

## **Production Situation of Glufosinate- ammonium in China 2023**

**Researched & Prepared by:**

**Kcomber Inc.**

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## Contents

Executive summary.....	1
Introduction and methodology.....	2
1 Production.....	4
1.1 Production of glufosinate-ammonium technical in China, 2019–2023.....	4
1.2 Production of glufosinate-ammonium formulations in China, 2019–2023.....	4
2 Producer.....	6
2.1 Producers of glufosinate-ammonium technical in China, 2019–2023.....	6
2.2 Producers of glufosinate-ammonium formulations in China, 2019–2023.....	8
3 Production technology.....	10
4 Export.....	12
4.1 Export of glufosinate-ammonium technical in China, 2019–2023.....	14
4.2 Export of glufosinate-ammonium formulations in China, 2019–2023.....	17
5 Price.....	20
6 Domestic consumption.....	21
7 Conclusions.....	24

## LIST OF TABLES

Table 2-1 Producers of glufosinate-ammonium TC in China, 2019–2023

Table 2.1-1 Capacity and output of glufosinate-ammonium technical producers in China, 2019–2023

Table 2.2-1 Output of glufosinate-ammonium formulations producers in China, 2019–2023

Table 4.1-1 Export volume of glufosinate-ammonium technical in China by month, 2022–2023, tonne

Table 4.2-1 Export volume of glufosinate-ammonium formulations in China by month, 2022–2023, tonne

Table 6-1 Planting areas of glufosinate-ammonium's main target crops in China, 2019–2023, '000 ha

Table 6-2 Application parameters of glufosinate-ammonium in main target crops in China, 2023

## LIST OF FIGURES

Figure 1.1-1 Capacity and output of glufosinate-ammonium technical in China, 2019–2023

Figure 1.2-1 Output of glufosinate-ammonium formulations in China, 2019–2023

Figure 3-1 Flowchart of glufosinate-ammonium technical production in China

Figure 4-1 China's export volume of glufosinate-ammonium, 2019–2023

Figure 4-2 China's export volume of glufosinate-ammonium technical and formulation, 2019–2023

Figure 4-3 Export destinations of China's glufosinate-ammonium by volume and share, 2019–2023, tonne

Figure 4-4 Export destinations of China's glufosinate-ammonium by volume and share, 2023, tonne

Figure 4.1-1 Export volume of glufosinate-ammonium technical in China by quarter, 2020–2023

Figure 4.1-2 Export destinations of China's glufosinate-ammonium technical by volume and share, 2019–2023, tonne

Figure 4.1-3 Export destinations of China's glufosinate-ammonium technical by volume and share, 2023, tonne

Figure 4.2-1 Export volume of glufosinate-ammonium formulations in China by month, 2020–2023

Figure 4.2-2 Export destinations of China's glufosinate-ammonium formulations by volume and share, 2019–2023, tonne

Figure 4.2-3 Export destinations of China's glufosinate-ammonium formulations by volume and share, 2023, tonne

Figure 5-1 Monthly ex-works prices of 95% glufosinate-ammonium technical in China, 2019–2023

Figure 6-1 Consumption of glufosinate-ammonium in China, 2019–2023, tonne

Figure 6-2 Consumption pattern of China's glufosinate-ammonium by main target crops, 2023, tonne

## Executive summary

Glufosinate-ammonium is a non-selective herbicide and its quick effectiveness falls between paraquat's and glyphosate's. It is commonly used in orchards, vineyards, potato fields, and non-crop land for control of annual and perennial dicotyledonous weeds and gramineous weeds in China.

Since the outbreak of the COVID-19 pandemic in early 2020, the ex-works price of Chinese glufosinate-ammonium has kept increasing. In H1 2021, the overseas demand for China's glufosinate-ammonium grew, but the inventory was insufficient, which worsened due to limited production capacity of manufacturers and abnormal production of its raw material diethyl phosphite. According to CCM price monitoring data, the ex-works price of 95% TC stood high in Nov. 2021 at USD50,162/t, up by 210% compared with that in Nov. 2019, driven by tight supply and rising costs of raw materials. Thanks to completion and operation of new capacities in China, the ex-works price started to go down in Dec. 2021 and dipped to USD30,736/t in April 2022, down 39% from the peak in Nov. 2021. However, the price recovered as a result of the sustained increase in the price of yellow phosphorus from April to June. From July to Dec., with the pesticide market gradually entering off-season and the continued release of production capacity, the ex-works price of glufosinate-ammonium continued to fall to USD25,455/t in Dec. 2022. In Jan.–Oct. 2023, glufosinate-ammonium witnessed an overall decline in quotation, with its price in Oct. slumping by 65.7% compared with that in Dec. 2022, and the relatively high inventory overseas and sluggish demand caused by production capacity expansion were attributable to the price drop. The product's price went up within the peak storage season from Nov. to Dec., driven by manufacturers' insistent demands for higher price, in spite of the fact that the downstream demand for the product did not grow significantly amid dull market.

Regarding production, from 2019 to 2023, the capacity of glufosinate-ammonium TC in China showed a fast growth from 35,340 t/a to 82,745 t/a, with a CAGR of 23.7%. And the output rose from 11,400 tonnes to 32,870 tonnes in 2019–2023, at a CAGR of 30.3%, mainly driven by soaring demand at home and abroad and technology improvement. As of Dec. 2023, there were 61 active registrations of glufosinate-ammonium TC and 11 active registrations of glufosinate-ammonium TK in China, only part of which have production lines approved and operated.

In consumption of glufosinate-ammonium, overseas consumption currently plays an important part in China's glufosinate-ammonium. The export volume of glufosinate-ammonium (converted to 100% AI) in China saw continuous growth for years. However, a drop appeared as China and the world suffered from COVID-19 in early 2020. Due to China's effective measures against the epidemic and the robust overseas demand, the 2021 export volume recovered from 5,118 tonnes in 2020 to 13,067 tonnes, up 155.3% YoY. On the other hand, its high price made the domestic consumption in China not much compared with export. In 2022, as the impact of the COVID-19 epidemic diminished, glufosinate-ammonium producers gradually recovered their production capacity and global demand for glufosinate-ammonium continued to grow, with exports surging to 37,723 tonnes, up 188.7% YoY. However, the export volume dropped by 22.3% YoY to 29,305 tonnes in 2023, due to high inventory and decreasing demand overseas in the first half of the year. In 2019–2023, consumption of glufosinate-ammonium in China increased from 2,540 tonnes to 5,811 tonnes, with a CAGR of 23.0%.

## **Introduction and methodology**

The report is formulated by methods as follows:

### **1. Desk research**

The sources of desk research are various, including published magazines, journals, government statistics, industrial statistics, customs statistics, seminars as well as information from the internet. A lot of work has gone into the compilation and analysis of the obtained information. When necessary, checks have been made with Chinese suppliers regarding production information.

### **2. Telephone interview**

CCM has carried out extensive telephone interviews in order to survey the actual production and producers' situation of glufosinate-ammonium in China.

Interviewees include:

- Key producers
- Key traders
- Associations
- Experts

## **Data processing and presentation**

The data collected and compiled are sourced from:

- CCM's database, ValoTracer
- Published articles from periodicals, magazines and journals, and third-party databases
- Statistics from governments and international institutes
- Telephone interviews with domestic producers, service suppliers, governments, etc.
- Third-party data providers
- Comments from industrial experts
- Professional databases from other sources
- Information from the internet

The data from various sources have been combined and cross-checked 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 them.

## **Unit**

RMB: currency unit in China, also called Yuan

USD: currency unit in the United States

Tonne: ton, equaling to metric ton in this report

t/a: tonne/annual or tonne/year

/t: per tonne

ha: hectare

## **Glossary**

TC: Technical material

TK: Technical concentrate

AS: Aqueous solution

SL: Soluble concentrate

SG: Water soluble granule

MDP: Methylphosphonous dichloride

AI: Active Ingredient

Table: USD/CNY exchange rate, Jan. 2019–Dec. 2023

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
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	6.6651	6.6863	6.7467	6.8821	7.0992	7.2081	7.1225	6.6972
2023	6.9475	6.7492	6.9400	6.8805	6.9054	7.0965	7.2157	7.1283	7.1788	7.1789	7.1778	7.1104	7.0424

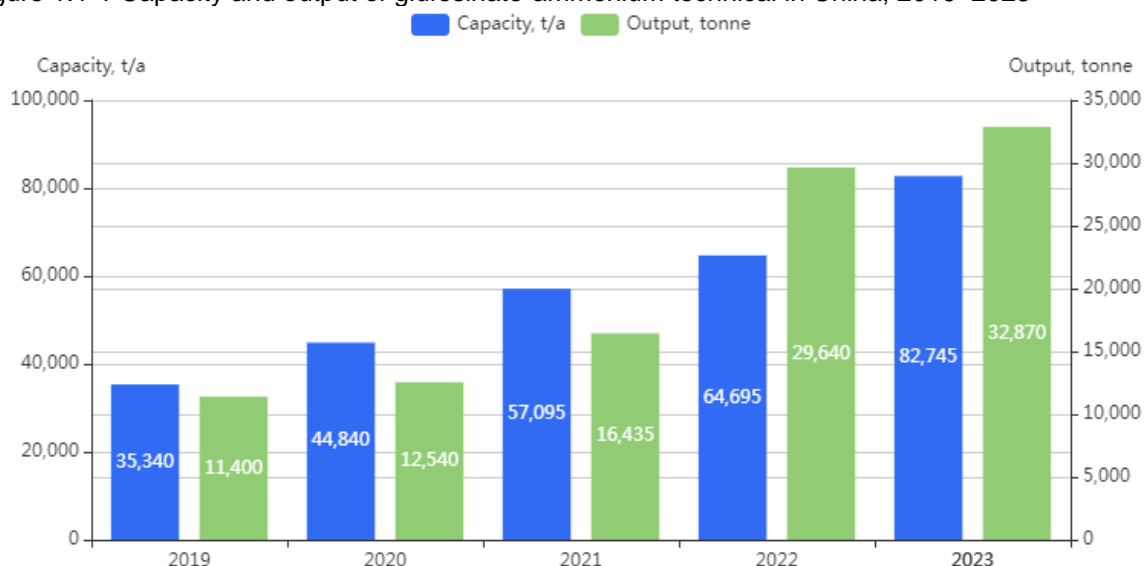
Source: The People's Bank of China

## 1 Production

Glufosinate-ammonium technicals produced in China include 95% technical (TC), 96% TC, 97% TC, 98% TC and 50% technical concentrate (TK), of which 95% TC is the main specification. And glufosinate-ammonium formulations include 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG, with 200 g/L AS as the dominant formulation.

