid and protein during fermentation. It is these substances that cause serious pollution to China's water environment, forming one of the major pollution sources here.

Sewage, exhaust gas and noise constitute the major pollution caused by textile industry. Sewage is the most serious one among all due to this industry's large water consumption and discharge. Since mid 1990s, this industry usually discharge over 1,100,000,000 tons of sewage, occupying about 6.5% of national industrial sewage of all kinds and ranking among the top ten among all industries. In addition, it discharges about 300,000 tons of COD, taking up 5% of all. Textile sewage mainly comes from printing and dyeing, chemical fiver production, scouring, degumming and chemical fiber pulp, among which printing and dyeing sewage is the most important pollution source of textile industry. According to incomplete statistics, domestic printing and dyeing enterprises discharge about 3 to 4 million tons of sewage every day. The processing of 100-meter fabric may produce 3 to 5 tons of sewage. The sewage discharged by textile industry, containing entrainments in fiber as well as size, oiling agent, dyestuff and additive chemicals and so on, has the following characteristics: (1) greatly varying COD even reaching 2000 to 3000 mg/L and BOD also stays at this level; (2) high PH value (some vulcanized dyestuff and vat dye sewage has a high PH value over 10); (3) high chroma and high content of organism, having a large amount of dyestuff, auxiliary and size as well as great glutinosity; (4) great changes in water temperature and amount due to differences in processing types and output and the temperature over 40 degrees Celsius will influence sewage disposal effect.

Besides, a large amount of poisonous sewage produced in the traditional printing and dyeing process has direct influence on people's health due to its poisonous dyestuff or auxiliary, such as azo dye, formaldehyde, fluorescent bleacher and softener tend to cause allergy; poval and polypropylene sizes are hard to decompose; chlorine bleaches cause serious pollution; some aromatic amine dyes may cause cancer; dyes contain harmful heavy metal; all types of dressing agent and printing and dyeing auxiliary with formaldehyde are harmful to health. If discharged without treatment or failing to reach proper standards even after treatment, such sewage may directly harm people's health and seriously destroy water, soil and eco-system.

Exhaust gas in textile industry mainly comes from boilers which contain 60,000 tons of steam capacity and 80% of which fulfill the standards of smoke discharge. Most of these boilers use coal (some raw coal) as fuels which contains sulfur discharging a lot of exhaust gas, sulfur dioxide and smoke, seriously polluting the environment. Another source of textile exhaust gas lies in the technique engineering of textile production. Such exhaust gas mainly comes from the production process of chemical fiver especially viscose fiber. A large amount of sulfur dioxide and sulfureted hydrogen are employed as raw materials in fiber production. Due to imperfect techniques and incomplete process control, some exhaust gas is discharged.

Noise pollution is one of the serious problems lying in current textile industry especially cotton textile industry. Using a great number of shuttle looms, a cotton textile factory may produce 90-to-106-db noise, exceeding human ear's capacity of 85db. In textile workshops, environmental noise ranges from 100 to 105db, seriously harming workers' hearing from hearing loss to deafness. Besides, noise may cause symptoms in nervous system, cardiovascular system, digestive system and reproductive system. It is reported that noise may cause tinnitus, headache, dizziness, insomnia, memory loss, hearing loss and electrocardiographic abnormality and so on among textile workers and therefore seriously threaten pregnant workers and their children's health. In addition, in a strong noise environment, some symptoms may be caused such as behavioral destruction, prolonged visual response, reading ability loss, thinking destruction and so on and these may get worse with time.

1.3 Statistical Analysis on Pollution Caused by Farming Produce Processing Industry between 2005 and 2007 in China

In *China Statistical Yearbook*, the discharge of pollutants caused by farming produce processing industry from 2005 to 2007 is shown in Table 3-1 and Table 3-2.

In these tables, food processing industry, food manufacturing industry, beverage manufacturing industry, tobacco processing industry, textile industry, garment and fiber manufacturing industry, leather and feather processing industry, timber and vine processing industry, furniture manufacturing industry, paper industry, duplication of record medium in printing industry and rubber processing industry are mentioned.

