

# Forecasts on crop pests and diseases in China in 2022

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## Executive summary

Due to the influence of global climate change and other factors in recent years, China has been under attack by pests such as *Spodoptera frugiperda*, *Schistocerca gregaria*, *Ceracris kiangsu Tsai*, and rice planthopper; and diseases such as wheat stripe rust, southern rice black-streaked dwarf disease and rice ragged stunt. According to the National Agro-tech Extension and Service Centre (NATESC), the overall occurrence of pests, diseases, weeds and rodents on crops in China was severe in general during 2011–2021. In 2021, lands of three main crops (i.e. wheat, rice and corn), we can learn that the occurrence of major pests and diseases varied.

After comprehensive analysis of previous occurrence of pests and diseases, crop distribution, planting methods, climatic trend and other factors, it is predicted that major pests and diseases will occur heavily in China in 2022 on main crops such as wheat, rice, corn, potato, etc., with a nationwide occurrence area of 135.13 million ha. The occurrence will pose threats on approximately 70% of the growing areas of food crops such as wheat, rice, corn and potato.

More issued by NATESC on 30 Dec., 2021, concern about the demand forecasts on pesticides in China for 2022.

## Methodology

The report is drafted by diverse methods as follows:

### - Desk research

The sources of desk research are various, including published magazines, journals, government websites and statistics, industrial 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.

### - Internet

CCM visited government websites and contacted with players in the domestic agrochemical industry through B2B websites and software.

### - Data processing and presentation

The data collected and compiled are sourced from:

- √ CCM's database
- √ Published articles in periodicals, magazines, journals and third-party databases
- √ Statistics from governments and international institutes
- √ Telephone interviews with domestic producers, joint ventures, service suppliers and governments
- √ 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 were held in order to analyse the data and draw the conclusions.

# 1 Overview

## 1.1 Occurrence, control and yield loss of crops resulted by pests, diseases, weeds and rodents, 2011-2021

In recent years, although the rising trend of the occurrence of pests, diseases, weeds and rodents has slowed down in China, the situation remained very serious. According to the National Agro-tech Extension and Service Centre (NATESC), the average annual occurrence area of pests, diseases, weeds and rodents in 2011–2021 was 445.95 million ha, thereinto, it was between 400 million ha and 447 million ha in 2016–2021 collectively, with the average annual occurrence area of 419.15 ha, down by 11.53% compared with 2011–2015.

During 2011–2021, the average annual control area was 548.87 million ha, while the average annual retrieved loss of grains was 96.32 tonnes, accounting for 15.16% of the total yield. What's more, in 2016–2021, controls of pests, diseases, weeds and rodents in agricultural production have been stressed out and have been proved effective. *Spodoptera frugiperda* invaded northern China and has then appeared all over the nation, now regarded as a migratory pest in China in 2019, while *Schistocerca gregaria* and *Ceracris kiangsu Tsai* entered China in 2020 through the borders of Tibet Autonomous Region and Yunnan Province, and have then appeared across production regions. Thanks to the government's timely response with monitoring, prevention and control measures and farmers' rapid extermination moves, the actual losses were limited. In 2016-2021, the average annual control area of pests, diseases, weeds and rodents on record was between 499.7 million ha and 540.7 million ha, down by 8.54% in comparison with 525.9 million ha, the average annual control area in 2011-2015. In 2021, the year yielding the largest amount of grains of 682.85 tonnes in the past decade, the annual retrieved loss of grains accounted for 18.31%.

Table 1.1-1 Occurrence area, control area and yield loss of crops resulted from pests, diseases, weeds and rodents in China, 2011-2021

