

# **Outlook for China Glyphosate Market 2022-2026**

**The Thirteenth Edition**

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**Researched & Prepared by:**

**Kcomber Inc.**

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## **Executive summary**

Glyphosate, the key active ingredient of Roundup, is one of the most commonly sold herbicides on the market today. With rapidly increasing demand, glyphosate has shared about 30% of the global herbicide market in terms of sales volume.

### **- Position of Chinese glyphosate in the world**

China is the largest production base of glyphosate technical in the world and has been supplying over 70% of the global production of glyphosate. Its output of glyphosate was about 604,000 tonnes in 2021 (converted to 95% technical), over 50% of which was exported.

### **- Production**

The domestic output of glyphosate technical increased greatly from 520,000 tonnes in 2015 to 600,000 tonnes in 2016, and it reached 604,000 tonnes 2021.

Glyphosate production adopting the AEA pathway remains dominant in China, with its output reaching 449,000 tonnes and taking up 74.3% of national total in 2021.

In the past few years, the domestic production of glyphosate technical tended to transfer from East China to Central China (Hubei) and Southwest China (Sichuan), and North China (Inner Mongolia). The output of glyphosate technical in Sichuan, Hubei, and Inner Mongolia increased from less than 100,000 tonnes before 2012, to over 200,000 tonnes in 2014–2015, around 300,000 tonnes in 2016, and over 320,000 tonnes in 2017–2021.

The number of glyphosate technical producers in China (both active and idle are included) declined from over 45 in 2014 to only 33 in 2015, less than 30 in 2016–2017, and 17 in 2021 caused by stricter environmental protection requirements and fierce competition.

Chinese glyphosate industry is dominated by the companies who own the latest technology, large-scale production capacity, strong financial and sales strength and complete industrial chain, etc. Leading producers of glyphosate technical in the country include Fuhua Tongda (153,000 t/a), Hubei Trisun (130,000 t/a), Zhejiang Wynca (80,000 t/a), Nantong Jiangshan (70,000 t/a), Jiangsu Weien (62,000 t/a), Leshan Hebang (50,000 t/a glyphosate technical, 180,000 t/a PMIDA), Jiangsu Yangnong (35,000 t/a), etc.

### **- Export**

Glyphosate is the largest export commodity in the pesticide sector in China in terms of both volume and value. China's glyphosate industry highly depends on overseas market, with over 80% of its output exported every year. Besides, China is the largest exporter of glyphosate in the world.

The major export destinations of Chinese glyphosate technical are Argentina, the US, Brazil, Malaysia, Indonesia, Australia, and Russia, and the major destinations of glyphosate formulations are Australia, Vietnam, the US, Ghana, Nigeria, Russia, Brazil, Uruguay, the Philippines, Japan, Mexico, Indonesia, Ukraine, etc.

The main exporters of glyphosate formulation in China include Xingfa (Shanghai) International Trade Co., Ltd., Shandong Weifang Rainbow Chemical Co., Ltd., Zhejiang Wynca Chemical Group Co., Ltd., etc. The main exporters of glyphosate technical in China include Sichuan Leshan Fuhua Tongda Agro-Chemical Technology Co., Ltd., Nantong Jiangshan Agrochemical & Chemicals Co., Ltd., Fuhua Tongda Agro-chemical Technology Co., Ltd., etc.

### **- Demand**

Glyphosate has taken an irreplaceable position for the control of weeds in China, and its consumption grew at a CAGR of 6.5% in 2017–2021, reaching about 122,000 tonnes (converted to 95% technical) in 2021.

In China, glyphosate is quite important for the weeding in orchard, vegetables, wasteland reclamation and traditional crop fields in the period of pre-seeding. Orchard is the largest consumption field of glyphosate, with a demand share of about 33.8% in 2020, followed by vegetables, corn, rice, wheat, tea, rubber, etc.

## **- Production technology**

There are two pathways for glyphosate production in China including the iminodiacetic acid (IDA) pathway and the aminoethanoic acid (AEA) pathway. According to the starting raw material, the former can also be subdivided into two routes, namely the diethanolamine (DEA) route and the iminodiacetonitrile (IDAN) route.

The IDA pathway had been developing rapidly in 2005–2009, and many domestic companies set up glyphosate technical production lines adopting the IDA pathway, especially the IDAN route. After that, the DEA route showed a downtrend with the number of producers decreasing from 10 in 2009 to only 1 in 2021 because of the strong competitiveness of the IDAN route stemming from its advantages such as low cost, sufficient IDAN supply, etc.

The AEA pathway is widely adopted in China's glyphosate industry. In 2021, the capacity of glyphosate technical by this pathway was about 548,000 t/a, accounting for 69.4% of China's total capacity.

## **- Price**

The annual average ex-works price of 95% glyphosate technical kept decreasing from USD2,870/t in 2016, recovered to USD3,746/t in 2017 and USD4,066/t in 2018, and then fell to USD3,584/t in 2019 and USD3,254/t in 2020 and then increased to USD7,771/t in 2021.



## **Methodology**

The research for the report is carried out by the following steps:

### **-Desk research**

The sources of desk research are various, including published magazines, journals, government statistics, industrial statistics, customs statistics, association seminars as well as information from the Internet. A lot of work went into compiling and analyzing the information obtained. Where necessary, checks were made with the Chinese suppliers regarding market information such as production, demand, use, competition, etc.

### **-Telephone interview**

The interviewees cover:

- Producers
- Agricultural experts
- Traders
- Local governments
- Researchers
- Associations
- Equipment suppliers
- Raw material suppliers

CCM carried out extensive telephone interviews with all manufacturers of glyphosate technical and PMIDA producers as well as some producers of glyphosate formulations. Detailed production information and market situation were sourced and verified. Furthermore, players' comments on glyphosate industry were obtained.

For directly analysing the imports and exports of glyphosate technical, its formulations and PMIDA, many importers and exporters were contacted whenever the verification was needed.

Raw material (glycine, DEA, IDAN, PMIDA, etc.) suppliers were also contacted to help understand the price, supply as well as governmental policies on raw materials and their impact on the glyphosate industry.

### **-Export analysis**

Analysis of export data (HS code 29313910, 29313990, 38089311 and 38089319) from the China Customs helps work out China's exports of glyphosate (glyphosate technical, glyphosate formulations and PMIDA) by producer, trader and destination.

### **-Data processing and presentation**

The data collecting and compiling are sourced from:

- Published articles from Chinese periodicals, magazines, journals, the third-party database
- Government statistics & customs statistics
- Telephone interviews with Chinese producers, traders, governments and farmers
- Comments from industrial experts
- CCM's database
- Professional database in other sources
- Information from internet

The data from various ways have been combined to make this report as precise and scientific as possible. Throughout the process, a series of internal discussions took place in order to analyse the data and draw conclusions from it.

### **-Report generation**

Logical analysis and scientific ratiocination were conducted to generate the report, such as supply & demand analysis and cross-checking of all data. All the data and findings obtained through the above methods will be presented in the report clearly.

### **-Glossary**

In this report, there are many abbreviations for formulation type and glyphosate-related products, including various glyphosate formulations, glyphosate technical, intermediates/raw materials, etc. They are listed as follows:

AEA	aminoethanoic acid (glycine)
IDA	iminodiacetic acid
IDAN	iminodiacetonitrile
DEA	diethanolamine
HCN	hydrocyanic acid
DMP	dimethyl phosphite
PCL3	phosphorus trichloride
PMIDA	N-(phosphomethyl) iminodiacetic acid
IPA	isopropylamine
AI	active ingredient
SP	soluble powder
SL	soluble concentrate
WSG	water soluble granule
CAGR	compound annual growth rate
COD	chemical oxygen demand
BOD	biochemical oxygen demand

If not specified, glyphosate tech. (technical) in this report refers to glyphosate acid with a content of 95%, and glycine refers to industrial grade (tech-grade) glycine with a content of 95%.

#### -Unit

RMB: currency unit in China, also called yuan  
 USD: currency unit in the US, also called US dollar  
 Tonne: equals to metric ton in this report  
 /t: per tonne  
 t/a: tonne/annual, tonne per year  
 t/d: tonne per day

Note: As for the export data in this report, the export volume in tonne were converted from those in kg and then rounded, influencing by this, totals in the tables may slightly differ from those calculated without decimal places.

Table Regions covered

Regions covered (Chinese mainland)	Name
Province (22)	Heilongjiang, Jilin, Anhui, Fujian, Liaoning, Hebei, Shandong, Gansu, Qinghai, Henan, Sichuan, Jiangsu, Hubei, Hunan, Jiangxi, Zhejiang, Guangdong, Shaanxi, Hainan, Shanxi, Guizhou, Yunnan
Autonomous region (5)	Guangxi, Inner Mongolia, Tibet, Xinjiang, Ningxia
Municipality (4)	Beijing, Shanghai, Tianjin, Chongqing

Source: CCM

Table USD/CNY exchange rate, Jan. 2012–May 2022

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
2012	6.3168	6.3000	6.3081	6.2966	6.3062	6.3178	6.3235	6.3404	6.3395	6.3144	6.2953	6.2900	6.3136
2013	6.2787	6.2842	6.2743	6.2471	6.1970	6.1718	6.1725	6.1708	6.1588	6.1393	6.1372	6.1160	6.1920
2014	6.1043	6.1128	6.1358	6.1553	6.1636	6.1557	6.1569	6.1606	6.1528	6.1441	6.1432	6.1238	6.1428
2015	6.1272	6.1339	6.1507	6.1302	6.1143	6.1161	6.1167	6.3056	6.3691	6.3486	6.3666	6.4476	6.2288
2016	6.5527	6.5311	6.5064	6.4762	6.5315	6.5874	6.6774	6.6474	6.6715	6.7442	6.8375	6.9182	6.6425
2017	6.8918	6.8713	6.8932	6.8845	6.8827	6.8019	6.7772	6.7148	6.5909	6.6493	6.6300	6.6067	6.7662
2018	6.5079	6.3045	6.3352	6.2764	6.3670	6.4078	6.6157	6.8293	6.8347	6.8957	6.9670	6.9431	6.6070
2019	6.8482	6.7081	6.6957	6.7193	6.7344	6.8896	6.8716	6.8938	7.0883	7.0726	7.0437	7.0262	6.8826
2020	6.9614	6.9249	6.9811	7.0771	7.0690	7.1315	7.0710	6.9980	6.8498	6.7796	6.7050	6.5921	6.9284
2021	6.5408	6.4623	6.4754	6.5584	6.4895	6.3572	6.4709	6.4660	6.4680	6.4604	6.4192	6.3693	6.4615
2022	6.3794	6.3580	6.3014	6.3509	6.5672	/	/	/	/	/	/	/	/

Source: The People's Bank of China

## 1 Factors influencing China's glyphosate industry

The development of China's glyphosate industry is influenced by the following factors:

- Domestic government policy
- Global and domestic economic environment
- Crop planting situation
- Global demand for glyphosate
- Raw material supply
- Technology level
- International market competition
- etc.

Among the above factors, global demand for glyphosate plays the most important role. The government policy will also play a more and more important role in the future. The other factors like the crop planting situation have a smaller effect on China's glyphosate industry.

The key factors influencing China's glyphosate industry such as global demand, government policy and economic environment are analyzed in detail in the following table.

Table 1-1 Factors influencing China's glyphosate industry, 2021

Item		Analysis
Favorable factor	Fast-growing GDP	China's GDP growth is faster than the global average, which will assure the domestic glyphosate industry and its related industries of a good environment.
	Low labor cost	There's abundant qualified labor in China and the labor cost is low.
	Increasing farmers' income	Rising income means farmers have stronger purchasing power.
	Rising demand for glyphosate globally	This is also applicable to China itself. More GM crops, larger no-tillage land and crops planting area will stimulate the demand, thus promoting glyphosate's development in China.
	Low production cost	Production cost in China is lower than the global average.
Unfavorable factor	Oversupply	Overcapacity in China's glyphosate industry has led to a long-term gloomy glyphosate market and undervalued glyphosate price.
	Inefficient formulation technology	The glyphosate formulating technology is inefficient in China.
	Policy on export	The export rebates for glyphosate and PMIDA have been canceled.
	Costly registration abroad	The cost will be unaffordable to Chinese enterprises.
	Low brand recognition overseas	The domestically made products are therefore exported at low prices.
	Higher environmental cost	The domestic glyphosate producers should invest much more in waste treatment and by-product recovery.

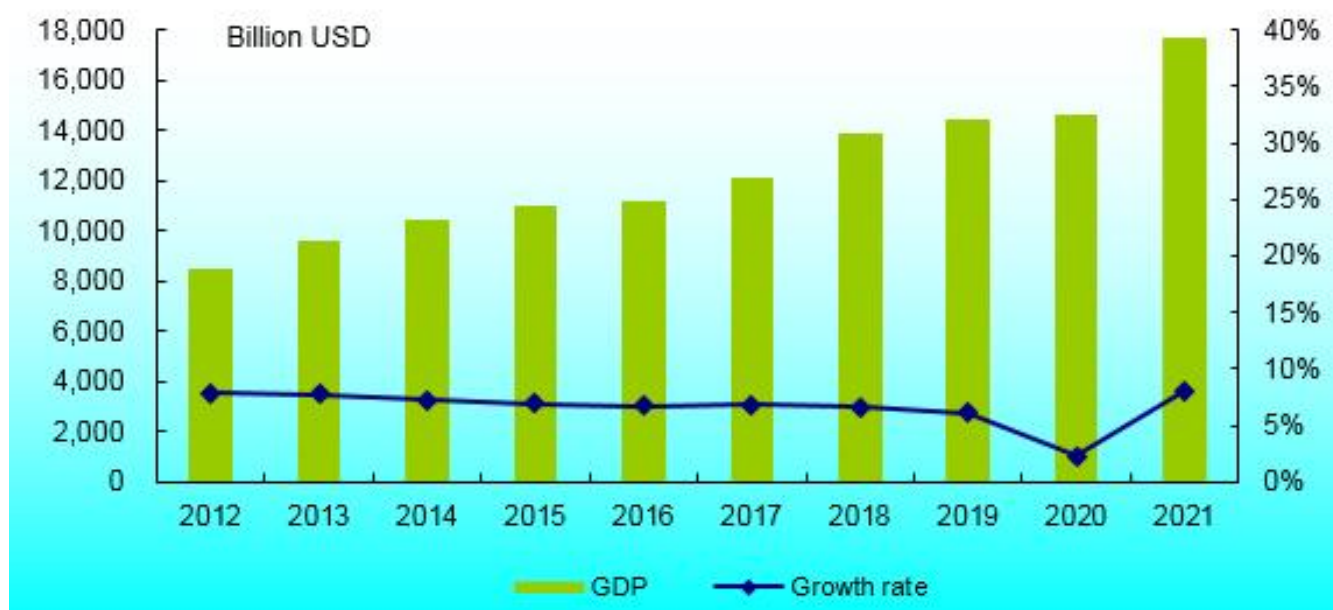
Source: CCM

### 1.1 Economic environment

#### - Stable economic development in China

China's economy has been continuously developing with a stable growth rate. The country is gradually turning from a world manufacturing center into a large consumer of all kinds of products. Stable economic growth will ensure the stable development of the domestic pesticide industry including glyphosate.

Figure 1.1-1 China's GDP growth, 2012–2021



Source: National Bureau of Statistics of China

### - Stable and continuous increase in farmers' income

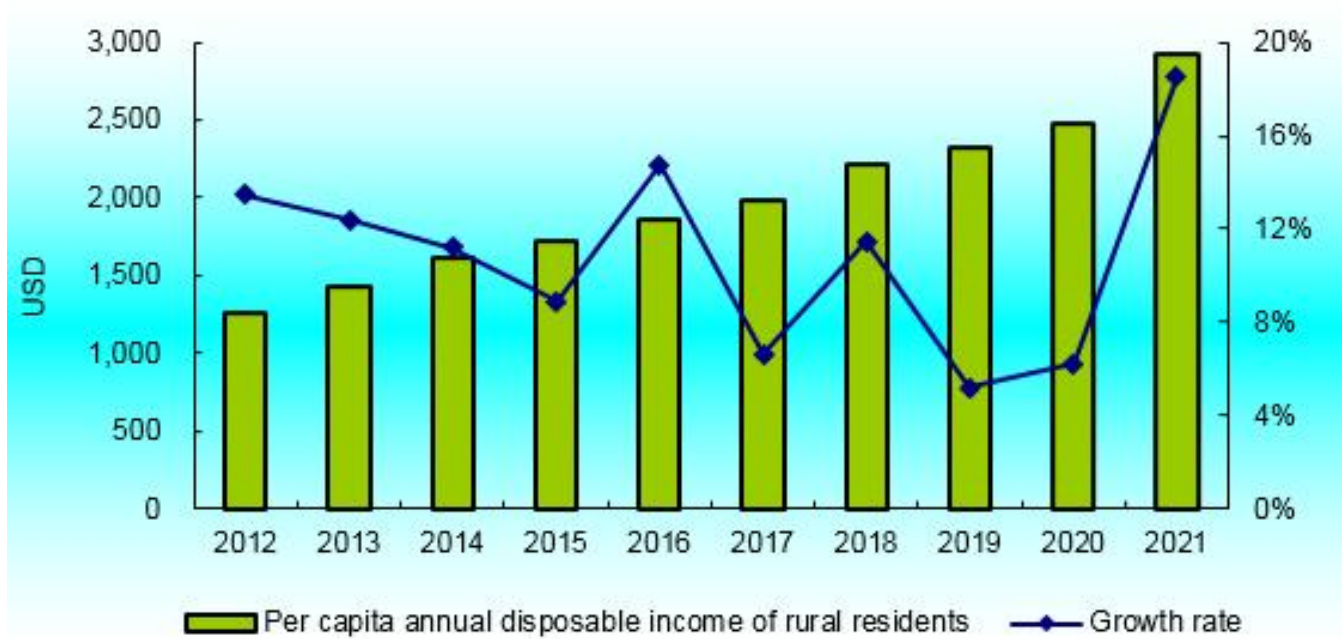
Chinese farmers' purchasing power, closely related to their income and the whole economic situation, plays an important role in the pesticide industry, as they are the end users of pesticides. In recent years, China has promulgated and implemented a series of policies and measures to increase farmers' income. These encouraging policies show that the Chinese government has attached more and more importance to agricultural development.

Table 1.1-1 China's policies to boost farmers' income in recent years

Item	Content
Agricultural subsidy system	Subsidies for grain production, high-class seeds, agricultural mechanization and agricultural means of production.
Policies on food crops' purchase price floor	Chinese government has raised price floor of food crops in China for many years.
Investment	Increase investment in agricultural infrastructure construction, animal epidemic disease prevention and control system.
Financial support	Increase financial support for agriculture by issuing preferential policies.
Policies on price of raw material for agricultural production	Curb the soaring price of agricultural means of production.
Cultivated land	Protection cultivated land especially the farmland.
Market	Strengthen the adjustment and management of agricultural products market.

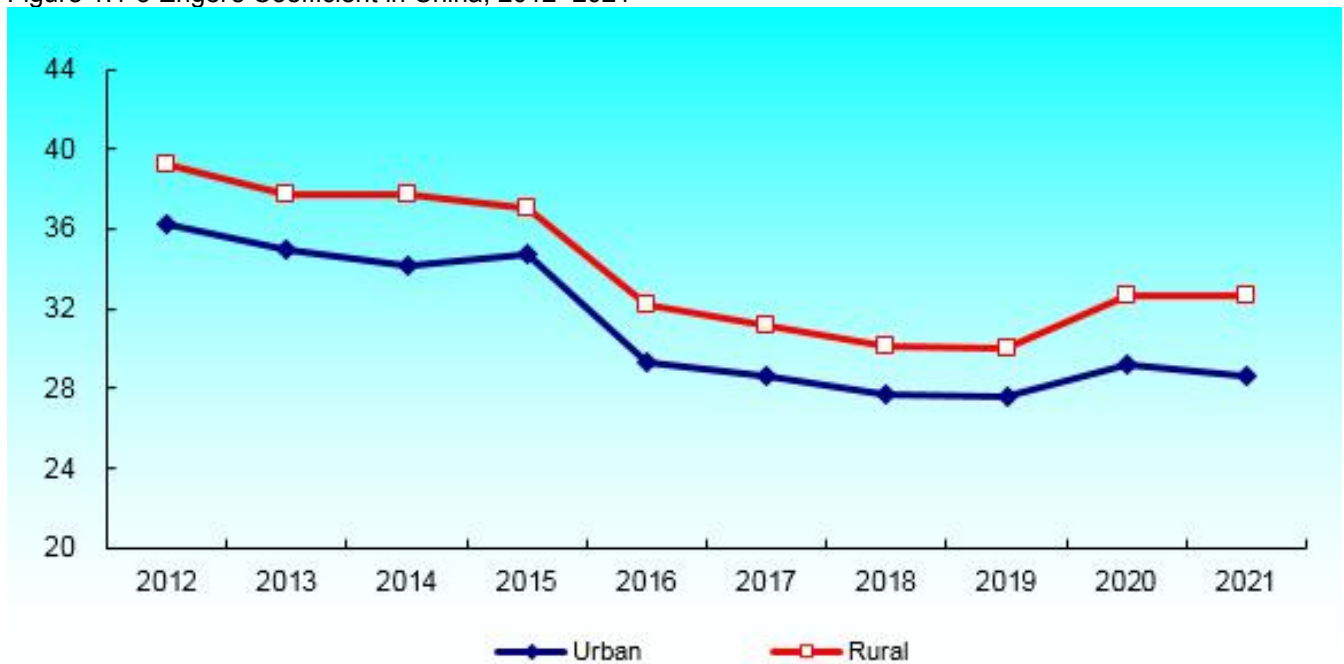
Source: CCM

Figure 1.1-2 Per capita annual disposable income of rural residents in China, 2012–2021



Source: National Bureau of Statistics of China

Figure 1.1-3 Engel's Coefficient in China, 2012–2021



Source: National Bureau of Statistics of China

With increasing profit in crop planting thanks to the government's efforts, farmers will be more willing to plant crops and invest more in pesticides. Meanwhile, the encouragement of no-tillage technology will boost the demand for pesticides. However, the increase in farmers' income is not always good for the glyphosate industry as stronger purchasing power means more choices, so some farmers might turn to other herbicides with better performance in some aspects than glyphosate. Notably, glyphosate has a disadvantage that it may lead to the death of crops while some other herbicides like diquat have no such problem.

**- Low labor cost**

As the "world factory", China has the advantage of relatively low labor costs. The average salary of Chinese employees keeps increasing stably every year and it has huge room to grow given its current low level. It is estimated that the average salary will rise in the coming few years, accordingly pushing up the production

cost of glyphosate.

The Chinese government has issued a series of laws to ensure workers' interest in recent years. The Labor Contract Law of the People's Republic of China has a great impact on the labor cost in China. Some important contents of the Law can be seen as follows:

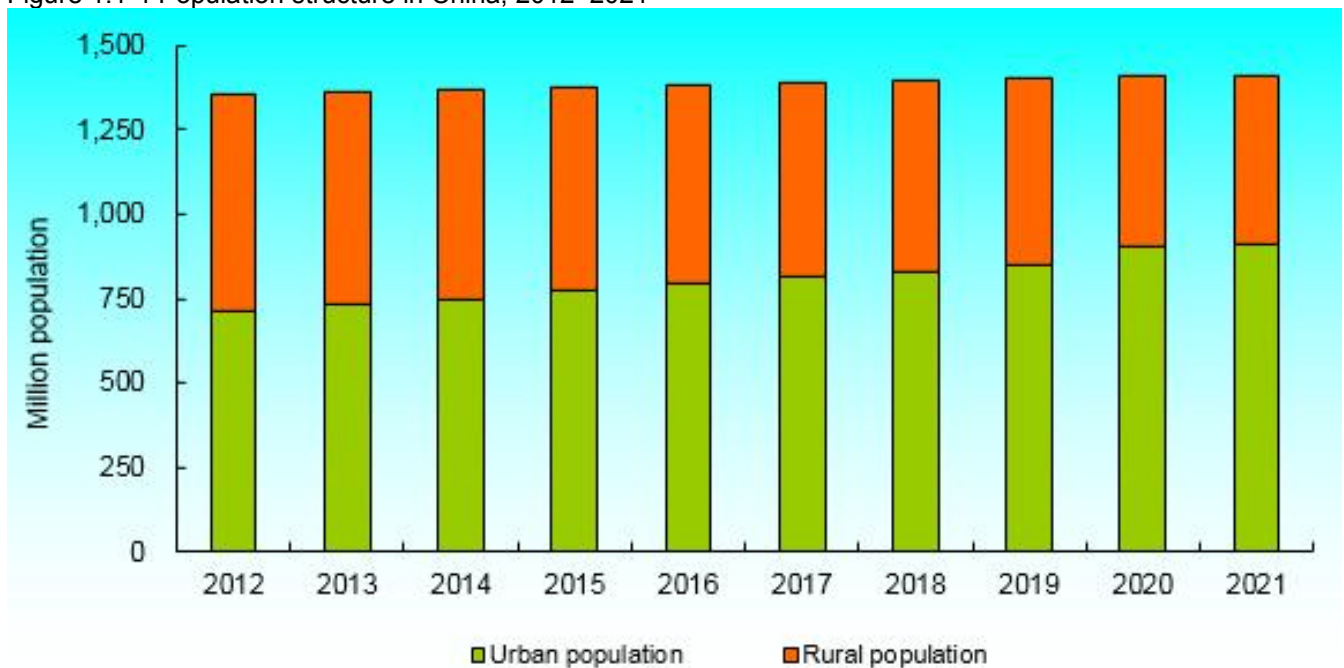
- Employers must sign non-fixed term labor contracts with their employees.
- Employers must pay employees for 150%–200% of the unit salary for overtime work.
- Government authorities concerned will be punished if they fail to perform their duties.
- The municipal human resources and social security bureaus should help employees to get what should be paid by employers if they refuse to pay.
- Employers must purchase social insurance for employees.
- Employers must pay salaries no less than the minimum wage prescribed by the local government.

The minimum wage has been increasing for years, and rural migrant workers' average monthly salary has increased from USD317 in 2011 to about USD776 in 2021.

### - Decreasing number of farmers

The number of Chinese farmers has been shrinking, since more and more young people from rural areas choose to work in cities in the process of China's urbanization. The growing per capita crop planting area suggests that more and more machines and pesticides will be used, and glyphosate consumption is expected to rise accordingly.

Figure 1.1-4 Population structure in China, 2012–2021



Source: National Bureau of Statistics of China

## 1.2 Government policy

Different from most countries in the world, the impact of policy on most industries in China has been significant and sometimes critical to their development. The glyphosate industry is no exception. However, what is unique in government policies on the glyphosate industry in China is that there are few policies directly targeting glyphosate, but the industry is influenced by policies targeting glyphosate-related industries.

### - Environmental policies

China's new environmental policies promote the adjustment of some industries such as the glyphosate industry.

Environmental and energy costs in China have been much lower than those in some developed countries for

a long time. That is why the global production of some industries with serious pollution has been shifted to China in recent years. Now the Chinese government is strengthening its management of environmental protection by issuing measures to restrict blind capacity enlargement and impel manufacturers to improve their production technology.

In May 2013, the Ministry of Environmental Protection of the People's Republic of China announced that environmental protection verification (EPV) for glyphosate (PMIDA) would be launched in the following years. It is required that during the pollution control procedure:

1. The yield of glyphosate technical (AEA pathway) shall be no less than 70%;
2. The yield of glyphosate technical (IDA pathway) shall be no less than 75%;
3. The comprehensive utilization rate of the phosphorus element shall be no less than 80%;
4. The recycling rate of sodium chloride shall be no less than 85%.

In April 2019, the Ministry of Ecology and Environment of the People's Republic of China issued the Implementation Plan for Investigation and Rectification Activities Targeting on "Three Phosphorous (phosphorite mining, phosphorus chemical and phosphogypsum stack)" Industries in Provinces along the Yangtze River, which clearly defined the overall requirements and work arrangements for the special program. It deals with the so-called "Three Phosphorous" industries and the work can be divided into five stages.

As to the "Three Phosphorous", tasks are:

- Phosphorite mining industry: treatments aim to achieve up-to-standard expelled mine water, effective control of dust in the mining area and ecological restoration after mining.
- Phosphorus chemical industry: focuses are separation of rainwater and sewage, effective collection and treatment of initial rainwater, setting-up and normal operation of pollution prevention and control facilities, and up-to-standard wastewater discharged. Specifically, phosphate fertilizer producers are to ensure that sewage treatment facilities are equipped and wastewater is effectively reused; phosphorous pesticide enterprises are to strengthen the recovery and treatment of mother liquor; yellow phosphorus manufacturers are to make sure zero discharge of phosphorous-contained wastewater and prevent yellow phosphorus loss during the process.
- Phosphogypsum stack: regular monitoring of groundwater, effective collection and treatment of leachate, standardized construction of return pool, flood detention ditch and floodway, and comprehensive utilization of phosphogypsum should be pursued.

The five stages include:

1. Problem checking: make a list of problems and sort out typical ones in the industries.
2. Rectification plan deciding: work out a plan for each enterprise. Classify the problems identified and record rectification measures.
3. Double check for loopholes and hidden hazards: strengthen supervision, check the problem list and corresponding rectification measures, watch out for loopholes and dig up hidden hazards. The rectification of yellow phosphorus manufacturers should be finished at this stage.
4. Follow-up supervision: track the rectification progress and the overall schedule. Complete the rectification of phosphorite mining, phosphate fertilizer and phosphorus pesticide enterprises.
5. Result assessment: promote the rectification of key phosphogypsum stacks, solve outstanding problems and assess the effectiveness of this special program.

#### **- Policies on export**

The export rebate of glyphosate in China had been canceled since 15 July, 2010, and the one of PMIDA had been canceled since 1 Jan., 2013.

#### **- Support for key enterprises**

On 29 Jan., 2022, the Ministry of Agriculture and Rural Affairs (MARA) issued the 14th Five-year (2021-2025) Development Plan for the National Pesticide Industry, encouraging domestic pesticide enterprises to expand their scale through M&A, restructure, transformation and upgrading approaches, and promoting the cultivation of large- and medium-sized producers with strong competitiveness. It is stipulated in the Plan that:

- 10 enterprises with an annual output value over RMB5 billion, 50 enterprises with an annual output value over RMB1 billion and 100 enterprises with an annual output value over RMB500 million will be cultivated by 2025;



- The number of pesticide producers will be reduced from 1,705 to below 1,600 by 2025.

### - Unfavorable policies on glyphosate enterprises

Newly constructed glyphosate technical installations have been listed as a restricted project in the Catalogue for Guiding Industry Restructuring (2011 Version), which means that new glyphosate technical projects would no longer be permitted in China since May 2013.

Among all the policies, the impact of environmental policies is the most direct and significant for the Chinese glyphosate industry at the time being, because the increasingly stricter environmental policies have led to a significant increase in the production cost of the product during the past few years.