According to the data in these tables, water pollution is the major problem caused by farming produce processing industry. The sewage discharged by this industry has taken up 40% of the total and this trend has been deteriorating annually these years.

2. Analysis on the Urgency of Environmental Cost Control in Jilin's Farming Industry

2.1 Poor Financial Revenue Intensifying the Urgency of Environmental Cost Control in Jilin's Farming Industry

Table 4 shows the expenditure in environmental protection in 2005 to 2007, according to which most of the money for environmental protection and urban construction of water resource comes from local finance.

Currently, however, Jilin has low financial revenue. According to Table 5, Table 6 and Table 7 which show the ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue from 2005 to 2007, Jilin ranked only 24th among all.

All these reveal that Jilin will have to spend more capital in renovating and controlling environment with more importance attached to people's living conditions and environmental issues and therefore more relevant laws issued if there is no proper control on current environmental pollution now.

2.2 Jilin's Advantages as a Major Grain Producing Area Intensifying the Urgency of Environmental Cost Control of Farming Produce Processing Industry

Jilin, an major agricultural province, has fertile soil especially fit for grain, oil plants, beet, tobacco, hemp, potatoes, ginseng, medicinal materials, fruits and so on. With a plantation area of 3,959,000 acres, it is rich in corn, beans, rice and so on. For many years Jilin has ranked in top two in the whole nation on the list of per capita grain ownership, grain commodity rate, grain off-take as well as corn export volume. (Table 8-1 and Table 8-2 show Jilin's position in the whole nation in per capita grain output).

Long-term laggard economy has led to Jilin's eagerness to develop its farming produce processing industry.

Therefore, in industrial planning, Jilin has regarded this industry as the third pillar industry, only next to automobile industry and petrochemical industry. As a result, its contribution value to pollution will be higher than that in other provinces.

2.3 Poor Resources Being a Restricting Factor from the Development of Jilin's Farming Produce Processing Industry

2.3.1 Jilin's Poor and Unevenly Distributed Water Resources

2.3.1.1 Jilin's Seriously Poor Water Resources

Although its farming produce processing industry leads to water pollution, Jilin itself has poor water resources actually. According to China's Statistical Yearbook in 2008, Jilin's gross amount of water resources reach $34,600,000,000 \text{ m}^3$; its surface water resources reach $30,150,000,000 \text{ m}^3$ and underground water resources $8,630,000,000 \text{ m}^3$; the repeatedly measured part of the two different water resources reaches $4,780,000,000 \text{ m}^3$. However, its per capita water resources reach 1269 m^3 /person, accounting for only 66.22% of the national average (1916.3 m³).

According to Table 9-1, Table 9-2, Table 10-1 and Table 10-2, Jilin ranks 21st among all the 31 provinces and municipalities in water resources and 17th in per capita water resources, falling into the category of serious water shortage.

2.3.1.2 Jilin's Unevenly-distributed Water Resources

Seen from the distribution of Jilin's water resources, the eastern area has sufficient water resources while little farmland, the middle area has little water while a large amount of farmland, the western area suffers from serious shortage. As a result, the whole province appears structural imbalance in water resources. From the view of administrative divisions, its water resources are also unevenly distributed. Table 11 shows that its middle area suffers from serious shortage of water resources.

However, middle Jilin is an important farming producing area as well as the centre for farming produce processing industry. Comparatively, environmental cost control must be conducted in order to achieve development due to water shortage there.

2.3.2 Jilin's Unfavorable Climatic Conditions

Jilin is located in the middle part of northeast China, belonging to the North Temperate Zone. Lying between 121' 38' and 131' 19' eastern longitude and from 40' 52' to 46' 18' northern longitude, Jilin has four distinctive seasons. In spring, it is dry and windy; in summer, it is hot and rainy; its winter is long and cold. River ice period lasts 4 to 5 months during which the runoff takes up 5-10% of the annual runoff volume. Generally, maximum ice thickness and minimum runoff appear in the period from late January to February, which is named the drought period. From May to early June is the level water period because the cold high moves north and the rainy period hasn't come yet. In these two periods, water degradation and self-purification are quite poor.