Year	Occurrence area, million ha	Control area, million ha	Retrieved loss, million tonne	Actual loss, million tonnes	Yield, million tonnes	Ratio of retrieved loss to yield	Ratio of actual loss to yield
2011	486.40	554.81	91.41	18.61	571.21	16.00%	3.26%
2012	485.10	605.04	110.53	22.51	589.58	18.75%	3.82%
2013	481.40	574.81	96.81	19.14	601.94	16.08%	3.18%
2014	477.30	577.22	100.50	19.17	607.03	16.56%	3.16%
2015	460.30	562.98	98.84	19.72	621.44	15.90%	3.17%
2016	447.00	540.70	91.70	17.09	660.44	13.89%	2.59%
2017	437.00	539.30	88.77	16.52	661.61	13.42%	2.50%
2018	415.90	516.10	83.37	15.23	657.89	12.67%	2.31%
2019	400.60	499.70	84.62	14.59	663.84	12.75%	2.20%
2020	414.40	533.60	87.94	14.49	669.49	13.14%	2.16%
2021	400.00	533.33	125.00	N/A	682.85	18.31%	N/A
<b>Average</b>	<b>445.95</b>	<b>548.87</b>	<b>96.32</b>	<b>17.71</b>	<b>635.21</b>	<b>15.22%</b>	<b>2.84%</b>

Source: NATESC & National Bureau of Statistics (NBS)

## **2 Situation of pests and diseases on three major crops in China, 2016-2021**

### **2.1 Review on control of crops resulted by pests, diseases, weeds and rodents in China in 2021**

According to the 2021 data from NATESC, the total occurrence area of pests, diseases, weeds and rodents was 400 million ha and the control area was over 533.33 million ha in China with the retrieved loss up to 125 million tonnes accounting for about 18.3% of the annual total yield of grains. In lands of three main crops (i.e. wheat, rice and corn), the occurrence of major pests and diseases varied: In the first half of 2021, wheat stripe rust and wheat scab, both have occurred severely; while entering the second half, some production areas of rice and corn suffered severe damages caused by rice borer, rice planthopper, rice blast and southern rice black-streaked dwarf disease, as well as some specific regions were under attacks of *Spodoptera frugiperda*, corn borer and other pests at ear stage of corn.

#### **Prevention and control of pests and diseases on wheat**

In 2021, the overall occurrence of pests and diseases on wheat was severe. There were over 125 million tonnes of wheat had been retrieved from loss with prevention and control efforts, accounting for 26.3% of the overall yield.

##### **Wheat stripe rust**

The disease has occurred severely in an area of 4.46 million ha nationwide, more than 2.4 times the control area of 10.67 million ha—this occurrence in 2021 arose as the severest one since 2017 in China. There were 10 million tonnes of wheat had been retrieved from loss in the year. Earlier in Oct. 2020, wheat stripe rust was first found and then happened occasionally in the wheat-growing regions of Jiangsu, Anhui and Zhejiang and other provinces, affecting a wide range of lands, particularly severe in Shaanxi, Shandong, Henan and Hebei provinces.

##### **Wheat scab**

The country is at a high risk catching on a larger range of the disease. The actual diseased area of wheat scab was up to 4.67 million ha and the standard occurrence area was 3.33 million ha in 2021. A lot of areas in Hubei, Jiangsu, Anhui provinces and southern Henan Province, were stroke severely. The sporadic outbreaks happened in the wheat-growing regions stretching from the north (Inner Mongolia Autonomous Region) to the west (Xinjiang Uygur Autonomous Region). The governments in Anhui, Henan and other provinces have allocated more than USD156.75 million (RMB1 billion) in 2021 to the prevention and control activities.

#### **Prevention and control situation of pests and diseases on rice**

In 2021, the occurrence of pests, diseases, weeds and rodents on rice in China was moderate or moderate-heavy as a whole, but the occurrence of pests and diseases in specific regions was severe. In details, the occurrence area of the year was 94.71 million ha, a slight decrease from the 2020 level. According to preliminary statistics, the occurrence area of pests, diseases, weeds and rodents on rice was 133.4 million ha with retrieval of over 41 million tonnes of rice from potential loss. Major pests and diseases of rice have occurred commonly and severely, causing heavy damages.

##### **Rice borer**

In the rice-growing regions along the middle and lower reaches of Yangtze River, the planting crop has changed from single cropping rice to double cropping rice, while the rice-growing regions in the south has expanded its scale of planting single cropping rice—these picked up the areas of bridge fields of rice borers, giving rise to a more severe occurrence of *Chilo suppressalis*, *Sesamia infer ens* (Walker) and *Chiloaunirilius* in part regions.

