

Survey of Phosphorus Industry in China

The Seventh Edition

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Kcomber Inc.

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Executive summary

Phosphate rock is the upstream source of phosphorus element. The distribution of the phosphate rock reserves in the world is uneven; they are primarily distributed in Morocco and Western Sahara. In China, most of the phosphate rock reserves are distributed in provinces including Hubei, Yunnan, Guizhou and Sichuan. China's yearly output of phosphate rock from 2017 to 2020 presented a downtrend. Yet in 2021, bolstered by the strong market demand, the output of phosphate rock moved up, which ended the continuous drop in the past four years. At present, the reserves-production ratio of phosphate rock in China is lower than the world average. And the pressure to protect the phosphate rock resources is intense, as serious over-exploitation still exists in China.

As for its application, phosphate rock is mostly used in the production of phosphate fertilizers. However, the production capacity for phosphate fertilizers in China has been declining in recent years, due to China's supply-side structural reform, increasingly stringent environmental regulation, and fluctuations in downstream demand. Since 2017, the outputs of DAP and MAP have been dropping in general. However, the output of MAP in 2021 climbed year on year, owing to increased export demand. In 2021, 15,473,000 tonnes of MAP and 13,544,000 tonnes of DAP were produced in China.

The output of yellow phosphorus in China accounts for a large proportion in the world. However, the rectification of environmental nonconformities in the yellow phosphorus industry is still in progress, because higher requirements of environmental protection and energy conservation have been imposed on the industrial production in the wake of China's economic development. From 2017 to 2021, China's yellow phosphorus output showed a downtrend overall. The capacity for yellow phosphorus in China was still 1,259,000 t/a in 2021, and the output decreased by 18.68% year on year to 632,250 tonnes, with an annual average ex-works price of USD4077.67/t, 78% higher than that in 2020.

Methodology

Research scope and targets

This research aims to study China's phosphorous industry by product categories, which include phosphate rock, phosphate fertilizer and yellow phosphorus.

Region scope: China

Time scope: primarily 2017 to 2021 unless otherwise stated

Methodology and sources

This report is based on data collected with diverse methods, which are listed as follows:

Desk research

This includes access to published magazines, journals, government, industry and Customs statistics, association seminars as well as information from the Internet. A lot of work has gone into the compilation and analysis of the obtained information. Data collected and compiled are variously sourced from:

- CCM's database
- Published articles from periodicals, magazines, journals, and third-party database
- Statistics from governments and international institutes
- Customs statistics
- Comments from industrial experts on various platforms
- Information from the Internet

Telephone interview targets

- Key producers
- Key traders
- Industrial associations
- Industrial experts

Data compilation and crosscheck

Data obtained from various sources have been combined and cross-checked to ensure that this report is as accurate and methodologically sound as possible.

Units and abbreviations

Units

tonne: equals to metric ton in this report

t/a: tonne per annum

CNY: currency code, China Yuan

RMB: Ren Min Bi, name of Chinese currency

USD: currency code, United States Dollar

Abbreviations

CAGR: compound annual growth rate

CCMA: China Chemical Mining Association

DAP: Diammonium phosphate

MAP: Monoammonium phosphate

MLR: Ministry of Land and Resources of the People's Republic of China

P₂O₅: Phosphorus pentoxide

The EU: the European Union

The US: the United States of America

USGS: the United States Geological Survey

NBS: National Bureau of Statistics of the People's Republic of China

Table Exchange rate USD/CNY, 2017–2021

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
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

Source: The People's Bank of China

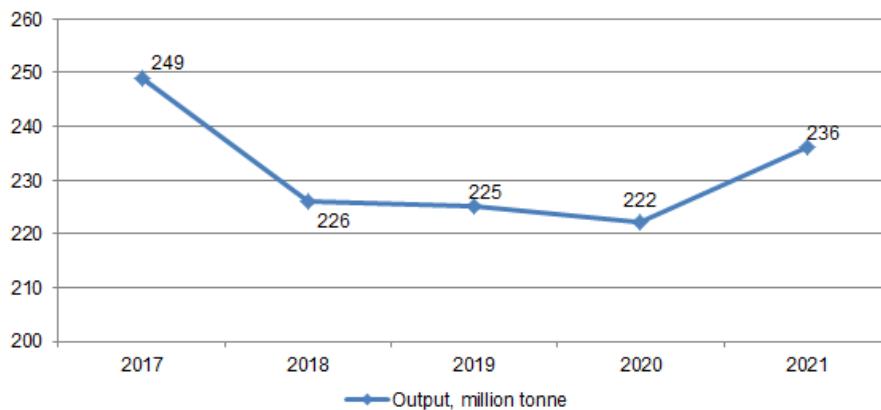
1 Phosphate rock

1.1 Overview of global phosphate rock

The estimated global output of phosphate rock in 2021 climbed by 6.10% compared to the output in 2020, and went down by 5.27% compared to the output in 2017.

The global output of phosphate rock declined year by year from 2017 to 2020, which can be attributed to the efforts to protect the environment and non-renewable phosphate rock resources. Some countries began to control their own phosphate rock production, and protected their local resources by importing phosphate rock from overseas and restricting exports. It is predicted that the tight supply of phosphate rock in the global market will become a general trend.

Figure 1.1-1 Global phosphate rock output, 2017–2021E



Source: United States Geological Survey (USGS), National Bureau of Statistics of the People's Republic of China (NBS), CCM

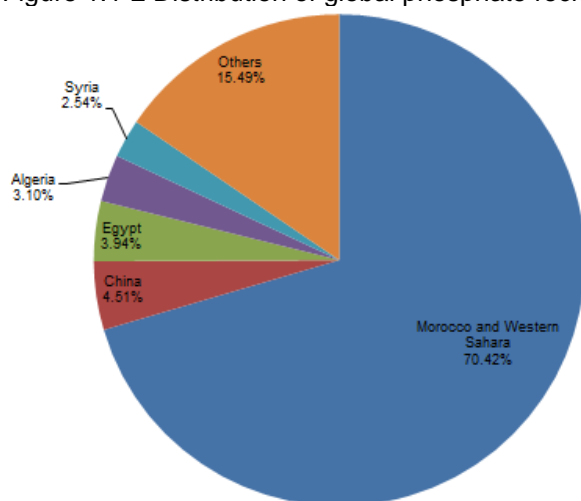
Table 1.1-1 Global phosphate rock output and economic reserves, 2017–2021E, '000 tonne

Region	Output					Reserves 2021
	2017	2018	2019	2020	2021E	
China	123,132	96,326	93,324	88,933	102,899	3,200,000
Morocco and Western Sahara	30,000	34,800	35,500	37,000	38,000	50,000,000
The US	27,900	25,800	23,300	24,000	22,000	1,000,000
Russia	13,300	14,000	13,100	13,000	14,000	600,000
Jordan	8,690	8,020	9,220	9,200	9,200	1,000,000
Saudi Arabia	5,000	6,090	6,500	6,500	8,500	1,400,000
Brazil	5,200	5,740	4,700	5,500	5,500	1,600,000
Egypt	4,400	5,000	5,000	5,000	5,000	2,800,000
Vietnam	3,000	3,300	4,650	4,700	4,700	30,000

Peru	3,040	3,900	4,000	4,000	3,800	210,000
Tunisia	4,420	3,340	4,110	4,000	3,200	100,000
Israel	3,850	3,550	2,810	2,800	3,000	53,000
Australia	3,000	2,800	2,700	2,700	2,200	1,100,000
Senegal	1,390	1,650	3,420	3,500	2,200	50,000
South Africa	2,080	2,100	2,100	2,100	2,000	1,600,000
Kazakhstan	1,500	1,300	1,500	1,500	1,500	260,000
India	1,590	1,600	1,480	1,500	1,400	46,000
Algeria	1,300	1,200	1,300	1,300	1,200	2,200,000
Togo	825	800	800	800	1,200	30,000
Mexico	1,930	1,540	558	600	530	30,000
Syria	100	100	2,000	360	N/A	1,800,000
Others	2,980	2,859	3,035	3,000	3,500	1,891,000
World total	248,627	225,815	225,107	221,993	235,529	71,000,000

Note: Data of output for 2021 are estimated, except that for China.
Source: USGS, NBS, CCM

Figure 1.1-2 Distribution of global phosphate rock marketable reserves by region, 2021



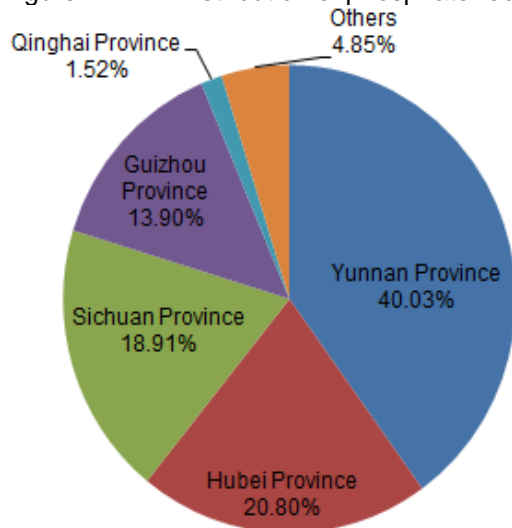
Source: USGS, CCM

1.2 Phosphate rock in China

1.2.1 Distribution of phosphate rock reserves, 2021

In 2021, the proven phosphate rock reserves in China were about 3,200 million tonnes, which was basically unchanged compared to that in 2020. Most of the phosphate rock reserves in China are distributed in provinces including Yunnan, Hubei, Sichuan, and Guizhou.