Obviously, compared with south China, environmental cost control in farming produce processing industry of Jilin seems particularly necessary. If left unsolved, this issue will affect the sustainable development of Jilin's farming produce processing industry.

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Table 1.	Per capita	grain output	of Jilin's far	ming produce	processing	industry	between 2004 and 2008.

	2004	2005	2006	2007	2008
Jilin's grain output (ten thousand tons)	2510	2581	2720	2454	2840
Jilin's population (ten thousand people)	2708.5	2716.0	2723	2729.82	2734.21
Jilin's per capita grain output (kilogram/person)	926.7	950.3	998.9	899.0	1038.7

Data source: Statistic bulletin of Jilin's national economy and social development in 2004 to 2008.

Index	Unit	2008	Growth compared with 2007 (%)
Total grain output	Ten thousand tons	2840	15.7
Total vegetable output	Ten thousand tons	857.60	-2.4
Total meat output	Ten thousand tons	384.48	10.6
Total egg output	Ten thousand tons	127.00	12.4
Total Dairy output	Ten thousand tons	61.75	30.5
Total aquatic product output	Ten thousand tons	15.50	2.2
Sold pig	Ten thousand	2450	11.4
Sold fowl	Hundred million	5.36	7.5

Table 3-1. Discharge of Pollutants from farming industry between 2005 and 2007

		of industria n thousand t		Discharg thousand		rial SO ₂ (ten
	2005	2006	2007	2005	2006	2007
Food processing industry	118964	94414	148589	15.6	16.8	17.03
Food manufacturing industry	42830	43113	42824	9.4	10.5	11.72
Beverage manufacturing industry	43404	56049	63156	10.7	11.6	12.36
Tobacco manufacturing industry	2809	2844	2873	1.3	1.5	1.36
Textile industry	172232	197934	225169	29.6	30.3	27.59
Garment and other fiber industry	9185	13685	14494	1.5	2.1	1.24
Leather and feather processing industry	18338	20340	23574	2.1	1.8	1.75
Timber and vine processing industry	6569	5223	4825	4.8	4.7	4.24
Furniture manufacturing industry	797	931	1848	0.4	0.3	0.34
Paper industry	367422	374407	424597	43.1	42.8	49.16
Duplication of record medium in printing industry	1618	1199	1964	0.2	0.2	0.24
Rubber industry	6118	5976	6435	4.4	4.6	4.49
Total	790286	816115	960348	123.1	127.2	131.52
Total national industrial pollutant discharge	2431121	2080440	2207566	2168.4	2234.8	2140
The proportion of pollution discharge from farming industry in similar industrial pollutants	32.51%	39.23%	43.50%	5.68%	5.69%	6.15%

		e of industri and tons)	al smoke	Discharge of industrial solid waste (ten thousand tons)			
	2005	2006	2007	2005	2006	2007	
Food processing industry	20.4	16.1	12.75	45	6.84	5.02	
Food manufacturing industry	5.1	5	5.48	3	1.77	2.26	
Beverage manufacturing industry	9	8.8	8.1	6	6.59	5.52	
Tobacco manufacturing industry	0.6	0.7	0.62	11	0.23	0.29	
Textile industry	12.8	12.4	12.73	17	2.89	3.5	
Garment and other fiber industry	0.7	1.1	0.48	1	0.99	0.06	
Leather and feather processing industry	1.1	1	1.1	0	0.56	0.49	
Timber and vine processing industry	5.5	3.7	3.17	1	0.41	0.82	
Furniture manufacturing industry	0.2	0.4	0.51	0	0.04	0.02	
Paper industry	24.1	20.9	23.6	8	6.84	9.63	
Duplication of record medium in printing industry	0.1	0.2	0.12	0	0.03	0.07	
Rubber industry	2	1.8	1.65	0	0.41	0.29	
Total	81.6	72.1	70.31	92	27.6	27.97	
Total national industrial pollutant discharge	854.9	864.2	771.1	1493	1199.93	1075.62	
The proportion of pollution discharge from farming industry in similar industrial pollutants	9.54%	8.34%	9.12%	6.16%	2.30%	2.60%	