### 1.1 Production of glufosinate-ammonium technical in China, 2019–2023

Figure 1.1-1 Capacity and output of glufosinate-ammonium technical in China, 2019–2023



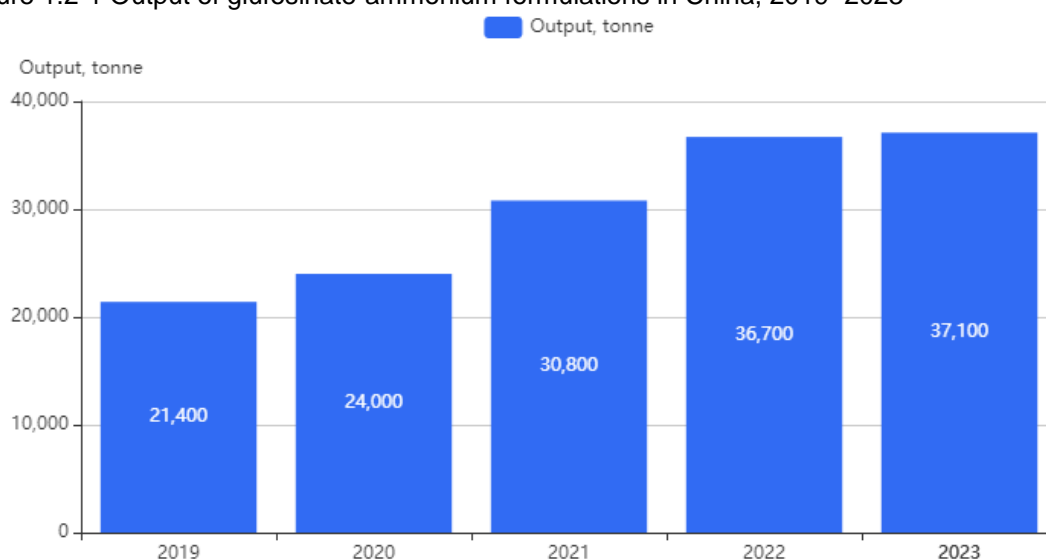
Source: CCM

Note: Capacity and output here refer to the total amount converted to 95% TC of glufosinate-ammonium products including 95% TC, 96% TC, 97% TC, 98% TC and 50% TK.

From 2019 to 2023, the capacity of glufosinate-ammonium TC in China showed a fast growth from 35,340 t/a to 82,745 t/a, with a CAGR of 23.7%. And the output rose from 11,400 tonnes to 32,870 tonnes in 2019–2023, at a CAGR of 30.3%, mainly driven by soaring demand at home and abroad and technology improvement. Meanwhile, domestic glufosinate-ammonium TC saw lower production costs and higher quality, making China's manufacturers increasingly competitive in the global market.

### 1.2 Production of glufosinate-ammonium formulations in China, 2019–2023

Figure 1.2-1 Output of glufosinate-ammonium formulations in China, 2019–2023



Source: CCM

Note:

1. Output here refers to the total amount of glufosinate-ammonium formulations including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG.
2. The output data of Bayer CropScience (China) Co., Ltd., which did not disclose its glufosinate-ammonium formulation output, is excluded.

From 2019 to 2023, China's output of glufosinate-ammonium formulations increased significantly from 21,400 tonnes to 37,100 tonnes, which was mainly boosted by the rocketing demand from both domestic and overseas markets, decreasing production cost and better product quality following technological improvements.



## 2 Producer

Table 2-1 Producers of glufosinate-ammonium TC in China, 2019–2023

No.	Producer	Abbr.	Status				
			2019	2020	2021	2022	2023
1	Lier Chemical Co., Ltd.	Lier Chemical	Active	Active	Active	Active	Active
2	Yongnong BioSciences Co., Ltd.	Yongnong BioSciences	Active	Active	Active	Active	Active
3	Hebei Veyong Bio-chemical Co., Ltd.	Hebei Veyong	Active	Active	Active	Active	Active
4	Ningxia Wynca Technology Co., Ltd.	Ningxia Wynca	/	/	/	Active	Active
5	Shandong Eshung Industrial Co., Ltd.	Shandong Eshung	Active	Active	Active	Active	Active
6	Fuhua Tongda Chemical Co., Ltd.	Fuhua Tongda	Active	Active	Active	Active	Active
7	Shijiazhuang Richem Co., Ltd.	Shijiazhuang Richem	Active	Active	Active	Active	Active
8	Nanjing Red Sun Biochemistry Co., Ltd.	Nanjing Red Sun	Active	Active	Active	Active	Active
9	Jiangsu Sevencontinent Green Chemical Co., Ltd.	Jiangsu Sevencontinent	Idle	Idle	Active	Active	Active
10	Inner Mongolia Jiaruimi Chemical Co., Ltd.	Inner Mongolia Jiaruimi	Active	Active	Active	Active	Active
11	Shandong Binnong Technology Co., Ltd.	Shandong Binnong	Idle	Idle	Idle	Active	Active
12	Jiangsu Huifeng Bio Agriculture Co., Ltd.	Jiangsu Huifeng	Idle	Idle	Active	Active	Idle
13	Rosi Chemical Co., Ltd.	Rosi Chemical	Active	Active	Active	Idle	Idle
14	Jiangsu Huangma Agrochemicals Co., Ltd.	Jiangsu Huangma	Idle	Idle	Idle	Idle	Idle
15	Shandong Weifang Rainbow Chemical Co., Ltd.	Weifang Rainbow	Idle	Idle	Idle	Idle	Idle
16	Shandong Zhongshi Pesticide Co., Ltd.	Shandong Zhongshi	Idle	Idle	Idle	Idle	Idle
17	Shandong Weitian Fine Chemical Technology Co., Ltd.	Shandong Weitian	Idle	Idle	Idle	Idle	Idle

Source: CCM

### 2.1 Producers of glufosinate-ammonium technical in China, 2019–2023

Table 2.1-1 Capacity and output of glufosinate-ammonium technical producers in China, 2019–2023

No.	Producer	Capacity, t/a					Output, tonne				
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
1	Lier Chemical	7,980	17,480	17,480	17,480	17,480	5,415	6,555	9,500	17,100	13,300
2	Yongnong BioSciences	2,850	2,850	6,080	6,080	6,080	2,280	2,280	2,850	5,700	3,800
3	Hebei Veyong	1,900	1,900	1,900	6,650	6,650	1,425	1,425	1,425	2,185	2,185
4	Ningxia Wynca	/	/	/	2,850	2,850	/	/	/	1,425	1,425

5	Shandong Eshung	950	950	950	950	19,950	285	475	475	855	9,500
6	Fuhua Tongda	5,700	5,700	5,700	5,700	5,700	475	475	475	760	760
7	Shijiazhuang Richem	1,425	1,425	1,425	1,425	5,225	855	665	665	760	950
8	Nanjing Red Sun	2,850	2,850	2,850	2,850	2,850	285	285	285	238	238
9	Jiangsu Sevencontinent	950	950	950	950	950	0	0	238	190	380
10	Shandong Binnong	1,900	1,900	10,925	10,925	10,925	0	0	0	190	190
11	Inner Mongolia Jiaruimi	570	570	570	570	570	238	238	238	143	143
12	Rosi Chemical	950	950	950	950	950	143	143	143	0	0
13	Jiangsu Huangma	950	950	950	950	950	0	0	0	0	0
14	Weifang Rainbow	950	950	950	950	950	0	0	0	0	0
15	Shandong Zhongshi	475	475	475	475	475	0	0	0	0	0
16	Shandong Weitian	190	190	190	190	190	0	0	0	0	0
17	Jiangsu Huifeng	4,750	4,750	4,750	4,750	0	0	0	143	95	0
<b>Total</b>		<b>35,340</b>	<b>44,840</b>	<b>57,095</b>	<b>64,695</b>	<b>82,745</b>	<b>11,400</b>	<b>12,540</b>	<b>16,435</b>	<b>29,640</b>	<b>32,870</b>

Source: CCM

Note: Capacity and output here refer to the total amount converted to 95% TC of glufosinate-ammonium products including 95% TC, 96% TC, 97% TC, 98% TC and 50% TK.

As of Dec. 2023, there were 61 active registrations of glufosinate-ammonium TC and 11 active registrations of glufosinate-ammonium TK in China, only part of which have production lines approved and operated.

In 2023, only 11 TC producers were active, as some industrial parks in Jiangsu Province were closed due to pollution concerns, causing some producers to stop production and upgrade their equipment and techniques to satisfy the environmental standards. Small producers found it difficult to survive the fierce competition. As the market demand increases, there will be newcomers in glufosinate-ammonium TC production in future, but it is still hard to change the situation where top producers dominate the glufosinate-ammonium market.

### Long-term leading players

Lier Chemical, Yongnong BioSciences, Hebei Veyong and Fuhua Tongda have been the top suppliers in terms of capacity or output in China.

- Lier Chemical: With 10,000 t/a capacity newly added in 2020, Lier Chemical's capacity reached 18,400 t/a, boasting the world's largest glufosinate-ammonium production capacity; its 3,000 t/a glufosinate-P TC (Phase I) production line started construction in Jan. 2020 and went into production in Jan. 2022.
- Yongnong BioSciences: In the past few years, its capacity expansion fell far behind Lier Chemical. While in May 2021, after the overall upgrading and transformation of all glufosinate-ammonium TC production lines, its capacity was expanded to 6,400 t/a; its subsidiary in Ningxia Hui Autonomous Region proposed a 20,000 t/a glufosinate-ammonium TC plan in June 2019, which was restarted in Oct. 2023 and is currently in progress. The company also planned a 3,000 t/a glufosinate-P TC project in Oct. 2020, which was completed and put into production in April 2021.
- Hebei Veyong: On 25 Oct. 2022, Hebei Veyong announced that the company had completed the construction and equipment installation of its 5,000 t/a glufosinate-ammonium project, which had passed the expert review for trial production plan and entered the commissioning stage. And its capacity is 7,000 t/a now.
- Fuhua Tongda: It completed its first production line of 6,000 t/a glufosinate-ammonium TC in Sept. 2018, making it an up-and-coming powerhouse in the industry. On 7 July 2022, it signed a new 20,000 t/a glufosinate-ammonium and related ancillary projects.