Figure 1.2.1-1 Distribution of phosphate rock reserves in China by region, 2021



Source: CCM

1.2.2 Output of phosphate rock, 2017–2021

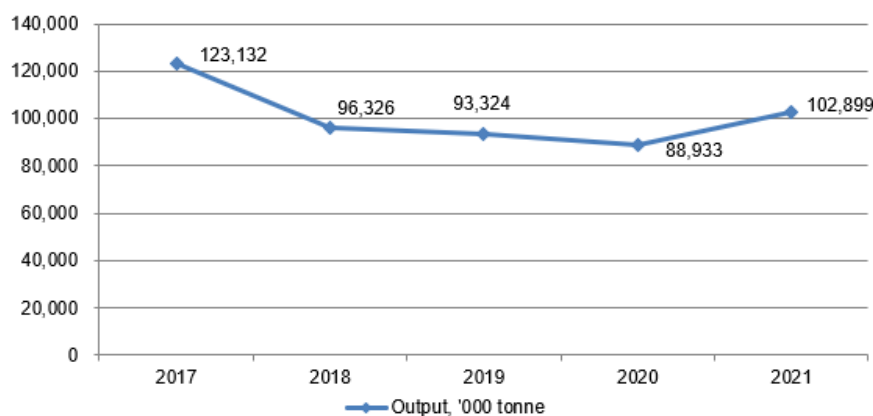
China's yearly output of phosphate rock from 2017 to 2020 presented a downtrend. Yet in 2021, bolstered by the strong market demand, the output of phosphate rock moved up, which ended the continuous drop in the past four years.

China's phosphate rock outputs in 2017 and 2018 decreased by 14.7% and 21.8% YoY respectively, because of the restriction on exploitation that was for the purpose of protecting ecological environment. And a year-on-year drop of 3.1% was witnessed in China's phosphate rock output for 2019, continuing the downtrend.

In 2020, the output of phosphate rock in China registered a year-on-year decline of 4.7%. Specifically, the outputs in Hubei Province and Sichuan Province increased by 2.6% and 10.2% YoY respectively, whereas the outputs in Yunnan Province and Guizhou Province declined by 10.8% and 14.8% YoY respectively. Notably, the output in Henan Province went up by 65.9% YoY.

In 2021, the output of phosphate rock in China saw a year-on-year growth of 15.7%. Specifically, the outputs in Hubei Province, Guizhou Province and Yunnan Province increased by 26.3%, 13.2% and 12.0% YoY respectively, whereas that in Sichuan Province declined by 6.8% YoY.

Figure 1.2.2-1 Output of phosphate rock in China, 2017–2021



Source: CCM

Table 1.2.2-1 Output of phosphate rock in China by region, 2021

Region	Output, '000 tonne	Proportion
Hubei Province	48,353	47.0%
Guizhou Province	24,154	23.5%
Yunnan Province	20,237	19.7%
Sichuan Province	7,846	7.6%
Henan Province	1,215	1.2%
Others	1,094	1.1%
Total	102,899	100.0%

Source: CCM

1.2.3 Price of phosphate rock, 2017–2021

During the period from 2017 to 2021, the ex-works price of phosphate rock in China was rising while slightly fluctuating.

In 2018, with the increasingly strict implementation of environmental protection policies in the Yangtze River Economic Belt, production of phosphate rock was restricted, yet market demand for the product rose, and then the price continued rising.

In 2019, the annual average price of phosphate rock increased a bit. The monthly price stayed relatively high into mid-Q3, though it dropped in Q2 when the output was stable while the demand from phosphate fertilizer industry was sluggish. Many phosphate rock suppliers chose price cut to avoid overstock. Later in Q4, as phosphate fertilizer manufacturers started winter stockpile for spring farming, the price of phosphate rock recovered a bit.

In 2020, the price of phosphate rock was generally lower than that in previous year because of COVID-19 pandemic and it was not until Q4 that it gained enough momentum from downstream demand to jump higher.

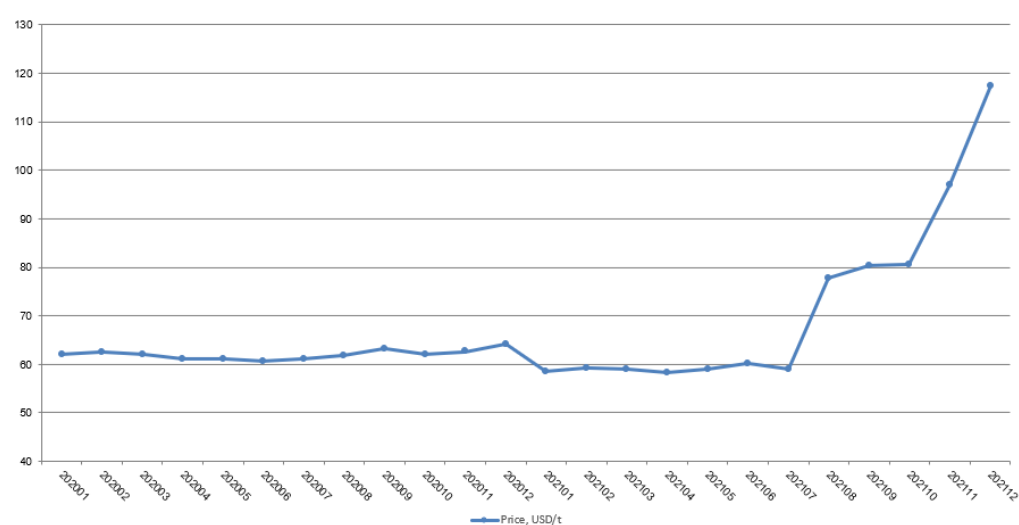
In 2021, the demand for phosphorus rock exceeded its supply, and the price rose dramatically. This was mainly due to the rapid rise of downstream demand, and it was difficult for suppliers to meet the increasing demand due to the impact of stringent environmental protection policies and transportation problems.

Table 1.2.3-1 Ex-works price of 29% phosphate rock in China, 2017–2021

Year	Ex-works price, USD/t												Annual average
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
2017	52.5	52.6	52.4	52.5	52.5	54.1	54.7	55.4	56.4	57.0	58.5	58.7	54.8
2018	60.1	61.7	61.5	61.9	61.3	64.8	62.7	60.8	61.8	61.6	61.0	61.2	61.7
2019	62.1	63.4	63.5	63.7	63.5	62.1	62.9	62.7	61.0	61.2	61.4	61.6	62.4
2020	62.1	62.5	62.0	61.1	61.2	60.6	61.2	61.8	63.1	62.0	62.6	64.1	62.0
2021	58.5	59.2	59.1	58.3	58.9	60.2	59.1	77.7	80.4	80.5	97.0	117.4	72.2

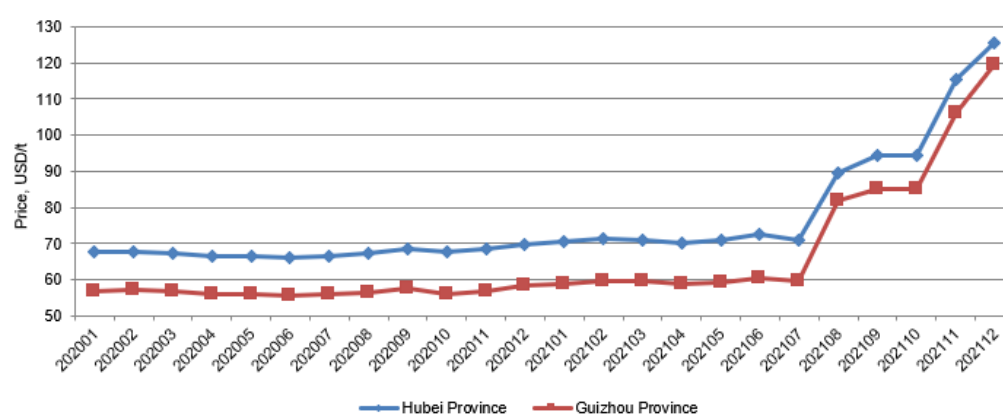
Source: CCM

Figure 1.2.3-1 Monthly ex-works price of 29% phosphate rock in China, 2020–2021



Source: CCM

Figure 1.2.3-2 Monthly ex-works price of phosphate rock in China by region, 2020–2021



Source: CCM

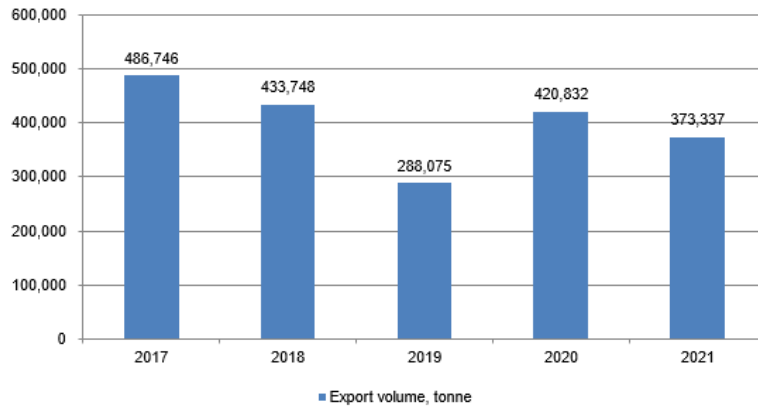
1.2.4 Export analysis of phosphate rock, 2017–2021

China's export volume of phosphate rock during 2017–2019 was in a continuous downtrend; subsequently, it climbed in 2020 but dropped again in 2021. Although China lowered tariffs on phosphate rock exports in 2018 and later eliminated them in 2019, plus canceled the quota on phosphate rock exports in 2019, the export volume during 2017–2021 was in downtrend

overall, which can be attributed to three factors including restrictive policies promulgated by the local authorities in some of the major producing areas of phosphate rock in order to control exports, increasingly stringent environmental policies, and governmental efforts to protect the resources from over-exploitation.