Table 3-2. Discharge of Pollut	ants from farming ind	dustry between 2005 and 2007

Table 4. China's Expenditure in Environmental Protection and Urban Construction of water resource from 2005 to 2007 (hundred million yuan)

		From local finance	From national finance
2005	132.97	132.97	0
2006	161.24	161.24	0
2007	995.82	180.14	14.21

Data source: China statistical yearbook from 2006 to 2008

Table 5-1. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2005 (ten thousand yuan)

1	2	3	4	5	6	7	8	9	10	11
Guangdong	Shanghai	Jiangsu	Shandong	Zhejiang	Beijing	Liaoning	Henan	Hebei	Sichuan	Fujian
18072044	14173976	13226753	10731250	10665964	9192098	6752768	5376514	5157017	4796635	4326003

Table 5-2. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2005 (ten thousand yuan)

12	13	14	15	16	17	18	19	20	21
Hunan	Hubei	Shanxi	Anhui	Tianjin	Heilongjiang	Yunnan	Guangxi	Inner Mogolia	Shaanxi
3952651	3755217	3683437	3340170	3318507	3182056	3126490	2830359	2774553	2753183

Data source: China statistical yearbook from 2006 to 2008

Table 5-3. Ranks of provinces,	municipalities	and	municipalities	directly	under	the	Central	Government in
financial revenue in 2005 (ten the	ousand yuan)							

22	23	24	25	26	27	28	29	30	31
Chongqing	Jiangxi	Jilin	Guizhou	Xinjiang	Gansu	Hainan	Ningxia	Qinghai	Tibet
2568072	2529236	2071520	1824963	1803184	1235026	686802	477216	338222	120312

Data source: China statistical yearbook from 2006 to 2008

Table 6-1. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2006 (ten thousand yuan)

1	2	3	4	5	6	7	8	9	10
Guangdong	Jiangsu	Shanghai	Shandong	Zhejiang	Beijing	Liaoning	Henan	Hebei	Sichuan
21794608	16566820	15760742	13562526	12982044	11171514	8186718	6791715	6205340	6075850

Data source: China statistical yearbook from 2006 to 2008

Table 6-2. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2006 (ten thousand yuan)

11	12	13	14	15	16	17	18	19	20
Shanxi	Fujian	Henan	Hubei	Anhui	Tianjin	Heilongjiang	Yunnan	Shaanxi	Inner Mongolia
5833752	5411707	4779274	4760823	4280265	4170479	3868440	3799702	3624805	3433774

Data source: China statistical yearbook from 2006 to 2008

Table 6-3. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2006 (ten thousand yuan)

21	22	23	24	25	26	27	28	29	30	31
Guangxi	Chongqing	Jiangxi	Jilin	Guizhou	Xinjiang	Gansu	Hainan	Ningxia	Qinghai	Tibet
3425788	3177165	3055214	2452045	2268157	2194628	1412152	818139	613570	422437	145607

Data source: China statistical yearbook from 2006 to 2008

Table 7-1. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2007 (ten thousand yuan)

1	2	3	4	5	6	7	8	9	10	11
Guangdong	Shanghai	Jiangsu	Zhejiang	Beijing	Shandong	Liaoning	Sichuan	Henan	Hebei	Fujian
24154724	19754796	18947700	15353548	14356708	13083516	8156685	6289529	6250156	6182963	5940236

Data source: China statistical yearbook from 2006 to 2008

Table 7-2. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2007 (ten thousand yuan)

12	13	14	15	16	17	18	19	20
Tianjin	Hubei	Shanxi	Hunan	Anhui	Yunnan	Shaanxi	Inner Mongolia	Heilongjiang
438364	4 4339759	4305002	4106600	4018799	3786361	3555047	3479057	3349661