### 1.3 Global demand

The global demand for glyphosate has kept increasing stably from 680,000 tonnes in 2012 to 734,000 tonnes in 2014, mainly because of its wider application in planting of soybean, cotton, and corn which have been genetically modified to tolerate glyphosate.

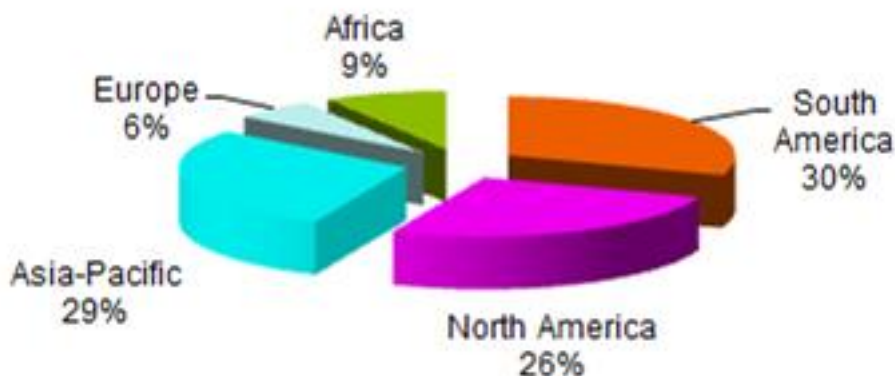
Nevertheless, the global demand for glyphosate decreased in 2015 because of the declining planting area of GM crops in the world. The decreasing planting area of GM crops was due to their low price, which made some farmers stop planting corn, cotton and rapeseed but turned to more easily managed crops such as GM soybean, and also to other less demanding crops like beans, sunflower, and sorghum.

The global demand for glyphosate increased in 2016–2018, because of the increasing planting area of GM crops in the world. The global demand in 2019–2021 was stable over 700,000 tonnes.

It has shown that most professionals deem that the global planting of GM crops is still the main driving force of future growth in glyphosate demand, and other factors influencing the future demand for glyphosate by importance are the development of biofuels, promotion of no-tillage technology, emergence or evolution of glyphosate-tolerant weeds, weather and competition from rival products. There is no substitute for glyphosate at present, so glyphosate will still be the key herbicide in the next ten years with a stable growth rate.

Glyphosate is mainly consumed in American countries, especially the US, Brazil and Argentina, which are the top three biotech crop planting countries worldwide, growing 75.0 million hectares, 56.0 million hectares and 26.0 million hectares of GM crops in 2021 respectively. The three countries consume over 380 million liters, 340 million liters and 300 million liters glyphosate-based herbicides annually with their total glyphosate demand accounting for about 50% of the global total.

Figure 1.3-1 Global consumption of glyphosate by region, 2021



Source:CCM

## 1.4 Entry barriers of glyphosate industry

It is not easy for new comers to enter China's glyphosate industry due to the following barriers.

### - Policy

The Chinese government has strict requirements on the registration, production licence, environment evaluation, etc. for pesticide production, which will restrict development of pesticide industry. Generally speaking, it takes about two years to obtain a pesticide production licence.

The pesticide production licence that Chinese producers obtained has a short validity period, and they have to apply again for a licence to maintain their production. The validity is only two years when they apply for the first time, and five years for later application.

To register a pesticide, an enterprise should meet the following conditions:

Likewise, newly constructed glyphosate technical installations have been listed as restricted project in the Catalogue for Guiding Industry Restructuring (2011 Version), it means those new glyphosate technical projects would no longer be permitted in China.

### - Capital

Only large companies who have considerable funds can enter glyphosate industry.

Table 1.4-1 Capital barriers for glyphosate manufacturers in China

Item	Technical producer	Formulation producer
Investment	≥RMB50 million (Land use fee excluded)	≥RMB20 million (Land use fee excluded)
Environmental protection investment	≥15% of total investment	≥8% of total investment
Registered capital	At least RMB50 million	At least RMB30 million
Others	Machine, technician, management and so on	
Cost	≥RMB100 million for 10,000 t/a glyphosate technical project (including supporting facilities, waste treatment equipment, by-product installations, etc.)	/

Source: Notice on Further Strengthening the Management of Pesticide Industry

### - Technology

All the three production routes adopted in China are mature, but waste treatment technology and by-products recovery technology are challenges for many companies. Actually, some producers have invested in improving their waste treatment technology or waste treatment equipment. Yet it is difficult for a player without much experience in R&D. Meanwhile, differences in key process indicators among different processes, or even the same process, have great influences on product quality and yield. Without long-term technology accumulation, it is impossible to master advanced technology in a short time, which means the production cost for new entrants is higher and the yield is unexpected.

In China, though most enterprises claim that their key technicians have been retained by offering very high salary, glyphosate technology is easily leaked by some job-hopping technicians. For example, with job-hopping of many technicians in Zhejiang Wynca Chemical Industry Group Co., Ltd. (Zhejiang Wynca), many manufacturers came to have a knowledge of and adopted the technology of recovering chloromethane in glyphosate production developed by Zhejiang Wynca. Zhejiang Wynca only sued one of them—Zhejiang Jinfanda Bio-chemical Co., Ltd. (Zhejiang Jinfanda) who finally had to pay RMB20 million to Zhejiang Wynca. But there are still many manufacturers using the technology. So how to protect the patent and retain technicians is a great challenge for China's glyphosate manufacturers, especially for new entrants.

## 2 Glyphosate upstream industries

### 2.1 Key raw materials & intermediates of glyphosate

Two production pathways of glyphosate technical have diverse raw materials.

#### - AEA pathway

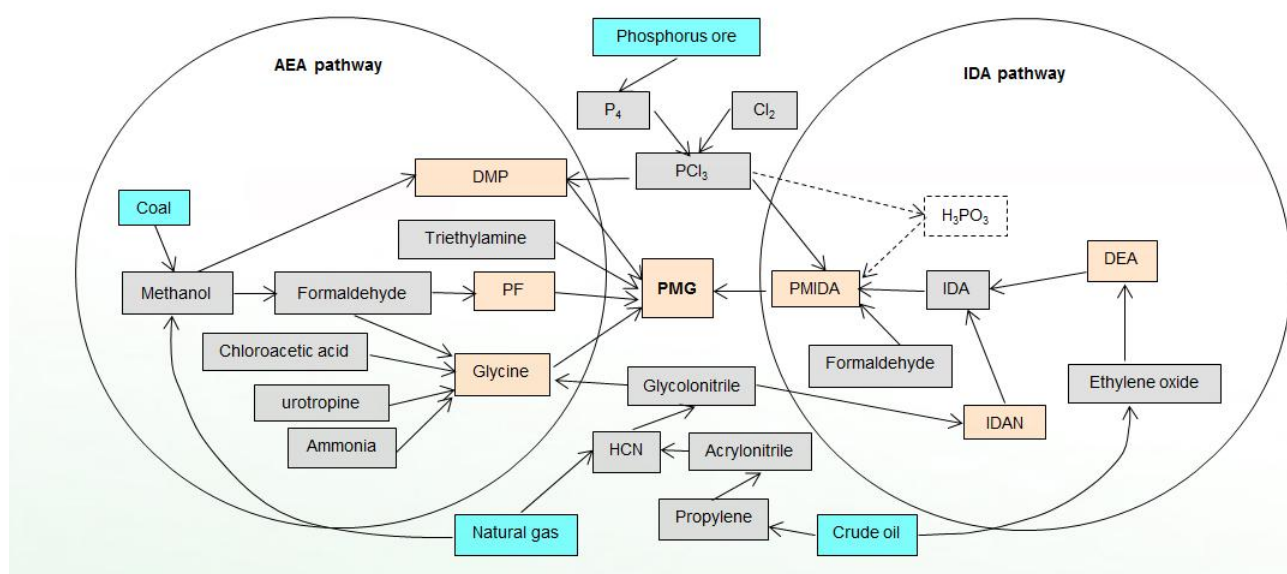
The key raw materials include glycine, dimethyl phosphite (DMP) and paraformaldehyde (PF). Since DMP is mainly produced by glyphosate producers themselves, DMP is not detailedly introduced here.

#### - IDA pathway

For the DEA route, the most important material is DEA. As for the IDAN route, the most important material is IDAN produced by the natural gas route.

In the IDA pathway, PMIDA is the most important intermediate. Some companies produce and sell it. Some companies purchase PMIDA to produce glyphosate technical.

Figure 2.1-1 Different pathways for producing glyphosate technical and value chain of key raw materials



Source:CCM

### 2.2 Glycine

In China, glycine is mainly consumed in the domestic glyphosate industry. According to the production process and product purity, glycine can be divided into four categories, namely pharmaceutical grade, food grade, feed grade and industrial grade (also called tech-grade), and only the last one is applied in glyphosate technical production for its cheaper price. Unit consumption of industrial grade glycine is 0.55t/t–0.60t/t in glyphosate technical production now.

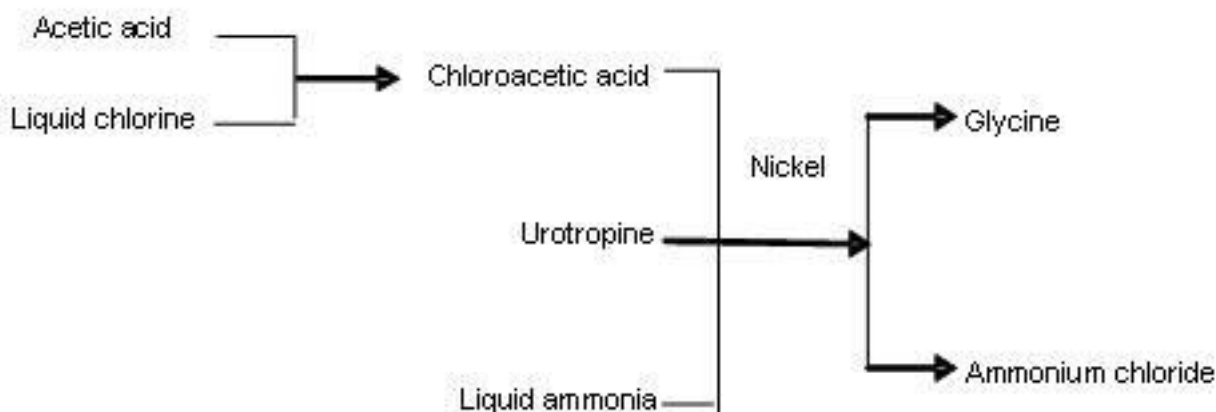
#### - Technology

There are three major glycine production methods in the world, namely the chloroacetic acid ammonolysis process, the Strecker process and the hydantion process.

In China, glycine is mainly produced via the chloroacetic acid ammonolysis process, which is a mature production technology adopted by almost all domestic glycine producers except Guang'an Chengxin.

Guang'an Chengyang is the only company in China adopting the hydantion process to produce glycine. This production process has advantages such as less reaction steps, higher yield, higher purity, lower production cost and less pollution, compared with the chloroacetic acid ammonolysis process.

Figure 2.2-1 Flowchart of the chloroacetic acid ammonolysis process for glycine production



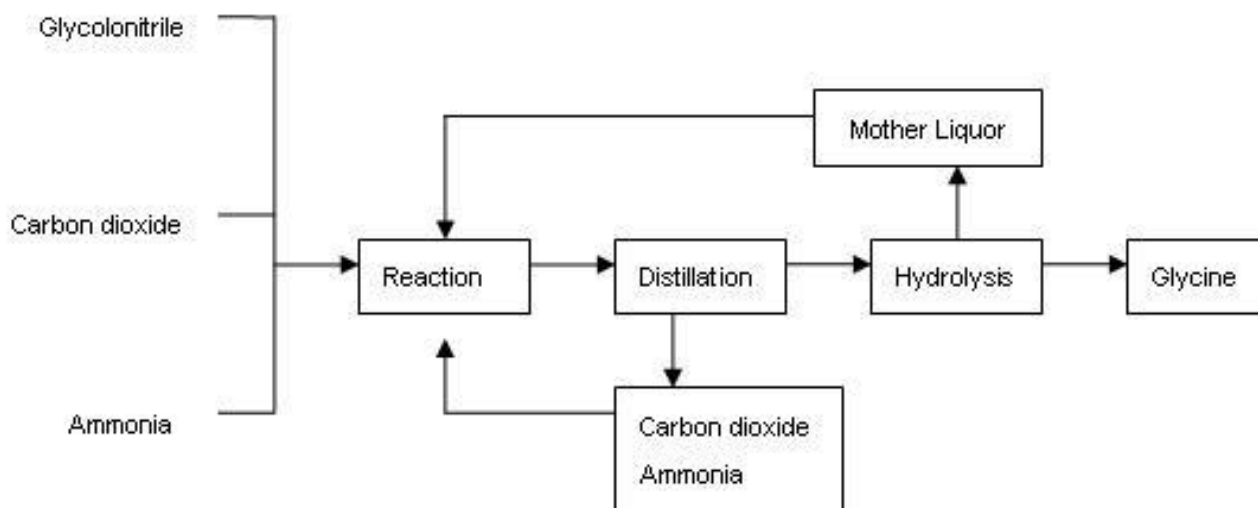
Source:CCM

Table 2.2-1 Raw material consumption and unit cost of the chloroacetic acid ammonolysis process for glycine production in China, May 2022

No.	Raw material	Purity, %	Unit consumption, t/t	Price, USD/t	Unit cost, USD/t
1	Chloroacetic acid	95	1.52	830	1,261
2	Liquid ammonia	99.6	0.58	754	437
3	Urotropine	98	0.16	1,249	200
4	Methanol	98	0.07	457	32
<b>Total</b>		/	/	/	<b>1,930</b>

Source:CCM

Figure 2.2-2 Flowchart of the hydantion process for glycine production



Source:CCM

### - Production

Chinese glycine industry has always witnessed overcapacity in the past few years, and this situation will not change much in the coming few years though some glycine producers may shift their glycine installations to produce other amino acids.

National capacity of glycine (tech-grade) reached 511,000 t/a in 2017, during which Hebei Chuncheng

finished a 10,000 t/a tech-grade glycine project and Hebei Huaheng completed a 22,000 t/a tech-grade glycine project.

The capacity came to 561,000 t/a in 2018, as Hebei Donghua's capacity expanded from 182,000 t/a to 192,000 t/a. Xizang Newtrend Fine Chemical Co., Ltd.'s 40,000 t/a tech-grade glycine project was completed and put into trail operation by the end of 2017. Besides, the 30,000 t/a tech-grade glycine and 10,000 t/a food-grade glycine of Hainan Zhengye Fine Chemical Co., Ltd. was put into production in 2018.

\*

In 2019, the capacity of tech-grade glycine maintained at 561,000 t/a, with the entry and exit of individual producers.

In 2020, the national capacity of tech-grade glycine reached 581,000 t/a. Linyi Hongtai Chemical Co., Ltd. 20,000 t/a glycine expansion project completed and put into operation. Shaanxi Beiyuan Chemical Industry Group Co., Ltd. proposed a 120,000 t/a glycine project, and the pilot installation with a capacity of 95 t/a was built up and put into pilot production in July.

In 2021, Cangzhou Huachen Biotechnology Co., Ltd. completed its 30,000 t/a new glycine project in November, thus achieving the national capacity of 603,000 t/a in 2021.

Table 2.2-2 Capacity and output of glycine in China, 2017–2021

Year	Capacity, t/a		Output, tonne	
	Industrial grade	Other grade	Industrial grade	Other grade
2017	511,000	119,800	307,000	52,900
2018	561,000	129,800	325,000	56,600
2019	561,000	138,800	338,000	56,400
2020	581,000	138,800	340,000	60,200
2021	603,000	138,800	352,500	61,500

Source:CCM

Table 2.2-3 Producers of tech-grade glycine in China, 2017–2021

No.	Producer	Capacity 2021, t/a	Output, tonne				
			2017	2018	2019	2020	2021
1	Hebei Donghua Chemical Group	192,000	130,000	140,000	130,000	130,000	130,000
2	Hubei Trisun Chemicals Co., Ltd.	100,000	83,000	73,000	84,000	80,000	88,000
3	Linyi Hongtai Chemical Co., Ltd.	70,000	30,000	30,000	28,000	35,000	35,000
4	Sichuan Leshan Fuhua Tongda Agro-chemical Technology Co., Ltd.	40,000	20,000	22,000	25,000	25,000	26,000
5	Xizang Newtrend Fine Chemical Co., Ltd.	40,000	0	6,000	6,000	6,000	6,000
6	Hainan Zhengye Fine Chemical Co., Ltd.	30,000	0	2,000	8,000	10,000	10,000
7	Cangzhou Huachen Biotechnology Co., Ltd.	30,000	/	/	/	/	3,000
8	Hebei Huaheng Biological Technology Co., Ltd.	22,000	3,000	4,000	5,000	5,000	5,000
9	Guang'an Chengyang Bio-tech Co., Ltd.	20,000	15,000	15,000	17,000	17,000	17,000
10	Henan HDF Chemical Co., Ltd.	15,000	10,000	12,000	11,000	10,000	11,000
11	Inner Mongolia Xingfa Technology Co., Ltd.	10,000	10,000	10,000	10,000	10,000	10,000
12	Hebei Chuncheng Biological Technology Co., Ltd.	10,000	0	5,000	5,000	5,000	3,500
Others		24,000	6,000	6,000	9,000	7,000	8,000
<b>Total</b>		<b>603,000</b>	<b>307,000</b>	<b>325,000</b>	<b>338,000</b>	<b>340,000</b>	<b>352,500</b>

Source:CCM

#### - Price

Only the price of tech-grade glycine in China is analysed here, as the products of the other three grades are made from the tech-grade and their prices are mainly subject to the tech-grade's.

Glycine price in China is influenced by the price of glyphosate technical, instant supply of & demand for glycine, government policies, and the price of glycine's raw materials including chloroacetic acid, urotropine, liquid ammonia and methanol.

#### - Glyphosate technical price

Glycine price in China is largely subject to the price of glyphosate technical, since about 75% of tech-grade glycine is applied in the domestic glyphosate industry.

#### - Instant supply of & demand for glycine

There is a great oversupply in glycine in China, and in most cases, glycine price won't change much. However, the price may increase a lot when the instant supply cannot meet the demand.

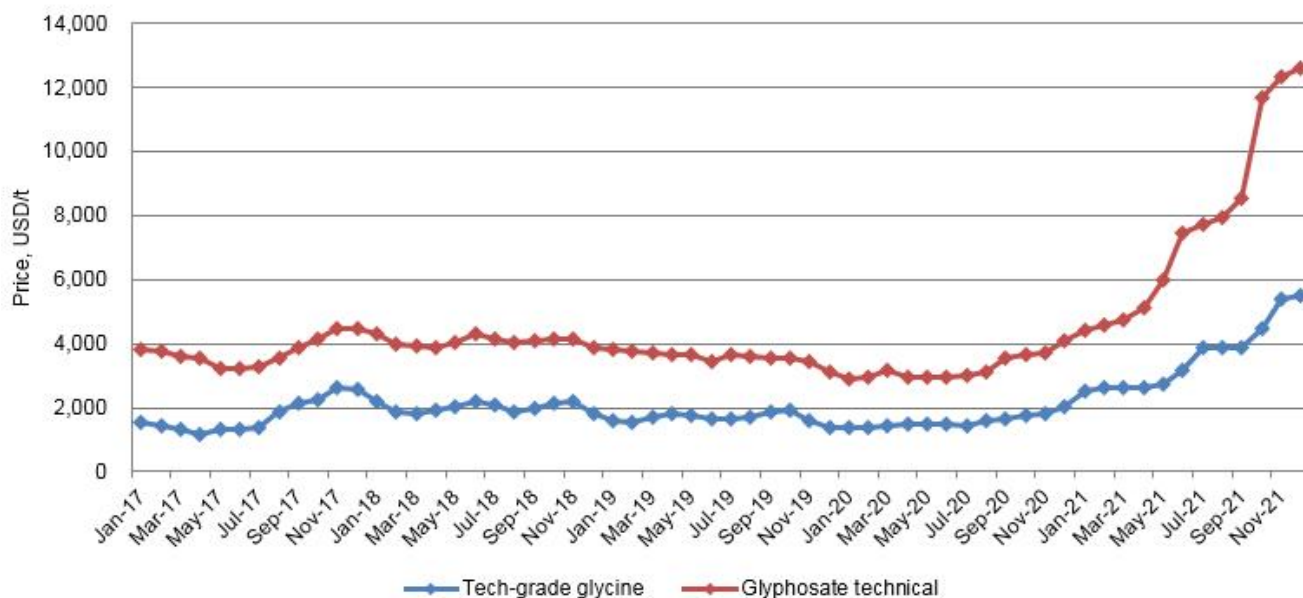
#### - Government policies

Under the guidance of national industrial policies, China's amino acid industry develops rapidly. And due to some environmental policies, supply of and demand for glycine and enterprises' operating profits in China are limited, affecting the price of glycine. For example, on 17 Nov., 2016, Hebei Province, the main glycine production base, issued the 2nd air pollution control scheduling order, and glycine production was under stricter supervision, leading to tight supply of glycine.

### - Raw material price

The cost of raw materials, like urotropine and chloroacetic acid, accounts for over 80% of the total production cost of glycine.

Figure 2.2-3 Monthly average ex-works price of tech-grade glycine and glyphosate technical in China, Jan. 2017–Dec. 2021



Note: The glycine price represented is tech-grade glycine price.  
Source: CCM

### - Consumption

Major end-use segments of glycine are glyphosate, food, feed and pharmaceutical in China. In 2021, 75% of tech-grade glycine was applied in the domestic glyphosate industry, and the rest was consumed to produce food-, feed- and pharmaceutical-grade glycine.

The domestic consumption of tech-grade glycine had kept increasing between 2011 and 2016. The figure dropped temporarily in 2017, but in the following years, it stabilized at around 260,000 tonnes. All these ups and downs are driven by changes in the output of glycine route glyphosate.

Table 2.2-4 Consumption of glycine in glyphosate production in China, 2017–2021

Year	2017	2018	2019	2020	2021
Output of glyphosate tech. (AEA pathway), tonne	437,900	444,000	442,000	452,000	449,000
Consumption of glycine, tonne	252,000	258,000	257,000	263,000	261,000

Source: CCM

Currently, three production routes are adopted in glyphosate industry in China, namely glycine route, IDAN route and DEA route. Output of glyphosate technical produced through glycine route, the dominated one, accounted for 72%–76% of the total glyphosate output in China in 2017–2021.

Table 2.2-5 Main glycine producers and glycine consumers in glyphosate industry in China, 2021

No.	Glycine producer	Glycine consumer
1	Hebei Donghua	Fuhua Tongda, Zhejiang Wynca, Nantong Jiangshan, Anhui Guangxin, etc.
2	Hubei Trisun	Hubei Trisun, Jiangxi Jinlong, Inner Mongolia Xingfa, etc.
3	Fuhua Tongda	Fuhua Tongda
4	Linyi Hongtai	Zhejiang Wynca, Nantong Jiangshan, etc.
5	Henan HDF	Henan HDF
6	Inner Mongolia Xingfa	Inner Mongolia Xingfa

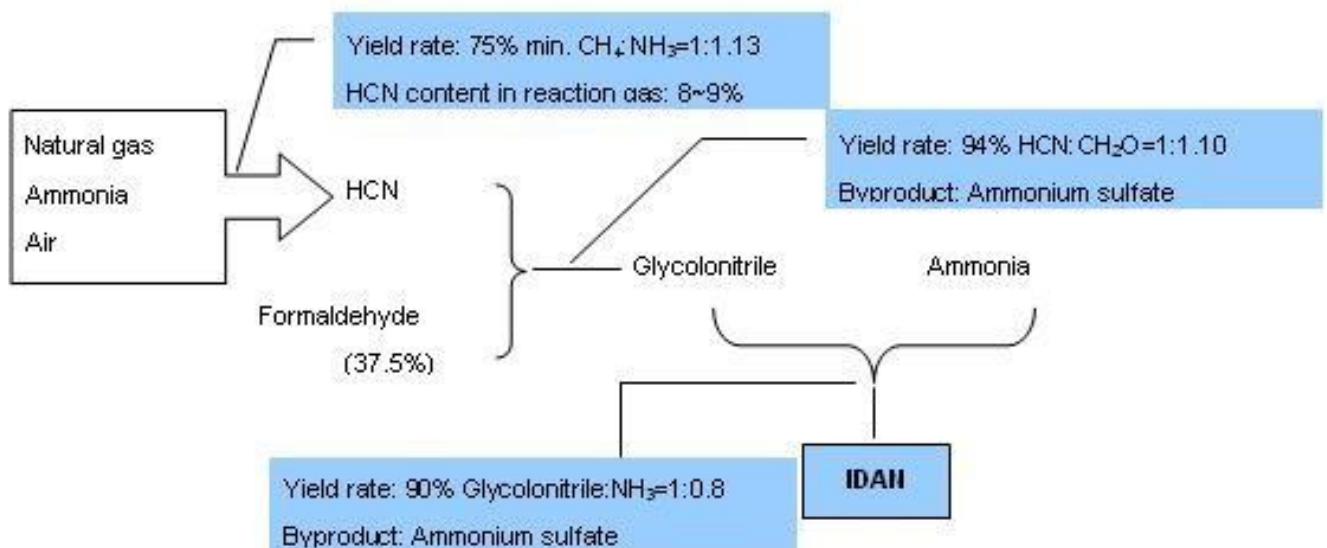
Source: CCM

### 2.3 IDAN

#### - Routes to produce IDAN

Natural gas is taken as the starting material to produce HCN & IDAN in China.

Figure 2.3-1 Production process of IDAN by natural gas route in China



Source:CCM



## - Production

Figure 2.3-2 Capacity and output of IDAN in China, 2012–2021



Source:CCM

During 2012–2016, the capacity of IDAN kept over 200,000t/a, but due to oversupply, it began to decline in 2017. By 2021, the capacity reduced to 175,000 t/a, with only 3 producers operating in China

As for output, IDAN's output in China peaked at 148,000 tonnes in 2014, but in the following years, IDAN's output decreased and kept stable at around 110,000–120,000 tonnes (except for 2019).

## - Key IDAN producers

Table 2.3-1 Capacity and output of IDAN producers in China, 2017–2021

No.	Producer	Status, 2021	Capacity 2021, t/a	Output, tonne				
				2017	2018	2019	2020	2021
1	Leshan Hebang Agricultural Technology Co., Ltd.	Active	100,000	70,000	70,000	70,000	99,000	100,000
2	Chongqing Unisplendour Chemical Co., Ltd.	Active	50,000	30,000	32,000	10,000	7,500	6,500
3	Guang'an Chengxin Chemical Co., Ltd.	Active	25,000	10,000	12,000	12,000	12,000	14,000
<b>Total</b>			<b>175,000</b>	<b>110,000</b>	<b>114,000</b>	<b>92,000</b>	<b>118,500</b>	<b>120,500</b>

Source: CCM

Chongqing Unisplendour, major IDAN supplier in China, has two IDAN production bases located in Inner Mongolia and Xinjiang with IDAN capacity of 30,000 t/a and 20,000 t/a respectively.

Leshan Hebang, which established a complete integrated chain of glyphosate (IDAN route) from natural gas to HCN (45,000 t/a), glycolonitrile (90,000 t/a), IDAN (100,000 t/a), PMIDA (180,000 t/a) and glyphosate technical (50,000 t/a), has successfully changed the domestic market structure of glyphosate industry. Almost all domestic glyphosate producers purchased IDAN to produce PMIDA and then glyphosate technical,

but since 2015, some of them switched to purchase PMIDA produced by Leshan Hebang to produce glyphosate technical.

### - Price of IDAN

The price of IDAN in China is mainly affected by the price of glyphosate technical and raw material costs, under the situation of IDAN oversupply.

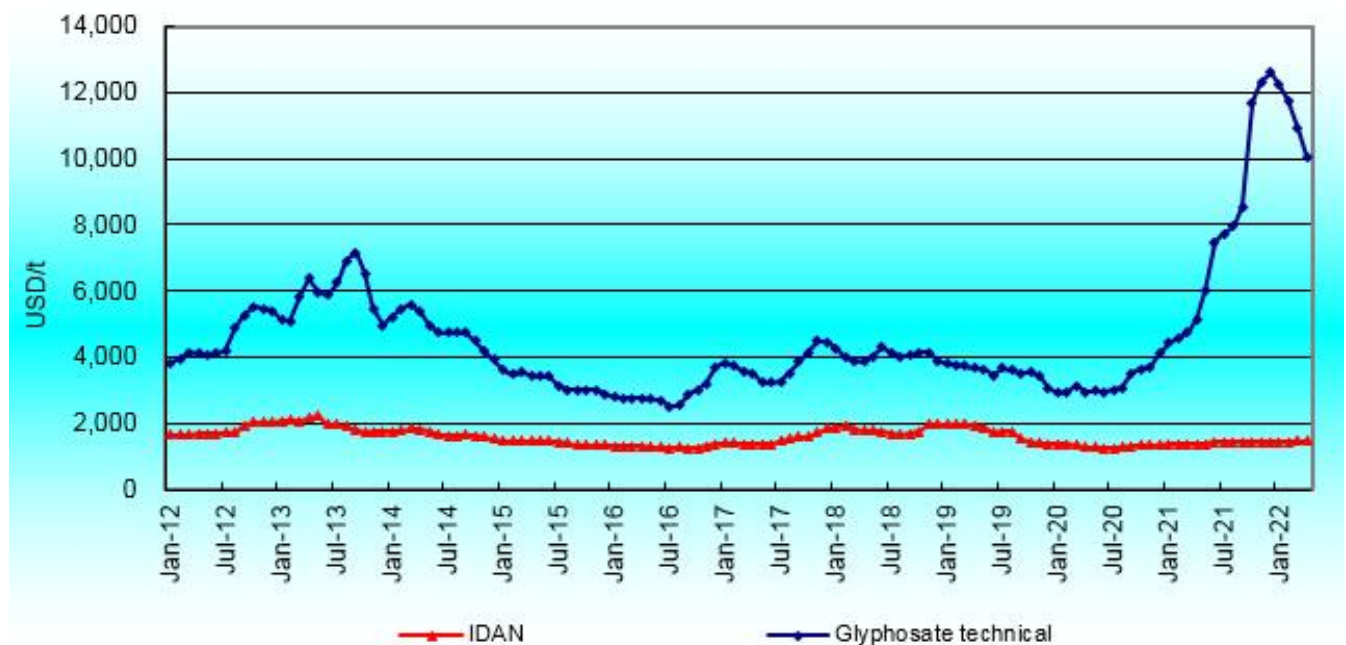
#### - Price of glyphosate technical

The domestic price of IDAN was deeply influenced by that of glyphosate technical, especially when the price of glyphosate technical is high because PMIDA & glyphosate technical is the only end-use segment of IDAN in China.