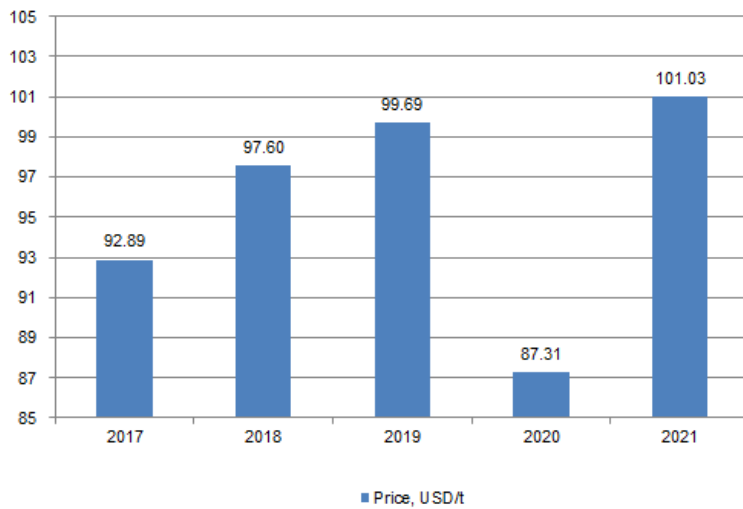
As for the export price, the average export price of phosphate rock climbed year by year from 2017 to 2021, except for the slight decline in 2020.

Figure 1.2.4-1 China's export volume of phosphate rock, 2017–2021



Source: CCM

Figure 1.2.4-2 Annual average export prices of phosphate rock from China, 2017–2021



Source: CCM

2 Phosphate fertilizers in China

Phosphate fertilizers are chemical fertilizers containing phosphorus and can be categorized into water-soluble phosphate fertilizers, citrate-soluble phosphate fertilizers and insoluble phosphate fertilizers, in terms of solubility and availability to plants.

- **Water-soluble phosphate fertilizers** are the most widely used phosphate fertilizers with a wide application scope, which can easily be absorbed into the soil. The main products include monoammonium phosphate (MAP), diammonium phosphate (DAP), single super phosphate (SSP), triple super phosphate (TSP), etc.
- **Citrate-soluble phosphate fertilizers** come with good physical properties, which are insoluble in water, but soluble in weak acids, such as 2% citric acid. The main products include fused calcium-magnesium phosphate (FMP), thomas phosphatic fertilizer and precipitated phosphate.
- **Insoluble phosphate fertilizers** are highly efficient phosphate fertilizers, which are insoluble in water, and poorly soluble in weak acids but soluble in strong acids, with slow and long-lasting fertilizer effects. The main products include phosphate powder and bone meal.

Among them, MAP and DAP are the most widely used phosphate fertilizers in China, which together account for more than 85% of the total consumption. MAP is usually made into a compound fertilizer by being compounded with potassium nitrogen fertilizer, whereas DAP is applied directly. Other phosphate fertilizers less used in China are mainly exported.

2.1 Output of phosphate fertilizers, 2013–2020

China's phosphate fertilizer industry started in the 1880s. Since 1994, preferential policies have been implemented for fertilizer production and circulation, including state tax exemption, preferential shipping rates, electricity prices, gas prices, etc.

Having undergone development for ten years amid favorable policies, the phosphate fertilizer industry entered a mature period in 2000. However, due to the low entry threshold, the industry surplus gradually emerged. In addition, excessive and blind use of chemical fertilizers brought cost increases and environmental pollution. As a result, China's phosphate fertilizer industry has turned from self-sufficiency to overcapacity since 2008.

In recent years, with the increasingly stringent environmental regulation and the deepening supply-side structural reform in China, some substandard enterprises have gradually withdrawn from the market and the construction of new production capacity for phosphate fertilizers has been restricted. Consequently, both capacity and output of China's phosphate fertilizers decreased significantly and are concentrated in the leading enterprises.

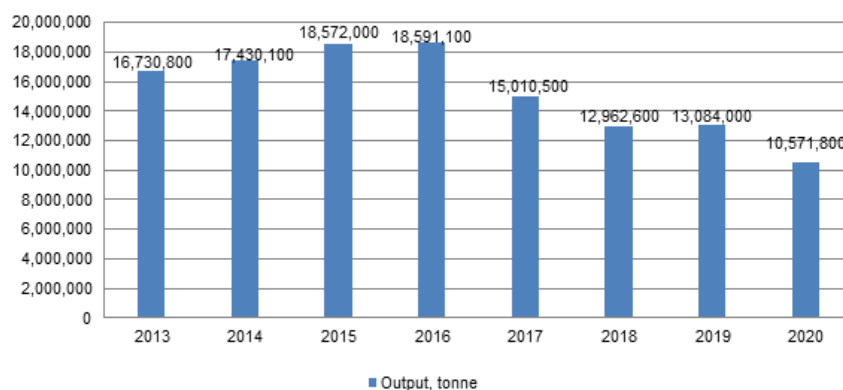
In 2012, China's phosphate fertilizer industry began to reduce capacity, and the growth rate of output slowed down. Since 2015, China has gradually canceled the preferential policies for fertilizer enterprises; in 2015, China launched the *Action Plan for the Zero Growth of Chemical Fertilizer Use by 2020*, aiming to lower the growth rate of chemical fertilizer usage.

In April 2019, China's Ministry of Ecology and Environment issued *the Action Plan for the Special Investigation and Rectification of "Three Phosphorus" in the Yangtze River*, instructing provinces including Hubei, Sichuan, Guizhou, Yunnan, Hunan and Jiangsu as well as Chongqing Municipality to carry out intensive investigation and rectification on phosphate rock, phosphorus chemical enterprises, and phosphogypsum reservoirs. The "Three Phosphorus" regulation prompted the elimination of small and medium-sized backward capacity, which imposed a significant impact on China's phosphate fertilizer industry.

According to National Bureau of Statistics (NBS) of China, the output of phosphate fertilizers in China showed an upward trend in 2013–2016. The output increased from 16,730,800 tonnes in 2013 to 18,591,100 tonnes in 2016, with a CAGR of 3.6%. In 2017–2018, the output

saw huge declines, and arrived at about 12,962,600 tonnes in 2018. The output went up slightly to 13,084,000 tonnes in 2019. However, the situation reversed in 2020, with output dropping to 10,571,800 tonnes.

Figure 2.1-1 Output of phosphate fertilizers (converted to 100% P₂O₅) in China, 2013–2020



Note: Data for 2021 is not available.
Source: NBS

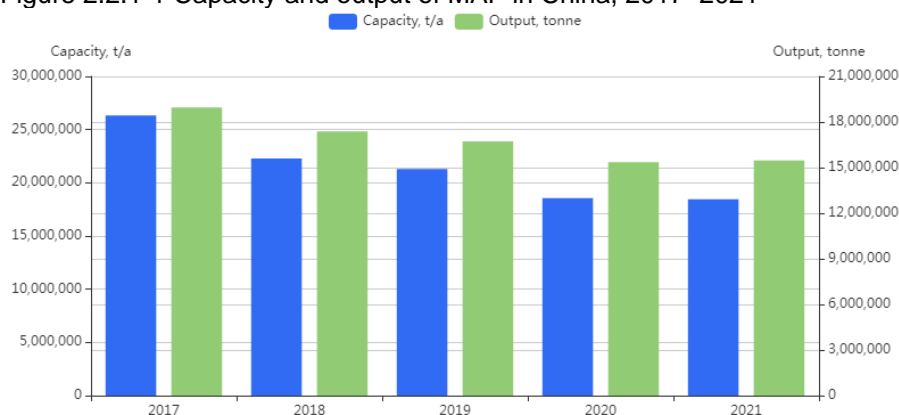
2.2 MAP in China, 2017–2021

2.2.1 Production

China's MAP industry has long suffered from overcapacity. However, Chinese authorities' moves to regulate the phosphate fertilizer industry in recent years, which were taken for the sake of environmental protection, had also affected the MAP industry. Resultantly, the production capacity for MAP in China dropped from 26,330,000 t/a in 2017 to 18,460,000 t/a in 2021, with a CAGR of -8.5%.

In 2017–2021, the output of MAP in China saw a continuous downtrend. In 2020, the output of MAP dropped by 8.2% YoY to 15,350,000 tonnes, mainly affected by environmental protection regulations and the COVID-19 pandemic. In 2021, driven by increased exports, the MAP output rose slightly.