Data source: China statistical yearbook from 2006 to 2008

Table 7-3. Ranks of provinces, municipalities and municipalities directly under the Central Government in financial revenue in 2007 (ten thousand yuan)

21	22	23	24	25	26	27	28	29	30	31
Chongqing	Guangxi	Jiangxi	Jilin	Xinjiang	Guizhou	Gansu	Hainan	Ningxia	Qinghai	Tibet
2944592	2826809	2818573	2373862	2206460	2118512	1420532	879935	585871	432855	116667

Data source: China statistical yearbook from 2006 to 2008

Table 8-1. Ranks of Provinces,	municipalities and	1 municipalities	directly u	under the	Central	Government in p	ber
capita grain output and national	per capita grain ou	ıtput (kg)					

1	2	3	4	5	6	7	8	9	10	
Heilong jiang	Jilin	Inner Mongolia	Henan	Ningxia	Anhui	Shandong	Jiangxi	Liaoning	Hunan	National average
906	900	754	559	533	475	444	437	428	424	381

Data source: China statistical yearbook from 2006 to 2008

Table 8-2. Ranks of Provinces, municipalities and municipalities directly under the Central Government in per capita grain output and national per capita grain output (kg)

11	12	13	14	15	17	18	19	20	21	22	
Xinjiang	Jiangsu	Hebei	Chongqing	Hubei	Sichuan	Tibet	Yunnan	Gansu	Shanxi	Guangxi	National average
418	413	411	387	384	372	332	325	316	298	294	381

Table 8-3. Ranks of Provinces, municipalities and municipalities directly under the Central Government in per capita grain output and national per capita grain output (kg)

23	24	25	26	27	28	29	30	31	32	
Guizhou	Shaanxi	Hainan	Qinghai	Fujian	Zhejiang	Guangdong	Tianjin	Beijing	Shanghai	National average
293	285	211	193	178	145	137	134	64	59	381

Data source: China statistical yearbook from 2006 to 2008

Table 9-1. The ranks of provinces, municipalities and municipality directly under the Central Government in gross amount of water resources (hundred million cubic meters)

1	2	3	4	5	6	7	8	9	10	11	12	13
Tibet	Sichuan	Yunnan	Guangdong	Hunan	Guangxi	Jiangxi	Fujian	Guizhou	Hubei	Zhejiang	Xinjiang	Anhui
4321.4	2299.8	2255.5	1581.2	1426.5	1386.3	1113	1072.9	1054.6	1015.1	892.1	863.8	712.5

Table 9-2. The ranks of provinces, municipalities and municipality directly under the Central Government in gross amount of water resources (hundred million cubic meters)

14	15	16	17	18	19	20	21	22	23
Chongqing	Qinghai	Jiangsu	Heilongjiang	Henan	Shandong	Shaanxi	Jilin	Inner Mongolia	Hainan
663	661.6	495.7	491.8	465.2	387.1	377	346	295.9	283.5

Data Source: China's Statistical Yearbook in 2006 to 2008

Table 9-3. The ranks of provinces, municipalities and municipality directly under the Central Government in gross amount of water resources (hundred million cubic meters)

24	25	26	27	28	29	30	31
Liaoning	Gansu	Hebei	Shanxi	Shanghai	Beijing	Tianjin	Ningxia
261.7	228.7	119.8	103.4	34.5	23.8	11.3	10.4

Data Source: China's Statistical Yearbook in 2006 to 2008

Table10-1. The ranks of provinces, municipalities and municipality directly under the Central Government in per capita amount of water resources (cubic meter/person)

1	2	3	4	5	6	7	8	9	10	11	12	13
Tibet	Qinghai	Yunnan	Xinjiang	Hainan	Fujian	Guangxi	Sichuan	Guizhou	Jiangxi	Chongqing	Hunan	Hubei
152969.2	12029.5	5013.9	4167.8	3373.3	3005.7	2922.4	2822.6	2805.2	2556.5	2357.6	2247.1	1782.1