##### **Bacterial leaf blight and bacterial leaf streak**

These two bacterial diseases prevailed to a larger and more severe scale, causing grave damages on partial areas.

### **Southern rice black-streaked dwarf disease and rice ragged stunt**

The bacterial diseases carried by rice planthoppers were prevalent in the rice-growing regions in South China but with a light harm.

### ***Tarsonemidae* and *meloïdogyne***

There was upward trend of the occurrence of these pests in larger occurrence areas, and the recurrence area was in greater harm.

### **Prevention and control of pests and diseases on corn**

In 2021, the overall occurrence of pests and diseases on corn was stable. According to preliminary statistics, the occurrence area of pests, diseases, weeds and rodents on corn was 58.43 million ha and the control area was 57.16 million ha with retrieval of over 42 million tonnes of corn from potential loss, accounting for 15.4% of the overall yield of corn. With effective prevention and control measures, the spread to the north has slowed down and the seedling stage of corn in Huang-Huai-Hai area was not affected with population of pests in most areas lower than the control index. There was no harm caused in the main corn-growing areas in North China.

### **Southern corn rust**

Under the influence of extreme weather such as rainstorm and typhoon, summer corn occurred heavily in Huang-Huai-Hai area, covering an area of 2.73 million ha. The occurrence area in Hebei Province was 0.92 million ha, a record level in this province. In addition, Tianjin City reported its first case of southern corn rust in the past decade.

### **Corn borer**

The occurrence area of this pest has been decreasing in recent years to 5.67 million ha this year.

### **Cotton bollworm and Armyworm**

The two pests had mainly concentrated in corn-growing areas in Huang-Huai-Hai and parts of Northeast China and Northwest China, accounting for an area of over 5.67 million ha and 3.27 million ha respectively.

### ***Spodoptera frugiperda***

Actual occurrence area was 1.38 million ha in 1,241 counties of 27 provinces (regions and cities). The collective area in Southwest China and South China made up more than 90% of the total in 2021.

## **2.2 Occurrence of pests and diseases on three major crops in China, 2016-2021**

Under China's scientific governance, the occurrence of pests and diseases on three main crops in China in 2016–2021 has lessened compared with the conditions in 2011-2015. According to the 2016–2021 records, cases of wheat diseases, namely, wheat stripe rust and wheat scab, were frequently reported; while pests, namely, *Chilo suppressalis* has severely stricken the rice-growing areas along Yangtze River where also marked increased occurrence of rice planthopper and rice leaf roller in some specific years. Although there are pests and diseases reported across the country, most of occurrences are controllable. Therefore, China has shielded from massive losses generated from widespread pests and diseases and is able to achieve a relatively stable crop production in all.

According to NATESC, the ratio of retrieved loss from pests and diseases on wheat was between 13.77% to 26.30%, averaging at 17.31% in 2016-2021, while that on rice ranged from 15.25% to 18.51%, averaging at 16.76% in the same period of time. Regarding the corn lands, the ratio of retrieved loss was between 8.29% and 15.40%, averaging at 9.72% in 2016-2021. It is worthy noted that the average annual control area on corn was 84.1 ha, accounting for 99.64% of the average occurrence area of pests and diseases in China in 2016-2021.

Table 2.2-1 Occurrence area, control area and yield loss of wheat pests and diseases in China, 2016-2021

Year	Occurrence area, million ha	Control area, million ha	Retrieved loss, million tonnes	Actual loss, million tonnes	Yield, million tonnes	Ratio of retrieved loss to yield	Ratio of actual loss to yield
2016	78.4	100.3	23.0	3.8873	133.2	17.31%	2.92%
2017	75.6	101.4	21.6	3.4244	134.2	16.06%	2.55%
2018	69.9	93.2	20.4	3.7132	131.4	15.48%	2.83%
2019	62.2	88.8	18.4	2.5479	133.6	13.77%	1.91%
2020	68.0	98.9	20.0	2.6463	134.3	14.93%	1.97%
2021	N/A	N/A	36.5	N/A	138.8	26.30%	N/A
<b>Average</b>	<b>68.925</b>	<b>95.575</b>	<b>23.36946</b>	<b>3.08295</b>	<b>134.46304</b>	<b>17.31%</b>	<b>2.31%</b>