#### - Raw material cost

The raw material cost usually takes up about 70% of the total production cost of IDAN. And natural gas plays the most important role in raw material cost, as it is not only the starting raw material of IDAN but also the raw material of the other important raw materials of IDAN, such as formaldehyde and liquid ammonia. Thus, the price change of natural gas has a large impact on the production cost of IDAN.

Figure 2.3-3 Monthly average ex-works price of IDAN and 95% glyphosate technical in China, Jan. 2012–April 2022



Source:CCM

### - Consumption of IDAN

IDAN can be applied to PMIDA & glyphosate technical, electroplate, water treatment, etc., but in China, it is used to produce PMIDA & glyphosate technical only.

Table 2.3-2 Key glyphosate technical producers adopting IDA pathway in China, 2021

No.	Company	Capacity 2021, t/a	
		Glyphosate technical (IDA pathway)	Glyphosate technical
1	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	62,000	62,000
2	Leshan Hebang Agricultural Technology Co., Ltd.	50,000	50,000
3	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	40,000	70,000
4	Jiangsu Yangnong Chemical Co., Ltd.	35,000	35,000
5	ADAMA Ltd.	20,000	20,000
6	Guang'an Chengxin Chemical Co., Ltd.	20,000	20,000
7	Jingma Chemicals Co., Ltd.	15,000	15,000
<b>Total</b>		<b>242,000</b>	<b>272,000</b>

*Note: Jiangsu Yangnong mainly consumes DEA to produce glyphosate technical, and it also purchases PMIDA produced by Leshan Hebang to produce glyphosate technical.*

*Source: CCM*

## 2.4 DEA

Diethanolamine (DEA) is produced together with monoethanolamine (MEA) and triethanolamine (TEA). The output ratio of MEA, DEA and TEA varies from company to company, according to the addition of ethylene oxide (EO). For example, Zhejiang Jiaying Jinyan Chemical Co., Ltd.'s output ratio is 7:8:5, while Lotte Chemical (Jiaying) Corp.'s output ratio is 2:6:2.

### - Production

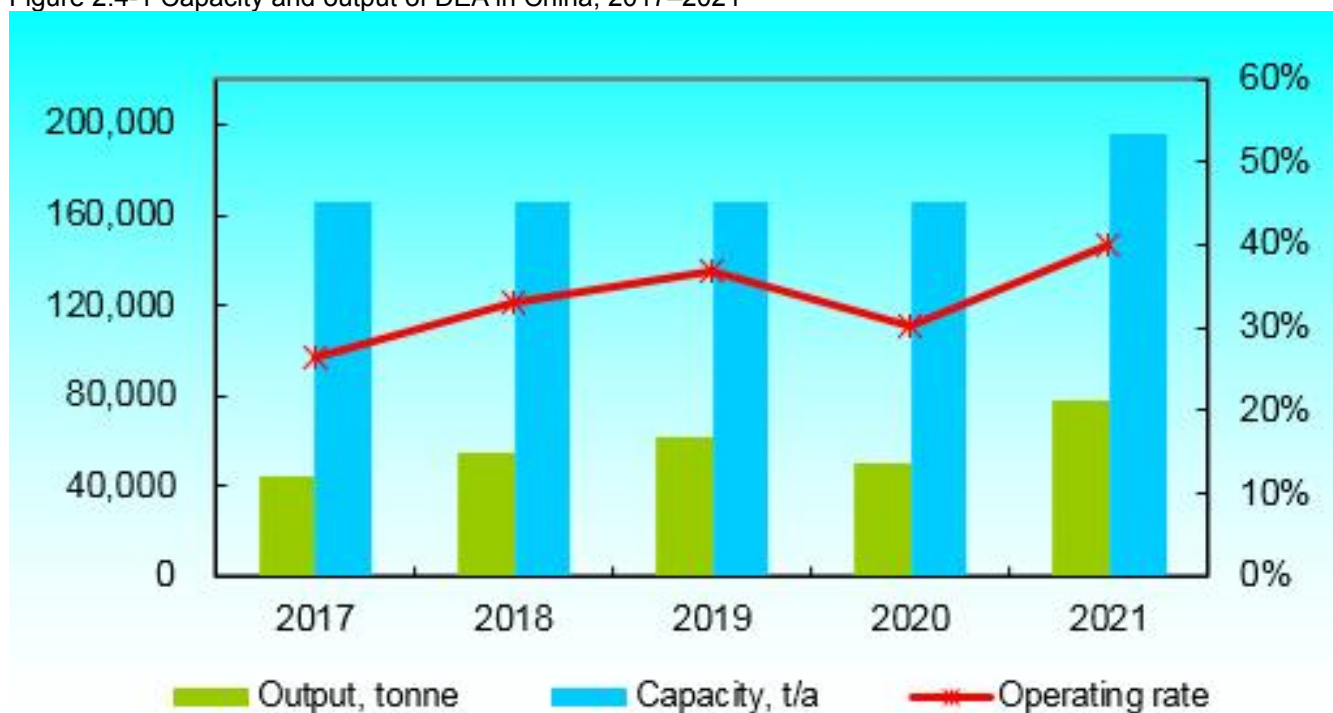
China's DEA capacity was maintained at 166,000 t/a in 2017–2020. But it increased to 196,000 t/a in 2021, up 18.07% year on year.

#### Domestic

DEA's output kept growing at a CAGR of 17.9% in 2017–2019, but in 2020, it declined to a record low because of the outbreak of COVID-19 and the surging volume of imported DEA.

In 2021, China's DEA's output recovered due to the decreasing volume of imported DEA.

Figure 2.4-1 Capacity and output of DEA in China, 2017–2021



Source:CCM

There were seven active DEA producers in China as of 2021.

Table 2.4-1 Capacity and output of DEA producers in China, 2017–2021

No.	Company	Status, 2021	Capacity 2021, t/a	Output, tonne				
				2017	2018	2019	2020	2021
1	Jiangsu Sailboat Petrochemical Co., Ltd.	Active	49,000	8,000	18,000	20,000	16,000	19,000
2	Lotte Chemical (Jiaxing) Corp.	Active	30,000	10,000	12,000	12,800	8,000	11,000
3	Zhongke (Guangdong) Refining&Chemical Co., Ltd.	Active	30,000	/	/	/	/	25,000
4	BASF-YPC Company Limited	Active	25,000	5,700	6,000	5,900	5,000	7,500
5	Hubei Xianlin Chemical Co., Ltd.	Active	20,000	5,000	3,500	6,500	5,000	7,000
6	Zhejiang Jiaxing Jinyan Chemical Co., Ltd.	Active	20,000	5,000	5,500	5,800	6,000	4,200
7	Maoming Petro-chemical Shihua Co., Ltd.	Active	6,000	4,300	3,800	3,900	4,500	4,600
8	Oriental Petrochemical (Yangzhou) Corporation	Idle	16,000	6,000	6,000	6,300	5,500	0
<b>Total</b>			<b>196,000</b>	<b>44,000</b>	<b>54,800</b>	<b>61,200</b>	<b>50,000</b>	<b>78,300</b>

Source: CCM

In Sept. 2017, Jiangsu Sailboat Petrochemical Co., Ltd. completed its 100,000 t/a ethanolamine project and started trial production, with the capacity of DEA reaching 49,000 t/a.

At the end of 2020, the 50,000 t/a EA project of Zhongke (Guangdong) Refinery & Petrochemical Co., Ltd. was successfully put into operation, producing MEA, DEA and TEA.

## - Import & export of DEA in China

China's Ministry of Commerce proclaimed on 30 October, 2017 that it would launch an anti-dumping investigation on EA (including MEA, DEA and TEA) originally produced in the US, Saudi Arabia, Malaysia and Thailand.

Finally, the Ministry of Commerce has decided that from October 30, 2018, import operators shall pay the relevant margin to the General Administration of Customs. The anti-dumping duties on the above-mentioned products are 10.1%–97.1% with a period of 5 years.

Table 2.4-2 China's margin rates on EA for different companies, since 23 June, 2018

	Origin	Margin rate
American companies	The Dow Chemical Company	76.0%
	INEOS Americas LLC	97.1%
	Huntsman Petrochemical LLC	97.1%
	Others	97.1%
Saudi Arabian companies	Saudi Basic Industries Corporation	10.1%
	Others	27.9%
Malaysian companies	Petronas Chemicals Derivatives Sdn Bhd	18.3%
	Others	20.3%
Thai companies	Toc Glycol Company Limited	37.6%
	Others	37.6%

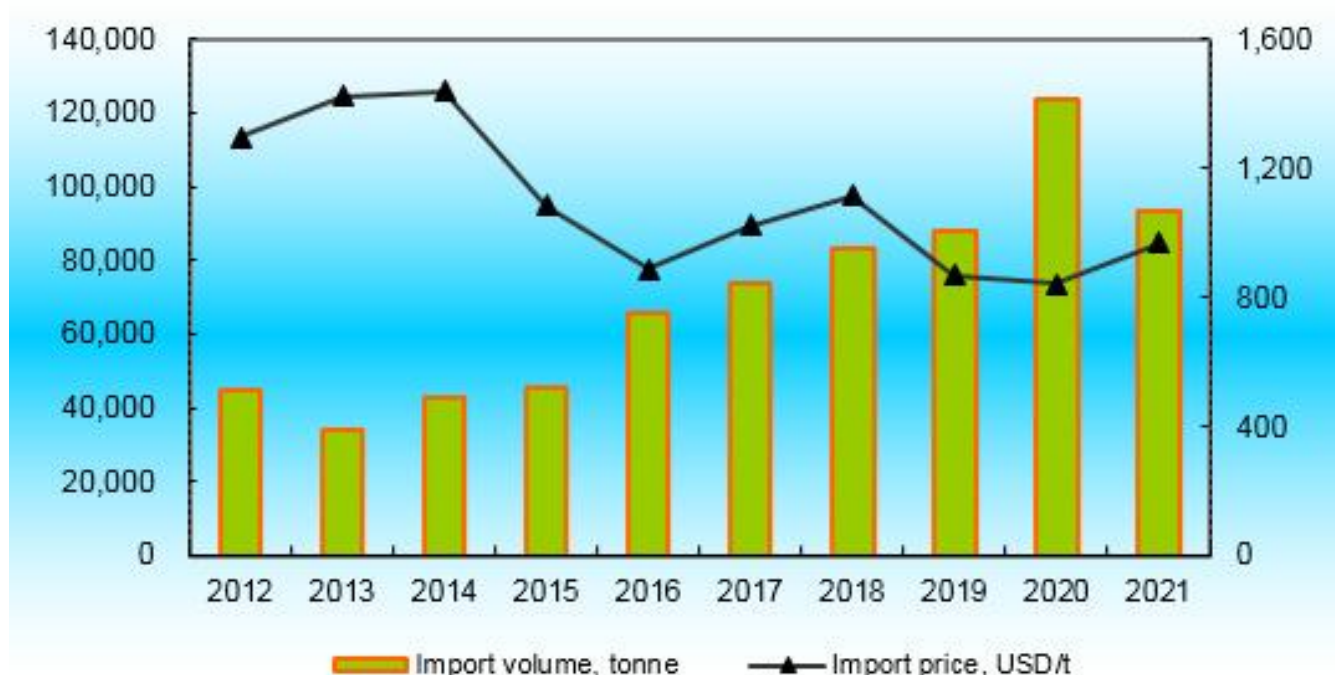
Source: CCM

Despite the levy of anti-dumping duties, the Chinese glyphosate industry is almost not affected by this measure, because Chinese PMIDA & glyphosate producers mainly consume imported DEA with the shipment mode of Processing with Imported Materials and no anti-dumping duty is imposed.

China is a net importer of DEA because of the low price of overseas DEA. China's import volume of DEA increased rapidly from 34,192 tonnes in 2013 to 124,023 tonnes in 2020. In 2021, the import volume decreased compared with 2020, due to the increased domestic output.

The average import price kept decreasing (from more than USD1,400/t in 2013–2014 to below USD1,000/t in 2019–2021), because of the declining production cost and weakening anti-dumping measures in recent years.

Figure 2.4-2 China's imports of DEA, 2012–2021



Source:CCM

### - Consumption of DEA

DEA can be widely used to produce DEA salts of long-chain fatty acids that are formulated into soaps and surfactants used in liquid laundry and dishwashing detergents, cosmetics, shampoos and hair conditioners. Also, it is used in textile processing, industrial gas purification to remove acid gases, as an anticorrosion agent in metalworking fluids, and in preparations of agricultural chemicals. Besides, aqueous DEA solutions are used as solvents for numerous drugs that are administered intravenously.

In China, DEA is mainly consumed in PMIDA & glyphosate technical and surfactants. Producing one tonne of glyphosate technical needs 0.78–0.92 tonne of DEA.

Figure 2.4-3 Apparent consumption of DEA in China, 2012–2021



Source:CCM

PMIDA & glyphosate technical is one of the key end-use segments of DEA in China, with an annual consumption of DEA of 57,000 tonnes–80,000 tonnes in 2007–2010.

DEA consumption in PMIDA & glyphosate technical decreased rapidly to about 42,000 tonnes in 2014, about 25,000 tonnes in 2015 and about 23,000 tonnes in 2016–2017, because of the increasing competition from its competitive products—glycine and IDAN, key raw materials for the other two production routes of glyphosate technical.

And annual DEA consumption in glyphosate production was about 27,000 tonnes in 2018–2021.

Table 2.4-3 Output of PMIDA & glyphosate technical by taking DEA as raw material and consumption volume of DEA, 2017–2021, tonne

Year	Output of glyphosate technical (DEA route)	Consumption of DEA	Output of PMIDA (DEA route)	Consumption of DEA	Total DEA consumption
2017	26,000	23,400	0	0	23,400
2018	30,000	27,000	0	0	27,000
2019	30,000	27,000	0	0	27,000
2020	30,000	27,000	0	0	27,000
2021	30,000	27,000	0	0	27,000

Source: CCM

DEA is one of the major raw materials for glyphosate production by the IDA pathway. Currently, among the five glyphosate producers adopting the IDA pathway in China, four take IDAN or PMIDA (produced from IDAN) as raw materials, and only one takes DEA as raw material.

The output of glyphosate technical taking DEA as raw material in China was 26,000 tonnes in 2015–2017, and 30,000 tonnes in 2018–2021.

## 2.5 Paraformaldehyde

### - Production

China's PF capacity increased from 589,000 t/a in 2017 to 667,000 t/a in 2021. Some companies in east China stopped PF production completely because of stricter environmental protection policies or poor performance, while many new projects were built up in northwest China. China's PF output kept increasing, from 267,500 tonnes in 2017 to over 300,000 t/a in 2021, along with stable increasing domestic demand.

参考路径

[http://sp.kcomber.net/MRD3/MRD3\\_Paraformaldehyde/Forms/AllItems.aspx?RootFolder=%2FMRD3%2FMRD3%5FParaformaldehyde%2FCompiled%20info%2FReport%2FMaterials%20for%20report%20writing%20022&FolderCTID=0x0120000722FE8D993F514E8F39599B5B3AF3AC&View=%7BF3EB95ED%2D13DB%2D4D0A%2DA14C%2D46E8E6B9A727%7D](http://sp.kcomber.net/MRD3/MRD3_Paraformaldehyde/Forms/AllItems.aspx?RootFolder=%2FMRD3%2FMRD3%5FParaformaldehyde%2FCompiled%20info%2FReport%2FMaterials%20for%20report%20writing%20022&FolderCTID=0x0120000722FE8D993F514E8F39599B5B3AF3AC&View=%7BF3EB95ED%2D13DB%2D4D0A%2DA14C%2D46E8E6B9A727%7D)

Table 2.5-1 Capacity and output of key PF producers in China, 2017–2021

No.	Producer	Capacity 2021, t/a	Output, tonne				
			2017	2018	2019	2020	2021
1	Fuhua Tongda Agro-chemical Technology Co., Ltd.	60,000	55,000	58,000	58,000	58,000	58,000
2	Zhenjiang LCY Performance Materials Co., Ltd.	30,000	33,000	33,000	33,500	33,000	33,600
3	Nantong Jiangtian Chemical Co., Ltd.	80,000	38,000	41,000	41,000	40,000	59,000
4	Hubei Trisun Chemicals Co., Ltd.	33,000	0	20,000	23,000	33,000	32,400
5	Hebei Jintaida Chemical Co., Ltd.	40,000	30,000	30,000	30,000	28,000	26,000
6	Hebei Yuhang Chemical Co., Ltd.	30,000	21,700	20,000	20,000	20,000	18,200
7	Xinjiang Dearsun Chemical Co., Ltd.	40,000	10,000	10,000	15,000	16,000	14,000
8	Hengshui Yinhe Chemical Co., Ltd.	30,000	10,000	10,000	8,500	8,000	8,000
9	Ningxia Jinhai Xinning Chemical Co., Ltd.	30,000	0	5,000	8,000	8,000	8,000
10	Inner Mongolia Jiaquan Chemical Technology Co., Ltd.	15,000	4,000	5,000	6,000	6,000	6,000
11	Xinjiang Wanchang New Energy Co., Ltd.	20,000	0	5,000	8,000	6,000	6,000
12	Jiangsu Sanmu Group Co., Ltd.	20,000	4,400	5,000	5,000	5,000	5,400
13	Shandong Zhengxin New Energy Co., Ltd.	40,000	/	/	/	5,000	5,000
14	Zibo Qixing Chemical Technology Co., Ltd.	20,000	2,200	4,000	5,000	4,500	5,000
15	Weifang Xudong Chemical Co., Ltd.	10,000	6,500	5,000	5,000	5,000	4,200
Others		169,000	52,700	22,000	17,800	19,700	19,800
<b>Total</b>		<b>667,000</b>	<b>267,500</b>	<b>273,000</b>	<b>283,800</b>	<b>295,200</b>	<b>308,600</b>

Source:CCM



Figure 2.5-1 Capacity and output of PF in China, 2017–2021



Source:CCM

### - Price of PF in recent years

At the beginning of 2015, the ex-works price of 96% PF saw a sharp decrease and hit the lowest level of the year in March 2015 at USD617/t. And then it recovered in April, reaching USD783/t. However, the price of PF started to decrease from May, falling to USD675/t in Dec. As the price of methanol and imported PF kept decreasing, the domestic ex-works price of PF decreased as well.

In 2016, the overall ex-works price of PF was lower than that in 2015. In Q1–Q3 2016, the ex-works price of PF declined from USD704/t in Jan. to USD559/t in Sept., mainly affected by its upstream raw materials' price fall (especially methanol). However, the ex-works price of PF began to increase in Q4 2016, due to the recovering demand for glyphosate.

In 2017, the average ex-works price of PF was higher than that in 2016. Throughout the year, the price of PF increased from USD662/t in Jan. to USD757/t by the end of the year. That was mainly affected by increasing costs of raw materials.

In 2018, the annual average ex-works price of PF continued to increase, reaching about USD897/t, the highest since 2010. Major reasons for the increase are high prices of formaldehyde and methanol, and production cuts in some PF producers triggered by stringent environmental protection inspections, especially in Shandong and Hebei.

In 2019, the annual average ex-works price of PF decreased by about USD154/t year on year.

In 2020, due to the impact of COVID-19, and new set-ups of PF capacity, especially in West China and North China (cost advantage, less influence from environmental protection concerns), the price of PF dropped to the 2020 lowest point at USD571/t in Aug. Later, with rising raw material prices and increasing demand for PF, the PF price rebounded and kept rising. Especially at the end of 2020, amid the continuous rise of methanol price, environmental protection restrictions in winter, high demand from downstream wood-based panel industry, and decreased supply and the rising price of formaldehyde, PF price jumped.

In 2021, due to a methanol price hike, PF market grew strongly with the ex-works price peaking at about USD1,200/t in Nov.

The production cost of methanol increased since the price of coal was kept at a high level. In addition, prices of PF downstream products were moving up in 2021, especially the price of glyphosate, which also supported growth of PF prices to some extent.

In Q1 2022, the ex-works price of PF has stayed high though decreased slightly.

Figure 2.5-2 Ex-works price of 99.9% methanol and 96% PF in China, Jan. 2012–March 2022



Source:CCM

### - Import & export

China imported 23,000 tonnes–28,000 tonnes of PF annually in 2016–2021.

China's export volume of PF increased rapidly from 12,000 tonnes–19,000 tonnes annually in 2012–2018 to over 22,000 tonnes in 2019. It jumped to more than 27,000 tonnes of PF in 2020 and over 42,000 tonnes in 2021.

Table 2.5-2 China's imports & exports of PF, 2012–2021

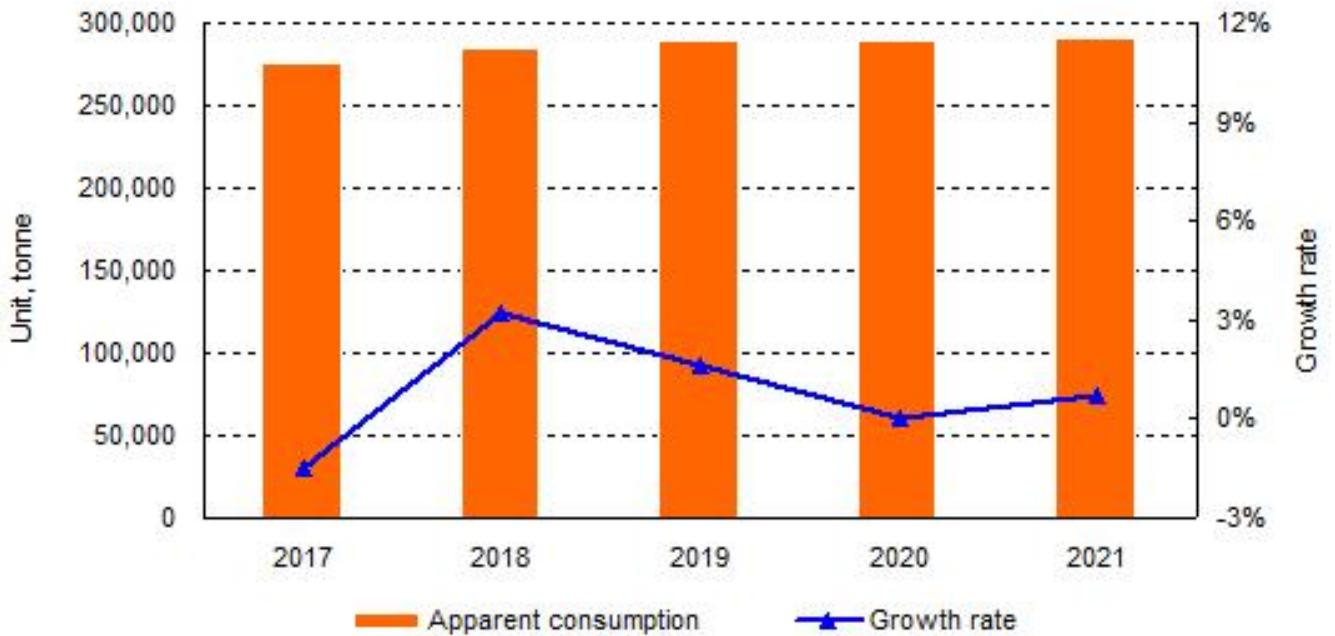
Year	Import			Export		
	Volume, tonne	Value, USD	Price, USD/t	Volume, tonne	Value, USD	Price, USD/t
2012	22,882	18,082,675	790	12,196	9,325,042	765
2013	28,098	24,315,107	865	17,144	14,539,425	848
2014	23,695	21,321,657	900	18,244	16,440,267	901
2015	18,351	14,242,131	776	17,877	13,033,631	729
2016	27,228	16,693,127	613	17,478	10,253,062	587
2017	23,682	16,169,213	683	15,644	10,702,508	684
2018	25,216	19,396,069	769	13,837	11,752,717	849
2019	27,747	19,721,149	711	22,660	16,120,527	711
2020	21,952	13,785,257	628	28,157	16,271,518	578
2021	24,339	20,254,740	832	42,084	35,485,792	843

Source:China Customs & CCM

**- Consumption pattern of PF in China**

On the whole, the apparent consumption volume of PF in China increased at a CAGR of 9.5% from 2012 to 2016, and then the growth decreased to a CAGR of 1.4% in 2017–2021. In 2021, China consumed about 290,855 tonnes of PF.

Figure 2.5-3 Apparent consumption of PF in China, 2017–2021

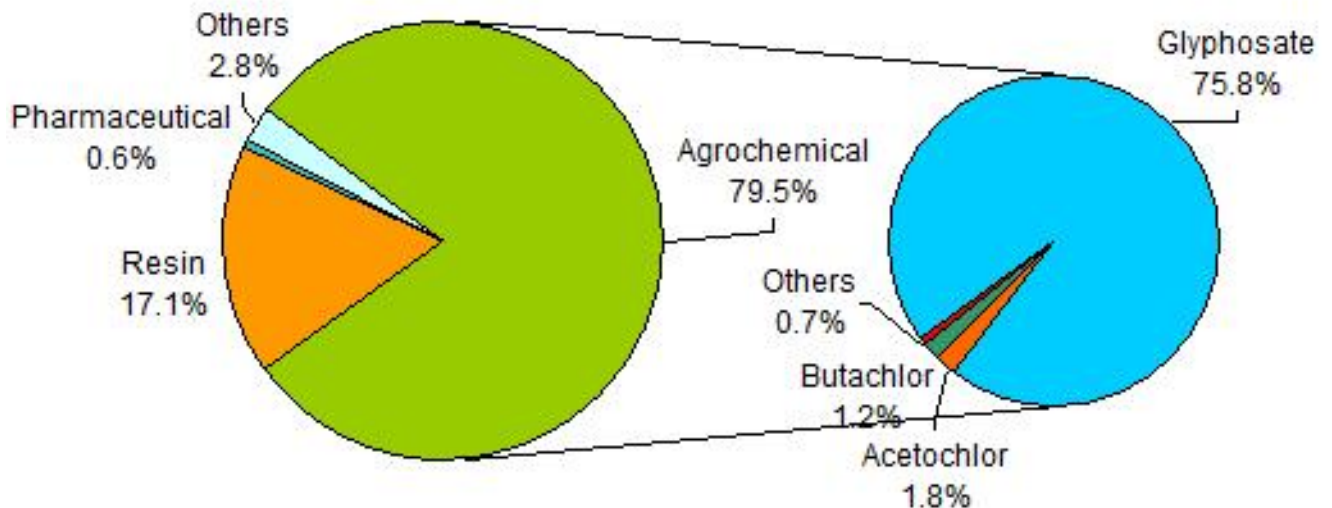


Source:CCM

**- Consumption structure of PF in China**

In China, the largest PF consumption field is agrochemicals, especially herbicides. The PF consumption volume in agrochemicals was 231,350 tonnes, accounting for 79.5% of the total in 2021, including 220,500 tonnes consumed in glyphosate, 5,340 tonnes in acetochlor, 3,560 tonnes in butachlor and 1,950 tonnes in other agrochemicals.

Figure 2.5-4 Consumption of PF in China by end use segment, 2021



Source:CCM

## - Consumption situation of PF in agrochemical industry

PF is mainly used to produce agrochemicals, such as glyphosate, acetochlor, butachlor, alachlor, etc.

Table 2.5-3 Consumption of PF in agrochemical industry in China, 2017–2021, tonne

Items	Unit consumption (kg/t)	2017	2018	2019	2020	2021
Glyphosate	490	94.3%	95.2%	95.4%	95.3%	95.3%
Acetochlor	200	3.2%	2.6%	2.4%	2.5%	2.3%
Butachlor	212	1.9%	1.5%	1.5%	1.5%	1.6%
Others	/	0.6%	0.7%	0.7%	0.7%	0.8%
<b>Total</b>	<b>/</b>	<b>224,220</b>	<b>229,980</b>	<b>228,980</b>	<b>231,990</b>	<b>231,350</b>

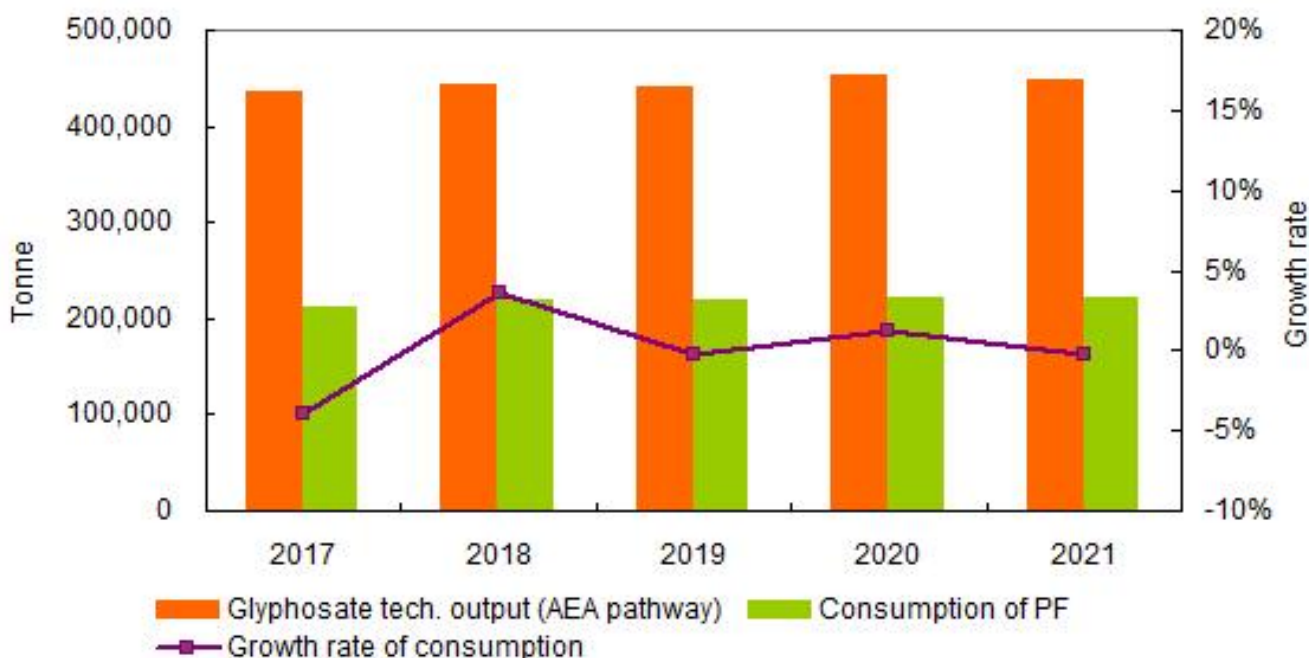
Source:CCM

In agrochemical field, glyphosate is the largest PF consumption sector in China. Its PF consumption has been accounting for about 95% of the total PF consumption in agrochemicals in 2017–2021.