## Newcomers

- Shandong Eshung: As a new entrant with its 1,000 t/a glufosinate-ammonium TC production line completed in Jan. 2019, the company released the environmental impact assessment (EIA) report of the pesticide project including 20,000 t/a glufosinate-ammonium TC and 10,000 t/a glufosinate-P technical in Oct. 2020, which was completed in June. 2023. The environmental impact report of the company's 35,000 t/a glufosinate-ammonium TC renovation and expansion project was approved in Dec. 2023, which would expand its glufosinate-ammonium TC capacity to 35,000 t/a when completed.
- Nanjing Red Sun: Its 3,000 t/a glufosinate-ammonium TC facilities were completed in Dec. 2018; another 20,000 t/a glufosinate-ammonium TC project underwent by its subsidiary in Chongqing Municipal started in 2019.
- Ningxia Wynca: In June 2022, it completed its first production line of 3,000 t/a glufosinate-ammonium TC; its another 3,000 t/a glufosinate-ammonium TC project is in progress.

## Others

- Jiangsu Sevencontinent: Its subsidiary Sevencontinent Green Chemical (Jining) Co., Ltd. in Jining City, Shandong Province released the EIA report of the fine chemical project (10,000 t/a glufosinate-P TC included) in Dec. 2019 and held a groundbreaking ceremony in July 2020.
- Shijiazhuang Richem: The company expanded its glufosinate-ammonium TC capacity to 1,000 t/a in 2017 from 300 t/a, and further increasing to 1,500 t/a in 2018. In Aug. 2022, the People's Court of Zhao County, Hebei Province, issued the first instance judgement in a lawsuit between Jiangsu Huifeng and Shijiazhuang Richem: the 5,000 t/a glufosinate-ammonium TC project was confirmed to be owned by the latter. In July 2023, Jiangsu Huifeng appealed against the verdict, but the court upheld the judgement.
- Shandong Binnong: Its wholly-owned subsidiary Gansu Binnong Technology Co., Ltd. had the 22,000 t/a pesticide intermediate project (10,000 t/a glufosinate-ammonium TC included) put into production in Sept. 2021; however, this project was found to be not going very smoothly, and was restarted in June 2023, with the planned capacity for glufosinate-ammonium changed to 9,000 t/a glufosinate-ammonium dustablepowder (DP) and 9,400 t/a 22% glufosinate-ammonium AS.
- Shandong Weitian, Inner Mongolia Jiaruimi and Rosi Chemical: These three companies have owned production lines for years but produced in a very small quantity or had no operation in recent years.

## 2.2 Producers of glufosinate-ammonium formulations in China, 2019–2023

Table 2.2-1 Output of glufosinate-ammonium formulations producers in China, 2019–2023

No.	Producer	Output, tonne				
		2019	2020	2021	2022	2023
1	Yongnong BioSciences	8,000	9,000	11,800	13,000	13,000
2	Jiangsu Sevencontinent	4,600	6,000	7,400	8,500	8,500
3	Lier Chemical	3,600	4,000	5,200	7,000	7,000
4	Hebei Veyong	2,000	2,000	2,500	3,000	3,000
5	Weifang Rainbow	1,700	1,500	2,000	2,500	3,200
6	Jiangsu Huifeng	500	500	700	700	400
7	Others	1,000	1,000	1,200	2,000	2,000
<b>Total</b>		<b>21,400</b>	<b>24,000</b>	<b>30,800</b>	<b>36,700</b>	<b>37,100</b>

Source: CCM

Note:

1. Output here refers to the total amount of glufosinate-ammonium formulations including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG.

2. The output data of Bayer CropScience (China) Co., Ltd., which did not disclose its glufosinate-ammonium formulation output, is excluded.

The registrations of glufosinate-ammonium formulations in China went up slightly. As of Dec. 2023, there have been 388 companies in China completing 723 active registrations, 246 of which are for the key

specification, 200 g/L AS. Despite a large number of registrations, there are only 6 key glufosinate-ammonium formulation producers in China capable of producing glufosinate-ammonium formulations exceeding 100 tonnes per year.

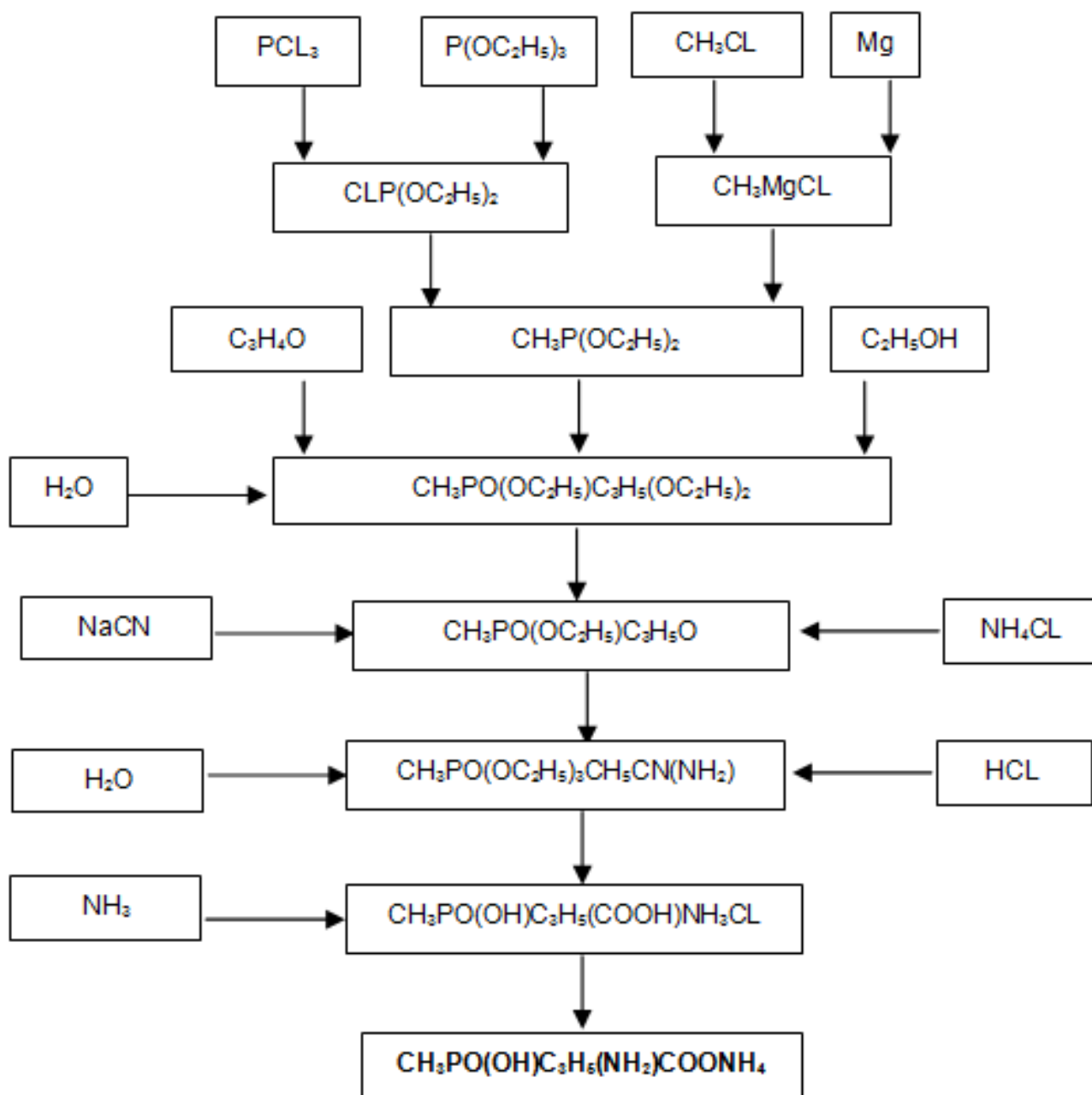
In 2020–2022, Lier Chemical, Jiangsu Sevencontinent and Yongnong BioSciences saw large increases in the output of formulations. Jiangsu Sevencontinent, in particular, has become one of the key producers of glufosinate-ammonium formulations in China, along with its vigorous promotion in the domestic market. In 2023, Weifang Rainbow's output of glufosinate-ammonium formulations rose, while Jiangsu Huifeng saw a fall in formulation production due to the unstable supply of raw materials caused by the dispute over the ownership of the 5,000 t/a glufosinate-ammonium TC project.

### 3 Production technology

There are two main routes for the industrial production of glufosinate-ammonium TC, namely Hoechst route and Strecker route. Hoechst route, which is mastered by Bayer CropScience AG, is of little pollution and low cost. But the majority of Chinese glufosinate-ammonium TC producers take Strecker route.

Strecker route has been the only route for glufosinate-ammonium production in China in recent years, which has remained complicated with many steps. Below are the key steps:

Figure 3-1 Flowchart of glufosinate-ammonium technical production in China



Source: CCM

The production technology of glufosinate-ammonium TC has been improving, and the ultimate yield is 60%–65% in China. Explosions have also been rare during production in recent years, because of Chinese producers' accumulated production experience and their efforts in technology improvement.