Source: NATESC &amp; NBS

Table 2.2-2 Occurrence area, control area and yield loss of rice pests and diseases in China, 2016-2021

Year	Occurrence area, million ha	Control area, million ha	Retrieved loss, million tonnes	Actual loss, million tonnes	Yield, million tonnes	Ratio of retrieved loss to yield	Ratio of actual loss to yield
2016	103.3	158.8	36.3	4.396	211.1	17.18%	2.08%
2017	100.3	152.6	35.2	4.184	212.7	16.56%	1.97%
2018	91.6	139.8	32.3	3.779	212.1	15.25%	1.78%
2019	89.4	137.1	34.6	3.842	209.6	16.48%	1.83%
2020	94.7	146	35.2	4.014	211.9	16.60%	1.89%
2021	94.7	133.3	41.0	N/A	221.5	18.51%	N/A
<b>Average</b>	<b>95.7</b>	<b>144.6</b>	<b>35.8</b>	<b>4.043</b>	<b>213.1</b>	<b>16.76%</b>	<b>1.91%</b>

Source: NATESC &amp; NBS

Table 2.2-3 Occurrence area, control area and yield loss of corn pests and diseases in China, 2016-2021

Year	Occurrence area, million ha	Control area, million ha	Retrieved loss, million tonnes	Actual loss, million tonnes	Yield, million tonnes	Ratio of retrieved loss to yield	Ratio of actual loss to yield
2016	97.8	93.3	23.3	6.1978	263.6	8.84%	2.35%
2017	92	89.5	22.8	6.3815	259.1	8.78%	2.46%
2018	86.9	89.3	21.3	5.3317	257.2	8.29%	2.07%
2019	85.2	86.8	21.9	5.2144	260.8	8.52%	2.03%
2020	85.9	88.5	22.1	5.0	260.7	8.47%	1.93%
2021	58.4	57.1	42.0	N/A	272.7	15.40%	N/A
<b>Average</b>	<b>84.4</b>	<b>84.1</b>	<b>25.6</b>	<b>5.633</b>	<b>262.3</b>	<b>9.72%</b>	<b>2.17%</b>

Source: NATESC &amp; NBS



### 3 Forecasts on pests and diseases of major crops in China in 2022

#### 3.1 Forecasts of major pests and diseases on wheat in China in 2022

In recent years, attacks of wheat pests and diseases have come severely and frequently, especially of the Class-I crop ones, affecting the yield and quality of wheat. The 2022 estimate on the occurrence area of the selective wheat pests and diseases, will reach 30.02 million ha, representing increases of 4.8% and 4.2% compared with that of 2021 and the average of 2016-2020, respectively. Here, the selective types are three diseases (i.e. wheat scab, wheat stripe rust and wheat sheath blight), and one pest (i.e. wheat aphid).

##### Wheat scab

The occurrence area of wheat scab is projected to cover 6.00 million ha and the control area to over 16.68 million ha in 2022. Thereinto, this disease will hit hard on the wheat-growing regions such as the middle and lower reaches of Yangtze River, Jiang-Huai Region and the southern part of the Huang-Huai Region—these regions spread across provinces such as Hubei, Anhui, Jiangsu, Henan, Shandong (mainly the southern part), etc. Other wheat-growing regions in North China, Southwest China and Northwest China will mark moderate occurrence of wheat scab.

##### Wheat stripe rust

The occurrence area of wheat stripe rust is projected to reach 2.00 million ha in 2022. The serious outbreaks of this disease will happen in wheat-growing regions such as the northern Hubei Province, southern Henan Province, southern Gansu Province, Guanzhong Region in Shaanxi Province and Yili Valley in Xinjiang Uyghur Autonomous Region. While the most parts of Hubei Province, mid-western Anhui Province, mid-northern Henan Province, southwest Shandong Province, river basins in Sichuan Province, mid-eastern Gansu Province, southern Ningxia Hui Autonomous Region, and eastern Qinghai Province, may see moderate occurrence, and heavy one in some specific areas.