Figure 2.2.1-1 Capacity and output of MAP in China, 2017–2021



Note: The calculation is based on actual volume.
Source: CCM

The capacity for MAP is mainly concentrated in Central and Western China, where phosphate ore is abundant. MAP enterprises in China are mainly located in provinces including Hubei, Yunnan, Sichuan, Anhui and Guizhou.

In 2021, with the continuous elimination of backward production capacity, the production of

MAP in China became increasingly concentrated. The top three producers produced a total of 3,905,500 tonnes, accounting for 25.2% of China's total MAP output in 2021. Notably, Xinyangfeng Agricultural Technology Co., Ltd.'s output of MAP in 2021 exceeded 1.56 million tonnes, ranking first in China.

Table 2.2.1-1 Capacity and output of MAP producers in China, 2019–2021

No.	Producer	Location	Capacity, t/a			Output, tonne		
			2019	2020	2021	2019	2020	2021
1	Xinyangfeng Agricultural Technology Co., Ltd.	Hubei Province	1,800,000	1,800,000	1,850,000	1,580,000	1,636,000	1,561,400
2	Hubei Xiangyun (Group) Chemical Co., Ltd.	Hubei Province	1,500,000	1,500,000	1,500,000	1,340,000	1,400,000	1,460,000
3	Anhui Sierte Fertilizer Industry Co., Ltd.	Anhui Province	850,000	850,000	850,000	753,600	809,300	884,100
4	Yunnan Yuntianhua Co., Ltd.	Yunnan Province	670,000	700,000	800,000	493,700	648,300	751,800
5	Sichuan Development Lomon Co., Ltd.	Sichuan Province	800,000	800,000	800,000	550,000	750,000	691,700
6	Guizhou Kailin Group Co., Ltd.	Guizhou Province	800,000	800,000	800,000	605,000	600,000	640,000
7	Hubei E-zhong Ecological Engineering Co., Ltd.	Hubei Province	700,000	700,000	700,000	420,000	480,000	530,000
8	Xiangyang Zedong Chemical Group Co., Ltd.	Hubei Province	535,000	535,000	535,000	405,000	450,000	480,000
9	Hubei Shilong Chemical Co., Ltd.	Hubei Province	500,000	500,000	500,000	360,000	400,000	420,000
10	Chengdu Wintrure Holding Co., Ltd.	Sichuan Province	430,000	430,000	430,000	491,800	524,700	491,800
11	Hubei Sanning Chemical Co., Ltd.	Hubei Province	360,000	360,000	360,000	353,900	352,800	374,400
12	Sichuan Hongda Co., Ltd.	Sichuan Province	360,000	360,000	350,000	298,000	364,000	259,000
13	Anhui Liuguo Chemical Co., Ltd.	Anhui Province	300,000	300,000	300,000	360,300	353,200	452,800
14	Hubei Fengli Chemical Co., Ltd.	Hubei Province	220,000	220,000	220,000	140,000	130,000	136,000
15	Hubei Xingfa Chemicals Group Co., Ltd.	Hubei Province	200,000	200,000	200,000	229,700	262,400	223,300
16	Yichang Xibu Chemical Co., Ltd.	Hubei Province	200,000	200,000	200,000	130,000	150,000	120,000
Others			11,075,000	8,305,000	8,065,000	8,216,000	6,039,300	5,996,700
Total			21,300,000	18,560,000	18,460,000	16,727,000	15,350,000	15,473,000

Note: The calculation is based on actual volume.
Source: CCM

2.2.2 Price

MAP prices showed an upward trend in 2017 owing to the rising price of a raw material—synthesis ammonia and shrinking supply of phosphate rock at the end of the year.

In 2018, the prices dropped due to low downstream demand and oversupply.

In 2019, the price showed a wavelike downtrend and hit a trough of USD229/t in July. The price drop was mainly due to weak demand and decreasing raw material prices.

In 2020, the price of MAP in China showed an "up-down-up" pattern, in which the price went up in Q1, fell back by May and then climbed to above USD300/t at the end of the year. In Q1, prices rose, which were bolstered by higher raw material prices and demand. However, prices declined slightly in Q2 due to weak demand. The demand for downstream remained weak, and the supply of MAP was sufficient. As a result, the price stayed stable in Q3. In Q4, there was an inflection point in the price change. MAP prices were boosted by positive factors such as tight supply and production costs.

In 2021, the price of MAP continued to rise from the beginning of the year. After rising to the highest price in Aug., the price began to dip to the end of the year, hit by slumping demand. In Jan.–Aug., prices rose for the main reasons as follows:

- High raw material prices: Both the prices of sulfur and phosphorus ore continued to increase, resulting in higher production costs for MAP manufacturers.
- Tight supply: Due to the increase in production costs, the operating rates of MAP manufacturers declined, leaving the MAP market in short supply.

Figure 2.2.2-1 Ex-works price of MAP (55% powder) in China, Jan. 2017–Dec. 2021



Source: CCM

2.2.3 Import and export

As a large phosphate fertilizer supplier in the world, China has exported a large quantity of phosphate fertilizers.

During 2017–2021, China's annual export volume of MAP exceeded 2 million tonnes.

During 2017–2021, China's import volume of MAP was generally low, and annual import volume of MAP in the period was less than 50,000 tonnes. In this period, the import volume saw a downtrend, dropping from 20,831 tonnes in 2019 to 27 tonnes in 2021.

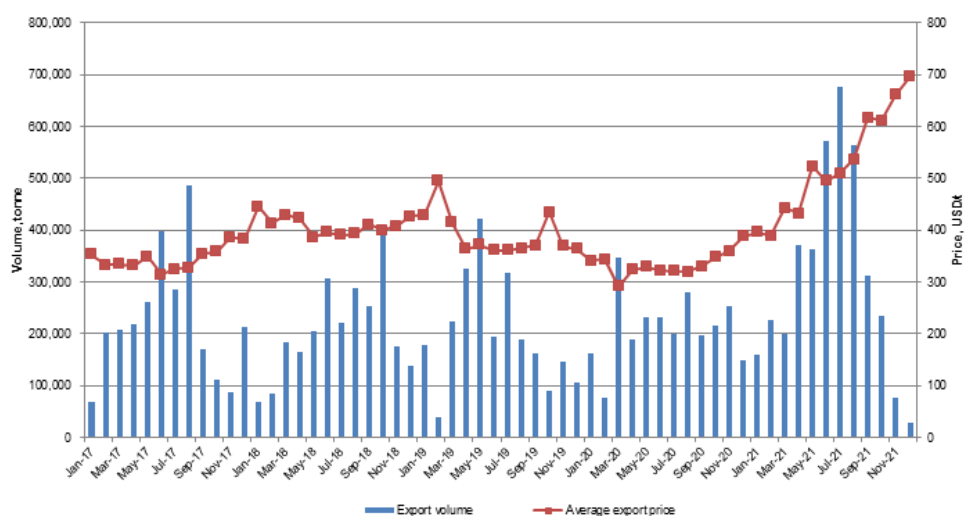
Table 2.2.3-1 Imports and exports of MAP in China, 2017–2021

Year	Import			Export		
	Volume, tonne	Value, USD	Price, USD/t	Volume, tonne	Value, USD	Price, USD/t
2017	46,261	10,118,864	219	2,712,241	917,498,901	338
2018	4,233	1,118,976	264	2,489,556	1,008,240,830	405
2019	20,831	5,139,844	247	2,391,366	909,067,751	380
2020	13,149	2,929,598	223	2,530,497	836,353,386	331
2021	27	19,331	724	3,785,796	1,927,428,744	509

Source: China Customs

During 2019–2021, the export volume of MAP in China kept increasing generally. However, the export price fluctuated, reaching the lowest point in 2020. The low price in 2020 was mainly due to the price drop of a raw material—sulfur and international phosphate fertilizers. In 2021, both the export volume and export price of MAP in China increased significantly due to tight supply and high prices of international phosphate fertilizers.

Figure 2.2.3-1 Monthly exports of MAP from China, Jan. 2017–Dec. 2021



Source: China Customs

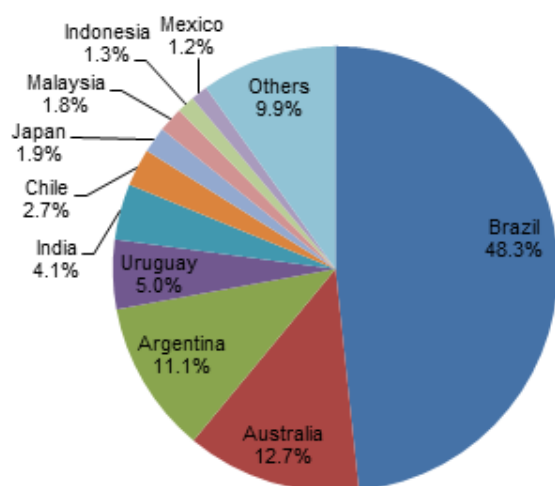
During 2019–2021, the top three export destinations of China's MAP exports were Brazil, Australia and Argentina, with an upward trend. 2,729,076 tonnes of MAP were exported to these three countries in 2021, accounting for about 72.1% of China's total MAP exports.