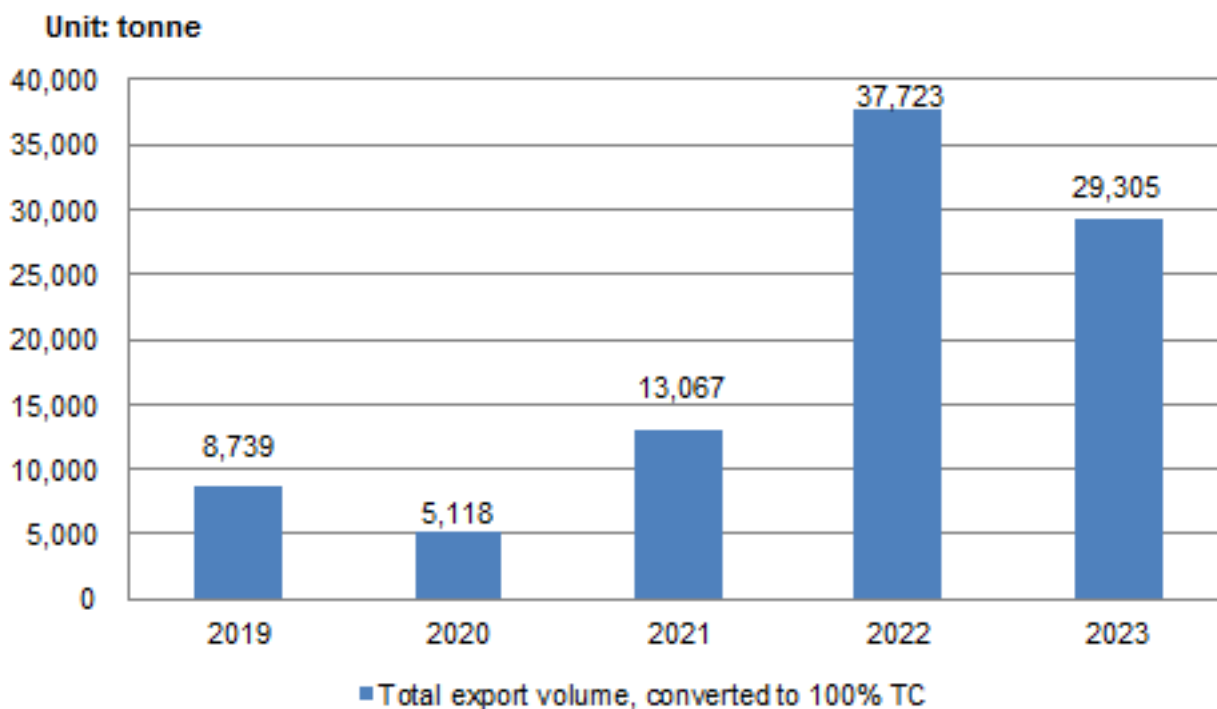
Chinese producers have made progress in their technology levels, having optimised the reaction conditions and parameters, reduced discharge of pollutants, lowered the unit consumption of raw materials and increased product yield, etc. For example, Lier Chemical has developed a new method to compound methyldiethoxyphosphine, by taking natural gas and phosphorus trichloride to produce methyl

dichlorophosphite, which then reacts with ethanol and ammonium to make the desired substance. Additionally, Lier Chemical switches from Grignard reaction to aluminium method in the production of the intermediate methyldiethoxyphosphine, which spares the trouble of recovering 2-methyltetrahydrofuran and 1,2,4-trimethylbenzene, increases yield and product quality, reduces the use of organic solvents, and cuts VOCs emissions and wastewater discharge.

The glufosinate-ammonium TC capacity of Lier Chemical was improved to 7,980 t/a in 2019. It claimed in Feb. 2019 that its subsidiary Guang'an Lier Chemical Co., Ltd. (Guang'an Lier) would start a 15,000 t/a methylphosphonous dichloride (MDP) project, and announced at the end of Dec. 2019 that the subsidiary would suspend production for upgrading (consolidation of MDP and glufosinate-ammonium technical production lines) for at least three months. In 2021, Guang'an Lier continued to improve the MDP project. In March 2023, Guang'an Lier's 95,700 t/a fine chemicals and intermediates project started construction, with the 40,000 t/a MDP production line entering trial run at present.

#### 4 Export

Figure 4-1 China's export volume of glufosinate-ammonium, 2019–2023



Source: Tranalysis

Note:

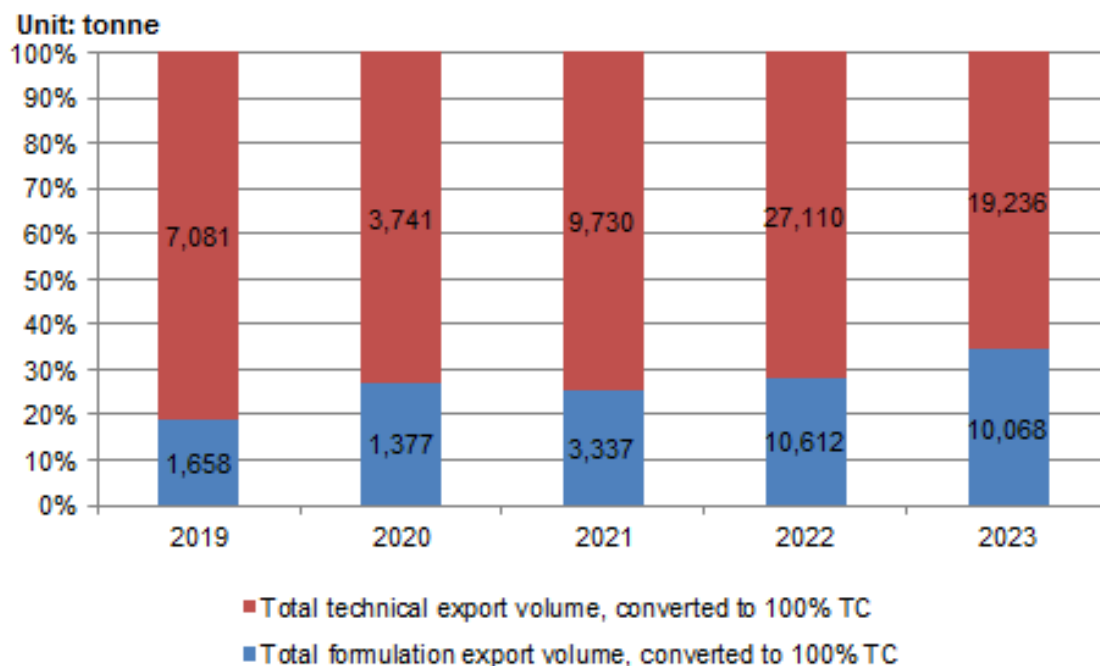
1. After April 2020, data of exports are incomplete mainly caused by the changed sources. As export data are continuously updated and refined, data prior to 2023 may be different from that in the previous issues.
2. All the volumes are calculated by 100% technical.

The export volume of glufosinate-ammonium (converted to 100% AI) in China saw continuous growth for years. However, a drop appeared as China and the world suffered from the outbreak of the COVID-19 epidemic in early 2020. Due to China's effective measures against the epidemic and the robust overseas demand, the 2021 export volume recovered, surging from 5,118 tonnes in 2020 to 13,067 tonnes, up 155.3% YoY. In 2022, as the impact of the epidemic waned, global demand for glufosinate-ammonium continued to gain momentum and glufosinate-ammonium producers gradually recovered and increased their production, with exports surging to 37,723 tonnes, up 188.7% YoY. In 2023, the export volume fell by 22.3% YoY to 29,305 tonnes, due to high inventory and decreasing demand overseas in the first half of the year.

Although glyphosate and paraquat remain the top two popular herbicides widely-used in the global market, the growing resistance to them coupled with the rising concerns over the carcinogenicity of glyphosate and the expanding bans on paraquat in more countries, give glufosinate-ammonium great opportunities to take up more market shares. The growing resistance of some weeds to glyphosate has led to the development of other herbicide-resistant transgenic crops. In recent years, the seeds of glufosinate-ammonium resistant transgenic crops have been approved worldwide. At present, glufosinate-ammonium resistant genes have been introduced into more than 20 crops such as rape, corn, cotton, wheat, and sugarcane.

In addition, in 2020 paraquat has been banned in Thailand from June and in Brazil from Sept. California state in the US also considered banning paraquat and glyphosate in the future against their poisoning effects. Once banned, paraquat on the market will be replaced by the remaining herbicides, and glufosinate-ammonium is regarded as one of the best substitutes. Therefore, overseas demand for glufosinate-ammonium will further increase.

Figure 4-2 China's export volume of glufosinate-ammonium technical and formulation, 2019–2023



Source: Tranalysis

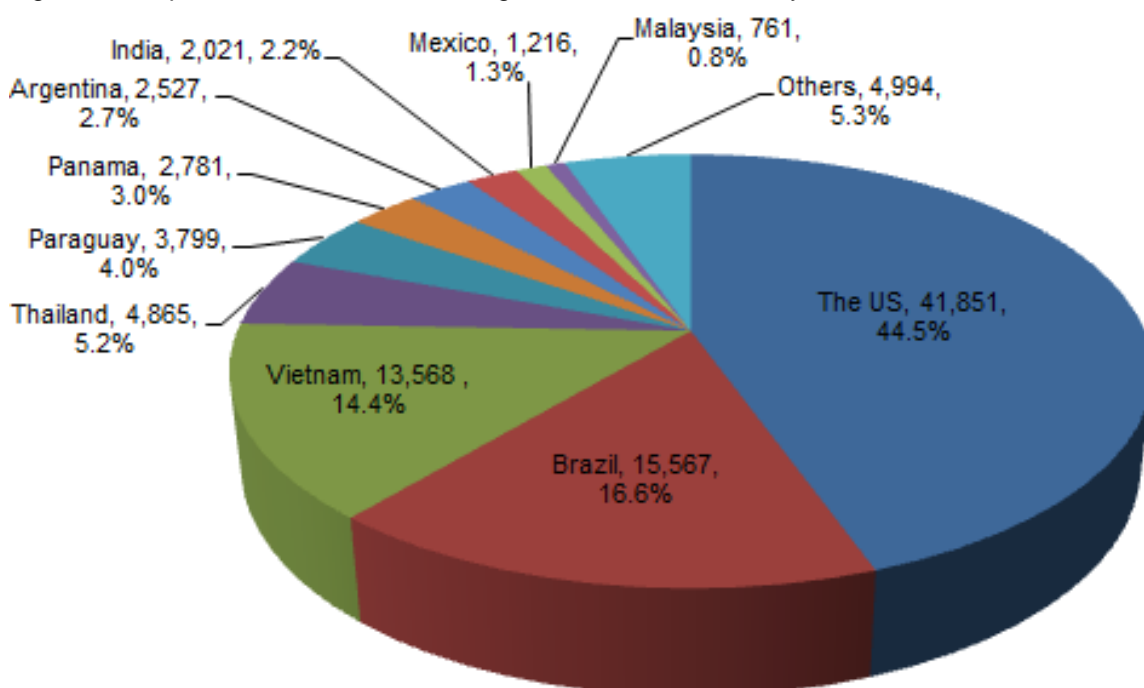
Note:

1. After April 2020, data of exports are incomplete mainly caused by the changed sources. As export data are continuously updated and refined, data prior to 2023 may be different from that in the previous issues.
2. Due to rounding-off, the annual total of export volume of glufosinate-ammonium technical and formulation (showed in Figure 4-2) is not equal to the annual total of export volume of glufosinate-ammonium (showed in Figure 4-1).
3. All the volumes are calculated by 100% technical.