Glyphosate technical is mainly produced through two pathways, the AEA pathway and the IDA pathway, with the former consuming PF. Glyphosate production uses PF with the content of 95%–97% as raw material. The production of one tonne of glyphosate through AEA pathway needs to consume 0.49–0.51 tonne of PF.

In 2021, glyphosate output by AEA pathway in China was 449,000 tonnes, consuming about 220,500 tonnes of PF.

Figure 2.5-5 Consumption of PF in glyphosate in China, 2017–2021

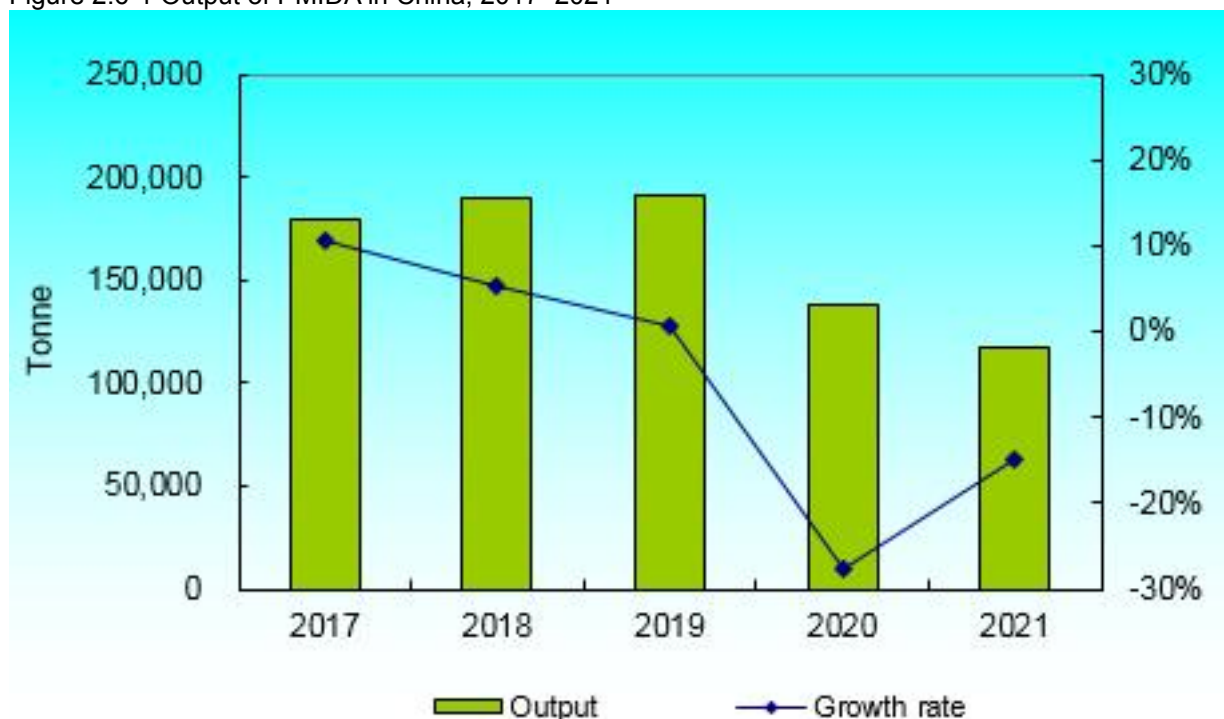


## 2.6 PMIDA

There are two ways to obtain PMIDA in China, namely the DEA route and the IDAN route. The IDAN route takes up a greater output share because of its low cost and abundant supply.

Almost no homemade DEA is consumed to make PMIDA, and PMIDA producers prefer imported DEA because PMIDA produced with imported one is of good quality and low cost.

Figure 2.6-1 Output of PMIDA in China, 2017–2021



Source:CCM

Table 2.6-1 Capacity and output of PMIDA producers in China, 2017–2021

No.	Producer	Capacity 2021, t/a	Output, tonne				
			2017	2018	2019	2020	2021
1	Leshan Hebang Agricultural Technology Co., Ltd.	180,000	135,000	155,900	173,000	120,000	114,000
2	Taixing Feitian Chemical Co., Ltd.	10,000	3,200	1,000	1,000	4,000	2,500
3	Inner Mongolia Unisplendour Chemical Co., Ltd.	20,000	7,000	3,000	2,500	2,000	1,000
4	ADAMA Ltd. (formerly Hubei Sanonda Co., Ltd.)	22,000	22,000	21,000	7,500	0	0
5	Guang'an Chengxin Chemical Co., Ltd.	15,000	2,000	1,000	0	0	0
6	Shanxian Runjin Biological Technology Co., Ltd.	5,000	1,000	700	0	0	0
7	Guangxi Yiduoshou Bio-technology Co., Ltd.	5,000	300	100	0	0	0
	Others	20,000	9,500	7,000	7,000	12,000	0
	<b>Total</b>	<b>277,000</b>	<b>180,000</b>	<b>189,700</b>	<b>191,000</b>	<b>138,000</b>	<b>117,500</b>

Source: CCM

Before 2014, domestically produced PMIDA (circulated in the market) was mainly for export. Since 2014, especially after the launch of Leshan Hebang's 135,000 t/a PMIDA installations, some domestic producers of glyphosate technical started to purchase homemade PMIDA instead of IDAN to produce glyphosate technical because of shortened production flow, reduced waste discharge, low cost with PMIDA as starting material and more and more PMIDA supply. Therefore, the domestic output of PMIDA (circulated in the market including both for domestic sales and for export) increased rapidly from 119,000 tonnes in 2014 to 180,000 tonnes in 2017, with a CAGR of 14.8%. The output grew slowly in 2018–2019, reaching 191,000 tonnes in 2019. In 2020–2021, the output dropped significantly, to less than 120,000 tonnes in 2021, and the number

of producers decreased from eight in 2018 to three in 2021. Among the producers, only Leshan Hebang have established a complete integrated chain of glyphosate (IDAN route), with a market share of more than 80%. This is mainly due to its advantages of easy access to natural gas and low raw material costs.

On April 19, 2022, Leshan Hebang announced that it was planning to invest RMB12.5 billion to build 500,000 t/a PMIDA production line, but the specific construction date has not been determined.

## **2.7 Impacts of raw materials on glyphosate industry**

In this part, CCM will discuss the impact of raw materials on glyphosate industry from two aspects—supply and price, and important raw materials including glycine, DEA and IDAN will be analysed in detail.

### **- Glycine**

Currently, the domestic supply of glycine greatly exceeds the domestic demand, with the operating rate of less than 60% in 2020–2021.

In addition, some glyphosate producers have achieved self-supply of glycine, and some glyphosate producers planned to construct glycine production lines for their production of glyphosate technical, which further weakens the bargaining power of glycine producers.

- Hubei Trisun has a glycine capacity of 100,000 t/a.
- Fuhua Tongda has glycine production lines with a total capacity of 40,000 t/a.
- Henan HDF has a 15,000 t/a glycine production line
- Inner Mongolia Xingfa has a 10,000 t/a glycine production line.

Nowadays, domestic glycine industry only has small impact on domestic glyphosate industry in terms of supply and price. Conversely, the former is largely governed by the latter.

However, during some specific periods when the requirements for environmental protection are especially higher (state-level congresses held in Beijing, flood, frequent severe atmospheric haze in winter, etc.), the supply of glycine will be tense and its price will be high, which may raise the price of glyphosate technical to some extent.

### **- IDAN**

Domestic glyphosate technical producers prefer purchasing PMIDA instead of purchasing IDAN, along with the launch of Leshan Hebang's 135,000 t/a of PMIDA installations since 2014 and stricter environmental protection requirements, and the volume of IDAN circulating in the domestic market declined.

The industrial concentration of IDAN is relatively high (only three producers), and it will be further heightened in the future, because Leshan Hebang has played an absolutely dominant role in IDAN & PMIDA industrial chain. Leshan Hebang also publicised that it proposed a 500,000 t/a PMIDA expansion plan in April 2022.

IDAN will have only a small impact on the domestic glyphosate industry in terms of supply and price in the future.

### **- DEA**

There was only one company adopting DEA to produce PMIDA and then glyphosate technical currently.

Only the imported DEA, most of which is imported with the shipment mode of Processing with Imported Materials, is consumed in PMIDA & glyphosate technical. Therefore, the supply of homemade DEA has no influence on the domestic glyphosate production.

DEA will have a small impact on domestic glyphosate industry in the future.

### 3 Glyphosate supply

#### 3.1 Glyphosate registration situation

As the world's most popular herbicide, glyphosate has been registered in China since the mid-1980s and now it is the herbicide with the highest number of registrations in China. There were 1,067 active registrations by 473 companies as of Oct. 2016, 1,128 active registrations by 489 companies as of Aug. 2017, 1,375 active registrations by 539 companies as of Oct. 2018, 1,377 active registrations by 534 companies as of Dec. 2019, 1,384 active registrations by 533 companies as of Feb. 2021 and 1,542 active registrations by 546 companies as of March 2022.

Table 3.1-1 Registrations of glyphosate in China, as of Oct. 2016, Aug. 2017, Oct. 2018, Dec. 2019 , Feb. 2021 and March 2022.

Specification		Number of registration					
		Oct. 2016	Aug. 2017	Oct. 2018	Dec. 2019	Feb. 2021	March 2022
Single formulations	SL	517	547	638	631	631	659
	SP	136	140	144	144	144	144
	SG/WSG	163	168	219	219	219	231
Mixed formulations		93	121	217	231	239	357
Technical		158	152	157	152	151	151
<b>Total</b>		<b>1,067</b>	<b>1,128</b>	<b>1,375</b>	<b>1,377</b>	<b>1,384</b>	<b>1,542</b>

Source: Institute for the Control of Agrochemicals, Ministry of Agriculture (ICAMA) & CCM

#### - Registration of glyphosate technical

The number of companies that have registered glyphosate technical products has been on the rise in recent years, but new registrations dwindled, with eight in 2014, six in 2015, five in 2016, two in 2017 and two in 2018.

As of March 2022, there were 151 active registrations of glyphosate technical by 132 companies in total.

Table 3.1-2 Registrations of glyphosate technical by content in China, as of March 2022

Content	Number of registration
95%	128
96%	5
98%	4
97%	3
95%, 93%, 90%	3
Others	8
<b>Total</b>	<b>151</b>

Source: ICAMA & CCM

Table 3.1-3 Registrations of glyphosate technical by AI in China, as of March 2022

Active ingredient	Number of registration
Glyphosate acid	132
Glyphosate ammonium	10
Glyphosate potassium	5
Glyphosate dimethylammonium	2
Glyphosate IPA	2
<b>Total</b>	<b>151</b>

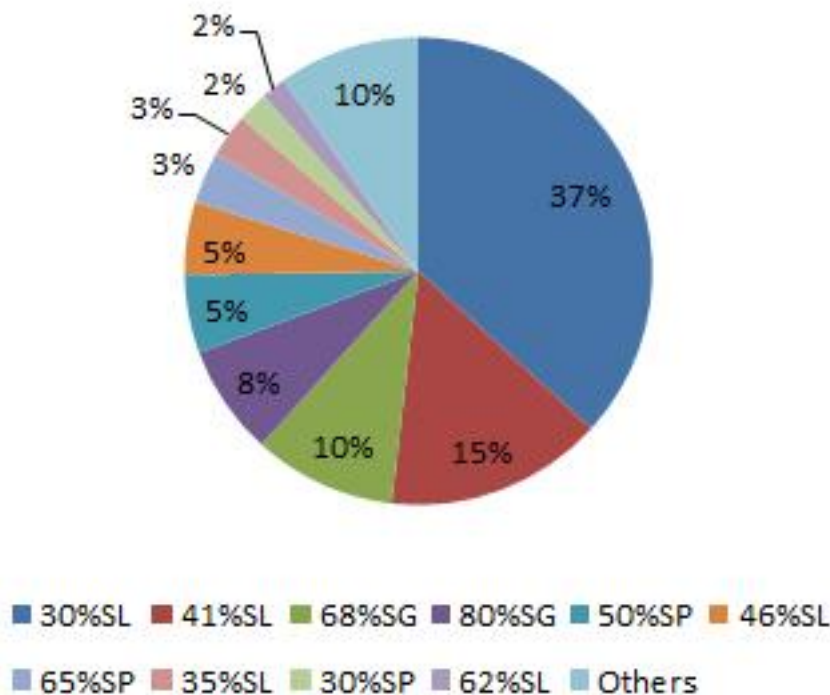
Source: ICAMA & CCM

### - Registration of glyphosate formulations

As of March 2022, there were 1,391 active registrations of glyphosate formulations by 512 companies, among which 1,034 were for single formulations.

Formulation types registered in China include soluble concentrate (SL), soluble powder (SP), soluble granule/water soluble granule (SG/WSG), etc. SL is the major formulation, taking up over 60% of the total glyphosate formulation registrations.

Figure 3.1-1 Active registrations of single glyphosate formulations by specification in China, as of March 2022



Source: ICAMA & CCM



Table 3.1-4 Active registrations of single glyphosate formulations by specification in China, as of March 2022

Specification	Number of registration	Proportion in total registration
30% SL	380	37%
41% SL	156	15%
68% SG	102	10%
80% SG	79	8%
50% SP	56	5%
46% SL	52	5%
65% SP	37	4%
35% SL	31	3%
30% SP	22	2%
62% SL	18	2%
Others	101	10%
<b>Total</b>	<b>1,034</b>	<b>100%</b>

Source: ICAMA & CCM

There existed about 80 specifications of registered single formulations in China as of March 2022. Among the current 1,034 active registrations of single formulations, 95 are registered with the registration name of "glyphosate" only; it's difficult to judge what AIs (IPA, ammonium, potassium, etc.) they are.

Some Chinese companies unfairly promoted their glyphosate formulations (the same content, low price, but different AI) and competed with other formulation suppliers by means of concept confusion (AI and content).

Table 3.1-5 Registrations of single glyphosate formulations by specification in China, as of March 2022

<b>Specification</b>	<b>Number of registration</b>
30% SL (IPA)	236
41% SL (IPA)	127
68% SG (ammonium)	93
30% SL (ammonium)	82
80% SG (ammonium)	79
46% SL (IPA)	49
30% SL (unspecified)	48
65% SP (ammonium)	34
50% SP (ammonium)	32
50% SP (unspecified)	21
41% SL (potassium)	21
62% SL (IPA)	18
80% SP (ammonium)	14
35% SL (potassium)	13
30% SP (ammonium)	11
30% SP (unspecified)	11
30% SL (potassium)	9
33% SL (ammonium)	8
58% SG (ammonium)	8
35% SL (IPA)	7
35% SL (dimethylammonium)	7
58% SP (ammonium)	6
68% SG (potassium)	6
Other 59 specifications	94
<b>Total</b>	<b>1,034</b>

Source: ICAMA & CCM

Glyphosate is mainly mixed with MCPA, dicamba, 2,4-D, fluoroglyphen-ethyl, fluroxypyr, triclopyr, bensulfuron-methyl, etc. There were 121 active registrations of mixed formulations as of Aug. 2017, and it increased rapidly to 217 as of Oct. 2018, 231 as of Dec. 2019, 239 as of Feb. 2021, and 357 as of March

2022.

### 3.2 Glyphosate technical

#### 3.2.1 Total supply

In 2021, the domestic capacity of glyphosate technical was 800,000 t/a, and the domestic output of glyphosate technical was about 604,000 tonnes.

Table 3.2.1-1 Capacity and output of glyphosate technical in China, 2012–2021

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Output, tonne	430,000	512,000	534,000	520,000	600,000	600,000	605,000	590,000	595,000	604,000
Capacity, t/a	806,500	906,500	909,500	998,500	999,000	905,000	805,000	795,000	795,000	800,000

Source:CCM

#### 3.2.2 Supplier

The number of glyphosate technical suppliers (idle included) showed a downward trend after 2010, and it decreased sharply from 58 in 2010 to 33 in 2015, 18 in 2018 and 17 in 2019–2021 caused by the sluggish market, low price, poor profit, unfavorable policies (high requirement for waste treatment, cancellation of VAT, EPV), etc.

Fuhua Tongda is the top glyphosate technical producer in China in terms of both capacity and output. The company is self-sufficient in some raw materials including liquid chloride, coal, yellow phosphorus, 200,000 t/a of ionic membrane caustic soda, 180,000 t/a of phosphorus trichloride, 120,000 t/a of DMP, 40,000 t/a glycine, 60,000 t/a of PF, 37,500 kW of thermoelectric station, 220 t/h of steam supply stations, etc. In April 2022, Fuhua Tongda acquired 24.19% shares of Nantong Jiangshan. Nantong Jiangshan has three glyphosate production lines with the capacity of 30,000 t/a (glycine route), 15,000 t/a (IDAN route) and 25,000 t/a (IDAN route) separately. Nantong Jiangshan is self-sufficient in some raw materials including 220,000 t/a of hydrochloric acid 31%, 160,000 t/a of caustic soda, 160,000 t/a of phosphorus trichloride, 40,000 t/a of DMP, 137,800 t/a of phosphorous acid 30%, etc.

Hubei Trisun, 76.87% share held by Hubei Xingfa Chemicals Group Co., Ltd., is one of the largest glyphosate technical producers, with glyphosate technical capacity only next to Fuhua Tongda in China. Hubei Trisun mainly produces glyphosate technical (130,000 t/a), glyphosate formulations (40,000 t/a), methylal (35,000 t/a), methyl chloride (130,000 t/a) and phosphorous acid solution (5,000 t/a). It also produces key upstream products of glyphosate technical, including phosphorus trichloride (190,000 t/a), DMP (130,000 t/a) and glycine (100,000 t/a). Some raw materials are supplied by its sister companies. For example, yellow phosphorus is supplied by Hubei Xingrui Chemical Co., Ltd. and Guangxi Xingfa Chemical Co., Ltd. Inner Mongolia Xingfa, a sister company of Hubei Trisun, also produces glyphosate technical (50,000 t/a), and is self-sufficient in 70,000 t/a of phosphorus trichloride, 50,000 t/a of DMP, 10,000 t/a of glycine, etc.

Zhejiang Wynca is one of key glyphosate producers in China with glyphosate technical capacity of 80,000 t/a. The company has two glyphosate plants: one is located in Jiande City of Zhejiang Province, and the other is located in Zhenjiang City of Jiangsu Province. Zhejiang Wynca adopts the AEA pathway only, and the company is No. 1 in cost control among all glyphosate producers adopt the AEA pathway in China. Zhejiang Wynca is the company which first developed the industrial chain of glyphosate-chloromethane-organosilicon and applied for patent. The company is also the most competitive in domestic glyphosate industry with an operating rate of nearly 100% in the past few years.

Table 3.2.2-1 Basic info of glyphosate technical manufacturers in China

No.	Company	Abbreviation	Location	Launch time	Status 2021
1	Fuhua Tongda Agro-chemical Technology Co., Ltd.	Fuhua Tongda	Sichuan	2002	Active
	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	Nantong Jiangshan	Jiangsu	1992	Active
2	Hubei Trisun Chemicals Co., Ltd.	Hubei Trisun	Hubei	2007	Active
	Inner Mongolia Xingfa Technology Co., Ltd.	Inner Mongolia Xingfa	Inner Mongolia	2013	Active
3	Zhejiang Wynca Chemical Industry Group Co., Ltd.	Zhejiang Wynca	Zhejiang	1987	Active
	Zhenjiang Jiangnan Chemical Co., Ltd.	Zhenjiang Jiangnan	Jiangsu	1987	Active
4	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	Jiangsu Weien	Jiangsu	1999	Active
5	Leshan Hebang Agricultural Technology Co., Ltd.	Leshan Hebang	Sichuan	2015	Active
6	Jiangsu Yangnong Chemical Co., Ltd.	Jiangsu Yangnong	Jiangsu	2008	Active
7	Henan HDF Chemical Co., Ltd.	Henan HDF	Henan	2013	Active
8	Jiangxi Jinlong Chemical Co., Ltd.	Jiangxi Jinlong	Jiangxi	2008	Active
9	Anhui Dongzhi Guangxin Agrochemical Co., Ltd.	Anhui Guangxin	Anhui	2007	Active
10	Guang'an Chengxin Chemical Co., Ltd.	Guang'an Chengxin	Sichuan	2014	Active
11	Jingma Chemicals Co., Ltd.	Jingma Chemicals	Zhejiang	1980	Active
12	ADAMA Ltd.	ADAMA	Hubei	1994	Idle

Source:CCM

Table 3.2.2-2 Capacity and output of glyphosate technical by producer in China, 2017–2021

No.	Company	Capacity in 2021, t/a	Output, tonne				
			2017	2018	2019	2020	2021
1	Fuhua Tongda	153,000	130,000	126,000	129,000	123,000	126,000
	Nantong Jiangshan	70,000	65,800	66,000	62,000	63,000	62,000
2	Hubei Trisun	130,000	122,900	110,000	110,000	115,000	122,000
	Inner Mongolia Xingfa	50,000	25,000	29,000	35,000	36,000	28,000
3	Zhejiang Wynca	30,000	5,000	31,000	31,000	31,000	30,000
	Zhenjiang Jiangnan	50,000	50,000	50,000	50,000	50,000	50,000
4	Jiangsu Weien	62,000	43,000	38,000	30,000	30,000	30,000
5	Leshan Hebang	50,000	45,000	55,000	55,000	50,000	55,000
6	Jiangsu Yangnong	35,000	32,000	32,000	30,000	30,000	30,000
7	Henan HDF	30,000	25,000	28,000	18,000	27,000	25,000
8	Jiangxi Jinlong	20,000	20,000	20,000	20,000	20,000	20,000
9	Anhui Guangxin	20,000	20,000	20,000	20,000	20,000	19,000
10	Guang'an Chengxin	20,000	1,300	0	0	0	1,000
11	Jingma Chemicals Co., Ltd.	15,000	5,000	0	0	0	6,000
12	ADAMA	20,000	0	0	0	0	0
Others		45,000	10,000	0	0	0	0
<b>Total</b>		<b>800,000</b>	<b>600,000</b>	<b>605,000</b>	<b>590,000</b>	<b>595,000</b>	<b>604,000</b>

Source:CCM

### 3.2.3 Production by region

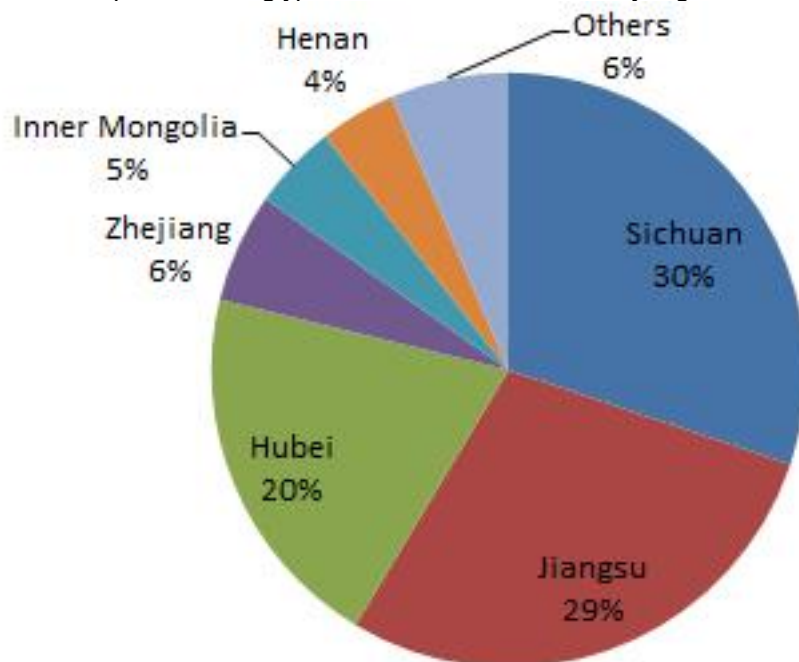
Jiangsu Province was the largest production region of glyphosate technical in China before 2019, but Sichuan Province came to the top in 2019.

3.2.3-1 Capacity and output of glyphosate technical in China by region, 2017–2021

Province/region	Capacity, t/a					Output, tonne				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Sichuan	215,000	213,000	213,000	213,000	223,000	176,300	181,000	184,000	173,000	182,000
Jiangsu	262,000	257,000	257,000	257,000	237,000	190,800	186,000	172,000	173,000	172,000
Hubei	150,000	150,000	150,000	150,000	150,000	122,900	110,000	110,000	115,000	122,000
Zhejiang	57,000	30,000	30,000	30,000	45,000	20,000	31,000	31,000	31,000	36,000
Inner Mongolia	50,000	50,000	50,000	50,000	50,000	25,000	29,000	35,000	36,000	28,000
Henan	60,000	30,000	30,000	30,000	30,000	25,000	28,000	18,000	27,000	25,000
Jiangxi	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Anhui	30,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	19,000
Others	61,000	35,000	25,000	25,000	25,000	0	0	0	0	0
<b>Total</b>	<b>905,000</b>	<b>805,000</b>	<b>795,000</b>	<b>795,000</b>	<b>800,000</b>	<b>600,000</b>	<b>605,000</b>	<b>590,000</b>	<b>595,000</b>	<b>604,000</b>

Source:CCM

Figure 3.2.3-1 Output share of glyphosate technical in China by region, 2021



Source:CCM

### 3.2.4 Production by production route

Table 3.2.4-1 Capacity of glyphosate technical in China by production route, 2012–2021

Year/pathway		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
AEA	Capacity, t/a	477,000	552,000	550,000	645,000	648,000	603,000	558,000	548,000	548,000	548,000	
	Number of producers	22	23	22	18	16	15	12	11	11	11	
ID A	DEA route	Capacity, t/a	85,000	85,000	80,000	65,000	65,000	60,000	55,000	55,000	55,000	35,000
		Number of producers	5	5	4	3	3	3	2	2	2	1
	IDAN route	Capacity, t/a	234,500	259,500	269,500	278,500	286,000	242,000	192,000	192,000	192,000	217,000
		Number of producers	21	22	22	15	13	10	6	6	6	7
	PMID A route	Capacity, t/a	10,000	10,000	10,000	10,000	0	0	0	0	0	0
		Number of producers	1	1	1	1	0	0	0	0	0	0
<b>Total</b>	<b>Capacity, t/a</b>	<b>806,500</b>	<b>906,500</b>	<b>909,500</b>	<b>998,500</b>	<b>999,000</b>	<b>905,000</b>	<b>805,000</b>	<b>795,000</b>	<b>795,000</b>	<b>800,000</b>	
	<b>Number of producers</b>	<b>45</b>	<b>47</b>	<b>46</b>	<b>33</b>	<b>28</b>	<b>24</b>	<b>18</b>	<b>17</b>	<b>17</b>	<b>17</b>	

Source:CCM

Table 3.2.4-2 Output of glyphosate technical in China by production route, 2012–2021

Year/pathway		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
AEA	Output, tonne	289,500	336,300	361,800	387,100	451,000	437,900	444,000	442,000	452,000	449,000	
	Growth rate	33.6%	16.2%	7.6%	7.0%	16.5%	-2.9%	1.4%	-0.5%	2.3%	-0.7%	
	Operation rate	60.7%	60.9%	65.8%	60.0%	69.6%	72.6%	79.60%	80.7%	82.5%	81.9%	
IDA	DEA route	Output, tonne	45,000	53,500	45,000	26,000	26,000	26,000	30,000	30,000	30,000	30,000
		Growth rate	1.1%	18.9%	-15.9%	-42.2%	0.0%	0.0%	15.4%	0.0%	0.0%	0.0%
		Operation rate	52.9%	62.9%	56.3%	40.0%	40.0%	43.3%	54.5%	54.5%	54.5%	85.7%
	IDA route	Output, tonne	95,500	122,200	127,200	106,900	123,000	136,100	131,000	118,000	113,000	125,000
		Growth rate	21.2%	28.0%	4.1%	-16.0%	15.1%	10.7%	-3.7%	-9.9%	-4.2%	10.6%
		Operation rate	40.7%	47.1%	47.2%	38.4%	43.0%	56.2%	68.2%	61.5%	58.9%	57.6%
Total	Output, tonne	430,000	512,000	534,000	520,000	600,000	600,000	605,000	590,000	595,000	604,000	
	Growth rate	26.5%	19.1%	4.3%	-2.6%	15.4%	0.0%	0.8%	-2.5%	0.8%	1.5%	
	Operation rate	53.3%	56.5%	58.7%	52.1%	60.1%	66.3%	75.2%	74.2%	74.8%	75.5%	

Source:CCM

### 3.3 Glyphosate formulations

#### 3.3.1 Overview

The solubility of glyphosate technical is quite weak (1.2% at 25°C). But glyphosate salts have good solubility in the water without losing the activity. For instance, the solubility of both glyphosate-isopropylammonium (IPA) and glyphosate sodium is 500g/L, and the solubility of glyphosate ammonium is 300g/L. Therefore, in actual application, glyphosate is converted into the following formulations: soluble concentrate (SL), soluble granule (SG)/water soluble granule (WSG) and soluble powder (SP).



Table 3.3.1-1 Key glyphosate formulations in China

Type of formulation	Active ingredient (AI)	Common name
Soluble concentrate (SL)	41% glyphosate IPA	41% IPA
		30% SL (glyphosate acid equivalent)
	33% glyphosate ammonium	30% SL (glyphosate acid equivalent)
	51% glyphosate IPA	51% IPA
		51% SL
		450g/L SL (glyphosate acid equivalent)
	55% glyphosate IPA	41% SL (glyphosate acid equivalent)
	62% glyphosate IPA	62% IPA
		46% SL (glyphosate acid equivalent)
	50% glyphosate-K	50% SL
		41% SL (glyphosate acid equivalent)
540g/L SL (glyphosate acid equivalent)		
Others (glyphosate ammonium, glyphosate dimethylammonium, glyphosate-Na, etc.)	30% SL, 35% SL, 41% SL, etc.	
Soluble granule (SG) / water soluble granule (WSG)	75.7% glyphosate ammonium	68% WSG (glyphosate acid equivalent)
		75.7% WSG
	88% glyphosate ammonium 88.8% glyphosate ammonium	80% SG (glyphosate acid equivalent)
	Others (glyphosate ammonium, glyphosate-K, etc.)	50% SG, 58% SG, 63% SG, 70% SG, etc.
Soluble powder (SP)	55% glyphosate ammonium	50% SP (glyphosate acid equivalent)
	71.5% glyphosate ammonium	65% SP (glyphosate acid equivalent)
	72% glyphosate ammonium	
	33% glyphosate ammonium	30% SP (glyphosate acid equivalent)
	Others (glyphosate ammonium, glyphosate-Na, etc.)	58% SP, 80% SP, etc.

Note: Mixed formulations are excluded.  
Source: ICAMA & CCM

Among various glyphosate formulations, the activity is shown as follows: glyphosate-K > glyphosate IPA > glyphosate ammonium > glyphosate-Na. In China, glyphosate IPA and glyphosate ammonium are the key

types of formulations produced, and the output of glyphosate-K and glyphosate-Na is very limited. Glyphosate IPA is mainly produced in the form of soluble concentrate, and glyphosate ammonium is produced in all these three forms including soluble concentrate, soluble granule and soluble powder.