Table 2.2.3-2 Top ten export destinations of MAP in China, 2019–2021

No.	2019			2020			2021		
	Destination	Volume, tonne	Price, USD/t	Destination	Volume, tonne	Price, USD/t	Destination	Volume, tonne	Price, USD/t
1	Brazil	650,648	336	Brazil	694,182	277	Brazil	1,829,330	485
2	Australia	481,843	384	Australia	571,630	313	Australia	480,320	497
3	Argentina	294,467	344	Argentina	321,016	284	Argentina	419,427	509
4	India	157,104	405	India	134,750	386	Uruguay	190,519	508
5	Uruguay	100,776	364	Chile	97,759	331	India	153,558	594
6	Japan	77,844	396	Uruguay	91,248	270	Chile	103,343	535
7	Thailand	62,587	333	Japan	67,347	371	Japan	71,577	595
8	Taiwan, China	54,854	340	Malaysia	57,743	296	Malaysia	68,810	463
9	Malaysia	54,014	340	Taiwan, China	55,987	291	Indonesia	48,351	452
10	Chile	51,684	376	Turkey	47,696	523	Mexico	46,836	621
	Others	405,545	482	Others	391,140	464	Others	373,726	589
	Total/Average	2,391,366	380	Total/Average	2,530,497	331	Total/Average	3,785,796	509

Source: China Customs

Figure 2.2.3-2 Share of top ten export destinations of MAP in China, 2021



Source: CCM & China Customs

In China, the major exporters of MAP are located in provinces including Yunnan, Hubei, Guizhou, and Anhui, as well as Beijing Municipality.

In 2021, the province with the largest export volume of MAP is Yunnan, with the export volume of 1,112,818 tonnes, which account for 29.4% of the total. Hubei Province followed with 828,363 tonnes, which account for 21.9% of the total. Guizhou Province ranked third, with the export volume of 513,668 tonnes, which take up 13.6% of the total.

Table 2.2.3-3 China's export volume of MAP by province/region/municipality, 2019–2021

No.	2019			2020			2021		
	Location	Export volume, tonne	Share	Location	Export volume, tonne	Share	Location	Export volume, tonne	Share
1	Yunnan Province	1,047,663	43.8%	Yunnan Province	1,038,462	41.0%	Yunnan Province	1,112,818	29.4%
2	Hubei Province	473,810	19.8%	Hubei Province	586,939	23.2%	Hubei Province	828,363	21.9%
3	Guizhou Province	285,912	12.0%	Guizhou Province	372,385	14.7%	Guizhou Province	513,668	13.6%
4	Sichuan Province	171,667	7.2%	Sichuan Province	212,660	8.4%	Beijing Municipality	356,522	9.4%
5	Anhui Province	122,838	5.1%	Anhui Province	137,182	5.4%	Anhui Province	277,769	7.3%
6	Chongqing Municipality	72,551	3.0%	Fujian Province	36,545	1.4%	Sichuan Province	200,874	5.3%
7	Fujian Province	71,415	3.0%	Beijing Municipality	34,372	1.4%	Fujian Province	193,116	5.1%
8	Beijing Municipality	50,885	2.1%	Heilongjiang Province	20,000	0.8%	Jiangsu Province	62,387	1.6%
9	Heilongjiang Province	32,964	1.4%	Hebei Province	15,108	0.6%	Shandong Province	57,442	1.5%
10	Hebei Province	19,039	0.8%	Chongqing Municipality	13,606	0.5%	Inner Mongolia Autonomous Region	52,000	1.4%
	Others	42,621	1.8%	Others	63,239	2.5%	Others	130,836	3.5%
	Total	2,391,366	100.0%	Total	2,530,497	100.0%	Total	3,785,796	100.0%

Source: China Customs

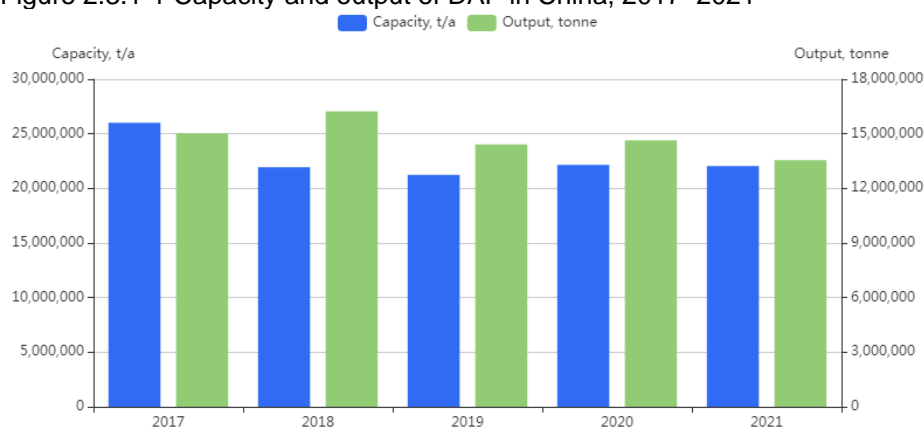
2.3 DAP in China, 2017–2021

2.3.1 Production

There is also overcapacity in China's DAP industry. The capacity for DAP in China dropped significantly in 2018, decreasing by 15.6% YoY. During 2019–2021, the capacity for DAP in China stayed at around 22 million t/a. However, the operating rates of DAP industry remained at a low level, as some manufacturers that failed to meet the requirements of environmental protection were in the state of production suspension for a long time. Besides, reduced downstream demand also contributed to the low operating rates.

China's DAP output increased from 15,024,000 tonnes in 2017 to 16,236,813 tonnes in 2018. During 2019–2021, China's DAP output fluctuated slightly, rising to 14,643,000 tonnes in 2020 and then dropping to 13,544,000 tonnes in 2021.

Figure 2.3.1-1 Capacity and output of DAP in China, 2017–2021



Note: The calculation is based on actual volume.

Source: CCM

The production of DAP in China is highly concentrated, with the capacity mainly located in Hubei Province, Yunnan Province and Guizhou Province.

Due to the improvement of environmental protection facilities, the operating rates of leading enterprises remain high, while that of some small and medium-sized enterprises are low.

During 2019–2021, the domestic top three producers were Yunnan Yuntianhua Co., Ltd., Guizhou Kailin Group Co., Ltd. and Hubei Yihua Chemical Industry Co., Ltd., the output of which exceeded half of the total output in the period.

Table 2.3.1-1 Production situation of DAP producers in China, 2019–2021

No.	Producer	Location	Capacity, t/a			Output, tonne		
			2019	2020	2021	2019	2020	2021
1	Yunnan Yuntianhua Co., Ltd.	Yunnan Province	4,450,000	4,450,000	4,450,000	3,679,300	4,533,000	4,477,000
2	Guizhou Kailin Group Co., Ltd.	Guizhou Province	4,200,000	4,200,000	4,200,000	2,800,000	2,500,000	2,600,000
3	Hubei Yihua Chemical Industry Co., Ltd.	Hubei Province	1,400,000	1,260,000	1,260,000	1,260,000	1,296,000	1,427,000
4	Yunnan Xiangfeng Chemical Fertilizer Co., Ltd.	Yunnan Province	1,200,000	1,000,000	1,000,000	1,010,000	800,000	780,000
5	Hubei Xingfa Chemicals Group Co., Ltd.	Hubei Province	400,000	400,000	800,000	412,100	413,500	589,600
6	Hubei Dayukou Chemical Co., Ltd.	Hubei Province	830,000	830,000	830,000	540,000	750,000	550,000
7	Anhui Liuguo Chemical Co., Ltd.	Anhui Province	640,000	640,000	640,000	599,100	677,000	583,900
8	Hubei Dongsheng Chemical Group Co., Ltd.	Hubei Province	600,000	600,000	600,000	395,000	400,000	350,000
9	Gansu Jinchang Chemical Industry Group Co. Ltd.	Gansu Province	400,000	400,000	400,000	260,000	280,000	260,000
10	Hubei Sanning Chemical Co., Ltd.	Hubei Province	300,000	300,000	300,000	338,400	336,000	330,000
11	Hubei Huangmailing Phosphate Chemical Co., Ltd.	Hubei Province	300,000	300,000	300,000	230,000	250,000	210,000
12	Shandong Lubei Chemical Co., Ltd.	Shandong Province	300,000	300,000	300,000	180,000	180,000	160,000
13	Shaanxi Shanhua Coal Chemical Group Co., Ltd.	Shaanxi Province	250,000	250,000	250,000	200,000	220,000	200,000
Others			5,970,000	7,220,000	6,720,000	2,514,100	2,007,500	1,026,500
Total			21,240,000	22,150,000	22,050,000	14,418,000	14,643,000	13,544,000

Note: The calculation is based on actual volume.

Source: CCM

2.3.2 Price

Similar to MAP prices, DAP prices saw an uptrend in 2017, because of the rising price of a raw material—synthesis ammonia and shrinking supply of phosphate rock at the end of the year. In 2018, DAP prices dropped due to weak downstream demand and oversupply.