##### Wheat sheath blight

The occurrence area of wheat sheath blight tends to stay at around 8.00 million ha in 2022, thereinto, the disease will occur heavily in north-central Jiangsu Province, most parts of Henan Province, southwest Shandong Province and most parts of Hubei Province. Meanwhile, most of the other wheat-growing area in Jiang-Huai Region, Huang-Huai Region and North China may meet a lighter level of attack.

##### Wheat aphid

The occurrence area of wheat aphid in 2022 is estimated to rise to 14.00 million ha. Specifically, the pest occurrence will be a heavy or severe strike in wheat-growing area such as Henan Province, Shandong Province, Hebei Province, Shanxi Province. On the other hand, for the most areas of wheat-growing regions in Jiang-Huai Region, Southwest China and Northwest China, wheat will suffer less.

Table 3.1-1 Forecasts on occurrence area of wheat pest and diseases in China, 2018–2022

No.	Pest and diseases	Occurrence area, million ha				
		2018	2019	2020	2021	2022
1	Wheat aphid	15.33	14.67	14.00	13.33	14.00
2	Wheat sheath blight	8.67	N/A	8.00	8.00	8.00
3	Wheat scab	6.67	10.00	6.00	6.00	6.00
4	Wheat stripe rust	4.00	2.00	4.00	4.00	2.00

Source: NATESC

### 3.2 Forecasts of major pests and diseases on rice in China in 2022

Taking combined factors of initial population of rice pests and diseases, rice varieties, planting methods, and climate conditions in winter and spring, into account, it is predicted that an area of 68.70 million ha will record happenings of three rice pests and two diseases, up by 13.6% year on year and 7.1% compared with the average of 2016-2020. Thereinto, the three major pests are rice planthopper, rice leaf roller, *Chilo suppressalis*, and the two diseases are rice sheath blight and rice blast.

#### Rice planthopper

The nationwide occurrence area of rice planthopper is projected to ease to 20.67 million ha, with a year-on-year decrease of 11.40%. Thereinto, brown planthopper will affect an area of 10.67 million ha across the country and occur heavily in the rice-growing regions like Jiangnan region, the middle and lower reaches of Yangtze River and the eastern part of South China. In terms of *Sogatella furcifera*, China may register a nationwide affecting area of this pest reaching 10.00 million ha with heavy occurrence in rice-growing areas in the eastern part of Southwest China. Whereas, the two pests in question will make a moderate occurrence in other rice-growing regions in southern China.

#### Rice leaf roller

The overall occurrence of rice leaf roller is projected to arrive at 14.67 million ha in 2022, down by 8.31% year on year. Thereinto, heavy breakout will fall on the rice-growing regions in Jiangnan region, the lower reaches of Yangtze River and the eastern part of South China, while the moderate occurrence will be in other rice-growing regions in southern China.

#### *Chilo suppressalis*

In 2022, *Chilo suppressalis* may appear in 13.33 million ha of lands in China, which is a year-on-year decline of 4.79%. Damages from this pest turn to be severe in rice-growing areas in Jiangnan region, the middle reaches of Yangtze River and northern part of Southwest China. However, there will be moderate occurrence in other rice-growing regions.

#### Rice sheath blight

2022 is estimated to find rice sheath blight on 16.00 million ha of lands in China, a year-on-year decline of 4.02%. This disease is very likely to occur heavily in the rice-growing areas in Jiangnan region, South China, the middle and lower reaches of Yangtze River, northern part of Southwest China and southern part of Northeast China. And it will have moderate occurrence in the rice-growing areas in the southern part of Southwest China and northern part of Northeast China.

#### Rice blast

At the same time, it is predicted that rice blast will break out affecting an area of 4.00 million ha nationwide, down by 7.62% year on year. In 2022, the disease will be moderate to heavy in main rice-growing areas in Northeast China, southern hilly regions of China, rice-growing regions along the Yangtze River and Huaihe River, while there will be a risk that susceptible varieties will be spreading in some parts with severe breakout.