China exports both glufosinate-ammonium technical and formulation products. During 2019–2023, export volume of technical products has on average accounted for 71.2% of China's glufosinate-ammonium export. In 2022, export volume of glufosinate-ammonium technical and formulation witnessed significant growth to reach 37,722 tonnes, with the technical accounting for 71.9% and formulation for 28.1%. In 2023, the technical export volume dropped slightly, accounting for 65.6% of the total and leaving 34.4% for formulation.

In 2023, producers have been more concentrated on 95% TC and 200 g/L AS production, which were the dominant specifications of glufosinate-ammonium products exported from China.

Figure 4-3 Export destinations of China's glufosinate-ammonium by volume and share, 2019–2023, tonne





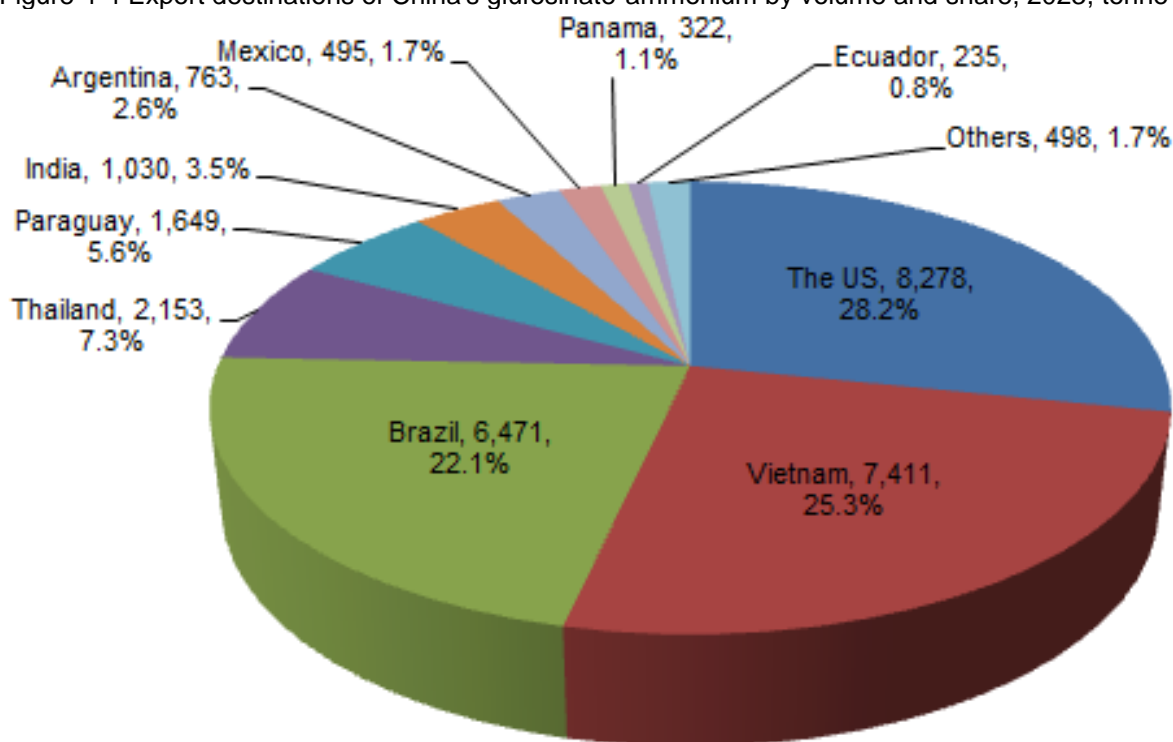
Source: Tranalysis

Note:

1. Due to rounding-off, the total export volume of China's glufosinate-ammonium by volume and share is not equal to the total of export volume of glufosinate-ammonium showed in Figure 4-1.

2. All the volumes are calculated by 100% technical.

Figure 4-4 Export destinations of China's glufosinate-ammonium by volume and share, 2023, tonne



Source: Tranalysis

Note:

1. All the volumes are calculated by 100% technical.

2. Due to rounding-off, the total share may not equal 100%.

Among the export destinations of China's glufosinate-ammonium, the US, Brazil, Vietnam, Thailand, and Paraguay were the top five in 2019–2023 by accumulated export volume, accounting for about 84.7% of the total amount.

#### 4.1 Export of glufosinate-ammonium technical in China, 2019–2023

Table 4.1-1 Export volume of glufosinate-ammonium technical in China by month, 2022–2023, tonne

Month	2022	2023	YoY change
Jan.	960.907	2,792.357	190.60%
Feb.	1,067.756	1,343.521	25.83%
March	2,625.008	1,956.651	-25.46%
April	1,968.303	1,293.858	-34.27%
May	888.447	1,497.668	68.57%
June	1,890.083	1,987.561	5.16%
July	2,814.411	1,388.158	-50.68%
Aug.	2,329.564	1,470.240	-36.89%

Sept.	2,614.362	2,094.812	-19.87%
Oct.	4,195.886	1,162.474	-72.29%
Nov.	3,799.394	1,448.428	-61.88%
Dec.	1,956.077	800.624	-59.07%
<b>Total</b>	<b>27,110.196</b>	<b>19,236.351</b>	<b>-29.04%</b>

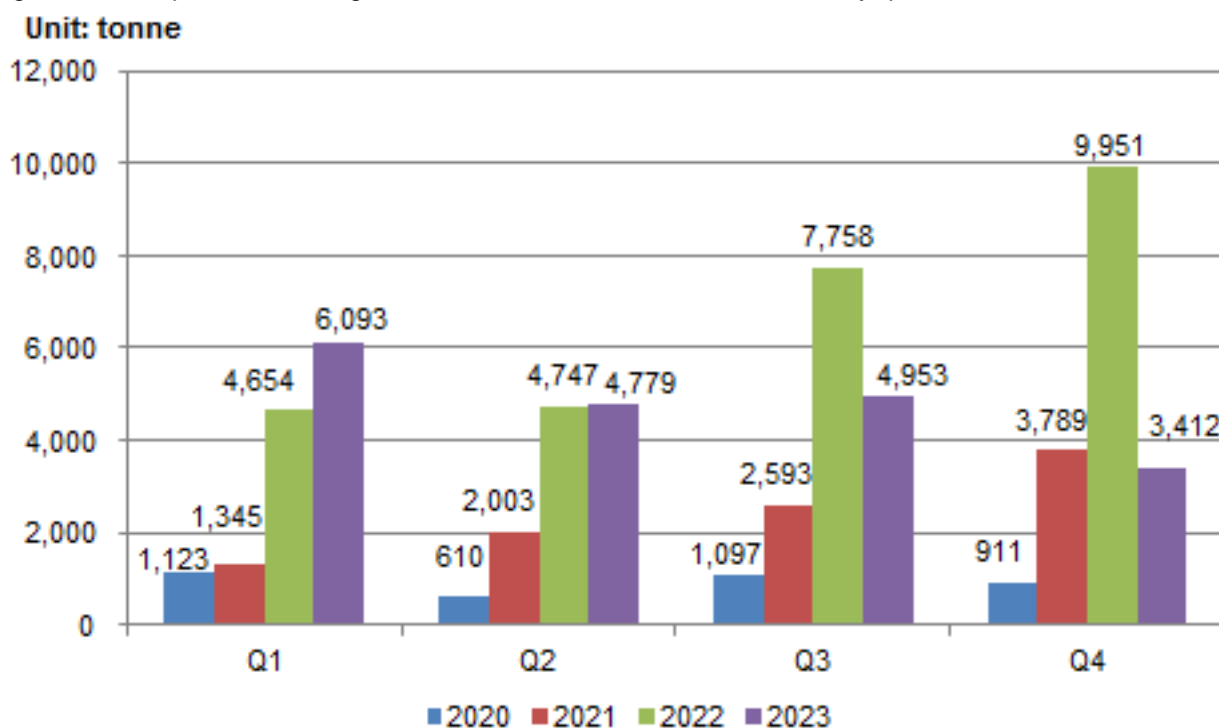
Source: Tranalysis

Note:

1. Export volume here refers to the total amount of five specifications, including 95% TC, 96% TC, 97% TC, 98% TC and 50% TK. All the volumes are calculated by 100% technical.

2. Since May 2020, China's export data are sourced from the customs of various destinations. As export data are continuously updated and refined, data in 2022 may be different from that in the previous issue.

Figure 4.1-1 Export volume of glufosinate-ammonium technical in China by quarter, 2020–2023



Source: Tranalysis

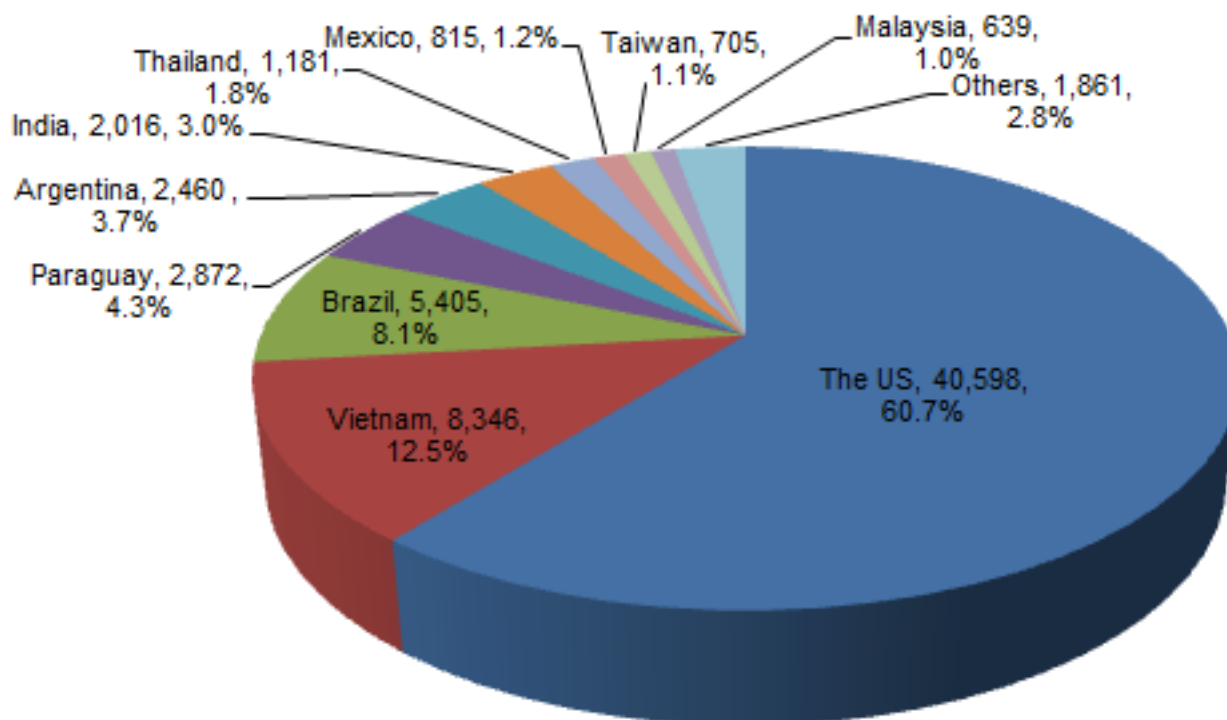
Note:

1. Export volume here refers to the total amount of five specifications, including 95% TC, 96% TC, 97% TC, 98% TC and 50% TK.