14	15	16	17	18	19	20	21	22	23	24
Zhejiang	Guangdong	Heilongjiang	Jilin	Inner Mongolia	Anhui	Shaanxi	Gansu	Jiangsu	Liaoning	Henan
1777.2	1686.3	1286.4	1269.2	1232.2	1165.2	1007.7	875.8	653.3	610.8	496.1

Table10-2. The ranks of provinces, municipalities and municipality directly under the Central Government in per capita amount of water resources (cubic meter/person)

Data Source: China's Statistical Yearbook in 2006 to 2008

Table 10-3. The ranks of provinces, municipalities and municipality directly under the Central Government in per capita amount of water resources (cubic meter/person)

25	26	27	28	29	30	31
Shandong	Shanxi	Shanghai	Hebei	Ningxia	Beijing	Tianjin
414.6	305.6	187.5	173.1	171.1	148.2	103.3

Data Source: China's Statistical Yearbook in 2006 to 2008

Table 11. The evaluation table of water resources in districts of Jilin

District	Area(km2)	Gross amount of water resources(hundred million m3)	Population in 2003 (ten thousand)	Per capita water resources (m3)	Degree of water shortage
Changchun	18881	27.46	742	370	Extremely serious
Jilin	27100	70.58	451.4	1564	Moderate
Siping	14037	16.45	326.7	504	Serious
Liaoyuan	5130	7.63	126	606	Serious
Tonghua	15100	55.30	226.2	2445	Light
Baishan	17852	71.51	133.2	5369	
Songyuan	21000	13.83	279.4	495	Extremely serious
Baicheng	25600	20.09	204.1	984	Serious
Yanbian	42700	115.98	218.6	5306	
The whole province	187400	398.83	2707.6	1473	Moderate

Note: According to the international standard of water shortage, 2000-3000m³ means light water shortage; 1000-2000 m³ means moderate water shortage; 500-1000m³ means serious water shortage; extremely serious water shortage means water resources less than 500m³.

Data source: Urban System Planning (2005-2020) compiled by Jilin chorography compilation committee, Jilin People's Press, 2005.

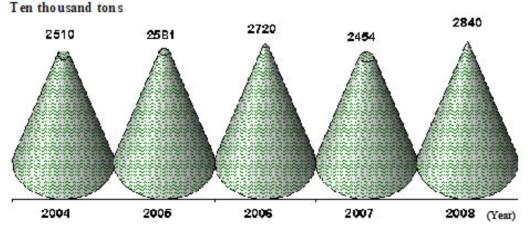


Figure 1. Grain Output and its Growth Rate between 2004 and 2008

Data source: Statistic bulletin of Jilin's national economy and social development from 2004 to 2008

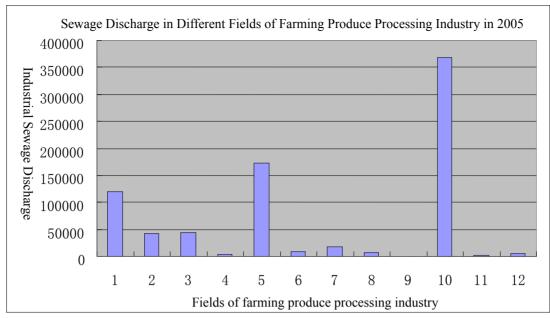


Figure 2. Sewage Discharge in Different Fields of Farming Produce Processing Industry in 2005

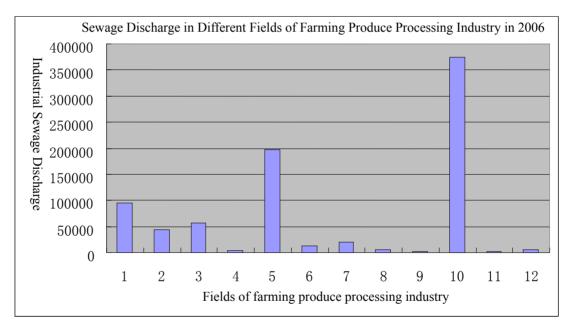


Figure 3. Sewage Discharge in Different Fields of Farming Produce Processing Industry in 2006