Table 3.2-1 Forecasts on occurrence area of rice pests and disease in China, 2018–2022

No.	Pests and diseases	Occurrence area, million ha				
		2018	2019	2020	2021	2022
1	Rice planthopper	25.33	20.00	20.00	23.33	20.67
2	Rice sheath blight	17.33	16.67	17.33	16.67	16.00
3	Rice leaf roller	15.33	14.67	14.00	16.00	14.67
4	<i>Chilo suppressalis</i>	14.67	12.00	14.00	14.00	13.33
5	Rice blast	5.00	4.67	4.33	4.33	4.00

Source: NATESC

### 3.3 Forecasts of major pests and diseases on corn in China in 2022

Based on the comprehensive analysis of previous occurrence of pests and diseases, crop distribution, planting methods, climatic trend and other factors, the combined occurrence area of three corn pests and one disease will reach 32 million ha, up by 9.10% compared with that in previous year. Specifically, the pests and disease are *Spodoptera frugiperda*, armyworm and corn borer, as well as southern corn rust.

#### ***Spodoptera frugiperda***

In 2022, *Spodoptera frugiperda* may appear frequently in China and estimatedly bring serious damage to a total area of 5.33 million ha, with the year-on-year growth of 99.63%. It is predicted to affect the most parts of the corn-growing areas frequently and severely in Southwest China and South China, Jiangnan region and the middle and lower reaches of Yangtze River, except the western part of Northwest and the north-central Northeast China, both with large number of pest generations. Jiang-H region, Huang-Huai Region, Northwest China and North China are likely to face moderate damages.

#### **Armyworm**

Armyworm will take on a moderate occurrence in an area of 4.00 million ha in 2022, falling by 20% as comparing with that of 2021. Damages are expected to concentrate to the corn-growing areas in North China, Northeast China, some parts of Northwest China and some of Southwest China.

#### **Corn borer**

It is predicted that corn borer will occur commonly in the corn-growing areas in China, heavily in some parts of summer corn-growing area in Huang-Huai region, and moderately in Northwest China, North China, most parts of Jiang-Huai region and some parts of Southwest China. The 2022 occurrence area of the pest is likely to reach 17.33 million ha which is basically the same as the 2021 figure.

#### **Southern corn rust**

On 2022 estimate, southern corn rust will strike heavily to extremely on the summer corn-growing area in Huang-Huai-Hai region with a nationwide appearance over 5.33 million ha of lands.

Table 3.3-1 Forecasts on occurrence area of corn pests and disease in China, 2018–2022

No.	Pests and disease	Occurrence area, million ha				
		2018	2019	2020	2021	2022
1	Corn borer	21.00	20.00	19.33	17.33	17.33
2	<i>Spodoptera frugiperda</i>	N/A	N/A	6.67	2.67	5.33
3	Southern corn rust	2.87	2.66	3.75	4.33	5.33
4	Armyworm	4.00	4.33	4.53	5.00	4.00

Source: NATESC

### 3.4 Forecasts of other pests and diseases in China in 2022

Based on comprehensive analysis of previous occurrence of pests and diseases, crop distribution, planting methods, climatic trend and other factors, it is predicted that the occurrence area of other grains' pests and diseases (potato late blight, *Loxostege sticticalis*, migratory locust, etc.) will reach 4.4 million ha. The overall occurrence area of the pests and diseases (citrus yellow shoot, pear fire blight, red imported fire ant, potato beetle, codling moth, etc.) will be 0.66 million ha, up by 11.9% and 8.7% respectively compared with the 2021 level and the average of 2016-2020.

#### Potato late blight

The prediction of occurrence area of potato late blight for 2022 in China is 2.00 million ha, an increase of 1.87% year on year and control area of over 2.67 million ha. In particular, the disease will occur heavily in Wuling mountainous areas, eastern Southwest China, eastern Northwest China. It is likely to see moderate occurrence in potato-growing areas in other regions of Southwest China and Northwest China, North China and Northeast China.

#### *Loxostege sticticalis*

The predict occurrence of *Loxostege sticticalis* for 2022 will attack on an area of 1.33 million ha, down 33.5% compared with the 2021 level. The pest will occur heavily in parts of Inner Mongolia Autonomous Region (representing 60% of the total occurrence area) and its surrounding areas. Slight occurrence might take place in North China, Northeast China and the most part of Northwest China.