2. Since May 2020, China's export data are sourced from data of the customs of various destinations. As export data are continuously updated and refined, data prior to 2023 may be different from that in the previous issues.

3. All the volumes are calculated by 100% technical.

Figure 4.1-2 Export destinations of China's glufosinate-ammonium technical by volume and share, 2019–2023, tonne

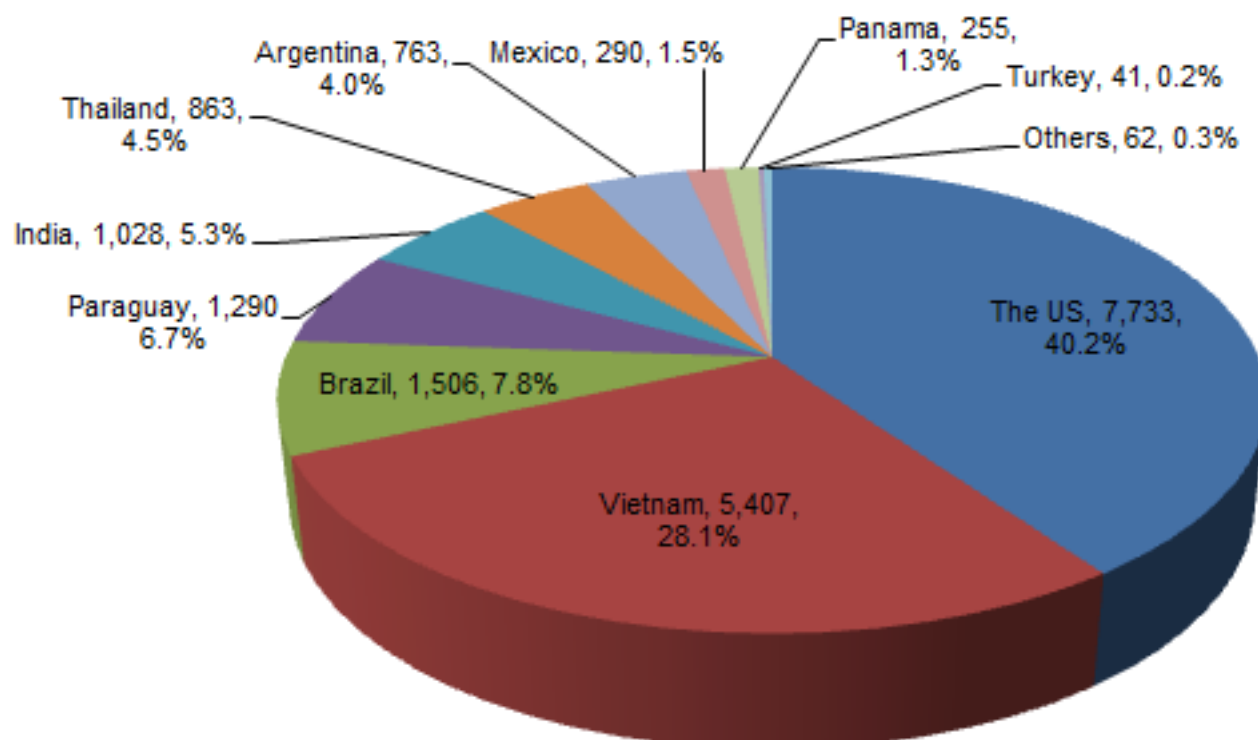


Source: Tranalysis

Note:

1. There are five specifications of glufosinate-ammonium technical produced in China, i.e. 95% TC, 96% TC, 97% TC, 98% TC and 50% TK.
2. All the volumes are calculated by 100% technical.

Figure 4.1-3 Export destinations of China's glufosinate-ammonium technical by volume and share, 2023, tonne



Source: Tranalysis

Note:

1. There are five specifications of glufosinate-ammonium technical produced in China, i.e. 95% TC, 96% TC, 97% TC, 98% TC and 50% TK.
2. All the volumes are calculated by 100% technical.

The US, Vietnam, Brazil, Paraguay and India were the top five export destinations in 2023, accounting for 88.1% of the total volume of exported glufosinate-ammonium technical.

#### 4.2 Export of glufosinate-ammonium formulations in China, 2019–2023

Table 4.2-1 Export volume of glufosinate-ammonium formulations in China by month, 2022–2023, tonne

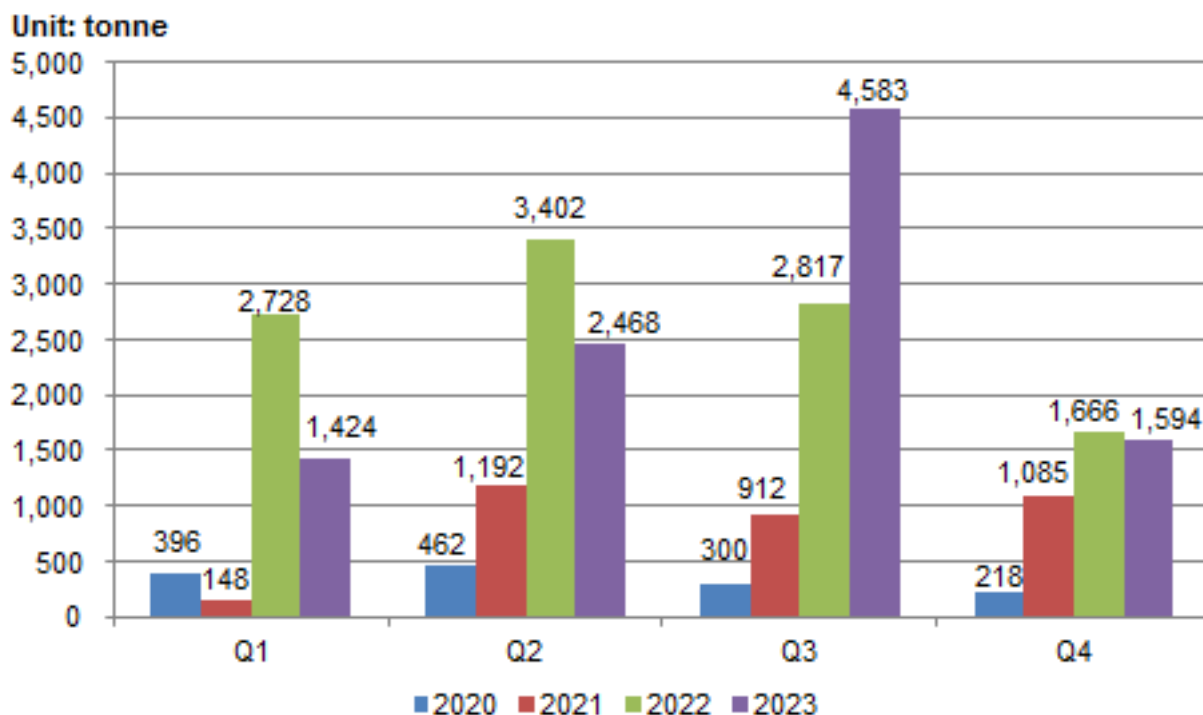
Month	2022	2023	YoY change
Jan.	396.726	540.088	36.14%
Feb.	501.249	550.774	9.88%
March	1,829.999	332.983	-81.80%
April	1,028.087	527.319	-48.71%
May	1,267.532	935.559	-26.19%
June	1,106.319	1,005.388	-9.12%
July	1,137.685	1,003.251	-11.82%
Aug.	866.151	1,891.631	118.39%
Sept.	812.887	1,687.627	107.61%
Oct.	618.548	956.751	54.68%
Nov.	531.726	367.340	-30.92%
Dec.	515.502	269.525	-47.72%
<b>Total</b>	<b>10,612.412</b>	<b>10,068.236</b>	<b>-5.13%</b>

Source: Tranalysis

Note:

1. Export volume here refers to the total amount of formulations including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG. All the volumes are calculated by 100% technical.
2. Since May 2020, China's export data are sourced from data of the customs of various destinations. As export data are continuously updated and refined, data in 2022 may be different from that in the previous issue.