Key glyphosate formulations produced in China include 30% SL (41% IPA mainly), 62% SL (62% IPA), 68% SG (75.7% WSG), 51% SL (51% IPA), 50% SP, and 80% SG (ranked in descending order of output in general).

There are over 300 suppliers of glyphosate formulations in China. Almost all glyphosate technical producers manufacture glyphosate formulations as well, and 51% SL is produced by glyphosate technical producers only.

These glyphosate formulation producers (producers of both technical and formulations excluded) are greatly subject to influences from those glyphosate technical producers, especially when the price of glyphosate technical is high, since they need to purchase glyphosate technical to produce various glyphosate formulations.

Domestic production of glyphosate formulations is mainly impacted by the export (overseas purchasing), and output of some glyphosate formulations fluctuates greatly from year to year.

Table 3.3.1-2 Output of key glyphosate formulations in China, 2017–2021, tonne

Year	30% SL (41% IPA mainly)	51% SL (51% IPA)	62% SL (62% IPA)	68% SG (75.7% WSG)	Others
2017	670,000	55,000	54,000	55,000	5,900
2018	664,000	36,000	56,000	64,000	6,000
2019	667,000	35,000	62,500	70,000	6,100
2020	706,000	41,000	65,200	85,200	6,200
2021	720,000	35,000	120,000	71,500	6,300

Source:CCM

### 3.3.2 Introduction to specific formulations

#### - Soluble concentrate (SL)

Key soluble concentrates produced in China include 30% SL, 51% IPA and 62% IPA.

33% glyphosate ammonium and 41% IPA are two major sub-types of 30% SL. In China, 30% SL (41% IPA mainly) is the most popular specification.

However, glyphosate 41% IPA made in China has the following drawbacks compared to overseas products:

- It is not transparent and tends to form floater and deposit.
- Too much foam which is not easy to disappear makes it difficult for plants to absorb glyphosate, thus resulting in relatively poor efficacy.
- The concentration of adjuvant is below CMC (carboxy methyl cellulose), so the full use of physical properties of adjuvant cannot be made.

The quality of adjuvant has been improved and most Chinese producers have grasped the technology to blend the mixture properly, and 41% IPA manufactured in China becomes competitive in the international market because of low price and better quality than before.

Domestic output of 30% SL (41% IPA mainly) has increased greatly from less than 100,000 tonnes before 2006 to over 500,000 tonnes after 2014 and over 600,000 tonnes after 2017 because of increasing demand at home and abroad.

Domestic production of 30% SL is mainly grasped by suppliers of glyphosate technical whose output of 30% SL account for over 90% of China's total.

51% IPA (450g/L SL), produced by glyphosate technical producers only, is meant for Australia and New Zealand markets. Key 51% IPA producers include Jiangsu Weien, Nantong Jiangshan, Shandong Rainbow, Zhenjiang Jiangnan, etc.

62% IPA is mainly produced for export, and only a small portion of this specification is consumed in domestic market. Key 62% IPA producers include Shandong Rainbow, Zhejiang Jinfanda, Zhejiang Wynca, Nantong Jiangshan, Jiangsu Weien, Fuhua Tongda, etc.

#### **- Soluble granule (SG)/water soluble granule (WSG)**

Main (W)SG forms of glyphosate produced in China include 68% (W)SG, 80% (W)SG, etc. (W)SG forms are produced for export mainly, and their domestic demand are limited. The annual consumption of (W)SG forms in China is estimated to be 1,000 tonnes–2,000 tonnes, and key players include Zhejiang Wynca, Zhejiang Jinfanda, Jiangsu Weien, Shandong Rainbow, etc.

#### **- Soluble powder (SP)**

Main SP forms of glyphosate produced in China include 30% SP, 50% SP, and 65% SP. SP forms are mainly consumed in China, and the demand is also limited. It is estimated that only about 2,000 tonnes–4,000 tonnes of glyphosate in SP forms are produced in China annually, and key players include Zhejiang Wynca, Jiangsu Kuaida, Jiangsu Weien, Nantong Feitian Chemical Industrial Co., Ltd., Anhui MKD Agrochemical Co., Ltd., etc.

### **3.3.3 China's glyphosate formulation trend and its impacts on global market**

#### **30% SL (41% IPA mainly) to keep a dominate role**

Since 2010, along with the ban of 10% SL, 30% SL (41% IPA mainly) seized more and more market share, playing a dominant role in the domestic glyphosate market. The trend will keep its momentum, mainly attributed to the following reasons:

Firstly, the domestic demand for glyphosate kept increasing, especially after 2016, along with the ban of paraquat AS formulations.

Secondly, the active ingredient of 30% SL (41% IPA mainly) is glyphosate-isopropylammonium, whose activity is only second to glyphosate-potassium, and the R&D of glyphosate-potassium is still at its infant stage.

Thirdly, solid formulations application in China is far less than that of 30% SL (41% IPA mainly), due to less promotion and higher technical requirements for solid formulations. Therefore, solid formulations, such as WSG, will not pose threat to the domination of 30% SL (41% IPA mainly) in the short term.

#### **Solid formulations to foresee promising market in the long term**

Though the output and consumption volume of solid formulations are far less than those of SL formulations at present, glyphosate solid formulations will see a promising market in the long term, because they have the following advantages over SL formulations:

China's export volume of glyphosate 75.7% WSG has increased rapidly in the past few years, indicating its brisk demand and rapid growth in overseas market.

#### **Impacts of China's formulation development on global market**

More glyphosate formulations consumed in the world will be directly produced in China. However, it is hard to define that homemade glyphosate formulations will have great impacts on global market in the following few years. Main reasons are as follows:

Firstly, there are many barriers such as strict quality certification, application patent, etc. for Chinese producers to register glyphosate formulations in overseas countries, all of which have blocked the first step for Chinese glyphosate formulations to enter overseas market.

Secondly, it's estimated that Chinese adjuvant quality can't make significant progress in the next five years, which leads to lower quality of products using domestic adjuvants than that of overseas products.

Thirdly, domestic glyphosate producers do not have comprehensive sales channel and rich marketing experience in overseas market. Moreover, they will face intense competition from overseas local suppliers whose sales channel has already been established locally.

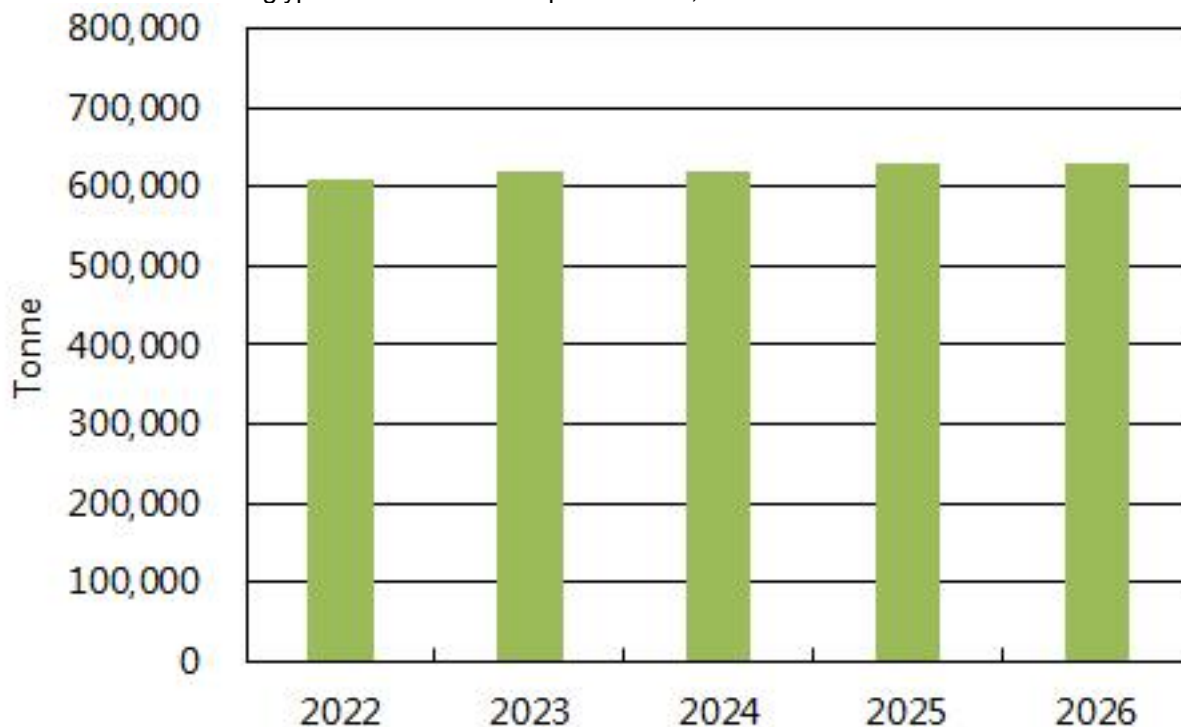
### 3.4 Forecast on glyphosate supply in the next five years

The number of producers of glyphosate technical in China decreased to only 17 in 2019–2021. Given the fierce market competition, it is expected that that number would continue to decrease. In addition, Inner Mongolia Xingfa's 50,000 t/a glyphosate expansion project is scheduled to be completed and run into production in Q3 2022. Therefore, Xingfa Group 's glyphosate capacity is expected to reach 230,000 t/a.

Key factors influencing China's glyphosate technical supply include global demand and supply beyond China.

China's glyphosate market will keep playing an important role in the global glyphosate market. Boosted by the strong demand for glyphosate technical in the global market, it is expected that the output of glyphosate technical in China would further increase, reaching 630,000 tonnes in 2026 with a CAGR of 0.8% in 2022–2026.

Figure 3.4-1 Forecast on glyphosate technical output in China, 2022–2026



Source:CCM

## 4 Trade analysis

### 4.1 Trade position in the world

China is an important player in the worldwide market of glyphosate.

China was a main raw material (glyphosate technical and PMIDA) supplier for glyphosate series in the world before, but the situation has changed in 2011. From then on, the export volume of glyphosate formulations increased rapidly and exceeded that of glyphosate technical by growing margins.

Table 4.1-1 China's export volume of glyphosate technical and formulations and PMIDA in 2015–2021, tonne

Year	Glyphosate technical	Glyphosate formulation	PMIDA
2015	268,567	440,664	58,101
2016	313,710	499,167	61,155
2017	293,165	552,012	66,260
2018	300,854	521,982	57,066
2019	275,968	516,751	46,728
2020	299,367	368,703	37,276
2021	321,694	287,685	42,779

*Note: Data of glyphosate formulation in 2021 only includes the exports to major export destinations; data of glyphosate formulation of other years include the exports to all destinations.*

*Source: China Customs & CCM*

Major glyphosate technical players in the world are mainly concentrated in China, the US, Argentina, Brazil, India, etc. China is the biggest exporter of glyphosate technical with the total export volume of 300,854 tonnes in 2018, 275,968 tonnes in 2019, 299,367 tonnes in 2020 and 321,694 in 2021.

Currently, the global capacity of glyphosate technical is about 1,100,000 t/a, and the capacity is relatively concentrated. In 2021, China's capacity of glyphosate technical was 800,000 t/a, accounting for 73% of the total global capacity.

Only China, the US and Brazil supply PMIDA in the global market. Among them, China is the biggest exporter, but the export volume decreased sharply from 100,567 tonnes in 2008 to 42,779 tonnes in 2021.

### 4.2 Trade barriers involving Chinese glyphosate

In recent years, China's international trade has faced challenges, mainly of anti-dumpings and tariff barriers.

#### Anti-dumping

Many countries and regions, such as Australia, Brazil and the EU, have implemented anti-dumping investigations against Chinese glyphosate products in order to protect their own glyphosate industry. Most initiations of such investigations concentrated before 2013, and by now, Chinese glyphosate industry has basically overcome obstacles caused by the anti-dumping tax. Chinese-made glyphosate stays competitive in the global market.

#### Tariff barriers

The US-China Trade War of 2018 has resulted in a 25% additional tariff of the US on USD50 billion worth of imports from China and China's responsive 25% tariffs on some of the US's goods, which is accompanied by price increase and volume decline of China's soybean imports from the US, and has had impacted the US's demand for Chinese glyphosate with increasing soybean stock in the country. China is the world's largest soybean importer. Before the US-China trade conflict, China registered about one-third of its soybean imports from the US, which represented about 60% of the US's total soybean exports.

Though weakening glyphosate trade between China and the US, the tariff barriers have induced China

attentions to the upgrade of its agricultural production of soybean, corn and other crops, to reduce its imports, and has facilitated China's trade relations with other countries, for example with the major exporters of agricultural products Brazil.

Brazil is one of the three major soybean-producing countries in the world, accounting for about 35% of the world's soybean stock, and is now China's biggest soybean trading partners. In 2019–2020, Brazil's increase of its soybean planting area has helped improved China's exports of glyphosate products to Brazil.

#### 4.3 Export situation of PMIDA and glyphosate

China's export volume of glyphosate products has increased rapidly from 2011 to 2014, but decreased a little in 2015 because of the decreasing demand. The total export volume of glyphosate (95% technical equivalent, excluding PMIDA) was about 510,000 tonnes in 2016, and about 505,000 tonnes both in 2017 and 2018. And in 2019, the export volume of glyphosate was about 480,000 tonnes. The total amount of glyphosate exported to major countries in 2020 is about 465,000 tonnes, and the total amount exported to major countries in 2021 is about 463,000 tonnes

China's export profit of glyphosate series is mainly sourced from technical grade products (glyphosate technical and PMIDA), but the contribution rate has kept decreasing since 2009.

Indeed, in terms of export value, the share of glyphosate formulation against the total (including technical, formulations and PMIDA) has increased from less than 20% in 2008 to more than 28% in 2021.

Export rebate of both glyphosate and PMIDA was canceled in China. To some extent, the export tax rebate policy not only limits the export volume of glyphosate and PMIDA, but also plays a role in preserving domestic phosphorus resources.

#### - Export destination and exporter of PMIDA

Only a few countries in the world import PMIDA. China's PMIDA is mainly exported to the US, Argentina and India.

Leshan Hebang Agricultural Technology Co., Ltd. (Leshan Hebang) is the key exporter of PMIDA in China. Leshan Hebang is currently the world's largest supplier of PMIDA, accounting for 70% of the global market share.

Table 4.3-1 China's export value of glyphosate and PMIDA, 2015–2021

Year	Export value, million USD		
	Glyphosate technical	Glyphosate formulations	PMIDA
2015	938	839	107
2016	907	816	97
2017	1,001	1,014	138
2018	1,198	1,140	134
2019	1,011	1,027	106
2020	811	665	76
2021	1,568	667	148

Source: China Customs & CCM

Table 4.3-2 Exporters of PMIDA in China and export destinations of PMIDA from China in 2021, tonne

<b>Exporters</b>	<b>Argentina</b>	<b>India</b>	<b>The US</b>	<b>Egypt</b>	<b>Malaysia</b>	<b>Total</b>
Leshan Hebang Agricultural Technology Co., Ltd.	12,566	7,358	9,108	0	18	<b>29,050</b>
China Jiangsu International Economic and Technical Cooperation Group, Ltd.	4,401	1,548	1,630	0	0	<b>7,579</b>
Dongying Shanmei Trade Co., Ltd.	2,883	54	0	0	0	<b>2,937</b>
Shanghai Spring International Trade Co., Ltd.	1,210	882	0	0	0	<b>2,092</b>
Shanghai Yancui Import and Export Corporation	0	612	0	0	0	<b>612</b>
C&D (Hainan) Co., Ltd.	0	216	0	0	0	<b>216</b>
Shanghai Agrotree Chemical Co., Ltd.	0	144	0	0	0	<b>144</b>
Dongying Yongxing Chemical Co., Ltd.	0	0	55	0	0	<b>55</b>
Shandong Qiaochang Modern Agriculture Import & Export Co., Ltd.	0	0	18	0	0	<b>18</b>
Others	0	0	0	78	0	<b>78</b>
<b>Total</b>	<b>21,059</b>	<b>10,814</b>	<b>10,810</b>	<b>78</b>	<b>18</b>	<b>42,779</b>

Source: China Customs & CCM

Table 4.3-3 Exporters of PMIDA in China and export destinations of PMIDA from China in 2020, tonne

Exporters	Argentina	India	The US	Egypt	Taiwan, China	Total
Leshan Hebang Agricultural Technology Co., Ltd.	9,252	4,867	17	0	0	14,136
Dongying Shanmei Trade Co., Ltd.	8,914	360	0	0	0	9,274
China Jiangsu International Economic and Technical Cooperation Group, Ltd.	6,354	486	0	0	0	6,840
DesiSage (Shanghai) Trade Co., Ltd.	3,913	0	0	0	0	3,913
Kunshan Microchem Specialties Co., Ltd.	907	306	0	0	0	1,213
Hangzhou Nutrichem Co., Ltd.	828	0	0	0	0	828
Shanghai Spring International Trade Co., Ltd.	252	432	0	0	0	684
Inner Mongolia Unisplendour Chemical Co., Ltd.	277	0	0	0	0	277
HK Gonghui Trading Co., Ltd.	0	36	0	0	0	36
Willowood (Hangzhou) Co., Ltd.	0	36	0	0	0	36
Hangzhou Hongqin Pharmaceutical Technology Co., Ltd.	0	18	0	0	0	18
Ceres Chemical Enterprises Limited	0	0	0	11	0	11
Dongying Yongxing Chemical Co., Ltd.	0	0	9	0	0	9
Shandong Binnong Technology Co., Ltd.	0	0	0	0	1	1
<b>Total</b>	<b>30,697</b>	<b>6,541</b>	<b>26</b>	<b>11</b>	<b>1</b>	<b>37,276</b>

Source: China Customs & CCM



Table 4.3-4 Exporters of PMIDA in China and export destinations of PMIDA from China in 2019, tonne

Exporters	Argentina	India	The US	Egypt	Total
Leshan Hebang Agricultural Technology Co., Ltd.	16,430	7,358	2,002	0	25,791
Hubei Sanonda Foreign Trade Co., Ltd.	1,981	1,224	2,873	0	6,078
Dongying Shanmei Trade Co., Ltd.	4,302	216	0	0	4,518
Dongying Yongxing Chemical Co., Ltd.	1,537	0	1,814	0	3,351
China Jiangsu International Economic and Technical Cooperation Group, Ltd.	2,250	216	0	0	2,466
Inner Mongolia Unisplendour Chemical Co., Ltd.	371	0	1,714	0	2,084
DesiSage (Shanghai) Trade Co., Ltd.	1,116	0	0	0	1,116
Kunshan Microchem Specialties Co., Ltd.	302	0	0	0	302
Shandong Delin Chemical Technology Co., Ltd.	50	0	202	0	252
Hangzhou Nutrichem Co., Ltd.	252	0	0	0	252
Haoyuan Industries (Shanghai) Co., Ltd.	0	151	0	0	151
Suzhou GUANDE Energy Technology Co., Ltd	0	0	126	0	126
BTP Pharmaceutical Co., Ltd.	0	72	0	0	72
Shanghai Chunnong Trade Co., Ltd.	0	67	0	0	67
High Hope Int'l Group Jiangsu Champion Holdings Ltd.	0	54	0	0	54
Nanjing Xinzhuo Chemical Technology Co., Ltd.	0	34	0	0	34
Henan Yunnong Plant Protection Technology Co., Ltd.	0	0	0	10	10
Ceres Chemical Enterprises Limited	0	0	0	4	4
Total	28,592	9,392	8,730	14	46,728

Source: China Customs & CCM

#### - Export destination of glyphosate

In general, China's major export destinations of glyphosate technical include Brazil, the US, Argentina, Indonesia, Australia, Malaysia and India, and those of glyphosate formulations are Nigeria, Vietnam, Ghana, Cote d'Ivoire, Australia, the US, Russia, etc.

South America has been the top destination continent of China's glyphosate.

Table 4.3-5 Export volume of China's glyphosate by continent, 2019–2021, thousand tonne

Continent	2019	2020	2021
South America	167	194	213
Asia	79	64	54
North America	73	60	99
Oceania	25	41	23
Africa	53	32	22
Europe	9	21	34

*Note: 1. Both technical and formulations are included and converted to 95% technical. 2. Data was based on top 20 destinations in 2019–2021.*

*Source: China Customs & CCM*

In 2019–2021, Nigeria is China's top export destination of 41% glyphosate IPA in terms of the total volume, and Australia and the US have been China's top export destinations of 51% glyphosate IPA and 62% glyphosate IPA respectively. During this period, Brazil is China's top export destination of 75.7% glyphosate WSG as well as the glyphosate technical.

Table 4.3-6 Major China's exports of glyphosate 41% IPA by destination, 2019–2021

2021			2020			2019		
Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg
Ghana	18,033	0.96	Nigeria	30,784	1.34	Nigeria	54,115	1.60
Nigeria	12,050	1.72	Ghana	16,575	1.25	Vietnam	38,525	1.50
The Philippines	8,545	1.77	The Philippines	12,580	1.40	Thailand	24,252	1.43
Uruguay	5,716	N/A	Uganda	11,086	1.52	Ghana	23,016	1.59
Uganda	5,566	2.62	Ukraine	6,459	1.54	Cote d'Ivoire	16,882	1.68
Peru	3,702	2.23	Peru	6,403	1.37	The Philippines	11,469	1.70
Pakistan	3,465	2.00	Uruguay	6,134	0.63	Japan	10,061	2.05
Brazil	2,982	3.25	Canada	5,855	1.66	Mexico	9,875	1.49
Ukraine	2,982	2.59	Russia	5,782	1.58	Myanmar	9,726	1.66
Russia	2,639	2.22	Kenya	5,490	1.43	Canada	9,195	1.81
Indonesia	2,476	1.53	Cambodia	5,274	1.52	Cambodia	9,070	1.70
The US	2,334	N/A	Guinea	5,264	1.53	Uruguay	8,140	1.84
Singapore	2,202	N/A	Colombia	4,451	1.22	Colombia	8,092	1.60
Tanzania	1,920	2.08	Japan	4,393	1.95	Ukraine	8,083	1.73
Mexico	1,703	3.97	Indonesia	4,318	1.51	Russia	7,504	1.82
Others	8,931	1.82	Others	52,769	1.40	Others	107,431	1.72
<b>Total</b>	<b>85,247</b>	<b>1.61</b>	<b>Total</b>	<b>183,617</b>	<b>1.39</b>	<b>Total</b>	<b>355,436</b>	<b>1.65</b>

Source: China Customs &amp; CCM

Table 4.3-7 Major China's exports of glyphosate 51% IPA by destination, 2019–2021

2021			2020			2019		
Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg
Australia	12,458	N/A	Australia	39,021	1.38	Australia	32,895	1.91
Singapore	1,650	N/A	United Kingdom	154	1.88	New Zealand	181	2.10
Kazakhstan	166	2.51	New Zealand	81	1.77	Ukraine	155	2.10
The US	77	N/A	Ukraine	77	1.97	United Kingdom	61	1.98
Paraguay	66	1.67	Malaysia	14	N/A	South Africa	39	1.99
<b>Total</b>	<b>14,418</b>	<b>0.04</b>	<b>Total</b>	<b>39,346</b>	<b>1.38</b>	<b>Total</b>	<b>33,330</b>	<b>1.92</b>

Source: China Customs & CCM

Table 4.3-8 Major China's exports of glyphosate 62% IPA by destination, 2019–2021

2021			2020			2019		
Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg
The US	71,916	N/A	The US	25,277	0.49	The US	20,099	2.04
The Philippines	7,335	2.91	Indonesia	9,349	1.90	Indonesia	7,211	1.99
Indonesia	7,113	2.68	The Philippines	5,819	1.73	The Philippines	4,167	1.94
Russia	6,147	3.12	Uganda	3,421	1.82	Thailand	3,890	2.11
Kazakhstan	4,404	2.38	Australia	2,539	1.73	Canada	2,856	2.42
Ghana	3,705	0.35	Paraguay	2,484	1.95	Uruguay	2,440	2.09
Brazil	3,165	5.12	Canada	2,111	2.37	Turkey	2,148	2.07
Turkey	2,621	3.45	Russia	1,151	1.83	South Africa	1,403	2.06
Peru	2,512	2.98	Turkey	970	1.61	Taiwan, China	1,390	2.08
Chile	1,812	3.70	Ukraine	910	1.79	Russia	1,351	2.12
Uganda	1,426	3.01	South Korea	839	0.74	Mexico	1,280	2.21
Colombia	1,229	0.67	Ghana	759	N/A	Israel	1,276	2.11
Paraguay	1,050	3.50	Kazakhstan	747	2.39	South Korea	1,240	2.09
Ukraine	1,012	2.93	Israel	545	1.90	Paraguay	1,170	2.04
Pakistan	359	2.38	Colombia	519	1.69	Ukraine	865	2.10
Others	2,019	2.52	Others	4,186	1.89	Others	6,160	2.17
<b>Total</b>	<b>117,824</b>	<b>1.09</b>	<b>Total</b>	<b>61,625</b>	<b>1.27</b>	<b>Total</b>	<b>58,947</b>	<b>2.07</b>

Source: China Customs &amp; CCM

Table 4.3-9 Major China's exports of glyphosate 75.7% WSG by destination, 2019–2021

2021			2020			2019		
Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg
Brazil	59,243	5.99	Brazil	63,483	3.32	Brazil	36,742	3.72
Paraguay	3,280	4.91	Cote d'Ivoire	3,285	2.95	Cote d'Ivoire	7,019	3.53
Uganda	2,377	5.11	Paraguay	2,699	2.83	Uruguay	3,655	3.47
Ghana	1,415	1.61	Uganda	2,616	3.31	South Africa	3,393	3.45
Peru	722	4.81	Cameroon	2,581	3.65	Paraguay	3,107	3.54
Kazakhstan	646	5.41	Mexico	900	3.98	Cameroon	1,937	4.27
Russia	624	5.17	Australia	791	2.83	Vietnam	1,396	3.83
Chile	420	5.47	South Africa	719	2.98	Chile	1,320	3.67
Singapore	372	N/A	Kazakhstan	660	5.38	Australia	856	3.43
The US	257	N/A	Peru	615	3.31	Peru	768	3.48
Nigeria	242	3.50	Russia	588	3.15	Nigeria	763	3.23
South Korea	186	N/A	Uruguay	514	3.01	Ghana	757	3.77
Ukraine	108	2.86	Chile	505	2.97	Argentina	595	3.48
Mexico	66	7.18	Ghana	420	2.91	Russia	586	3.85
Kyrgyzstan	57	3.80	Kenya	357	2.84	Kazakhstan	579	4.06
Others	183	6.78	Others	3,384	3.01	Others	5,565	3.58
<b>Total</b>	<b>70,196</b>	<b>5.72</b>	<b>Total</b>	<b>84,115</b>	<b>3.29</b>	<b>Total</b>	<b>69,037</b>	<b>3.66</b>

Source: China Customs &amp; CCM

Table 4.3-10 Major China's exports of glyphosate technical by destination, 2019–2021

2021			2020			2019		
Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg	Destination	Volume, tonne	Price, USD/kg
Brazil	86,851	7.09	Brazil	88,225	3.30	Brazil	79,996	3.66
Argentina	63,834	6.92	Argentina	49,261	3.38	The US	50,515	3.63
The US	62,793	0.11	The US	44,242	0.89	Argentina	36,738	3.71
Australia	18,300	0.04	Australia	23,273	1.41	Indonesia	16,667	3.62
Russia	15,203	6.70	Indonesia	21,450	3.38	Australia	11,550	3.66
Indonesia	14,235	5.42	India	18,675	2.96	Malaysia	10,714	3.56
India	13,021	4.94	Russia	7,619	3.32	India	10,155	3.62
Ireland	12,072	6.19	Ireland	6,898	2.92	Nigeria	7,409	3.59
Paraguay	8,271	6.11	Malaysia	5,515	3.14	Russia	5,405	3.89
Malaysia	4,828	6.13	Kazakhstan	3,339	3.24	Vietnam	5,290	3.68
Turkey	2,295	4.08	Nigeria	3,229	2.99	Paraguay	4,290	3.71
Ghana	2,270	3.68	Paraguay	2,925	3.29	Ghana	4,013	3.60
Singapore	2,168	N/A	Guatemala	2,868	0.27	Ireland	3,870	3.61
Nigeria	1,999	5.24	Ghana	2,032	2.97	Colombia	3,199	3.68
Poland	1,296	5.25	Poland	1,998	3.16	Mexico	3,193	3.70
Others	12,259	5.67	Others	17,818	2.68	Others	22,964	3.76
<b>Total</b>	<b>321,694</b>	<b>4.87</b>	<b>Total</b>	<b>299,367</b>	<b>2.71</b>	<b>Total</b>	<b>275,968</b>	<b>3.66</b>

Source: China Customs &amp; CCM

Table 4.3-11 China's exports of glyphosate by month, 2021

Month	41% IPA		51% IPA		62% IPA		75.7% WSG		Tech		Total
	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	
January	7,454	0.98	66	1.67	6,303	1.03	780	2.31	15,700	2.79	<b>30,304</b>
February	4,415	1.02	2,308	0.08	13,837	1.33	1,560	1.99	23,597	2.96	<b>45,717</b>
March	11,807	1.39	83	1.38	11,203	0.85	2,143	3.43	27,908	3.32	<b>53,145</b>
April	14,978	1.14	316	N/A	10,123	0.98	3,833	3.88	24,347	3.07	<b>53,597</b>
May	14,001	1.16	190	N/A	11,154	0.85	7,426	4.02	28,047	3.91	<b>60,818</b>
June	6,371	1.09	1,616	0.02	9,952	0.74	8,796	5.42	28,313	3.80	<b>55,048</b>
July	3,072	2.04	179	0.44	8,718	1.55	7,118	4.92	36,409	5.35	<b>55,496</b>
August	5,711	2.75	6,294	N/A	10,345	0.72	7,268	5.28	30,236	4.74	<b>59,854</b>
September	5,795	2.09	1,890	N/A	4,238	0.56	10,840	5.46	28,742	6.72	<b>51,505</b>
October	3,427	2.35	1,022	N/A	12,580	1.85	5,393	7.19	26,104	6.47	<b>48,526</b>
November	5,793	3.83	137	N/A	6,386	1.45	9,005	8.50	30,675	7.10	<b>51,997</b>
December	2,421	1.74	318	N/A	12,986	0.88	6,032	8.08	21,616	7.01	<b>43,373</b>
<b>Total</b>	<b>85,247</b>	<b>1.61</b>	<b>14,418</b>	<b>0.04</b>	<b>117,824</b>	<b>1.09</b>	<b>70,196</b>	<b>5.72</b>	<b>321,694</b>	<b>4.87</b>	<b>609,379</b>

Source: China Customs &amp; CCM



Table 4.3-12 China's exports of glyphosate by month, 2020

Month	41% IPA		51% IPA		62% IPA		75.7% WSG		Tech		Total
	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	
January	30,981	1.50	1,705	1.90	4,986	1.87	4,540	3.36	21,014	3.17	<b>63,226</b>
February	8,988	1.47	2,319	1.67	1,760	1.93	609	3.47	14,477	3.09	<b>28,153</b>
March	46,139	1.45	14,132	1.65	6,762	1.84	5,453	3.14	32,460	3.12	<b>104,946</b>
April	45,424	1.46	14,548	1.64	8,340	1.82	9,958	3.14	31,099	3.11	<b>109,369</b>
May	9,383	1.29	873	N/A	6,937	0.75	5,919	3.42	25,782	2.53	<b>48,894</b>
June	10,649	1.52	560	N/A	5,933	0.71	22,972	3.25	34,137	2.35	<b>74,251</b>
July	7,990	1.36	3,423	N/A	4,932	0.85	8,202	3.29	20,320	2.19	<b>44,867</b>
August	5,247	1.37	203	N/A	4,496	0.76	14,929	3.38	32,650	2.73	<b>57,525</b>
September	5,011	0.86	315	N/A	3,790	0.76	7,987	3.37	19,800	2.59	<b>36,904</b>
October	6,222	1.04	969	N/A	3,533	1.51	2,414	3.53	17,351	2.43	<b>30,488</b>
November	4,752	0.99	164	N/A	3,517	1.64	814	3.03	27,593	2.53	<b>36,840</b>
December	2,832	0.48	136	N/A	6,639	1.02	319	2.74	22,685	2.63	<b>32,610</b>
<b>Total</b>	<b>183,617</b>	<b>1.39</b>	<b>39,346</b>	<b>1.38</b>	<b>61,625</b>	<b>1.27</b>	<b>84,115</b>	<b>3.29</b>	<b>299,367</b>	<b>2.71</b>	<b>668,070</b>

Source: China Customs &amp; CCM

Table 4.3-13 China's exports of glyphosate by month, 2019

Month	41% IPA		51% IPA		62% IPA		75.7% WSG		Tech		Total
	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	Volume, tonne	Price, USD/kg	
January	30,251	1.77	7,173	2.03	4,087	2.23	2,816	3.87	21,193	3.92	<b>65,520</b>
February	26,086	1.74	5,102	2.00	4,995	2.17	3,283	3.83	16,900	3.89	<b>56,365</b>
March	48,340	1.71	3,293	1.96	6,919	2.19	5,307	3.81	24,704	3.86	<b>88,564</b>
April	29,784	1.67	351	1.93	3,692	2.21	6,836	3.87	21,037	3.77	<b>61,701</b>
May	59,969	1.59	470	1.86	5,652	2.11	9,556	3.73	38,348	3.68	<b>113,995</b>
June	34,840	1.60	957	1.89	5,091	2.07	7,321	3.69	22,299	3.68	<b>70,508</b>
July	24,386	1.67	2,604	1.81	3,684	2.04	8,341	3.66	17,697	3.59	<b>56,711</b>
August	20,855	1.66	2,319	1.92	5,586	1.99	7,560	3.46	25,606	3.70	<b>61,925</b>
September	16,700	1.65	4,434	1.85	4,040	2.00	5,508	3.51	19,311	3.55	<b>49,992</b>
October	18,906	1.64	2,064	1.80	7,573	1.97	5,930	3.56	24,703	3.51	<b>59,176</b>
November	20,449	1.60	3,425	1.80	6,279	1.98	3,141	3.55	21,190	3.55	<b>54,484</b>
December	24,871	1.54	1,139	1.74	1,350	1.95	3,437	3.43	22,980	3.30	<b>53,778</b>
<b>Total</b>	<b>355,436</b>	<b>1.65</b>	<b>33,330</b>	<b>1.92</b>	<b>58,947</b>	<b>2.08</b>	<b>69,037</b>	<b>3.66</b>	<b>275,968</b>	<b>3.66</b>	<b>792,719</b>

Source: China Customs & CCM

#### 4.4 Chinese glyphosate flow

China is the largest glyphosate supplier in the world. In 2019–2021, the main exporters of glyphosate formulation in China include Xingfa (Shanghai) International Trade Co., Ltd., Shandong Weifang Rainbow Chemical Co., Ltd., Zhejiang Wynca Chemical Group Co., Ltd., etc. Key export destinations of China's glyphosate formulation include Brazil, Nigeria and the US.