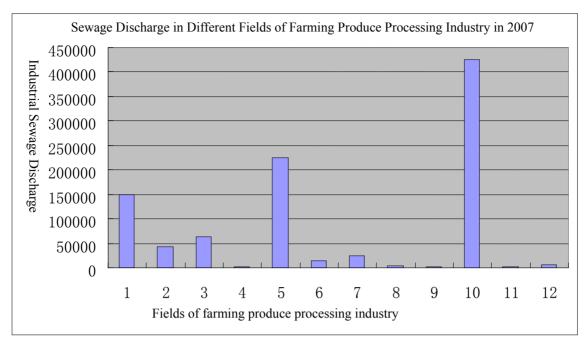


Figure 4. Sewage Discharge in Different Fields of Farming Produce Processing Industry in 2007

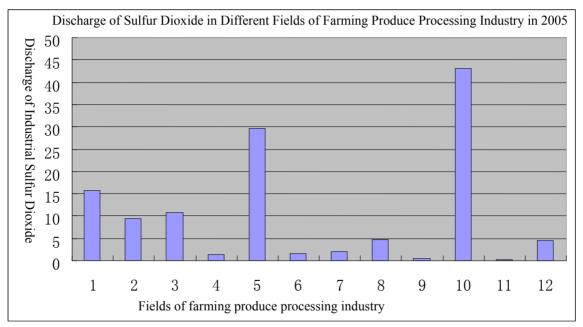


Figure 5. Discharge of Sulfur Dioxide in Different Fields of Farming Produce Processing Industry in 2005

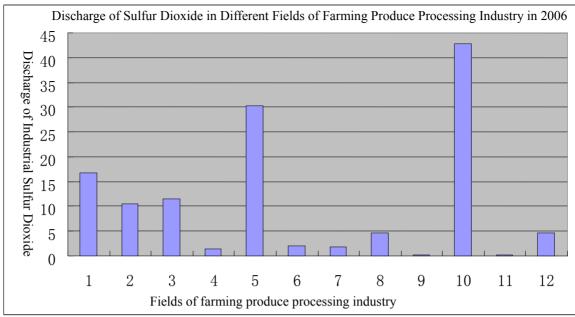


Figure 6. Discharge of Sulfur Dioxide in Different Fields of Farming Produce Processing Industry in 2006

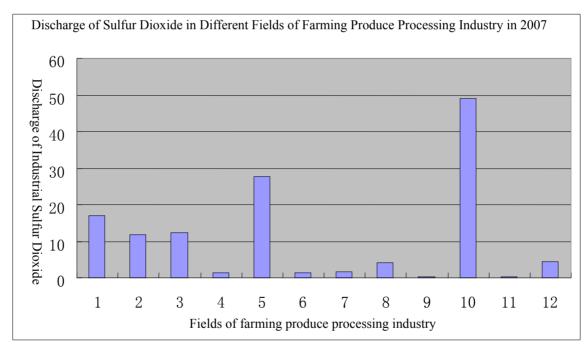


Figure 7. Discharge of Sulfur Dioxide in Different Fields of Farming Produce Processing Industry in 2007

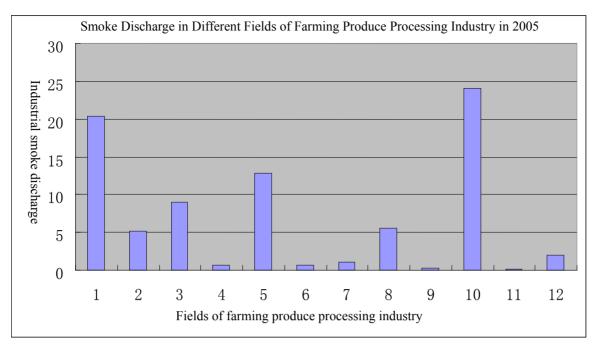


Figure 8. Smoke Discharge in Different Fields of Farming Produce Processing Industry in 2005