Figure 4.2-1 Export volume of glufosinate-ammonium formulations in China by month, 2020–2023



Source: Tranalysis

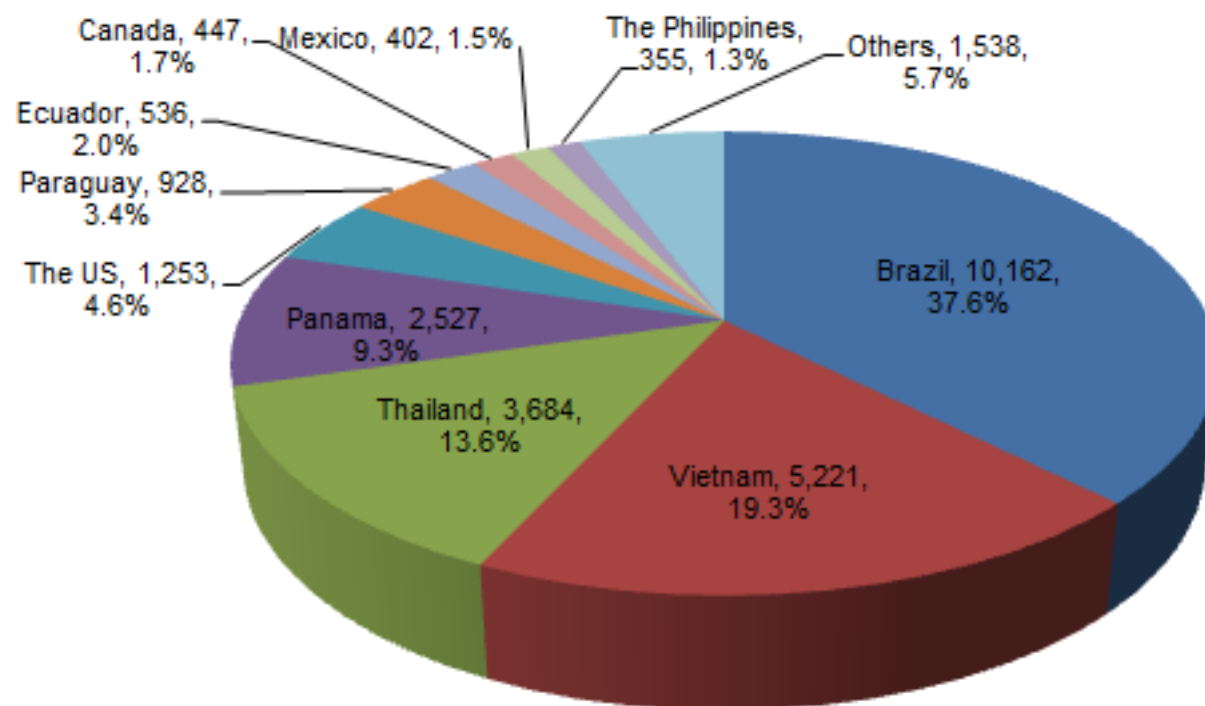
Note:

1. Export volume here refers to the total amount of formulations, including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG.

2. Since May 2020, China's export data are sourced from data of the customs of various destinations. As export data are continuously updated and refined, data prior to 2023 may be different from that in the previous issues.

3. All the volumes are calculated by 100% technical.

Figure 4.2-2 Export destinations of China's glufosinate-ammonium formulations by volume and share, 2019–2023, tonne



Source: Tranalysis

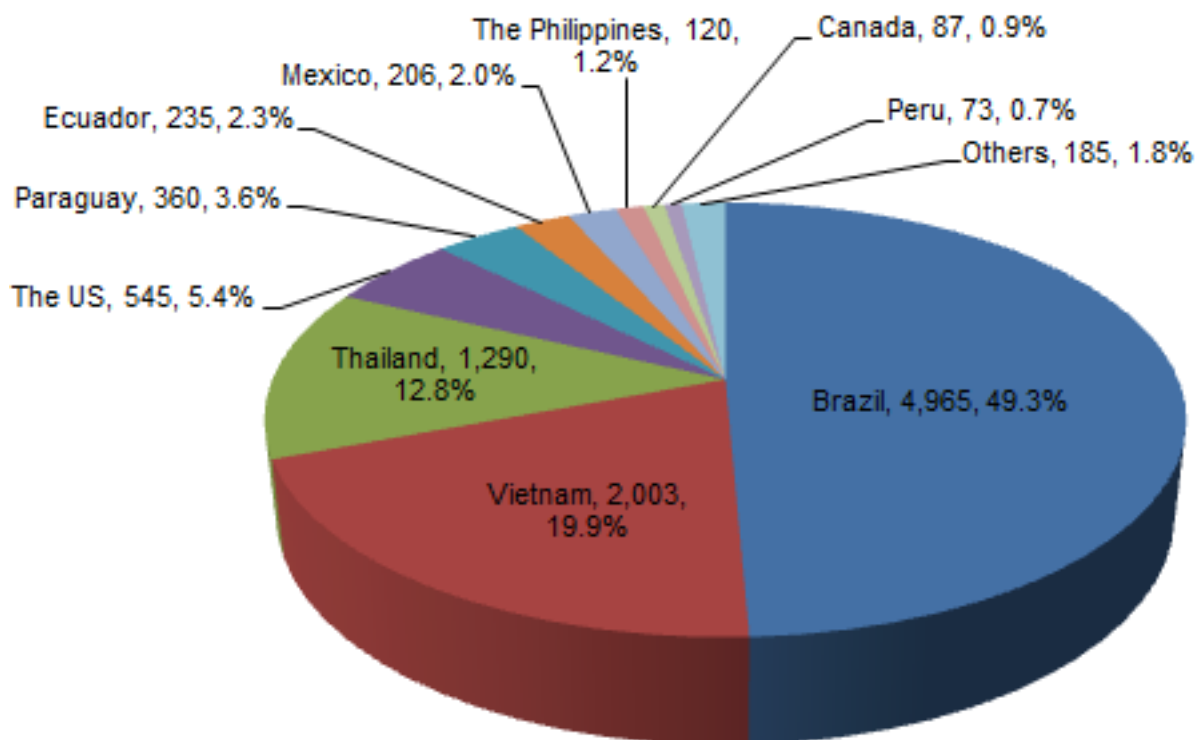
Note:

1. Export volume here refers to the total amount of formulations including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG.

2. All the volumes are calculated by 100% technical.

3. Due to rounding-off, the total share may not equal 100%.

Figure 4.2-3 Export destinations of China's glufosinate-ammonium formulations by volume and share, 2023, tonne



Source: Tranalysis

Note:

1. Export volume here refers to the total amount of formulations including 100 g/L AS, 150 g/L AS, 180 g/L AS, 200 g/L AS, 50% AS, 150 g/L SL, 180 g/L SL, 200 g/L SL, 280 g/L SL, 80% SG and 88% SG.

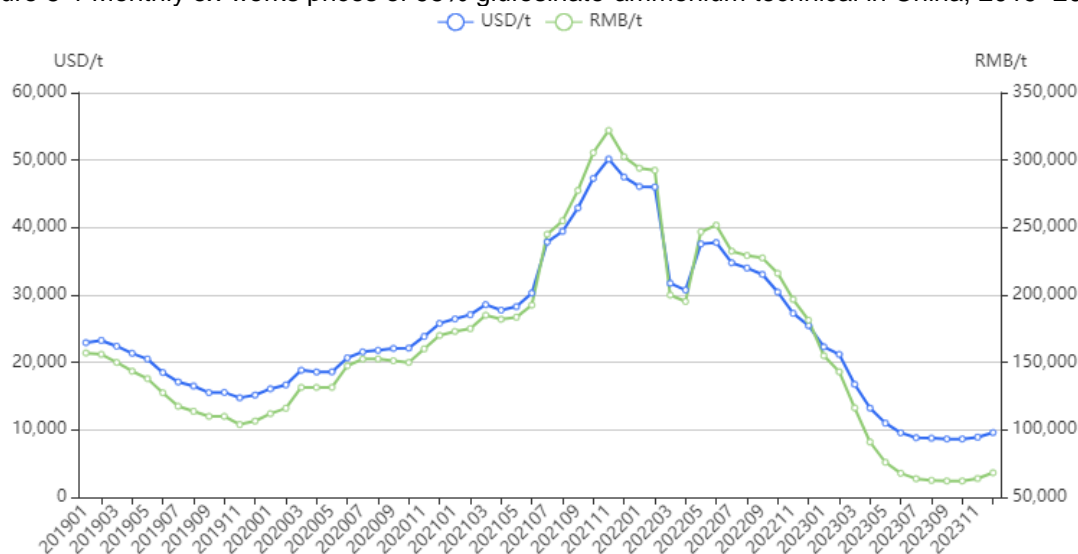
2. All the volumes are calculated by 100% technical.

3. Due to rounding-off, the total share may not equal 100%.

Brazil, Vietnam, Thailand, the US and Paraguay were the top five export destinations in 2023, accounting for 91.0% of the total volume of exported glufosinate-ammonium formulations.

## 5 Price

Figure 5-1 Monthly ex-works prices of 95% glufosinate-ammonium technical in China, 2019–2023



Source: CCM

During 2019, domestic ex-works price of glufosinate-ammonium TC was in a downtrend and slipped by about 32%, mainly caused by more glufosinate-ammonium TC capacity expansion worldwide.

Since the outbreak of the COVID-19 pandemic, the price has kept increasing. In H1 2021, the overseas demand for China's glufosinate-ammonium TC grew, but the inventory was insufficient, which worsened due to limited production capacity of manufacturers and unstable production of its raw material diethyl phosphite (DEP). The ex-works price of 95% TC stood high in Nov. 2021 at USD50,162/t, up 210% from Nov. 2019, driven by tight supply and rising costs of raw materials.

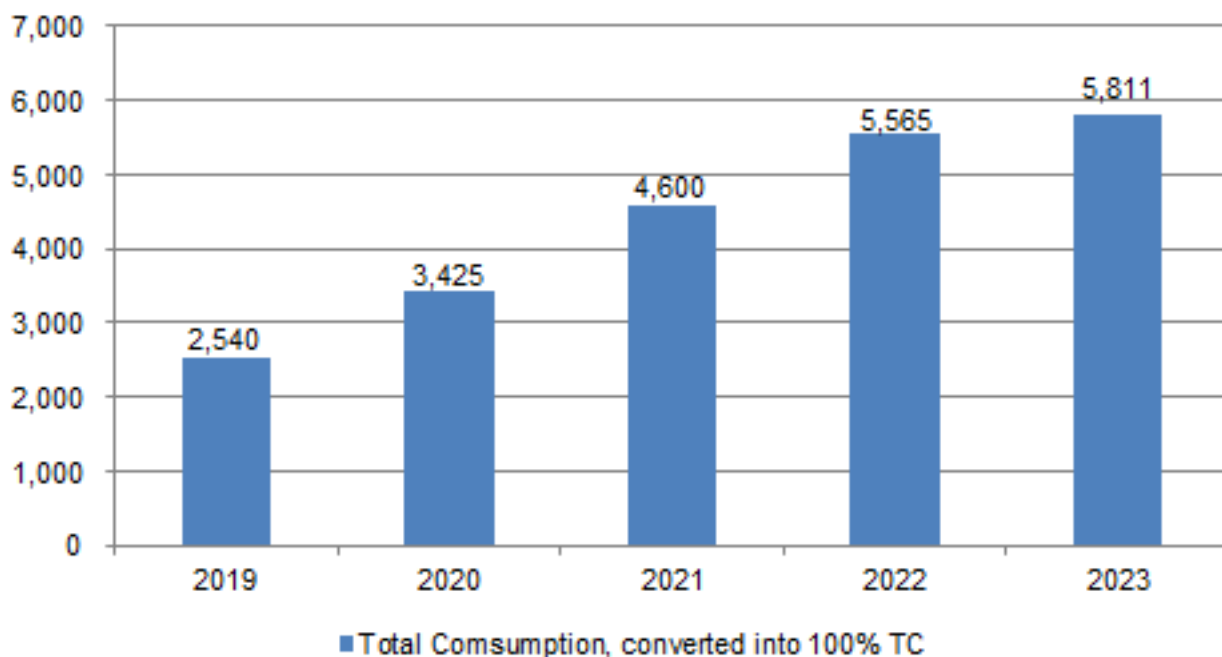
Thanks to the completion and operation of new capacities in China, the ex-works price started to go down in Dec. 2021 and dipped to USD30,736/t in April 2022, down 39% from the peak in Nov. 2021. However, the price recovered from April to June as a result of the sustained increase in the price of yellow phosphorus. From July to Dec., with the pesticide market gradually entering the off-season and the continued release of production capacity, the ex-works price of glufosinate-ammonium TC continued to fall to USD25,455/t in Dec.