In 2019–2021, the main exporters of glyphosate technical in China include Fuhua Tongda Agro-chemical Technology Co., Ltd., Nantong Jiangshan Agrochemical & Chemicals Co., Ltd., Youth Chemical Co., Ltd., etc. Key export destinations of China's glyphosate technical include Brazil, Argentina and the US, whose total volume reached 213,478 tonnes, accounting for 66.4% of the national total export volume in 2021. In 2021, a total of 213,478 tonnes of China's glyphosate technical was exported to the three countries, accounting for 66.4% of China's total export volume.

Table 4.4-1 Exporters of glyphosate formulation in China, 2019–2021

2021		2020		2019	
Exporter	Volume, tonne	Exporter	Volume, tonne	Exporter	Volume, tonne
Xingfa (Shanghai) International Trade Co., Ltd.	16,556	Shandong Weifang Rainbow Chemical Co., Ltd.	80,508	Shandong Weifang Rainbow Chemical Co., Ltd.	61,952
Shandong Weifang Rainbow Chemical Co., Ltd.	16,088	Zhejiang Wynca Chemical Group Co., Ltd.	28,103	Zhejiang Wynca Chemical Group Co., Ltd.	40,625
Zhejiang Wynca Chemical Group Co., Ltd.	15,697	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	21,315	Fuhua Tongda Agro-chemical Technology Co., Ltd.	38,954
Shanghai Good Farm International Trading Co., Ltd.	10,101	Fuhua Tongda Agro-chemical Technology Co., Ltd.	20,452	Zhejiang Jinfanda Bio-Chemical Co., Ltd.	23,939
Fuhua Tongda Agro-chemical Technology Co., Ltd.	9,371	Xingfa (Shanghai) International Trade Co., Ltd.	17,779	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	22,172
Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	7,658	Hubei Trisun Chemical Co., Ltd.	11,767	Eastchem Co., Ltd.	20,714
Zhejiang Jinfanda Biochemical Co., Ltd.	6,961	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	7,830	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	19,171
Afri Ventures FZE	6,934	Zhejiang Jinfanda Bio-Chemical Co., Ltd.	7,380	Hubei Trisun Chemical Co., Ltd.	15,841
Hubei Xingfa Chemicals Group Co., Ltd.	6,151	Sinochem Agro Co., Ltd.	7,070	Xingfa (Shanghai) International Trade Co., Ltd.	13,555
Shanghai Hui Song (H&S) Agro-Solution Co., Ltd.	5,904	Shanghai Hui Song (H&S) Agro-Solution Co., Ltd.	6,054	China Jiangsu International Economic and Technical Cooperation Group, Ltd.	10,301
Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	5,436	Ningbo Generic Chemical Co., Ltd.	5,547	Shanghai Lianrui Chemical Co., Ltd.	7,755
Excel Chemical Co., Ltd.	3,920	Anhui Huaxing Chemical Co., Ltd.	5,235	Shenzhen Baocheng Chemical Industry Co., Ltd.	7,522
Shenzhen Baocheng Chemical Industry Co., Ltd.	3,764	Shanghai Lianrui Chemical Co., Ltd.	5,151	Jadesheen Chemical Co., Ltd.	7,200
Nufarm Chemical (Shanghai) Co., Ltd.	3,732	Shenzhen Baocheng Chemical Industry Co., Ltd.	5,100	Jixi Qingfeng Tianying Biochemical Co., Ltd.	6,789
Hubei Trisun Chemical Co., Ltd.	3,614	Sh-Inform Chemical Co., Ltd.	4,098	Guangdong Keywa Chemical Exchange Center Stock Co., Ltd.	6,444
Others	165,798	Others	135,314	Others	213,818
<b>Total</b>	<b>287,685</b>	<b>Total</b>	<b>368,703</b>	<b>Total</b>	<b>516,751</b>

Source: China Customs &amp; CCM

Table 4.4-2 Exporters of glyphosate technical in China, 2019–2021

2021		2020		2019	
Exporter	Volume, vonne	Exporter	Volume, vonne	Exporter	Volume, vonne
Fuhua Tongda Agrochemical Technology Co., Ltd.	37,872	Fuhua Tongda Agrochemical Technology Co., Ltd.	63,774	Fuhua Tongda Agrochemical Technology Co., Ltd.	52,487
Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	23,345	Youth Chemical Co., Ltd.	29,614	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	39,766
Youth Chemical Co., Ltd.	23,251	Hubei Trisun Chemical Co., Ltd.	26,197	Youth Chemical Co., Ltd.	30,864
Nufarm Chemical (Shanghai) Co., Ltd.	16,947	Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.	22,678	Hubei Trisun Chemical Co., Ltd.	24,684
Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	13,335	Zhejiang Wynca Chemical Group Co., Ltd.	16,605	Zhenjiang Jiangnan Chemical Co., Ltd.	20,945
Zhejiang Wynca Chemical Group Co., Ltd.	10,330	Shandong Weifang Rainbow Chemical Co., Ltd.	11,806	Zhejiang Wynca Chemical Group Co., Ltd.	13,738
Sinochem Agro Co., Ltd.	8,694	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	11,786	Sinochem Agro Co., Ltd.	10,383
Hubei Trisun Chemical Co., Ltd.	7,503	Sinochem Agro Co., Ltd.	10,605	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	10,133
Hebei Bestar Commerce and Trade Co., Ltd.	5,994	Xiamen C&D Chemical Co., Ltd.	10,538	Ningxia Gerui Fine Chemical Co., Ltd.	6,700
Zhenjiang Jiangnan Chemical Co., Ltd.	5,417	Sichuan Hebang Biotechnology Co., Ltd.	9,924	Xiamen C&D Chemical Co., Ltd.	6,145
Ningbo Tide Import and Export Co., Ltd.	5,347	Ningbo Tide Import and Export Co., Ltd.	7,503	Luzhou Yunxin Supply Chain Management Co., Ltd.	5,413
FH Agrochemical International Trade Pte Ltd.	4,914	Zhenjiang Jiangnan Chemical Co., Ltd.	7,381	Shanghai Agrohao International Trade Co., Ltd.	4,241
Syngenta (Suzhou) Crop Protection Co., Ltd.	4,256	Hebei Bestar Commerce and Trade Co., Ltd.	4,360	Jingma Chemicals Co., Ltd.	2,945
Xingfa (Shanghai) International Trade Co., Ltd.	4,154	Yichang Three Gorges bonded supply chain Co., Ltd.	3,952	Haoyuan Industries (Shanghai) Co., Ltd.	2,790
Sichuan Hebang Biotechnology Co., Ltd.	4,108	Shanghai Agrohao International Trade Co., Ltd.	3,615	Sichuan Hebang Biotechnology Co., Ltd.	2,580
Others	146,228	Others	59,028	Others	42,153
<b>Total</b>	<b>321,694</b>	<b>Total</b>	<b>299,367</b>	<b>Total</b>	<b>275,968</b>

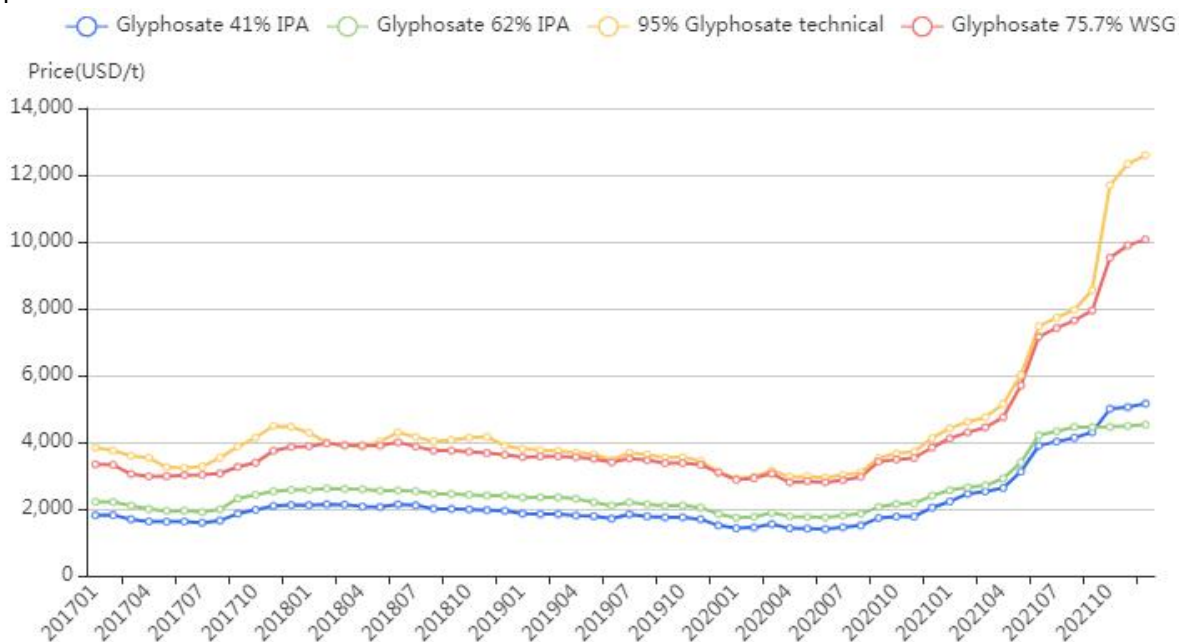
Source: China Customs &amp; CCM

## 5 Price

### 5.1 Price changes in the past and key factors

The price of glyphosate technical and formulations is highly correlated. When the price of glyphosate technical increased, the price of glyphosate formulations increased obviously. Therefore, only the factors influencing glyphosate technical price are introduced in detail here.

Figure 5.1-1 Monthly ex-works price of glyphosate technical and key formulations in China, Jan. 2017~Dec. 2021



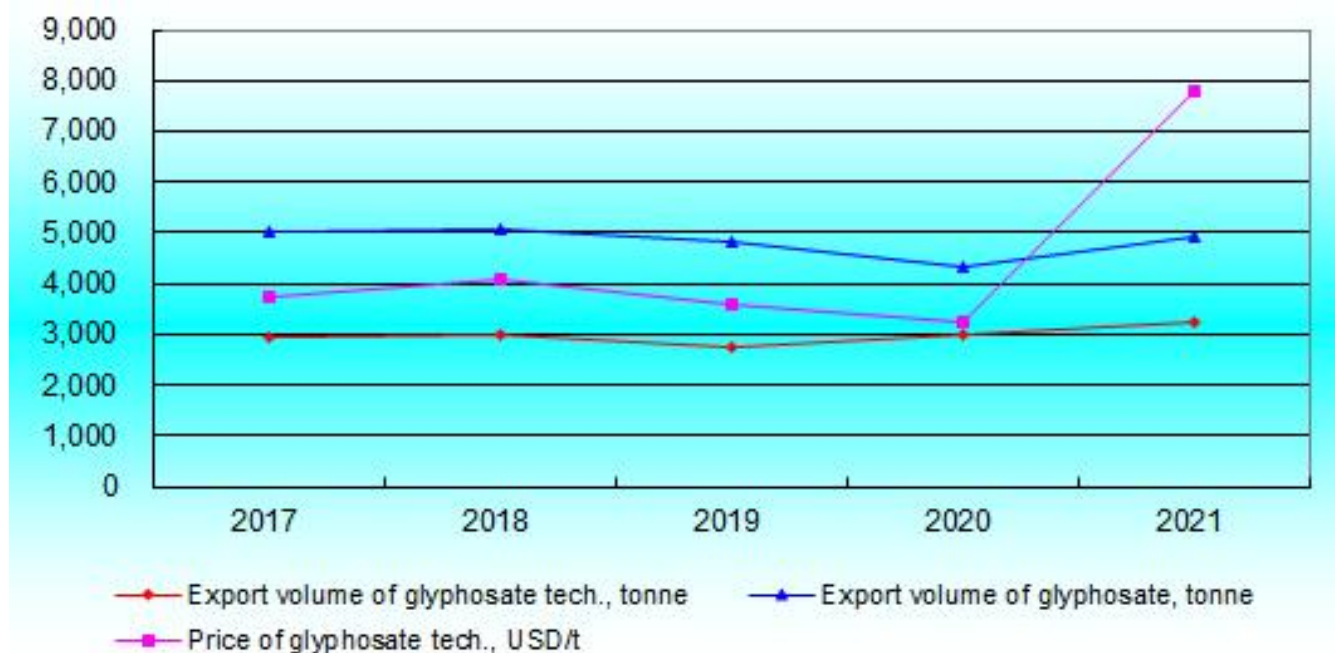
Source:CCM

#### - Supply and demand

Since around 85% of the glyphosate products made in China are exported annually, the demand for glyphosate technical in overseas market influences the ex-works price in China.

Though China plays an important role in the global glyphosate market (capacity of glyphosate technical in China was about 800,000 t/a, and that beyond China was less than 400,000 t/a as of 2021), its bargaining power is relatively weak because China's glyphosate formulations are less competitive in overseas market.

Figure 5.1-2 Annual average ex-works price of glyphosate technical and annual export volume of glyphosate in China, 2017–2021



Note:1. Export volume in this figure is equal to the actual export volume divided by 100. 2. Export volume of glyphosate = export volume of glyphosate technical + export volume of glyphosate formulations (converted to 95% technical) 3. The export volume of glyphosate and in 2020 and 2021 was estimated  
Source: China Customs & CCM

In 2017, the price rebounded because of increasing price of raw materials.

In 2018, since overseas demand was stable, the price of glyphosate kept stable with small fluctuations.

The price decreased a little in 2019 for the demand declined in overseas market.

In 2020, the price decreased by 9.22% year on year due to the aftermath of COVID-19 on the glyphosate market.

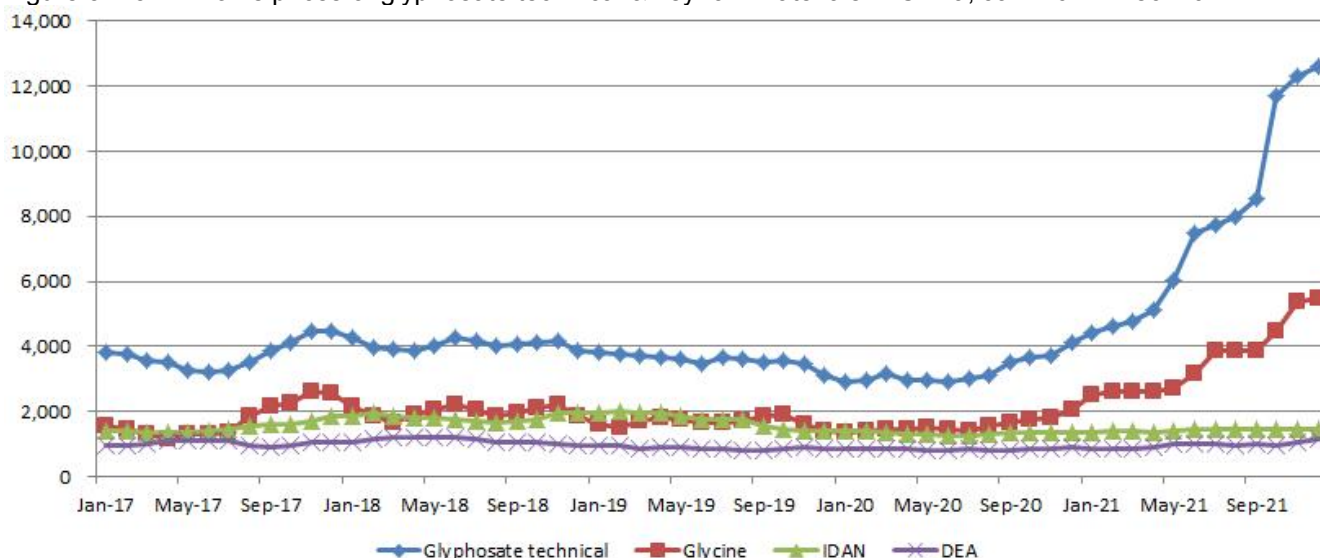
In 2021, the price increased by 138.81% year on year due to the strong demand of market, tight supply and increasing price of raw materials.

### - Production cost

The production cost is one of the key factors determining the price of glyphosate technical, but its influence is decreasing along with technology progress (yield increase, establishment of integrated industrial chain, etc.), and the production cost has actually been decreasing in recent years. Moreover, through adjustment of product mix, some key Chinese producers have lowered their dependence on glyphosate technical. In other words, these players can operate normally even when the price and profit margin of the product are low.

There is generally positive correlation between the price of glyphosate technical and the price of raw materials.

Figure 5.1-3 Ex-works prices of glyphosate technical & key raw materials in China, Jan. 2017–Dec. 2021



Note: Price of DEA is the monthly average of imported DEA, because Chinese producers take imported DEA to produce glyphosate technical mainly.

Source: CCM

### - Governmental policy

The governmental policies such as environmental protection standard, tax policy and natural gas pricing have certain impacts on the supply, manufacturing cost as well as the price of glyphosate technical.

The natural gas' price influences the cost of IDAN, and then PMIDA and glyphosate technical.

In Aug. , 2021, the National Development and Reform Commission (NDRC) issued the *Barometer of Achievement of Dual Energy Consumption Control Targets by Regions in H1 2021*. Glyphosate capacity in 12 provinces, including Zhejiang, Jiangsu, Anhui and Ningxia, was severely restrained in October due to dual control of energy consumption, insufficient power supply and strict environmental protection. Capacity is expected to drop by more than 30%. Strict power and production caused tightly supply that ex-works price of glyphosate technical increased rapidly.

## 5.2 Price forecast, 2022–2025

### - Price forecast

According to the data in 2012–2021, it's summarized that:

- The year-on-year growth rates of annual average ex-works price vary a lot, indicating there is no reference to the future prospect.
- The average annual growth rate of ex-works price from 2012–2021 was about 15.2%.

Table 5.2-1 Year-on-year growth rates of glyphosate's annual average ex-works price and export volume in China, 2012–2021

Item	2012	2013	2014	2015	2016	2017	2018	2019	2020 (est.)	2021 (est.)
Annual average ex-works price	28.3%	30.1%	18.7%	32.9%	11.9%	30.5%	8.5%	11.9%	-9.2%	138.8%
Export volume (tech.)	28.6%	22.0%	-4.7%	-6.1%	16.8%	-6.5%	2.6%	-8.3%	8.5%	7.5%
Export volume (all)	29.3%	20.3%	3.6%	-7.6%	16.8%	-0.6%	0.1%	-4.6%	-9.6%	12.9%

Note: The growth rates of export volumes of glyphosate and glyphosate technical in 2020 and 2021 are estimated numbers.

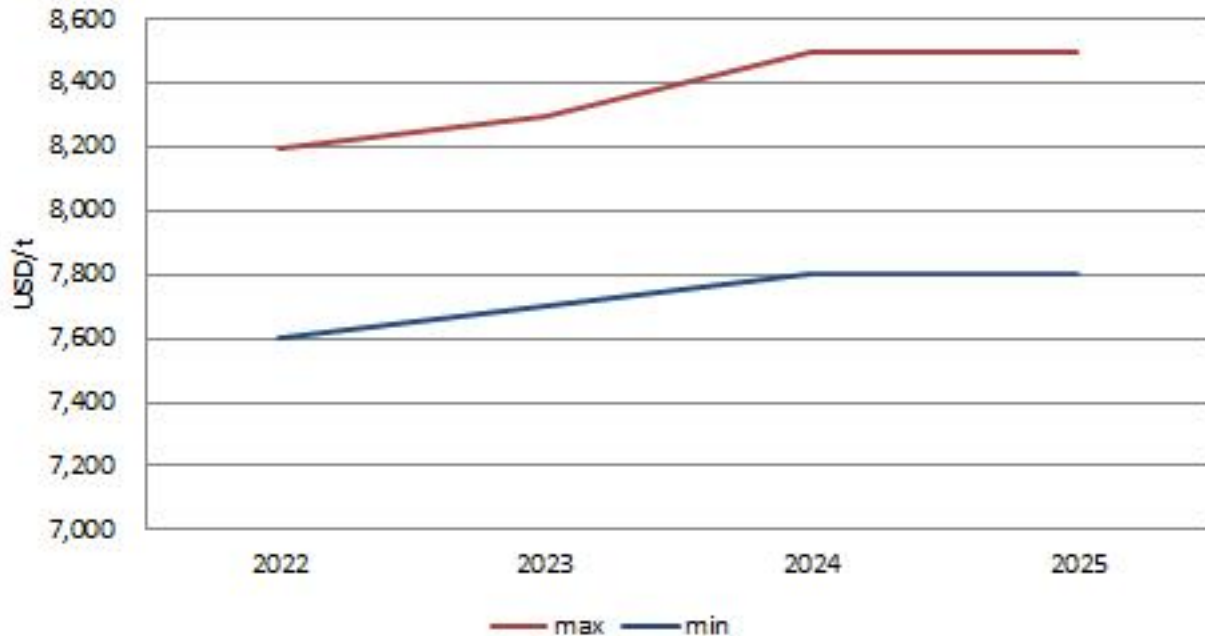
Source: CCM

This 4-year forecast on glyphosate technical price is made under the conditions below:

- Supply & demand beyond China (export volume and demand from GM crops' planting) is the key factor for the future prospect;
- China's supply will be stable and will not decrease a lot since many medium- and small-sized manufacturers have stopped production completely and the industrial concentration rate goes up year by year;
- The global demand for glyphosate will keep increasing but the growth rate will decline because the

- adoption of GM crops in key planting countries tends to be saturated;
- Suppose that there is no suitable substitute for glyphosate;
- Suppose that the economic development in China and in the world keep stable;
- Suppose that there is no publication of new policies with eventful effects on glyphosate in China and in the world;
- Suppose that key Chinese players don't go bankrupt;
- Suppose that planting areas of GM crops stop declining (the planting areas firstly decreased in 2015) but increasing (about ten years are needed for the commercialization of a new GM seed);
- Suppose that the annual growth rate of the USD/CNY exchange rate is within  $\pm 3\%$ .

Figure 5.2-1 Forecast on glyphosate technical price in China, 2022–2025

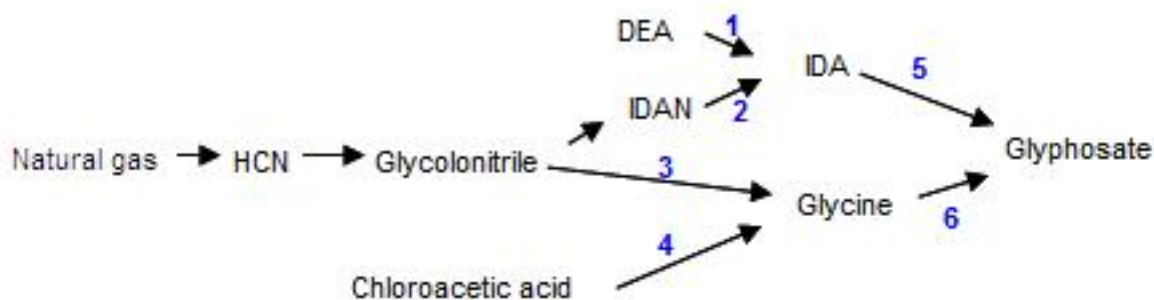


Source:CCM



## 6 Production technology & technology level

Figure 6-1 Production pathways of glyphosate technical in China



Note: Note: 1) DEA route 2) IDAN route 3) HCN route (No enterprise in China adopted this route since 2010) 4) Glycine route  
5) IDA pathway 6) AEA pathway  
Source:CCM

Currently, there are two production pathways of glyphosate technical in China, namely the aminoethanoic acid (AEA) pathway (also named glycine route) and the iminodiacetic acid (IDA) pathway. The latter includes two routes: the DEA (diethanolamine) route and the IDAN (iminodiacetonitrile) route.

The IDA pathway is popular in western countries, while most domestic glyphosate producers in China adopt the AEA pathway due to its mature technology, low cost, sufficient supply of raw materials, complete industrial chain, etc.

During the last few years, the Chinese government has taken a series of measures to strengthen environmental protection, such as the ban on glyphosate SL with a content less than 30% and the launch of environmental protection verification (EPV) by the Ministry of Environmental Protection of China in 2013. The stricter environmental protection policies have driven up the cost of disposing glyphosate mother liquor dramatically. As the impurity of mother liquor waste generated from the AEA pathway is the most difficult to be disposed of among the three routes, the treatment cost for the AEA pathway is also the highest. However, the cost of the AEA pathway has an advantage over the IDAN route and the DEA route if by-product recovery is included.

### 6.1 Introduction of AEA pathway

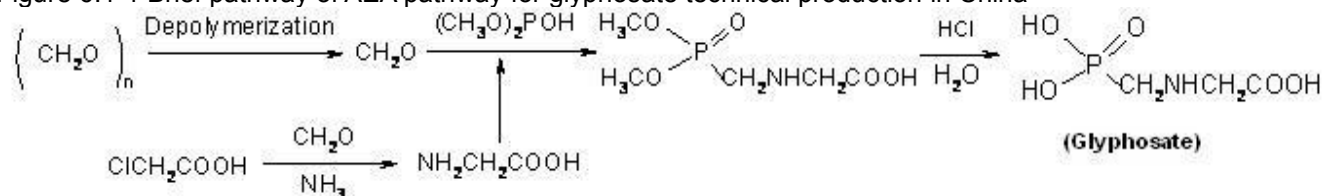
The aminoacetic acid (AEA) pathway, with chloroacetic acid as the starting raw material and glycine as the main raw material, was developed by the Shenyang Research Institute of Chemical Industry in the 1980s.

However, this route is only used in China. Most overseas countries in Europe and South America refuse to adopt the AEA pathway, because it causes serious environmental pollution, and the product quality is also not so good as the one from the iminodiacetic acid (IDA) pathway. So, most international glyphosate traders have registration of IDA-pathway glyphosate only.

In China, the AEA pathway is still widely used, as the technique of this pathway is quite simple for most glyphosate producers to master.

The AEA pathway involves three major procedures: preparation of glycine, preparation of glyphosate and hydrolysis process. Raw materials needed include glycine, paraformaldehyde, triethylamine, methanol, yellow phosphorus or dimethyl phosphite (DMP), hydrochloric acid and sodium hydroxide. Some producers use yellow phosphorus to produce DMP by themselves, while most producers just purchase DMP.

Figure 6.1-1 Brief pathway of AEA pathway for glyphosate technical production in China



Source:CCM

The unit cost of each raw material of the AEA pathway for glyphosate technical production in China hardly changed from 2012 as the production technology became mature.