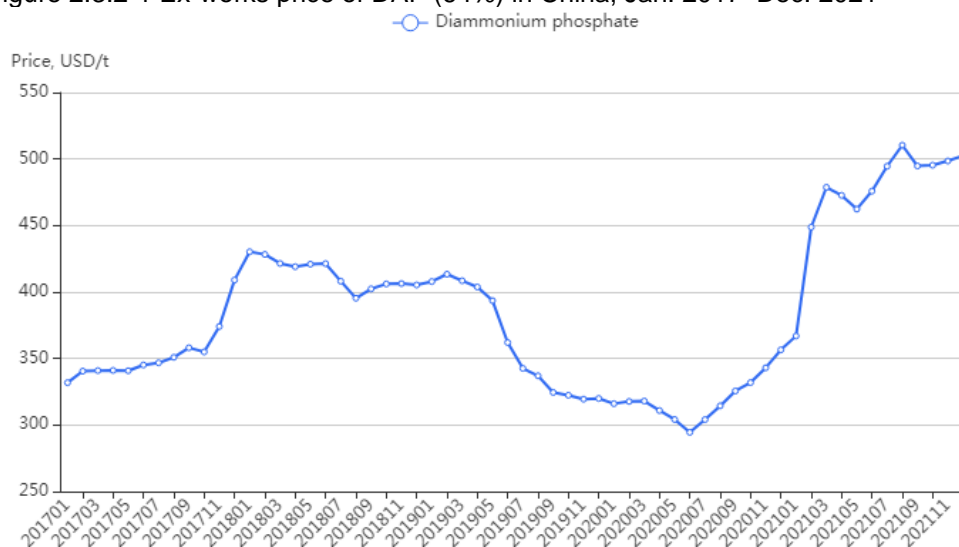
In 2019, the domestic DAP price declined steadily, dragged by weak demand and the continuous decline of international prices.

In Q1 2020, although the market supply decreased due to the impact of the COVID-19 pandemic, Chinese authorities introduced a series of policies to ensure supply and stabilize prices; thus, the ex-works price of DAP in China remained stable. In Q2, the price fell owing to the weak demand. In July, the price continued to rise, mainly driven by increased exports and

domestic demand.

In 2021, the price of DAP in China increased overall: in Q1, the price surged, supported by tight supply, rising raw material prices, and strong demand. But during April–May, the situation took a turn for the worse because of insufficient demand. Since June, the price rose again and peaked at USD510/t in Aug., due to improved export markets and rising costs. Subsequently, the DAP price levelled off in Q4.

Figure 2.3.2-1 Ex-works price of DAP (64%) in China, Jan. 2017–Dec. 2021



Source: CCM

2.3.3 Import and export

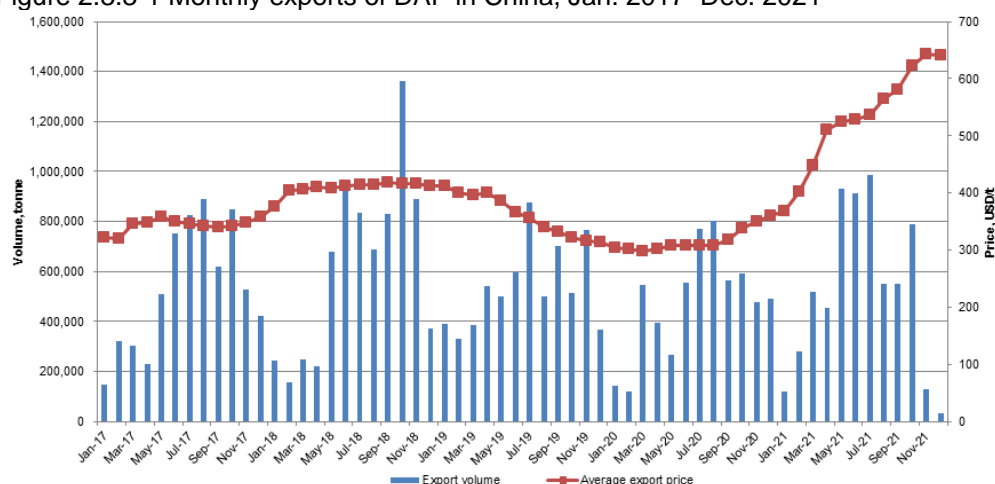
Similar to MAP exports, the export volume of DAP in China far exceeded the import volume. During 2017–2021, the annual export volume of DAP in China fluctuated between 5.7 million tonnes and 7.5 million tonnes.

Table 2.3.3-1 Imports and exports of DAP in China, 2017–2021

Year	Import			Export		
	Volume, tonne	Value, USD	Price, USD/t	Volume, tonne	Value, USD	Price, USD/t
2017	4	28,902	7,152	6,400,605	2,207,850,444	345
2018	64,658	24,545,226	380	7,468,248	3,080,522,605	412
2019	2	13,800	8,214	6,475,003	2,312,900,732	357
2020	62,792	18,600,683	296	5,732,478	1,826,479,734	319
2021	5	32,757	5,964	6,254,733	3,347,837,553	535

Source: China Customs

Figure 2.3.3-1 Monthly exports of DAP in China, Jan. 2017–Dec. 2021



Source: China Customs

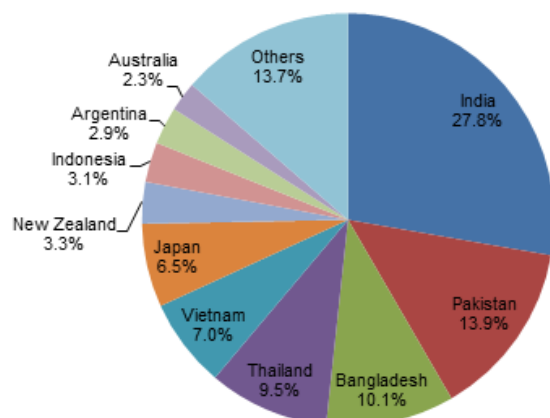
With regard to export destinations, China's DAP is mainly exported to India, Pakistan, Vietnam, Japan, Thailand, etc. In 2021, top three destination of China's DAP were India, Pakistan and Bangladesh; the volume of exports to these three countries was 1,736,497 tonnes, 867,714 tonnes and 629,855 tonnes respectively, accounting for 51.8% of the total.

Table 2.3.3-2 Top ten export destination of DAP in China, 2019–2021

No.	2019			2020			2021		
	Destination	Volume, tonne	Price, USD/t	Destination	Volume, tonne	Price, USD/t	Destination	Volume, tonne	Price, USD/t
1	India	2,486,025	355	India	1,754,893	312	India	1,736,497	561
2	Pakistan	859,265	334	Pakistan	745,534	322	Pakistan	867,714	547
3	Vietnam	492,282	348	Vietnam	573,740	317	Bangladesh	629,855	533
4	Thailand	458,513	367	Thailand	483,343	315	Thailand	591,321	522
5	Japan	378,610	379	Japan	373,874	326	Vietnam	437,692	489
6	Indonesia	337,555	356	Bangladesh	344,243	330	Japan	408,841	544
7	New Zealand	284,159	352	New Zealand	321,601	323	New Zealand	203,806	590
8	Bangladesh	262,000	333	Indonesia	278,230	315	Indonesia	195,202	482
9	Australia	183,188	388	Australia	186,574	330	Argentina	183,450	520
10	The Philippines	102,221	347	The Philippines	128,402	321	Australia	145,224	527
	Others	631,186	389	Others	542,045	322	Others	855,130	505
	Total/Average	6,475,003	357	Total/Average	5,732,478	319	Total/Average	6,254,733	535

Source: China Customs

Figure 2.3.3-2 Share of top ten export destination of DAP in China, 2021



Source: CCM & China Customs

With regard to registration places of Chinese DAP exporters, the main exporters of DAP in China are located in Yunnan Province, Hubei Province, Guizhou Province, Beijing Municipality, Fujian Province, Anhui Province and so on.

In 2021, the DAP exporters in Hubei Province, ranking first in terms of export volume, exported 1,975,013 tonnes of DAP, which account for 31.6% of the total; following that, the exporters in Yunnan Province exported 1,754,768 tonnes, which account for 28.1%; the exporters in Guizhou Province came in third and exported 1,093,314 tonnes, which take up 17.5%.

Table 2.3.3-3 China's DAP export volume by province/region/municipality, 2019–2021

No.	2019			2020			2021		
	Location	Export volume, tonne	Share	Location	Export volume, tonne	Share	Location	Export volume, tonne	Share
1	Yunnan Province	1,902,537	29.40%	Yunnan Province	2,267,884	39.60%	Hubei Province	1,975,013	31.60%
2	Hubei Province	1,586,981	24.50%	Hubei Province	1,436,045	25.10%	Yunnan Province	1,754,768	28.10%
3	Guizhou Province	1,087,494	16.80%	Guizhou Province	1,149,523	20.10%	Guizhou Province	1,093,314	17.50%
4	Fujian Province	613,260	9.50%	Fujian Province	267,149	4.70%	Beijing Municipality	313,864	5.00%
5	Beijing Municipality	248,515	3.80%	Chongqing Municipality	167,636	2.90%	Shanghai Municipality	290,985	4.70%
6	Anhui Province	239,359	3.70%	Inner Mongolia Autonomous Region	119,712	2.10%	Fujian Province	231,626	3.70%
7	Liaoning Province	238,330	3.70%	Beijing Municipality	117,104	2.00%	Anhui Province	178,237	2.80%
8	Chongqing Municipality	137,505	2.10%	Anhui Province	59,964	1.00%	Chongqing Municipality	167,061	2.70%
9	Heilongjiang Province	106,000	1.60%	Shanghai Municipality	52,052	0.90%	Shandong Province	68,626	1.10%
10	Shanghai Municipality	81,203	1.30%	Jiangsu Province	38,948	0.70%	Inner Mongolia Autonomous Region	55,532	0.90%
	Others	233,818	3.60%	Others	56,462	1.00%	Others	125,708	2.00%
	Total	6,475,003	100.00%	Total	5,732,478	100.00%	Total	6,254,733	100.00%

Source: China Customs

3 Yellow phosphorus in China

3.1 Capacity and output of yellow phosphorus, 2017–2021

Since the reform and opening up in 1978, China has become the world's largest yellow phosphorus producer after more than 40 years of rapid development. However, in recent years, under the national supply-side structural reform, backward production capacity has been eliminated. Because of the pressure from environmental protection supervision, yellow phosphorus production capacity and output have shown a downtrend in general during the period from 2017 to 2021.