In Jan.–Aug. 2023, the product still saw a sustained decline in pricing, quoted at USD8,768/t in Aug., slumping by 66% compared with that in Dec., 2022, with the relatively high inventory overseas and continued sluggish demand being the main contributors for the price drop. From late Aug. to Oct., the price was flatlining, as most overseas inventory had been consumed and some glufosinate-ammonium TC purchasers began to actively stock up. Besides, the ex-works price of the product had been close to cost price and meagre profits led producers to cut production or even put the production on hold, and turn to purchasing glufosinate-ammonium TC from other manufacturers to satisfy their own production needs for formulated products. Glufosinate-ammonium TC witnessed a rise in quotation when heading into the peak storage season in Nov., and was quoted at USD9,592/t in Dec. However, the downstream demand for the product in fact did not grow significantly amid dull market, and the price increase was mainly driven by manufacturers' insistent demands for higher price.

## 6 Domestic consumption

Figure 6-1 Consumption of glufosinate-ammonium in China, 2019–2023, tonne

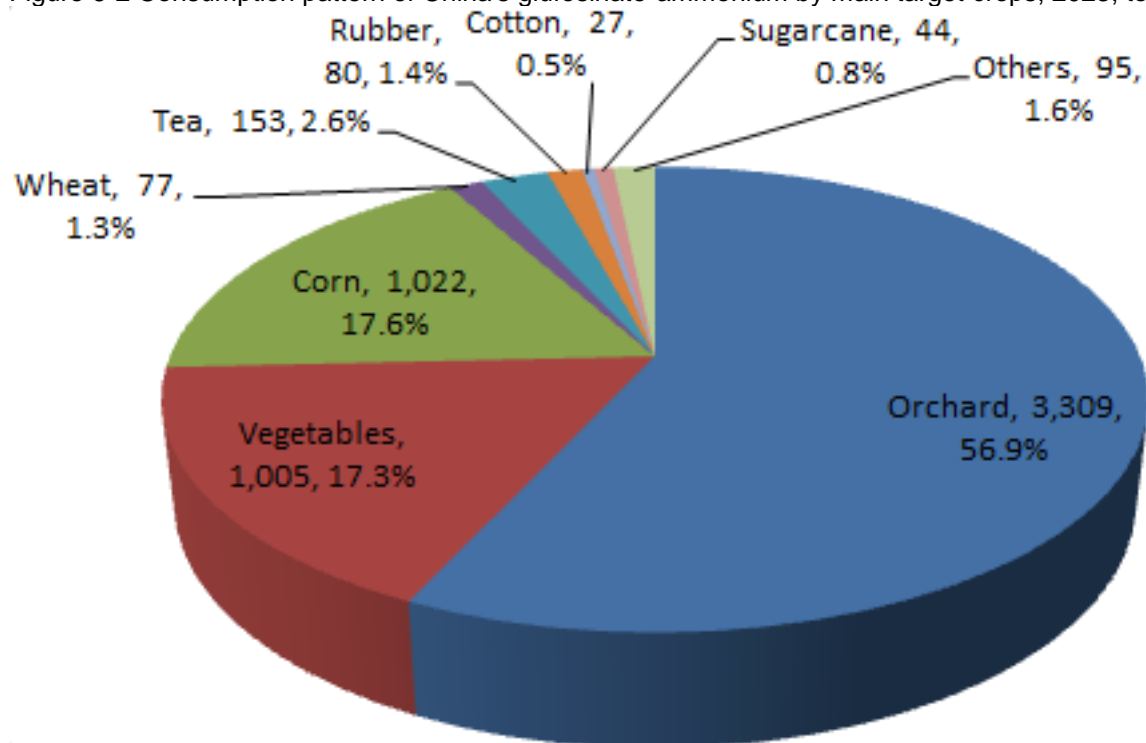
Unit: tonne



Source: CCM

Note: The resulting consumption is rounded up.

Figure 6-2 Consumption pattern of China's glufosinate-ammonium by main target crops, 2023, tonne



Source: CCM

Note:

1. The consumption in this figure is all the specifications' consumption converted to 95% TC, including both technicals and formulations of glufosinate-ammonium.

2. The consumption of the specification converted in 95% TC = the actual consumption of the specification \* its content rate of active ingredient of glufosinate-ammonium / 0.95.

Glufosinate-ammonium is a non-selective herbicide and its quick effectiveness falls between paraquat's and glyphosate's. It is commonly used in orchards, vineyards, potato fields, and non-crop land for control of



annual and perennial dicotyledonous weeds and gramineous weeds. In 2019–2023, consumption of glufosinate-ammonium in China increased from 2,540 tonnes to 5,811 tonnes, with a CAGR of 23.0%. However, its high price made the domestic consumption not much compared with export.

In China, glyphosate is the most consumed herbicide. In terms of the weeding effect, long-term use of glyphosate will generate the weeds' resistance to glyphosate, which will affect crop yields. Glyphosate is not as effective against *eleusine indica* and *conyza canadensis* as before, while there is no such problem in the use of glufosinate-ammonium. As a result, compound utilisation of these two herbicides is an inevitable trend. More and more Chinese producers start to produce glufosinate-ammonium and the production cost continuously goes down. Besides, in July 2016, China completely banned the sale and use of paraquat AS, which provides a good opportunity for glufosinate-ammonium's development.

Table 6-1 Planting areas of glufosinate-ammonium's main target crops in China, 2019–2023, '000 ha

Crop	2019	2020	2021	2022	2023
Orchard	12,277	12,646	12,962	13,547	13,873
Vegetables	20,863	21,485	21,744	22,356	23,854
Corn	41,284	41,264	43,320	43,066	44,220
Wheat	23,728	23,380	23,570	23,533	23,630
Tea	3,105	3,217	3,264	3,200	3,395
Rubber	1,143	1,010	1,217	1,133	1,146
Cotton	3,339	3,169	3,028	3,100	2,790
Sugarcane	1,391	1,353	1,326	1,340	1,288
<b>Total planting area</b>	<b>107,129</b>	<b>107,524</b>	<b>110,431</b>	<b>111,275</b>	<b>114,196</b>

Source: National Bureau of Statistics of China & CCM

Table 6-2 Application parameters of glufosinate-ammonium in main target crops in China, 2023

Crop	Annual application frequency	Usage, g(AI)/ha	Rate per application
Orchard	1	450	53.0%
Vegetables	1	430	9.8%
Corn	1	500	4.6%
Wheat	1	250	1.3%
Tea	1	250	18.0%
Rubber	1	250	28.0%
Cotton	1	250	3.8%
Sugarcane	1	500	6.8%

Source: CCM

Glyphosate, one of the sterilant herbicides, is generally not for the crops which have shallow roots or whose roots are exposed, such as vegetables, parsley, pepper, grapes, and papaya, while glufosinate-ammonium is almost applicable to all crops. It is mainly registered for application in areas like non-crop land, rubber, tea, orchard and vegetables. However, because of the relatively high prices of glufosinate-ammonium products,

the largest consumption field for glufosinate-ammonium is orchard with high economic value, and the second goes to corn.

Since glufosinate-ammonium eliminates grass by contact, its herbicidal effect is mainly influenced by three factors—humidity, temperature and light condition. Once under an environment with relatively high humidity and temperature, as well as good light conditions, it works better. In China, the agricultural planting structure is adjusted annually and thus the planting area of glufosinate-ammonium's main targets fluctuates. However, the growing resistance to glyphosate, prohibition of paraquat AS and the rising application rate of glufosinate-ammonium all make its domestic consumption increase rapidly. However, there was a slowdown in domestic demand for glufosinate-ammonium, as the expansion of orchard planting areas had been restricted in recent years due to the "returning forests to farmland" policy.

## 7 Conclusions

In 2019–2023, China's glufosinate-ammonium production has been in a fast expansion period, with significant growth in capacity and output. However, the export volume saw fluctuations during this period, with growth slowing down in 2019 and even a large drop in 2020. Since the US is the No.1 importer of glufosinate-ammonium from China, the trade war and tariffs might explain the slowdown and decline, in addition to the COVID-19 epidemic. In 2022, as the impact of the COVID-19 epidemic diminished, glufosinate-ammonium producers gradually recovered their production capacity and global demand for glufosinate-ammonium continued to grow, resulting in a significant increase in export volume. In 2023, due to the high inventory of glufosinate-ammonium overseas, the export volume of glufosinate-ammonium decreased.

In the future, the market demand for glufosinate-ammonium is expected to remain robust for the reasons as follows:

- Expanding scale of paraquat prohibition worldwide;
- Development of glufosinate-ammonium and glyphosate mixed formulations;
- Increasing cultivation of glufosinate-ammonium tolerant crops, stacked glyphosate/glufosinate traits crops, and stacked glufosinate/dicamba traits crops.

China is still the biggest exporter of glufosinate-ammonium in the global market. In China, many producers intend to expand glufosinate-ammonium capacity in the next few years, even though they have to tackle key issues like relatively high production costs, technical barriers, and strict environmental inspections. The price of glufosinate-ammonium has dropped due to the capacity expansion in recent years, producers has stepped up efforts for technological transformation and upgrading and enhancing their production techniques to improve yield and reduce costs, so as to carve out a niche in the glufosinate-ammonium market.

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