Table 6.1-1 Raw material cost of AEA pathway for glyphosate technical production in China, April 2022

Item	Unit consumption, t/t	Price, USD/t	Unit cost, USD/t
Glycine (industrial grade)	0.57	1,735	989
Dimethyl phosphite (DMP)	1.02	1,643	1,679
Paraformaldehyde (96%)	0.45	713	319
Triethylamine (99.5%)	0.03	2,166	69
Methanol (95%)	0.32	410	130
Hydrochloric acid (31%)	2.14	26	55
Methyl chloride (99%)	-0.55	470	-259
<b>Total</b>	/	/	<b>2,983</b>

Note: The unit price is not only based on the ordinary market price but also the degree of economic scale, operating rate and backward integration of glyphosate manufacturers.

Source: CCM

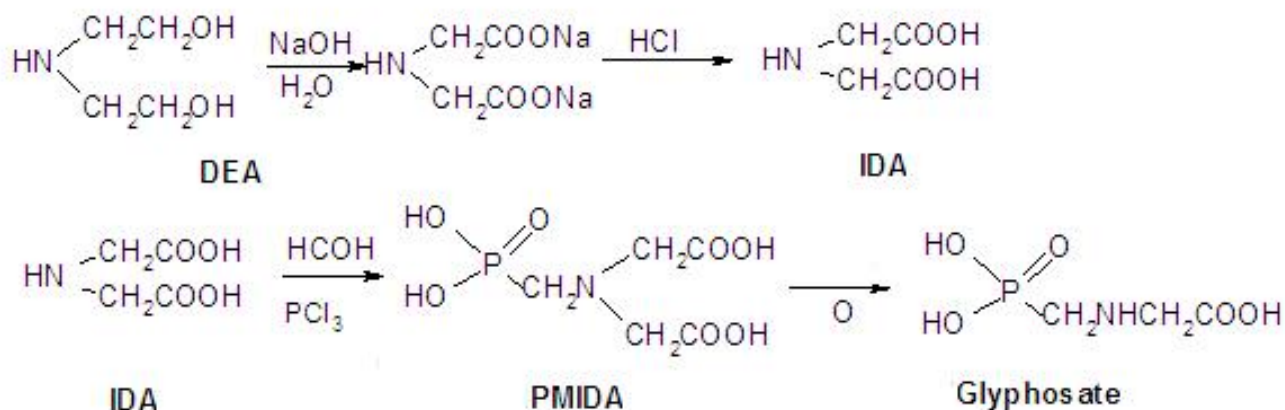
## 6.2 Introduction of DEA route

In the 1990s, the competition in the international glyphosate industry was very intense and the price of glyphosate kept dropping. The lowest price of glyphosate fell to USD2,900/t and many domestic glyphosate producers adopting the AEA pathway could not maintain their normal production. Meanwhile, some research institutes and producers turned their attention to the research and development of the IDA pathway. As they did not have the technology to produce IDAN from HCN, in 1997, Chinese producers independently developed another way to produce IDA and glyphosate, namely the DEA route, although this route had already been developed by Monsanto and Syngenta years before.

The quality of glyphosate made by the DEA route is quite good. It is reported that it's relatively easy to register the glyphosate technical made by this route in overseas countries. However, as the production cost of the DEA route has no competitive advantage compared with the AEA pathway and IDAN route, the number of production lines adopting the DEA route has shown a decreasing trend during the past few years.

The DEA route has three major procedures, namely dehydrogenation, condensation reaction and oxidation process.

Figure 6.2-1 Brief pathway of DEA route for glyphosate technical production in China



Source:CCM

Table 6.2-1 Raw material cost of DEA route for glyphosate technical production in China, April 2022

Item	Unit consumption, t/t	Price, USD/t	Unit cost, USD/t
DEA (99%)	0.90	1,145	1,031
Phosphorous acid (99%)	0.88	738	649
Formaldehyde (37%)	0.89	217	193
Sodium hydroxide (99%)	0.77	622	479
Hydrochloric acid (31%)	2.58	26	67
Raney Cu	0.02	8,664	173
Activated carbon catalyst	0.01	1,643	16
<b>Total</b>	/	/	<b>2,608</b>

Note: The unit price is not only based on the ordinary market price but also the degree of economic scale, operating rate and backward integration of glyphosate manufacturers.

Source: CCM

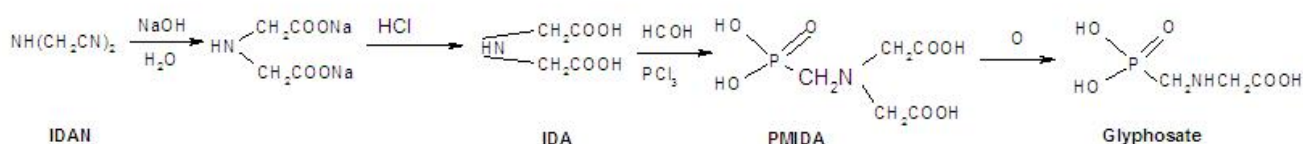
### 6.3 Introduction of IDAN route

After several years of development, IDAN supply can satisfy the current glyphosate production in China. Compared with the DEA route, the IDAN route has an advantage in production cost, and this will continue in a long term.

As IDA is used both in the DEA route and the IDAN route, many Chinese producers adopting the IDA pathway have DEA production lines as well as IDAN production lines; therefore, they can switch between the raw materials DEA and IDAN, depending on their supply and price.

The detailed IDAN route involves three major procedures, namely hydrolysis reaction, condensation reaction and oxidation process.

Figure 6.3-1 Brief pathway of IDAN route for glyphosate technical production in China



Source:CCM

Table 6.3-1 Raw material cost of IDAN route for glyphosate technical production in China, April 2022

Item	Unit consumption, t/t	Price, USD/t	Unit cost, USD/t
IDAN (92%)	0.80	1,608	1,287
Phosphorus trichloride (99%)	1.33	614	817
Sodium hydroxide (99%)	0.82	622	510
Hydrochloric acid (31%)	2.75	26	71
Formaldehyde (37%)	0.78	217	169
Activated carbon catalyst	0.01	1,643	16
<b>Total</b>	<i>/</i>	<i>/</i>	<b>2,870</b>

*Note: The unit price is not only based on the ordinary market price but also the degree of economic scale, operating rate and backward integration of glyphosate manufacturers.*

Source: CCM

#### 6.4 Comparison of different pathways and development trend

The three production routes will still coexist in China in the future, and the competitiveness of the three routes is determined by technology maturity level, production cost and raw material accessibility, etc.

It is estimated that the AEA pathway will remain competitive and maintain its dominant position in China in the coming few years because of mature technology, abundant supply of raw materials, complete industrial layout, and huge market of by-products.

The IDAN route also will keep competitive in China because the supply of raw materials (mainly IDAN and PMIDA) is sufficient and more producers tend to directly purchase PMIDA to produce glyphosate and the overall production cost of the IDAN route is still relatively low.

The DEA route will be less advantageous in the future competition, because there is only one company adopting DEA route in China, who has no expansion plan. of high cost and weak accessibility of raw materials compared with other two routes. Some producers have purchased homemade PMIDA to produce glyphosate technical instead of using DEA as starting material.

Table 6.4-1 Comparison of the three production routes of glyphosate technical in China

Route	AEA	DEA	IDAN
<b>Strong point</b>	Mature technology , low investment (waste treatment and by-product recovery excluded), easily available raw materials	High yield, good product quality, good safety control during production, and mature technology	High yield, good product quality, available raw materials and low production cost
<b>Shortcoming</b>	Long production process, high impurity content, and much wastes (high investment on waste treatment), low yield	High dependence on imported DEA (caused by high price of homemade DEA), high requirement on equipment and thus high investment	High technology barrier, high requirement on equipment and thus high investment; raw material cost may rise sharply if the domestic price of nature gas catches up with the international level
<b>Raw material supply</b>	Sufficient	Depending on imported DEA	Sufficient, especially PMIDA
<b>Wastewater</b>	There are nearly saturated inorganic salt, OP compounds of high concentration and glyphosate isomer in the wastewater, which is with biological toxicity.	PMIDA wastewater from condensation process: There are OP compounds of high concentration in the wastewater, which is with biological toxicity; 3% of formaldehyde contained in wastewater becomes a biological inhibitor; the intermediate, DEA or IDAN, and its derivative are refractory; it contains 18%–22% of NaCl which is nearly saturated saline solution. PMIDA oxidation: There are OP compounds of high concentration in the wastewater, which is with biological toxicity; the wastewater contains 3% of formaldehyde, 2.5% of glyphosate products, unspent PMIDA and other by-products.	
<b>Product quality</b>	Content is about 95%	Content can reach 97%	Content can reach 97%
<b>Major recyclable by-products</b>	Chloromethane, methylal, sodium chloride, phosphorous acid, hydrochloric acid, sulphuric acid, sodium pyrophosphate, etc.	Urotropine, sodium chloride, ammonium sulphate, etc.	Urotropine, sodium chloride, ammonium sulphate, etc.
<b>Initial application time in China</b>	1986	1995	2005
<b>Cost</b>	Highest (mainly due to high raw materials prices)	Lowest	Middle
<b>Typical company</b>	Zhejiang Wynca, Hubei Trisun and Fuhua Tongda	Jiangsu Yangnong	Nantong Jiangshan, Leshan Hebang
<b>Development trend</b>	Will keep the dominant role in China in the future	Will remain relatively stable	Will keep competitive

Note: The cost mainly includes that of raw materials, utilities, labor, packing, maintenance and depreciation.

Source: CCM

## 7 Demand for glyphosate

### 7.1 Overview of China's glyphosate consumption

Only a small share of glyphosate is consumed domestically every year, and it was 16%–20% of the output in 2017–2021.

### 7.2 Position and market size of glyphosate in herbicide industry

Table 7.2-1 Supply and consumption of glyphosate and share in herbicides in China, 2012–2021, tonne

Year	Output			Consumption		
	Herbicide	Glyphosate	Share	Herbicide	Glyphosate	Share
2012	1,657,306	430,000	25.90%	194,000	61,800	31.90%
2013	1,799,823	512,000	28.40%	209,000	65,500	31.30%
2014	1,803,049	534,000	29.60%	215,000	70,000	32.60%
2015	1,771,918	520,000	29.30%	220,000	76,000	34.50%
2016	1,772,982	600,000	33.80%	222,000	86,000	38.70%
2017	1,016,000	600,000	59.10%	209,000	95,000	45.50%
2018	931,000	605,000	65.00%	208,000	100,000	48.10%
2019	935,000	590,000	63.10%	208,000	106,000	51.00%
2020	1,004,000	595,000	59.30%	207,000	115,000	55.60%
2021	N/A	604,000	N/A	212,000	122,000	57.50%

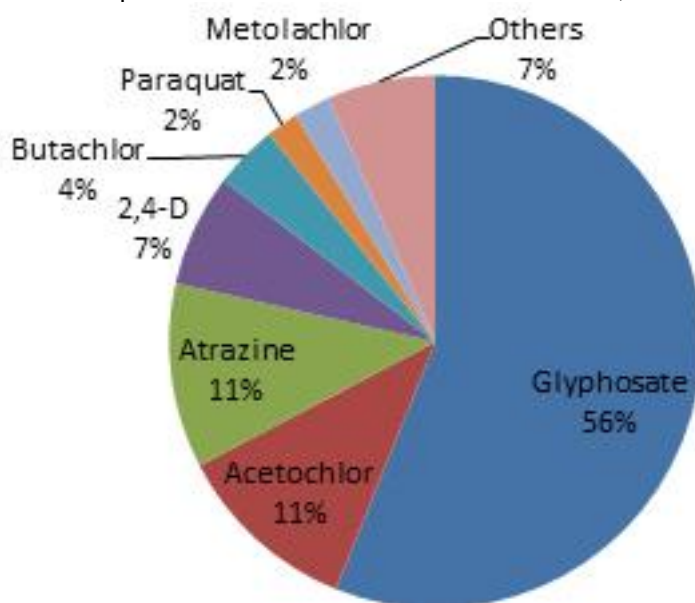
Note: The consumption volume is converted to the most frequently used technical of each herbicide.

Source: National Bureau of Statistics & CCM

As a non-selective herbicide, after so many years' promotion, glyphosate has taken an irreplaceable position in the weeding for orchard, wasteland reclamation and traditional crop fields in pre-seeding period. Its consumption grew at a CAGR of 7.9% in 2012–2021, higher than that of the total herbicide consumption (about 1.0%) during the same period, reaching about 122,000 tonnes (calculated by 95% technical) in 2021, accounting for 57.5% of the total herbicide consumption in China (converted to the most frequently used technical of each herbicide).

In 2020, the most popular herbicides in China with annual consumption volume exceeding 5,000 tonnes each (calculated by 100% technical) included glyphosate, acetochlor, atrazine, 2,4-D, and butachlor; among which, those with annual consumption volume of above 10,000 tonnes each were glyphosate, acetochlor, atrazine and 2,4-D.

Figure 7.2-1 Consumption structure of main herbicides in China, 2020



Note: Converted to and calculated by the most frequently used technical of each herbicide.  
Source: CCM

### 7.3 Glyphosate application in China

#### 7.3.1 By specific formulation

The domestic consumption of glyphosate has been increasing in the past few years, and glyphosate 30% SL (41% IPA mainly) is the most popular formulation consumed in the domestic market, whose consumption volume accounted for over 90% of total consumption volume of glyphosate (converted to and calculated by glyphosate technical) in 2017–2021.

Table 7.3.1-1 Consumption of glyphosate formulations in China, 2017–2021

Year	Consumption volume, tonne			Market share (converted to glyphosate technical)		
	30% SL	62% IPA	Others	30% SL	62% IPA	Others
2017	280,000	3,200	7,000	93.6%	1.6%	4.8%
2018	295,000	3,400	7,200	93.8%	1.6%	4.6%
2019	315,000	3,600	7,300	94.0%	1.6%	4.4%
2020	340,000	3,600	7,700	94.2%	1.5%	4.3%
2021	360,000	3,700	8,100	94.4%	1.5%	4.2%

Note: 30% SL include glyphosate 41% IPA and 33% glyphosate ammonium.  
Source: CCM

#### 7.3.2 By crop

China's crop planting area gradually decreased in 2016-2018, but rebounded in 2019-2020. The main crops include corn, rice, wheat, beans and cotton, whose total planting area accounted for about 65.4% of the national total in 2020.

Table 7.3.2-1 Planting area of main crops in China, 2016–2020, '000 hectare

Main crops	2016	2017	2018	2019	2020
Orchard	10,903	11,136	11,875	12,277	12,646
Vegetables	19,553	19,981	20,439	20,863	21,485
Corn	44,178	42,399	42,130	41,284	41,264
Rice	30,746	30,747	30,189	29,694	30,076
Wheat	24,694	24,508	24,266	23,728	23,380
Rubber	1,230	1,250	1,260	1,270	1,270
Tea	2,723	2,849	2,986	3,105	3,217
Beans	9,287	10,051	10,186	11,075	11,593
Cotton	3,198	3,195	3,354	3,339	3,169
Sugarcane	1,402	1,371	1,406	1,391	1,353
Sub-total	147,913	147,487	148,092	148,025	149,454
<b>National total</b>	<b>166,939</b>	<b>166,332</b>	<b>165,902</b>	<b>165,931</b>	<b>167,487</b>
<b>Share in total crop area</b>	<b>88.60%</b>	<b>88.70%</b>	<b>89.30%</b>	<b>89.20%</b>	<b>89.20%</b>

Source: National Bureau of Statistics of China

Though China's planting area of GM crops ranks seventh in the world, BT cotton is only commercially planted here.

In China, glyphosate is widely used to weed for orchard, wasteland reclamation and traditional crops before seeding for its broad weed spectrum and high efficiency. Mainly applied in upland crops, glyphosate sees small application in rice fields.

#### - Orchard

Orchard covered an area of about 12.6 million hectares in China in 2020, and main fruits are orange, apple, pear, peach, grape, litchi, banana, etc.

As the largest application field of glyphosate in China, orchard takes up about 34% of domestic consumption of glyphosate in 2020.

As to the weeding for orchards, glyphosate is mainly used in the planting areas of orange, apple and litchi in China. The three types of orchard consumed about 29,309 tonnes of glyphosate (calculated by 95% technical) in 2020, accounting for over 75% of the total consumption of glyphosate in orchard and about 25.5% of the total consumption of glyphosate in China.

Glyphosate is suitable to remove weeds for deep-rooted fruit trees, such as orange, apple and litchi, but not for shallow-rooted trees, such as peach, pear and grape, so a higher share of the orchards including orange, apple and litchi use glyphosate to weed compared with that of pear and grape. In orchards of shallow-rooted fruits, paraquat is widely used by farmers in China.



Figure 7.3.2-1 Geographical distribution of main orchards in China, 2020



Source:CCM

Table 7.3.2-2 Consumption of glyphosate (calculated by 95% technical) in fruits in China, 2016–2020, tonne

Main fruits	2016	2017	2018	2019	2020
Orange	10,883	12,889	14,267	15,677	17,479
Apple	4,741	5,545	6,295	7,344	8,732
Litchi	2,295	2,410	2,593	2,800	3,098
Grape	963	991	1,070	1,145	1,229
Others	6,544	6,995	7,400	7,845	8,315
<b>Total</b>	<b>25,427</b>	<b>28,830</b>	<b>31,625</b>	<b>34,811</b>	<b>38,853</b>

Source:CCM

Orange and litchi are mainly distributed in two regions with abundant rainfall, namely South China and Central China, where weed damage is serious and frequent weeding is necessary for orchards.

Apple is mainly distributed in dry areas, including North China and Northwest China with rainy season stretching from July to August, where twice weeding for orchards is enough. The first time is in early spring, when weeds start to germinate. The second time is in July, when weeds grow wildly. However, in some apple orchards, farmers have no regular time to weed and whenever there is weed, they spray glyphosate. Therefore, they weed three or four times every year. In fact, it's the best time for weeding in apple orchards when weeds' height reaches 15cm, which generally falls in June or July in North China. If weeding is done

too early, glyphosate just kills the tender leaf of perennial weeds but not the roots; if weeding comes too late, the bloom growth stage has gone and weeds have little vitality, then it is not easy for glyphosate to reach the roots of the weeds.

Despite its high efficiency, the long-term and frequent use of glyphosate is likely to cause damage to fruit trees. Besides, glyphosate can completely kill the roots of weeds to prevent their future growth, but orchard needs some weeds to hold the moisture of the soil, which is helpful for fruit growth, and the dead weed in soil is helpful for maintaining soil fertility. Moreover, the long-term application of glyphosate can lead to zinc deficiency in the soil and influence the growth of fruits.

Now some researchers suggest using machine to cut down shrubs and weeds. Though most farmers still use herbicides for weed control, they begin to control the application times of glyphosate in China. For example, some farmers in Shandong Province use glyphosate in orchard once every three years. However, with the ban of paraquat AS formulations in China, the consumption of glyphosate has kept increasing stably.

#### **- Traditional crops (mainly including corn, rice, wheat, beans and cotton)**

As a non-selective herbicide, glyphosate can kill weeds and crops when it is directly sprayed onto the leaves of crops. As to weeding for traditional crops, including rice, wheat, corn, beans and cotton, glyphosate is mainly used before seeding or after harvest of crops. Farmers generally choose selective herbicides to control the weeds in the post-emergence of crops, so selective herbicides have wider application in traditional crops compared with non-selective ones. For example, acetochlor is the most widely used selective herbicide in the upland crops and butachlor is most popular in the weeding for rice.

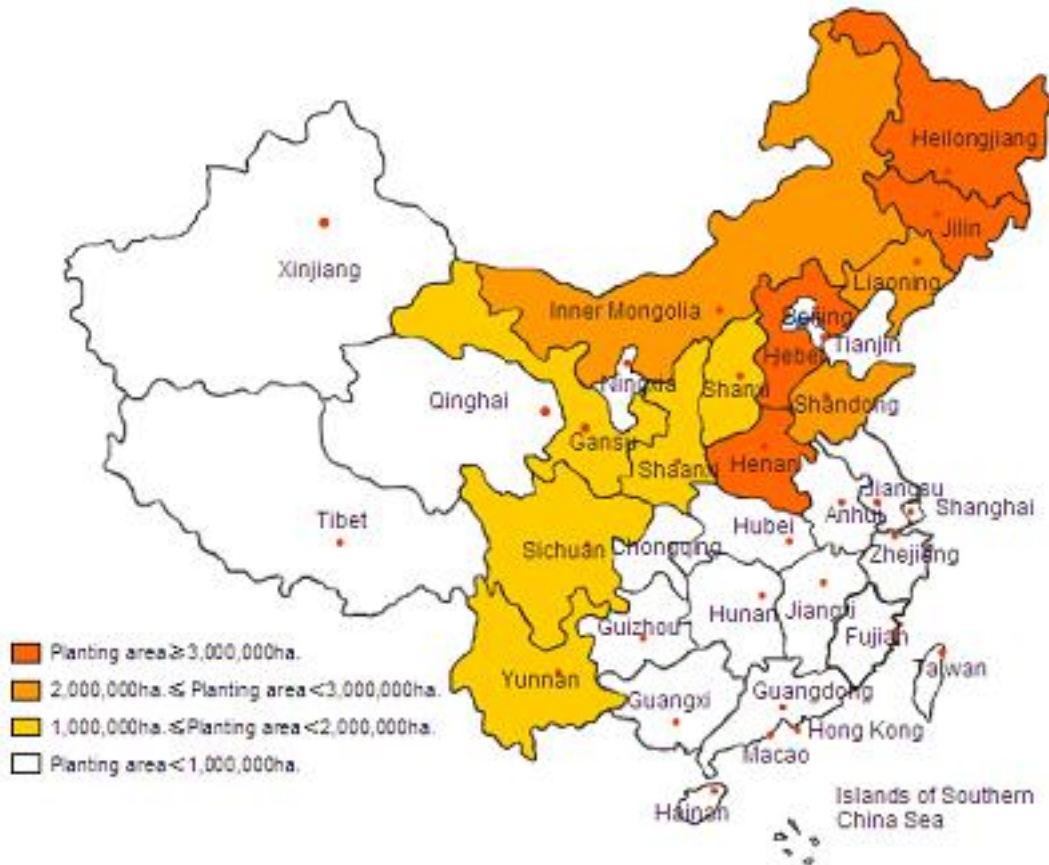
#### **Corn**

Corn is the largest crop in China, though its planting area reduced to about 41.3 million hectares in China in 2020, at a CAGR of -1.7% in 2016–2020. Corn planting is mainly concentrated in Northeast China, Shandong, Hebei and Henan provinces.

The consumption of glyphosate in corn fields was about 9,771 tonnes (calculated by 95% technical) in 2020, taking up 8.5% of the total consumption in China.

Glyphosate is only used in pre-seeding stage of corn as it is a shallow-rooted crop. In the pre-emergent stage of corn, acetochlor and atrazine are commonly used in corn fields. Before the period of crop with 5–6 leaves, farmers choose selective herbicides, mainly nicosulfuron, to weed for corn. When it reaches about 70cm's height, farmers use non-selective herbicides, mostly paraquat, by orientation spraying method to control weeds in most corn planting areas. And many farmers in Northeast China, especially in Heilongjiang Province, mainly use nicosulfuron or nicosulfuron mixed with atrazine rather than non-selective herbicides to weed in the whole post-emergent state.

Figure 7.3.2-2 Geographical distribution of corn planting area in China, 2020

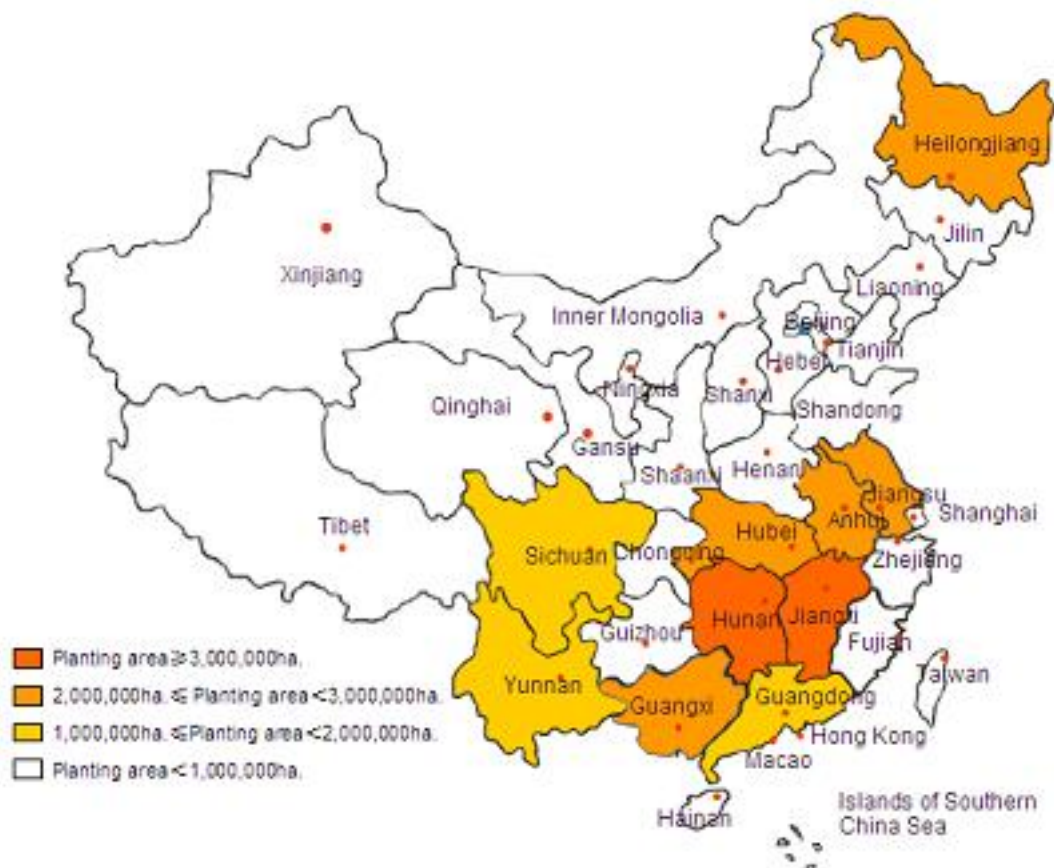


Source:CCM

### Rice

Rice is the second largest crop in China, but its planting area kept decreasing in 2017–2019, but increased to 30.1 million hectares in 2020, up 1.3% year on year. Rice planting is mainly concentrated in Hunan, Jiangxi, Jiangsu, Anhui, Guangdong, Hubei, Sichuan, Heilongjiang and Guangxi.

Figure 7.3.2-3 Geographical distribution of rice planting area in China, 2020



Source:CCM

Glyphosate is used in the field and the field ridges before rice planting. As glyphosate kills the roots of weeds, leading to water and soil loss and resulting in the collapse of the field ridges, most farmers choose paraquat for weeding of rice fields.

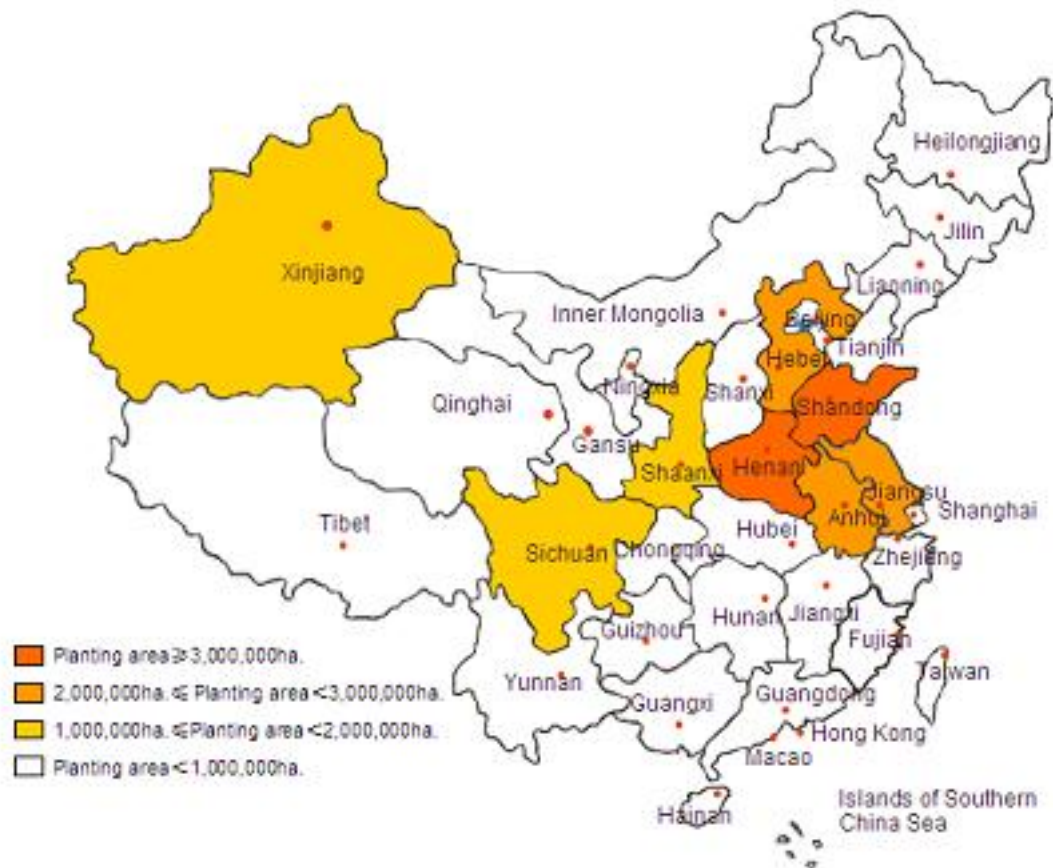
The consumption of glyphosate in rice fields reached 9,077 tonnes (calculated by 95% technical) in 2020, accounting for 7.9% of the national total consumption of glyphosate.

### Wheat

Wheat is the third largest crop in China, and its planting area was gradually decreased at a CAGR of -1.4% during 2016–2020, dropping to about 23.4 million hectares in 2020.

Wheat planting is mainly concentrated in Henan, Shandong, Anhui, Hebei, Jiangsu, Xinjiang, Sichuan, and Shaanxi, whose planting area of wheat accounts for over 80% of national total.