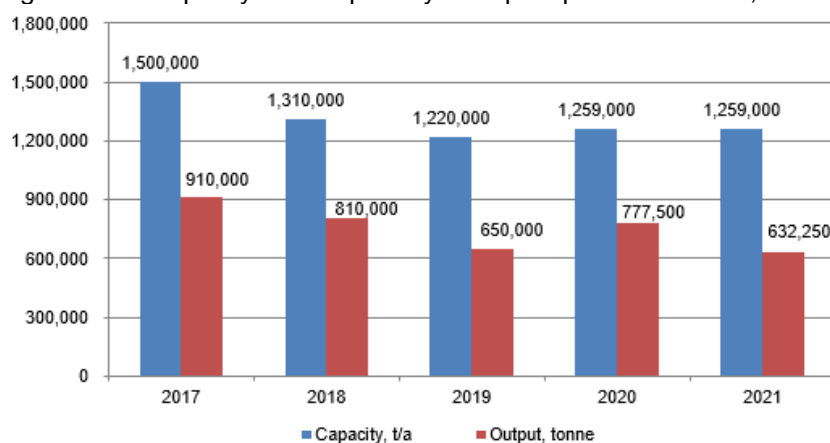
As for the output during 2017–2018, some yellow phosphorus producers' production was adversely affected in the period, since the environmental authorities in the local areas urged producers to rectify the non-conforming waste gas emissions. Additionally, some downstream industries were replacing thermal process phosphoric acid with purified wet process phosphoric acid, which also imposed an impact on the output of yellow phosphorus. Therefore, the domestic yellow phosphorus output dropped rapidly from 910,000 tonnes in 2017 to 810,000 tonnes in 2018.

In 2019, the capacity shrank by 90,000 t/a, down 6.9% year on year; the output also decreased, dropping to 650,000 tonnes. The average operating rate reduced to around 53% because the production in Hubei Province was limited by high electricity price, and some of the producers in Yunnan Province were only producing yellow phosphorus during wet season.

In 2020, the capacity increased to 1,259,000 t/a as some enterprises in provinces like Guizhou and Yunnan had passed acceptance inspection on technical renovations that were conducted in order to meet the standards for production resumption. The output reached 777,500 tonnes due to uptick in operating rate, which was encouraged by high price of yellow phosphorus the year before.

Owing to the temporary impact of limited power supply and restricted production in a certain period of 2021, the average operating rate in 2021 decreased compared to that in 2020. Although the production capacity remains unchanged, the output in 2021 declined by about 19% year on year.

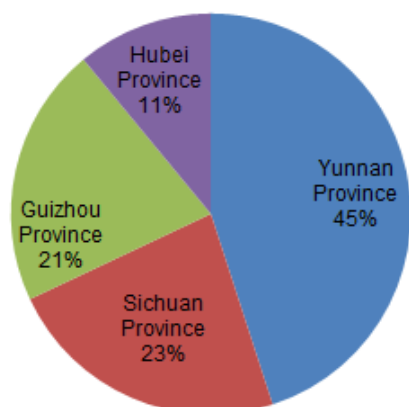
Figure 3.1-1 Capacity and output of yellow phosphorus in China, 2017–2021



Source: CCM

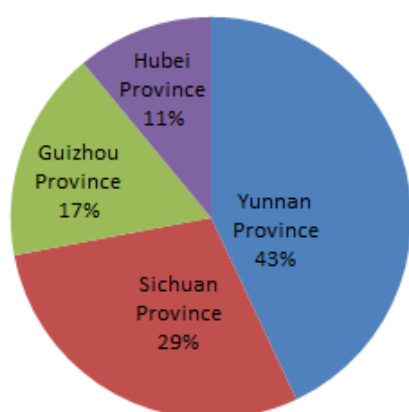
At present, the production capacity for yellow phosphorus in China is mainly distributed in Southwest China and Hubei Province, which have abundant hydropower and phosphate rock resources. In 2021, Yunnan Province and Sichuan Province, where the raw materials are easily accessible, made up 45% and 23% of the total yellow phosphorus capacity respectively; Guizhou Province and Hubei Province took up 21% and 11% respectively, which boast rich hydropower resources in the local areas that can help producers save certain costs.

Figure 3.1-2 Capacity distribution of yellow phosphorus in China, 2021



Source: CCM

Figure 3.1-3 Output distribution of yellow phosphorus in China, 2021



Source: CCM

3.2 Price of yellow phosphorus, 2017–2021

During 2017–2021, the price of yellow phosphorous was rising in general. Ex-works price of yellow phosphorous in China showed a general downward trend during Jan. to Aug. 2018, because the downstream demand was sluggish. Most of yellow phosphorous producers ran at low operating rates in this period. During Sept. to Nov. 2018, the price ticked up, mainly owing to increased production costs.

In 2019, under the tightened environmental regulation on yellow phosphorous production, many enterprises shut down their production lines, which led to short supply of yellow phosphorous. Thus, the average price in 2019 rose to USD2,457/t, up 7.6% year on year. Moreover, monthly price peaked in July because comprehensive environmental rectification was carried out in major production areas, which resulted in low operating rates.

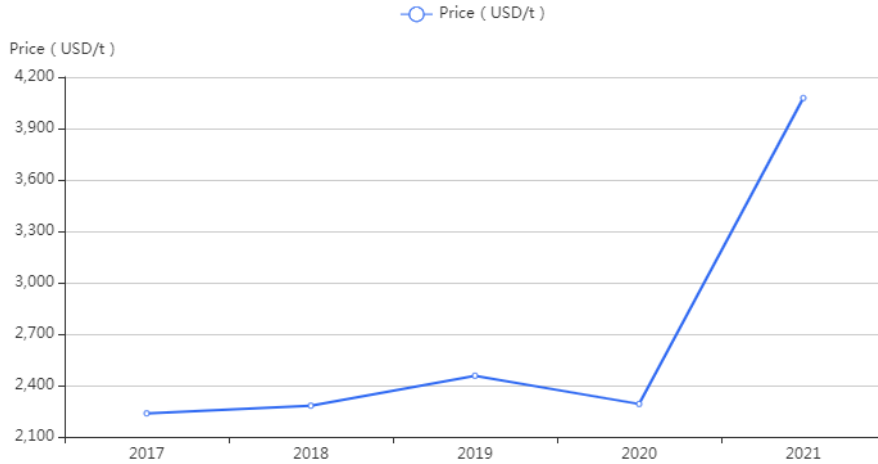
In 2020, the average price decreased to USD2,292/t, down 6.7% year on year. The price saw big fall in June because of falling prices of raw material and electricity, as well as sluggish downstream demand. However, the price rebounded since July, as some yellow phosphorous enterprises were shut down due to the floods in Sichuan Province.

In 2021, the price of yellow phosphorous increased significantly. The main reasons are as follows:

- In May, Southern rivers were in dry season, which made the producers run at low operating rates in this period.

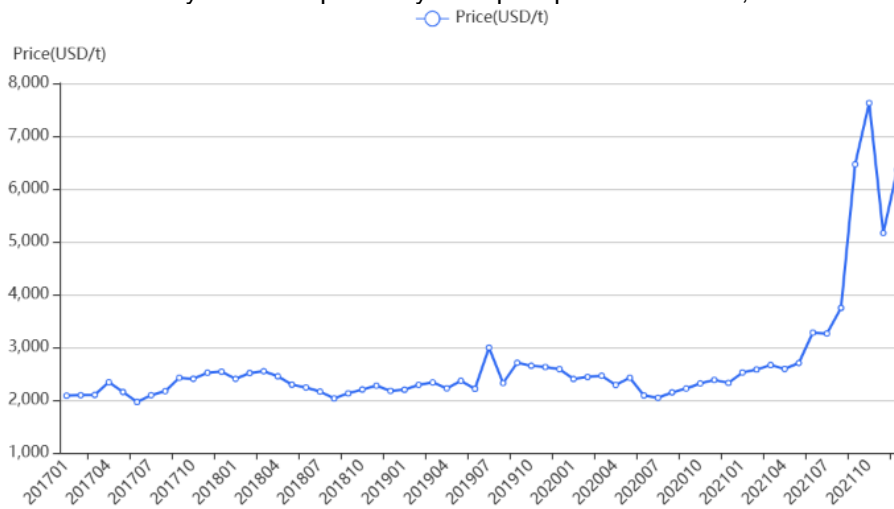
- In Aug., Yunnan Province implemented the "Dual Control" policy (governmental control on energy consumption and energy intensity). Since producers in Yunnan Province deliver a large amount of supplies, it stimulated yet another rise in the price of yellow phosphorous.
- In Oct., the price of yellow phosphorous dropped due to decreased production costs, which can be attributed to the fact that the high price of commercial electricity started to slide. However, the price of yellow phosphorous was still at a high level.