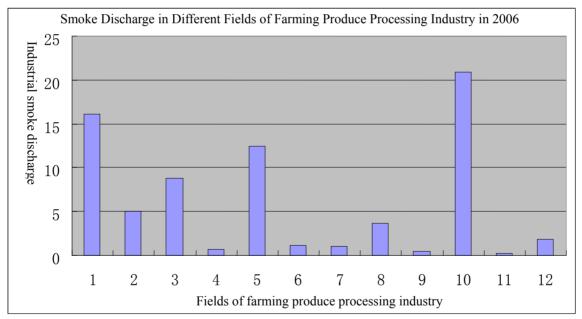


Figure 9. Smoke Discharge in Different Fields of Farming Produce Processing Industry in 2006

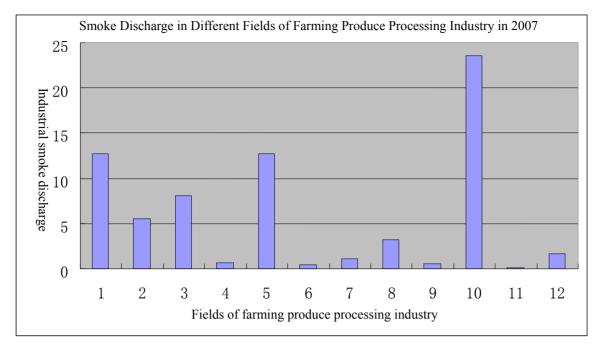


Figure 10. Smoke Discharge in Different Fields of Farming Produce Processing Industry in 2007

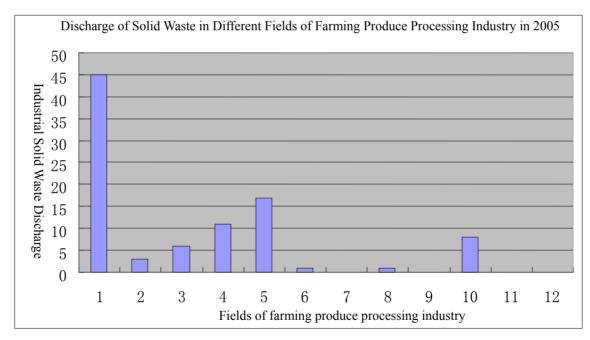


Figure 11. Discharge of Solid Waste in Different Fields of Farming Produce Processing Industry in 2005

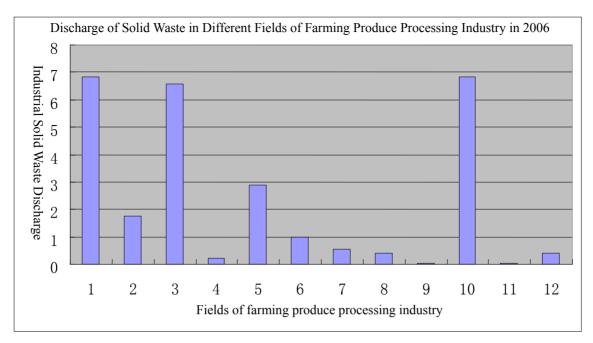


Figure 12. Discharge of Solid Waste in Different Fields of Farming Produce Processing Industry in 2006

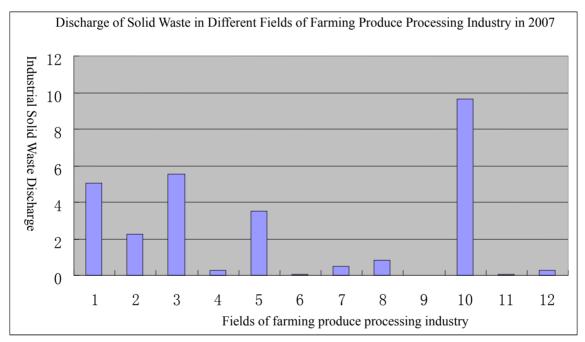


Figure 13. Discharge of Solid Waste in Different Fields of Farming Produce Processing Industry in 2007