#### Migratory locust

The prediction of occurrence area of migratory locusts for 2022 in China sets at 1.07 million ha. Occurrence features of the three kinds of migratory locusts are as follows:

- Oriental migratory locusts (*Locusta migratoria manilensis*) may appear in areas around Bohai Gulf, beach areas of the middle-lower reaches of Yellow River, lake and reservoir areas in North China.
- Asiatic migratory locust (*Locusta migratoria migratoria*) may occur in Xinjiang Uygur Autonomous Region, specifically areas along lakes and rivers in Zhungeer Basin, Tarim Basin, and pond wetlands in parts of Northeast China.
- Tibetan migratory locusts (*Locusta migratoria tibetensis*) will occur in the river valley regions of Chinsha River, Yalong River, Yalu Zangbu River and Tongtian River, etc. with a possibility of high concentration among them. The possibility of damages from migratory locusts from beyond the borders of China-Kazakhstan, China-Laos, and China-Nepal, should not be ruled out.

#### Citrus yellow shoot

The projection of overall occurrence area of citrus yellow shoot is 146,670 ha in China in 2022, the same as that in last year, and control area is over 1.33 million. Thereinto, the disease may occur moderately in northeastern Guangxi Province, southern Hunan Province, southern Jiangxi Province, north-central Hainan Province and south-central Yunnan Province. But there is a risk of severe occurrence in the citrus-growing

area for navel orange, tangerine and mandarin, etc. Slight occurrence will be in most parts of Fujian Province, most parts of Guangdong Province, the northern Yunnan Province; the sporadic outbreaks of the disease may affect slightly in southern Sichuan Province, parts of Guizhou Province. The possibility of citrus yellow shoot occurrence spreading to Chongqing Municipality, Hubei Province, north-central Hunan Province, central Jiangxi Province, eastern Sichuan Province and the north-western parts of Zhejiang Province, is high.

### **Pear fire blight**

The overall occurrence area of pear fire blight in 2022 is estimated to reach 33,330 ha in China, down by 34% year on year and control area is over 0.26 million ha. Thereinto, there will be moderate occurrence in pear-growing and apple-growing areas located in most parts of Xinjiang Uyghur Autonomous Region which will see heavy disease in some areas. Counties of Hexi Corridor of Gansu Province may see moderate occurrence. Particularly, sporadic outbreaks of Asian pear fire blight may take place in some counties of northwestern Zhejiang Province, eastern Anhui Province, and northeastern Chongqing Municipality. There is a high risk of further spread to main pear-growing and apple-growing areas.

### **Red imported fire ant**

The prediction of occurrence area of red imported fire ant (*Solenopsis invicta*) is 433,000 ha in China in 2022. Thereinto, slight occurrence of red imported fire ant will be in the most part of Guangdong Province, most part of Hainan Province, mid-eastern Guangxi Province, south-central Fujian Province, southern Jiangxi Province, south-eastern Yunnan Province and southern Sichuan Province, however, with severe ones in some parts or areas among them. There will be sporadic outbreaks in the most part of Chongqing Municipality, southern Hunan Province, southern Guizhou Province and south-central Zhejiang Province, as well as central Hubei Province.

### **Potato beetle**

The projection of overall occurrence area of potato beetle is 6,000 ha in China in 2022, up 10.04% year-on-year. Thereinto, this pest will break out slightly in northern Xinjiang Uyghur Autonomous Region as a whole, and some parts thereof may be ravaged severely. There is a possibility of migratory pest into Heilongjiang Province and Jilin Province from other countries adjacent to the Sino-Russia border areas.

### **Codling moth**

The projection of occurrence area of codling moth is 40,000 ha, basically the same as that in last year in China. It is estimated that the pest may occur slightly in apple-growing areas located in the most parts of Xinjiang Uyghur Autonomous Region, western Gansu Province, eastern Heilongjiang Province, central-eastern Jilin Province, southwest Liaoning Province, northeast Hebei Province, northern part of Tianjin Municipality, central Inner Mongolia Autonomous Region and northern part of Ningxia Hui Autonomous Region, and some parts thereof may be ravaged severely. There is a high risk of spread to the main apple-growing areas in Shaanxi Province, Shandong Province, eastern Gansu Province and central Hebei Province.