Figure 3.2-1 Annual average ex-works price of yellow phosphorus in China, 2017–2021



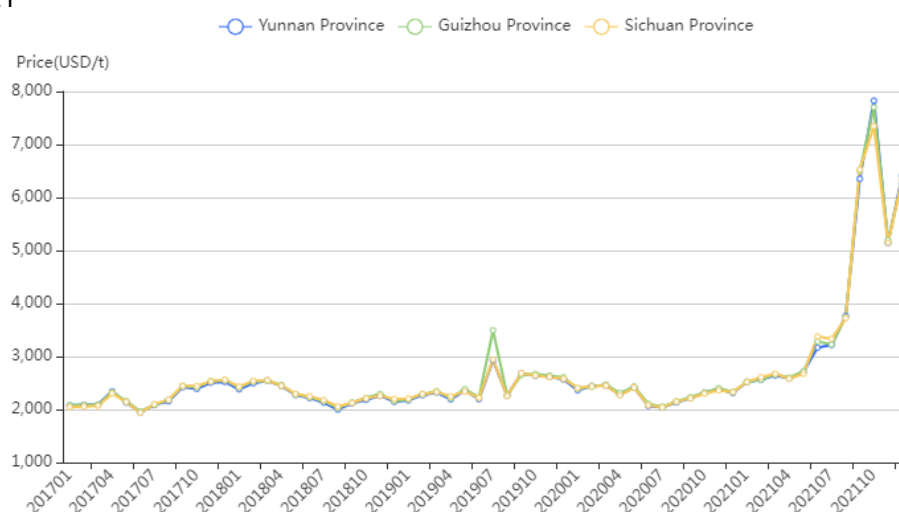
Source: CCM

Figure 3.2-2 Monthly ex-works price of yellow phosphorus in China, Jan. 2017–Dec. 2021



Source: CCM

Figure 3.2-3 Monthly ex-works price of yellow phosphorus in China by region, Jan. 2017–Dec. 2021



Source: CCM

3.3 Export analysis of yellow phosphorus, 2017–2021

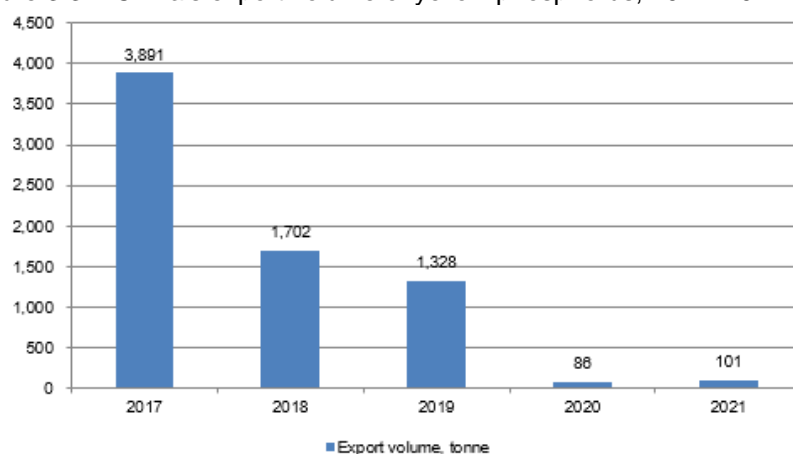
Since the reform and opening up in 1978, China has gradually become a major exporter of yellow phosphorus in the world. In the wake of China's economic development, higher requirements of environmental protection and energy conservation have been imposed on the industrial production in China. And the rectification of environmental nonconformities in the yellow phosphorus industry is in progress. Like the lessening output, China's exports of yellow phosphorus fell in recent years. Instead, growth in exports has been seen in its downstream products, such as glyphosate and sodium tripolyphosphate.

In 2019, the export volume of yellow phosphorus from China was 1,328 tonnes, down 22.0% YoY, with an average monthly export price of USD3,236/t.

The export of yellow phosphorus plummeted by 93.5% to 86 tonnes in 2020; the export price was USD3,237/t, which was averaged from the prices of two only months when there were yellow phosphorus exports—July and Nov.

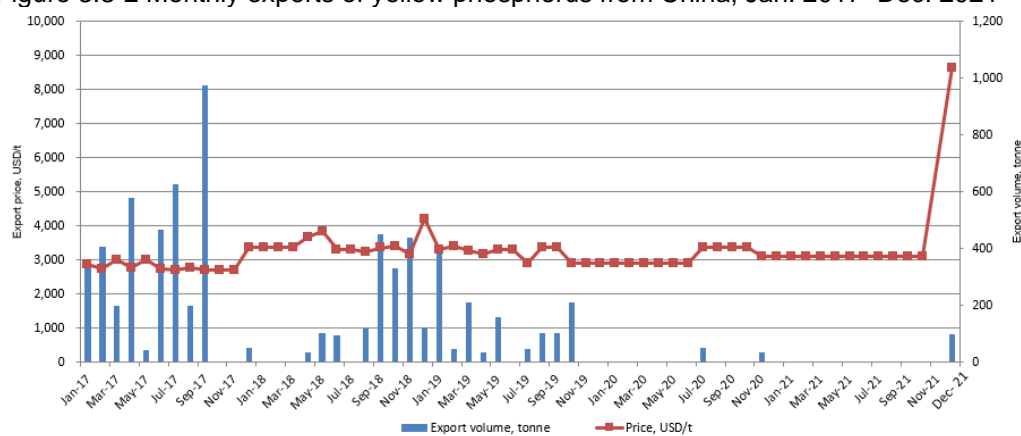
In 2021, the export volume of yellow phosphorus from China was 101 tonnes, up 16.67% YoY; but it was still at a low level. There was no yellow phosphorus export from China in the first 11 months of 2021. In Dec., 2021, 52.8 tonnes of yellow phosphorus were exported from China to South Africa and 48.0 tonnes were exported to the UK, with an average export price of USD8,650/t. The jump of export price was mainly due to the lessening output.

Figure 3.3-1 China's export volume of yellow phosphorus, 2017–2021



Source: China Customs, CCM

Figure 3.3-2 Monthly exports of yellow phosphorus from China, Jan. 2017–Dec. 2021



Note: China's export volume of yellow phosphorus was 0 in Oct. 2017, Nov. 2017, Jan. 2018, Feb. 2018, March 2018, July 2018, June 2019, Nov. 2019–June 2020, Aug. 2020–Oct. 2020, Dec. 2020. and Jan. 2021–Nov. 2021.
Source: China Customs, CCM

Table 3.3-1 China's exports of yellow phosphorus by destination, 2021

No.	Destination	Export volume, tonne	Export price, USD/t
1	South Africa	52.8	8,000
2	The UK	48	9,365

Source: China Customs, CCM

4 Key phosphorus producers in China, 2021

Currently, most of China's producers in the phosphorus industry are still located in regions with abundant phosphate rock reserves, such as Yunnan Province, Guizhou Province and Hubei Province.

Table 4-1 List of major phosphate rock producers in China, 2021

No.	Producer	Abbreviation	Location	Capacity, t/a
1	Guizhou Phosphate Chemical (Group) Co., Ltd.	Guizhou Phosphate Chemical	Guizhou Province	17,000,000
2	Yunnan Yuntianhua Co., Ltd.	Yuntianhua	Yunnan Province	14,500,000
3	Guizhou Chanhen Chemical Corporation	Chanhen	Guizhou Province	5,000,000
4	Hubei Xingfa Chemicals Group Co., Ltd.	Hubei Xingfa	Hubei Province	4,150,000
5	Sichuan Development Lomon Co., Ltd.	SD Lomon	Sichuan Province	1,150,000

Note: Chanhen's 2.50 million t/a mining project in Jigongling Phosphorus Mine is still under preparation.

Source: CCM

Table 4-2 List of major yellow phosphorus producers in China, 2018–2021

No.	Producer	Abbreviation	Location	Capacity, t/a			
				2021	2020	2019	2018
1	Jiangsu Chengxing Phosph-Chemical Co., Ltd.	Jiangsu Chengxing	Jiangsu Province	180,000	180,000	180,000	180,000
2	Hubei Xingfa Chemicals Group Co., Ltd.	Hubei Xingfa	Hubei Province	160,000	160,000	160,000	142,500
3	Yunnan Phosphorus Group Co., Ltd.	Yunnan Phosphorus Group	Yunnan Province	90,000	120,000	120,000	120,000
4	Yunnan Jianglin Group Co., Ltd.	Jianglin Group	Yunnan Province	37,400	31,000	31,000	47,600
5	Chengdu Wintrue Holding Co., Ltd.	Wintrue Holding	Sichuan Province	60,000	60,000	60,000	60,000

Source: CCM

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