Figure 7.3.2-4 Geographical distribution of wheat planting area in China, 2020



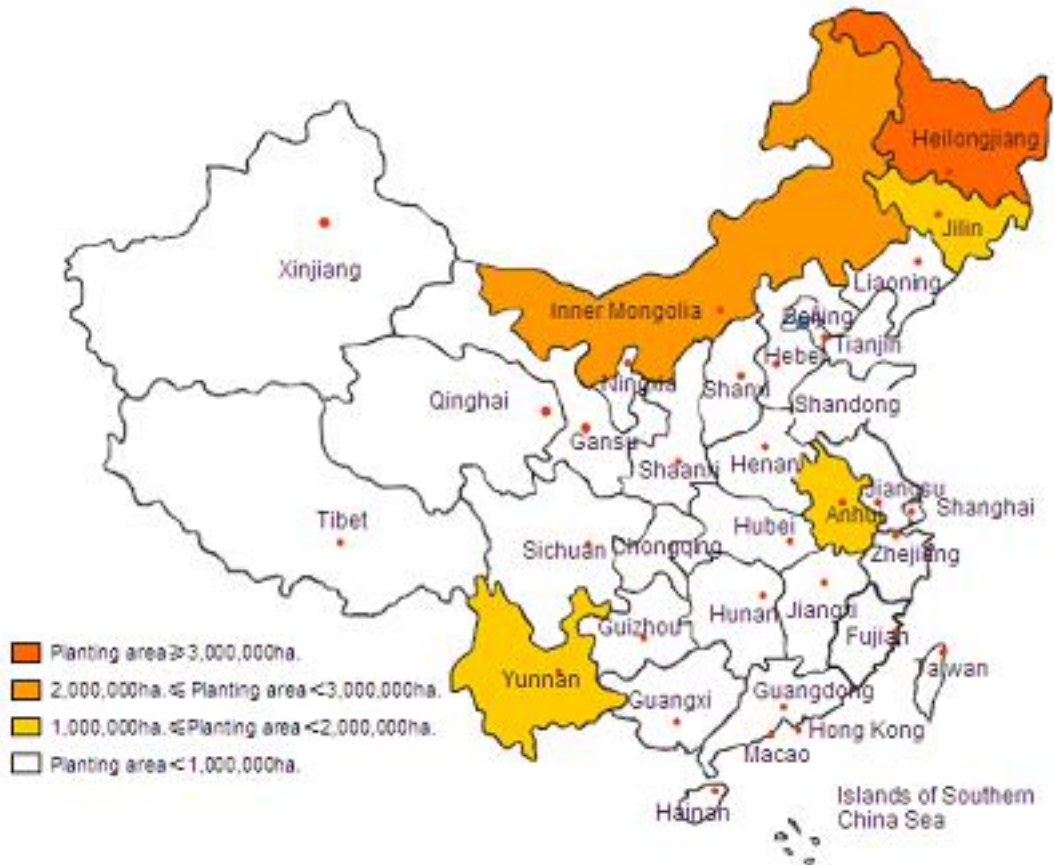
Source:CCM

As glyphosate is only applied in the pre-seeding period of wheat in China, the consumption of glyphosate in wheat fields is small, reaching about 5,816 tonnes (calculated by 95% technical) in 2020, accounting for about 5.1% of the total.

### Beans

The total planting area of beans in China kept increasing with a CAGR of 5.7% in 2016–2020, and it reaches 11.6 million hectares in 2020. Bean planting is mainly located in Heilongjiang, Jilin, Yunnan, Anhui and Inner Mongolia. Generally speaking, glyphosate is used at the pre-emergent stage. Glyphosate consumption in bean fields was about 2,668 tonnes (calculated by 95% technical), accounting for 2.3% of the national total consumption in 2020.

Figure 7.3.2-5 Geographical distribution of bean planting area in China, 2020



Source:CCM

### Cotton

The total planting area of cotton in China was about 3.2 million hectares in 2016–2017. In 2018, it rose to 3.4 million hectares, but fell again to 3.2 million hectares in 2020. Cotton planting is mainly concentrated in Xinjiang, Shandong, Henan and Hebei.

Figure 7.3.2-6 Geographical distribution of cotton planting area in China, 2020



Source:CCM

In 2020, about 1,119 tonnes of glyphosate (calculated by 95% technical) was used in cotton fields, accounting for 1.0% of the total consumption in China.

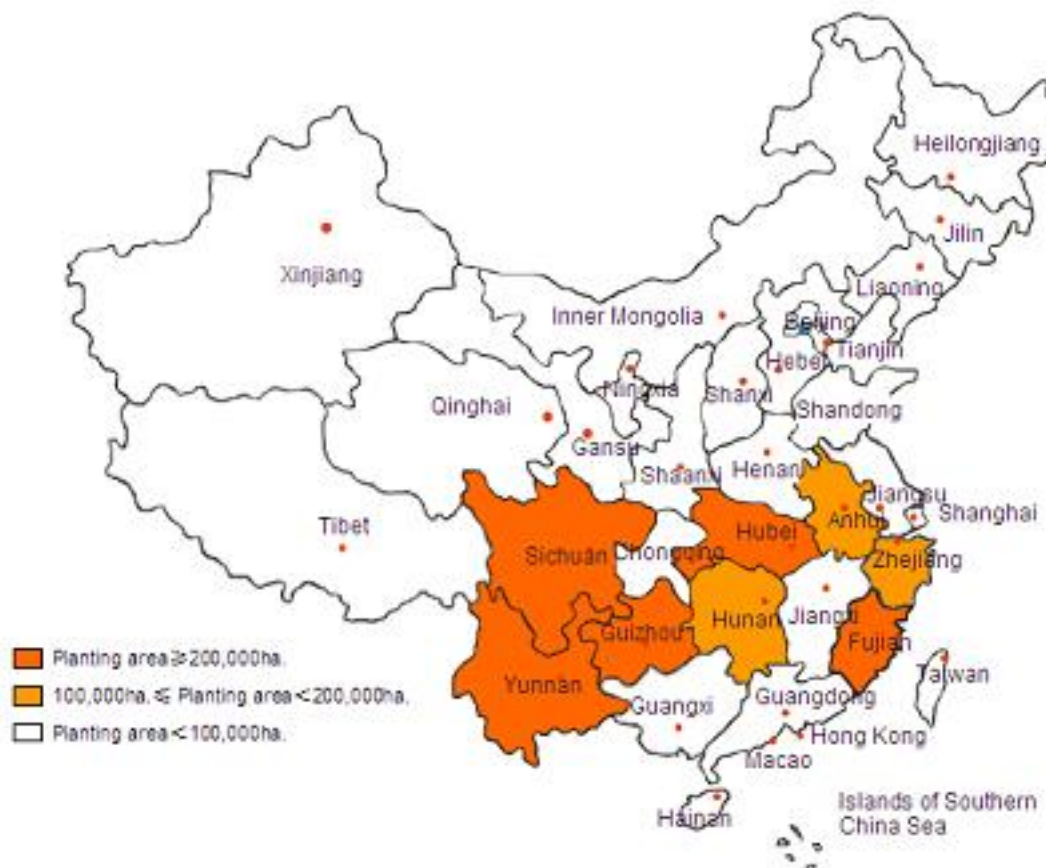
Glyphosate is mainly used at two stages, namely pre-emergent stage and the stage when cotton height is above 70cm. Farmers mainly use glyphosate to control weeds by placement spraying method.

In Xinjiang and Gansu, the height of cotton is about 40 cm–50 cm, much shorter than that in other regions, where the height of cotton is about 90 cm–130 cm. Many farmers smear glyphosate on weeds by brush after cutting weeds with scissors to put them under control.

### Tea

The total planting area of tea in China kept increasing with an estimated CAGR of about 4.3% in 2016–2020, and it was about 3.2 million hectares in 2020. The main planting areas are: Yunnan, Fujian, Sichuan, Zhejiang and Hubei provinces.

Figure 7.3.2-7 Geographical distribution of tea planting area in China, 2020



Source:CCM

Manual cultivation is the traditional and main method for weeding in tea plantations in China, though it costs much time and labor. The weed growth season is in accordance with the peak season of tea making, so the labor is insufficient during this period. Moreover, more and more rural people flow into urban areas, causing the shortage of rural labor. Therefore, some tea plantations also use herbicides, such as glyphosate and paraquat.

Owing to the different action mechanism between glyphosate and paraquat, they are used in different situations. When tea plantation is on hills or other higher terrain, where protection of water and soil is much needed, planters choose paraquat, but when the plantation is located at even terrain with many weeds, they choose glyphosate.

Usually, twice weeding is necessary for tea plantation, and the first time is before June and the second is after July.

The consumption of glyphosate is small as there are many "green" tea plantations, where the use of agrochemicals is not allowed. In 2020, the consumption of glyphosate in tea plantation was 5,164 tonnes (calculated by 95% technical), accounting for 4.5% of the total consumption of glyphosate in China.

### Sugarcane

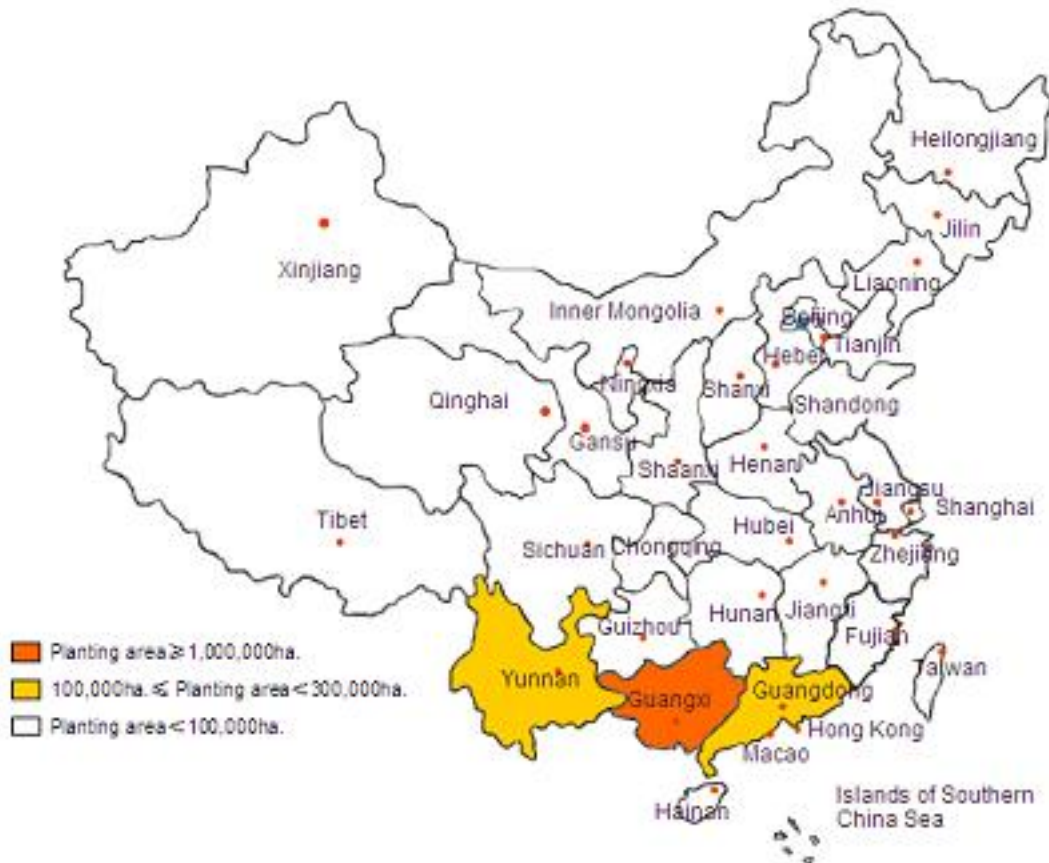
Sugarcane planting area in China hovered around 1.4 million hectares in 2016–2020. Yunnan, Guangdong and Guangxi are the main planting areas, whose share combined accounted for over 90% of the national total in 2020.

Glyphosate is only used before sugarcane planting. After it grows up, farmers use special herbicides or paraquat to control weeds. Some farmers reclaim wasteland to plant sugarcane, which needs much more glyphosate than in common situation. However, this has seldom been seen since sugarcane's profit is not large. As the price of special herbicides is too high, some farmers prefer to use glyphosate.

The consumption of glyphosate in sugarcane fields was about 764 tonnes (calculated by 95% technical) in China in 2020.



Figure 7.3.2-8 Geographical distribution of sugarcane planting area in China, 2020



Source:CCM

### Rubber

The total planting area of rubber in China increased stably in 2016–2020, reaching about 1.3 million hectares (estimated) in 2020. Hainan and Yunnan make up over 90% of the national total of rubber growing.

Two to three times of weeding is needed for rubber planting every year. About 2,923 tonnes of glyphosate (calculated by 95% technical) was consumed in rubber fields in China in 2020, accounting for about 2.5% of the national total consumption of glyphosate.

Figure 7.3.2-9 Geographical distribution of rubber planting area in China, 2020



Source:CCM

Other application fields of glyphosate in China mainly include non-agricultural use and wasteland reclamation.

Table 7.3.2-3 Consumption of glyphosate (calculated by 95% technical) in China by crop, 2016–2020, tonne

Crop	2016	2017	2018	2019	2020
Orchard	25,427	28,830	31,625	34,811	38,853
Vegetables	15,274	17,469	18,668	20,308	22,658
Corn	9,021	9,366	9,481	9,575	9,771
Rice	7,518	8,543	8,659	8,691	9,077
Wheat	5,021	5,433	5,589	5,624	5,816
Tea	4,042	4,435	4,650	4,874	5,164
Rubber	2,674	2,760	2,806	2,876	2,923
Beans	2,105	2,345	2,377	2,593	2,668
Cotton	926	975	1,030	1,068	1,119
Sugarcane	669	721	739	755	764
Others	13,323	14,124	14,375	14,825	16,188
<b>Total</b>	<b>86,000</b>	<b>95,000</b>	<b>100,000</b>	<b>106,000</b>	<b>115,000</b>

Source:CCM

Table 7.3.2-4 Consumption of glyphosate (calculated by 95% technical) in fruits in China, 2016–2020, tonne

Main fruits	2016	2017	2018	2019	2020
Orange	10,883	12,889	14,267	15,677	17,479
Apple	4,741	5,545	6,295	7,344	8,732
Litchi	2,295	2,410	2,593	2,800	3,098
Grape	963	991	1,070	1,145	1,229
Others	6,544	6,995	7,400	7,845	8,315
<b>Total</b>	<b>25,427</b>	<b>28,830</b>	<b>31,625</b>	<b>34,811</b>	<b>38,853</b>

Source:CCM

## 7.4 Forecast on glyphosate demand in the next five years

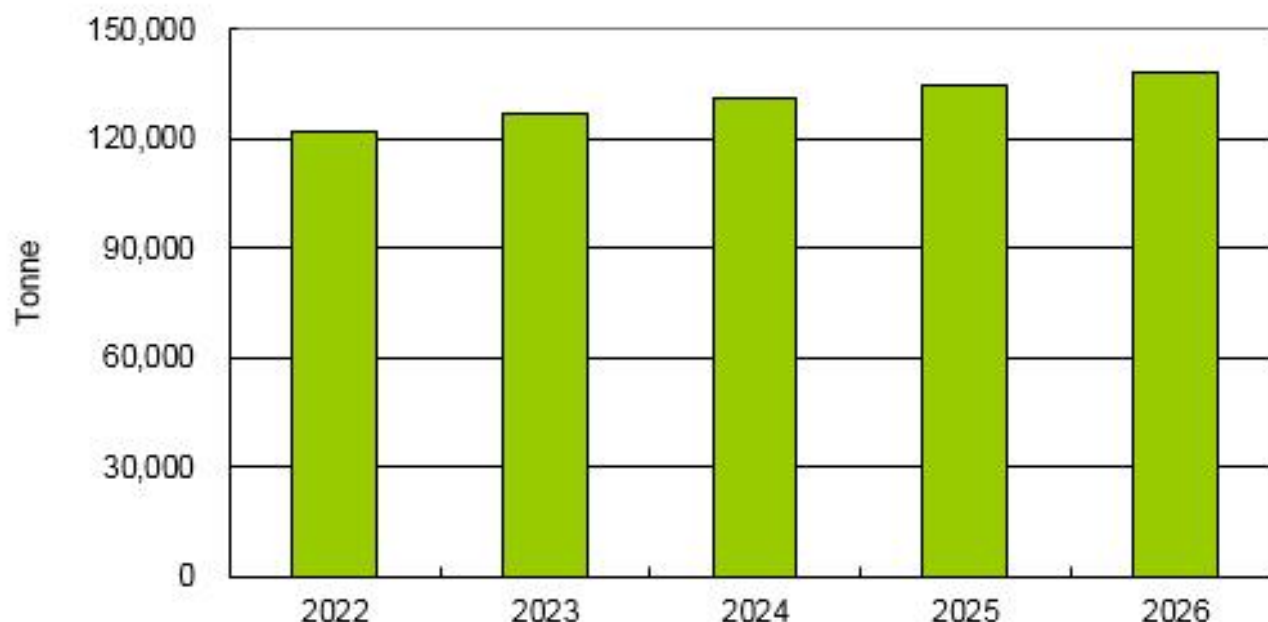
### Main factors influencing glyphosate demand in China

The government has issued a series of encouraging policies to stimulate grain production, which accordingly ensure the increasing demand for pesticides.

The government issued the Notice No. 1745 to ban the application of paraquat AS in the domestic market from 1 July, 2016. The domestic demand for paraquat has declined greatly, and the domestic demand for glyphosate, glufosinate-ammonium, diquat, etc. increased to different degree after 2016 correspondingly.

### Forecast on glyphosate demand in China

Figure 7.4-1 Forecast on glyphosate demand in China, 2022–2026



Note:Converted to 95% technical  
Source:CCM

## 8 Profiles of key glyphosate technical producers

### 8.1 Fuhua Tongda Agro-chemical Technology Co., Ltd. & Nantong Jiangshan Agrochemical & Chemicals Co., Ltd.

Address: Gongyu Village, Qiaogou Town, Wutongqiao District, Leshan City, Sichuan Province 614800, P. R. China

Tel: +86-833-3359989

Website: www.fuhua-tongda.com

#### Company background

Fuhua Tongda Agro-chemical Technology Co., Ltd. (Fuhua Tongda), established in Leshan City of Sichuan Province in Dec. 2007, is specialized in R&D, production and sales of glyphosate and related chemicals. The company's number of staff is about 2,600.

Fuhua Tongda achieved revenues of USD514.5 million, USD514.9 million and USD603.8 million in 2015, 2016 and 2017 respectively. In 2018, its revenues climbed to USD677.4 million and its net profit was USD61.6 million.

Fuhua Tongda is the second-largest shareholder of Nantong Jiangshan, owning 25.66% share of the latter as of 31 March, 2022.

#### Situation of glyphosate

Fuhua Tongda has three glyphosate technical production lines with the total capacity of 153,000 t/a, and only the glycine route is taken.

The company also is engaged in production of related raw materials and supporting facilities as well, including 300,000 t/a of ionic membrane caustic soda, 180,000 t/a of phosphorus trichloride, 120,000 t/a of dimethyl phosphite, 60,000 t/a of paraformaldehyde, 40,000 t/a of glycine, 37,500 kW of thermoelectric station, 220 t/h of steam supply stations, etc. (by Dec. 2021).

Table 8.1-1 Capacity and output of glyphosate technical in Fuhua Tongda, 2017–2021

Year	2017	2018	2019	2020	2021
Capacity, t/a	135,000	153,000	153,000	153,000	153,000
Output, tonne	130,000	126,000	129,000	123,000	126,000

Source:CCM

Nantong Jiangshan has three glyphosate production lines with the capacity of 30,000 t/a (glycine route), 15,000 t/a (IDAN route) and 25,000 t/a (IDAN route) separately. Key raw materials for glyphosate production—glycine and IDAN, are both bought from outside. Paraformaldehyde is mainly supplied by its holding company, Nantong Jiangtian Chemicals Co., Ltd.

Table 8.1-2 Glyphosate technical and its supporting products in Nantong Jiangshan, 2021

No.	Project	Product	Capacity, t/a
1	Glyphosate 30,000 t/a (Glycine route)	Glyphosate technical	30,000
		Phosphorus trichloride	60,000
		DMP	40,000
		Methyl chloride	40,000
		Methylal	18,800
		Hydrochloric acid 31%	90,000
2	Glyphosate 40,000 t/a (IDAN route)	Glyphosate technical	40,000
		Aqueous ammonia 20%	49,252
		Ammonium sulfate	24,477
3	Treatment of phosphorus-containing mother liquor	Mother liquor treatment	45,000
		Sodium pyrophosphate	15,318
		Sodium dihydrogen phosphate	1,074
		Disodium hydrogenorthophosphate	1,338
		Trisodium phosphate	9,363

Source:CCM

Table 8.1-3 Capacity and output of glyphosate technical in Nantong Jiangshan, 2017–2021

Year	Glycine route		IDAN route	
	Capacity, t/a	Output, tonne	Capacity, t/a	Output, tonne
2017	30,000	30,000	40,000	35,800
2018	30,000	30,000	40,000	36,000
2019	30,000	29,000	40,000	33,000
2020	30,000	30,000	40,000	33,000
2021	30,000	29,000	40,000	33,000

Source:CCM

## 8.2 Hubei Trisun Chemicals Co., Ltd.

Address: No. 66-4 Xiaoting Avenue, Xiaoting District, Yichang City, Hubei Province 443007, P. R. China  
Tel: +21-51698668 (Foreign trade department)

### Company background

Hubei Trisun Chemicals Co., Ltd. (Hubei Trisun), was founded in Sept. 2005. Hubei Trisun covers an area of 33 ha and has over 730 employees. Its registered capital was RMB260 million as of April 2022.

Currently, Hubei Trisun's 76.87% share is held by Hubei Xingfa Chemicals Group Co., Ltd. and the rest is held by Agricultural Bank of China Financial Asset Investment Co. Ltd.

Table 8.2-1 Performance of Hubei Trisun, 2017-2021

Year	2017	2018	2019	2020	2021
Revenue, USD million	455.3	457.0	594.6	658.3	1,162.0
Net profit, USD million	33.8	22.8	12.5	6.9	201.2

Source:Hubei Trisun

### Situation of glyphosate

Hubei Trisun started glyphosate production in 2008, adopting the glycine route.

Hubei Trisun mainly produces glyphosate technical (capacity in 2021: 130,000 t/a), glyphosate formulations (40,000 t/a), methylal (35,000 t/a), chloromethane (130,000 t/a) and phosphorous acid solution (5,000 t/a). It also produces key upstream products of glyphosate technical, including phosphorus trichloride (190,000 t/a), glycine (100,000 t/a) and dimethyl phosphite (130,000 t/a).

In addition, 90% of Hubei Trisun's glyphosate technical is sold directly, and the rest is made into various formulations.

Table 8.2-2 Capacity and output of glyphosate technical in Hubei Trisun, 2017–2021

Year	2017	2018	2019	2020	2021
Capacity, t/a	130,000	130,000	130,000	130,000	130,000
Output, tonne	122,900	110,000	110,000	115,000	122,000

Source:CCM

### 8.3 Zhejiang Wynca Chemical Industry Group Co., Ltd.

Address: No.1 Xin'an Building, Middle Jiangbin Road, Jiande City, Hangzhou City, Zhejiang Province 311600, P. R. China

Tel: 86-571-64723891/64713652/64723949

Fax: +86-571-87220464/64721344

Person to contact: Shao Bingyi (Manager), Mr. Xu (Manager)

Website: www.wynca.com

#### Company background

Zhejiang Wynca Chemical Industry Group Co., Ltd. (Zhejiang Wynca) is a comprehensive enterprise focusing on production of pesticides, chemical products, and organic silicone series products, etc. It got listed on the Shanghai Stock Exchange in Sept. 2001 (Stock Code: 600596).

Zhejiang Wynca produces more than 100 varieties of products falling into two categories, namely agrochemicals and organic silicone materials. Among agrochemicals, glyphosate technical and formulations play a leading role, and some insecticides and fungicides are also produced. The latter category includes four main series: silicone rubber, silicone oil, silicone resin and silane coupling agent.

Zhejiang Wynca achieved a revenue of USD2.9 billion in 2021.

#### Situation of glyphosate

Zhejiang Wynca has two production plants of glyphosate, namely Jiande Chemical No. 2 Plant (Jiande Chemical) and Zhenjiang Jiangnan Chemical Co., Ltd. (Zhenjiang Jiangnan) with the glyphosate technical capacity of 30,000 t/a and 50,000 t/a respectively.

Zhejiang Wynca adopts the glycine route to produce glyphosate technical only. Jiande Chemical's 30,000 t/a glyphosate technical installations are equipped with supporting facilities of 30,000 t/a of DMP and 40,000 t/a of phosphorus trichloride. Zhenjiang Jiangnan's 50,000 t/a glyphosate technical installations are equipped with supporting facilities of 50,000 t/a of DMP.

In order to take up more overseas market share, Zhejiang Wynca established some overseas subsidiaries in Argentina, Ghana, Nigeria, The US, Cote d'Ivoire, and Mali.

The revenues of its agrochemicals reached USD1.2 billion in 2021.

Table 8.3-1 Capacity and output of glyphosate technical in Zhejiang Wynca, 2017–2021

Plant	Item	2017	2018	2019	2020	2021
Jiande Chemical	Capacity, t/a	30,000	30,000	30,000	30,000	30,000
	Output, tonne	5,000	31,000	31,000	31,000	30,000
Zhenjiang Jiangnan	Capacity, t/a	50,000	50,000	50,000	50,000	50,000
	Output, tonne	50,000	50,000	50,000	50,000	50,000

Source:CCM

#### 8.4 Jianguo Good Harvest-Weien Agrochemical Co., Ltd.

Address: Binjiang Fine Chemical Park, Qidong City, Jiangsu Province 226221, P. R. China

Tel: +86-513-83885555

Fax: +86-513-83883939

Person to contact: Mr. Yang, Mr. Lu, Mr. Gu

Email: wechem@pub.nt.jsinfo.net

Website: www.good-harvest.cn

#### Company background

Covering an area of about 430,000 m<sup>2</sup>, with a construction area of more than 100,000 m<sup>2</sup>, Jianguo Good Harvest-Weien Agrochemical Co., Ltd. (Jianguo Weien) focuses on the production of agrochemicals and fine chemicals.

Jianguo Weien has over 700 staffs, 200 of which are technicians, and its total capital has been over USD278 million as of Dec. 2019.

Key products of Jianguo Weien and capacities in 2021:

- Phenmedipham technical: 1,000 t/a
- Desmedipham technical: 1,000 t/a
- Ethofumesate technical: 1,000 t/a
- n-butyronitrile and Isobutyronitrile: 2,500 t/a
- 2,4-D dimethylamine salt: 2,500 t/a
- Glyphosate technical: 62,000 t/a
- Glyphosate formulations: 29,000 t/a

#### Situation of glyphosate

Jianguo Weien adopts IDA pathway to produce glyphosate technical, with a capacity of 62,000 t/a.

- 32,000 t/a production lines take IDAN to produce PMIDA and then glyphosate technical, or take PMIDA to produce glyphosate technical directly.
- 30,000 t/a production lines take PMIDA to produce glyphosate technical.

Currently, Jianguo Weien mainly purchases PMIDA for producing glyphosate technical.

Jianguo Weien exported 10,133 tonnes glyphosate technical and 19,171 tonnes glyphosate formulations in

2019.

Table 8.4-1 Capacity and output of glyphosate technical in Jiangsu Weien, 2017–2021

Year	2017	2018	2019	2020	2021
Capacity, t/a	62,000	62,000	62,000	62,000	62,000
Output, tonne	43,000	38,000	30,000	30,000	30,000

Source:CCM

### 8.5 Leshan Hebang Agricultural Technology Co., Ltd.

Address: Niu Hua Town, Wutongqiao District, Leshan City, Sichuan Province 614801, P. R. China

Tel: 86-0833-3208293

Fax: 86-0833-3207446

Person to contact: Mrs. Yang (Manager)

Website: www.hebang.cn

#### Company background

Leshan Hebang Agricultural Technology Co., Ltd. (Leshan Hebang) was established in 2013, owned by Sichuan Hebang Biotechnology Co., Ltd. (Sichuan Hebang). Its registered capital was RMB492 million as of April 2022.

Sichuan Hebang got listed in Shanghai Stock Exchange in 2012 (Stock code: 603077).

Glyphosate and PMIDA are key products of Leshan Hebang. It has already become one of key glyphosate player in China with a capacity of 50,000 t/a glyphosate technical and 180,000 t/a PMIDA.

In 2021, the revenue of Leshan Hebang's glyphosate and PMIDA was USD343.42 million and USD372.17 million respectively, and it produced 50,000 tonnes of glyphosate technical and 114,000 tonnes PMIDA.

#### Situation of glyphosate

In 2015, Leshan Hebang started to produce glyphosate technical by IDAN route. It uses IDAN as the raw material to produce PMDIA and then glyphosate technical. It owns 180,000 t/a PMDIA facilities by 2021. And the output of PMIDA was 120,000 tonnes in 2020 and 114,000 tonnes in 2021. So far, Leshan Hebang has two production lines of glyphosate technical with a total capacity of 50,000 t/a.

Most of glyphosate technical produced by Leshan Hebang was sold in domestic market and only a few were exported to overseas market. Its glyphosate technical export volume was 2,011 tonnes in 2018 and 2,580 tonnes in 2019.

Table 8.5-1 Capacity and output of glyphosate technical in Leshan Hebang, 2017–2021

Year	2017	2018	2019	2020	2021
Capacity, t/a	50,000	50,000	50,000	50,000	50,000
Output, tonne	45,000	55,000	55,000	50,000	50,000

Source:CCM

### 8.6 Jiangsu Yangnong Chemical Co., Ltd.

Address: No.39 Wenfeng Road, Yangzhou City, Jiangsu Province 225009, P. R. China

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#### Company background



Jiangsu Yangnong Chemical Co., Ltd. (Jiangsu Yangnong), established in Dec. 1999 and listed on the Shanghai Stock Exchange in April 2002 (Stock Code: 600486), is engaged in R&D and production of chemicals used in agricultural and public health sectors.

Pyrethroids for sanitary use or agricultural use are the key products of Jiangsu Yangnong, with capacity of 8,000 t/a. It can provide 60 or more species of this kind of products.

Jiangsu Yangnong achieved revenues of USD655.9 million in 2017, USD1.3 billion in 2018, USD1.3 billion in 2019, USD1.4 billion in 2020 and USD1.8 billion in 2021 respectively.

### Situation of glyphosate

Jiangsu Yangnong started to research glyphosate production technology since 2003. It is the earliest glyphosate supplier adopting the IDA pathway in China. Jiangsu Yangnong purchases DEA as raw material for the production of PMIDA and then glyphosate technical. In addition, it's equipped with facilities for PMIDA production from IDAN.

As its glyphosate is produced from DEA, with good product quality, it is well accepted in the overseas market. Most of its glyphosate is exported. Its export volume of glyphosate technical was around 26,000 tonnes during 2015–2017, and increased to 29,728 tonnes in 2018 and 30,864 tonnes in 2019.

Table 8.6-1 Capacity and output of glyphosate technical in Jiangsu Yangnong, 2017–2021

Year	2017	2018	2019	2020	2021
Capacity, t/a	35,000	35,000	35,000	35,000	35,000
Output, tonne	32,000	32,000	30,000	30,000	30,000

Source:CCM

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