## 4 Forecasts on pesticide demand situation in China in 2022

### 4.1 Prediction of overall demand on herbicides

As of 30 Dec., 2021, according to the 2022 Demand Forecast and Outlook for Pesticide Market published by the NATESC, the estimate of herbicides sales for 2022 remains largely flat or dip down in China. This publish also pointed out the China implements ban on the production and supply of herbicide 2, 4-dibutyl. Businesses and applications (within 2 years of valid terms) of this product shall discontinue starting in 29 Jan., 2023—currently, market demand show a significant decline and inventory is running low expecting to be emptied in the near future.

Table 4.1-1 Herbicides on increased demand by volume (>2,000 tonnes, converted into 100% AI).

No.	Herbicide
1	Glyphosate (ammonium, sodium salt & monopotassium salt)
2	Acetochlor
3	Atrazine
4	Glufosinate-ammonium
5	Butachlor
6	Bentazone
7	Metolachlor
8	2-Methyl-4-chlorophenoxyacetic acid
9	Pretilachlor

Source: NATESC

Table 4.1-2 Emerging herbicides and their advantages

No.	Herbicide	Product advantage
1	Diquat	High efficiency against weeds that resistant to herbicides such as glyphosate and paraquat; available alternative of paraquat which is current banned in China
2	Glufosinate-ammonium	End-users' acceptance has been increasing resulting in an expectation of increasing consumption
3	Halauxifen-methyl	New biological pesticides which have seen growing applications
4	Quintrione	

Source: NATESC

## 4.2 Prediction of overall demand on insecticides and acaricides

Over the past 10 years, the domestic use of insecticides & acaricides has been dropping year by year and the fall is predicted to carry on to 2022. Under the backdrop that ten highly-toxic pesticides that are still in use now domestically are set to be phased out gradually in 2021-2025, market for the alternatives will grow as a consequence. In addition to the popularisation of genetically modified crops (GM crops), there will be further decline in the use of insecticides in 2022, but not in a mass scale. In particular, the future market demand for organophosphorus insecticides is expected to go down because of its relatively high toxicity under the limited control effect, especially with the use prohibition of the country on highly toxic pesticides.

Table 4.2-1 Insecticides on increased demand

No.	Insecticide
1	Indoxacarb
2	Isoprocarb
3	Pirimicarb
4	Carbosulfan
5	Imidacloprid
6	Acetamiprid
7	Thiamethoxam
8	Nitenpyram
9	Thiacloprid
10	Clothianidin
11	Dinotefuran
12	Chlorantraniliprole
13	Tetrachlorantraniliprole
14	Tetraniliprole
15	Cyantraniliprole
16	Triflumezopyrim
17	Disosultap
18	Pymetrozine
19	Monosultap
20	Bacillus thuringiensis
21	Chlorfluazuron
22	Abamectin

Source: NATESC

Table 4.2-2 Insecticides on declined demand

No.	Insecticide
1	Beta cypermethrin
2	Lambda-cyhalothrin
3	Fenpropathrin
4	Bifenthrin

Source: NATESC

Table 4.2-3 Acaricides on increased demand

No.	Acaricide
1	Petroleum oil
2	Lime sulfur
3	Propargite
4	Pyridaben
5	Spirotetramat
6	Bifenazate
7	Cyetpyrafen

Source: NATESC



### 4.3 Prediction of overall demand on fungicides

Generally, the demand of fungicides is expected to increase in 2022.

Table 4.3-1 Fungicides on large demand

No.	Fungicide
1	Copper sulfate
2	Ethylenebisdithiocarbamate (EBDC)
3	Carbendazim
4	Thiophanate Methyl
5	Tricyclazole
6	Chlorothalonil
7	Tebuconazole
8	Isoprothiolane
9	prochloraz
10	Triadimefon
11	Jiangangmycin
12	Copper hydroxide
13	Difenoconazole
14	Pyraclostrobin
15	Propiconazol
16	Metalaxyl
17	Azoxystrobin
18	Dimethyldithiocarbamate
19	Dimethomoph
20	Propineb
21	Bacillus subtilis
22	Procymidone
23	Hexaconazole
24	Propamocarb hydrochloride

Source: NATESC

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