

Forecasts on crop pests and diseases in China in 2023

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Executive summary

In China, the average annual occurrence area of pests, diseases, weeds and rodents in 2017–2022 stayed above 400 million ha. But it was down by 12.36% compared with data averaged in 2012–2016. In particular, pests and diseases on three major crops (wheat, rice and corn) in 2022 were under effective control, as data show the loss ratio was down 0.19 percentage point to 4% in the year.

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 Class-I crop pests (including 9 main kinds of pests) and diseases (including 8 main kinds of diseases) will occur heavily in China in 2023 on main crops such as wheat, rice, corn, potato, etc., with a nationwide occurrence area of 134.67 million ha, threatening more than 175 million tonnes of annual yield on grain crops, an increase of 29.5% year on year.

For 2023, the overall occurrence area of other major quarantine pests and diseases is expected to decrease by 4.20% compared with the 2022 level and the occurrence area of the other grain crops' pests and diseases will reach 3.47 million ha.

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 pests, diseases, weeds and rodents, 2012–2022

In 2017–2022, the overall control of pests, diseases, weeds and rodents in agricultural production was summarised as effective. On 9 Dec, 2022, the National Agro-tech Extension and Service Centre (NATESC), together with governments of Henan, Shandong, Hebei and Anhui and other major crop producing provinces, briefed on results of the national prevention and control of pests and diseases on wheat, rice, corn and other crops in the year. In 2022, the Ministry of Agriculture and Rural Affairs of the P. R. China designated more than 120 counties for the implementation on green prevention and control of pests and diseases, bringing the accumulated number to 320. 100 green prevention and control demonstration bases applying over 150 green prevention and control technological models have been built by the province-level departments. 20 technical programs for prevention and control of major pests and diseases on rice, wheat, corn, fruits, vegetable and tea crops fields have been drawn up.

Data from NATESC and National Bureau of Statistics (NBS) show that in 2022 the total occurrence area of pests, diseases, weeds and rodents was 404.80 million ha, while the control area totaled over 539.73 million ha in China retrieving loss of up to 159.15 million tonnes (=23.18% of the total grain yield in 2022). The average annual occurrence area of pests, diseases, weeds and rodents in 2012–2022 was 438.53 million ha: in 2017–2022, the annualised occurrence area was 412.12 ha, down by 12.36% compared with the annualised number in 2012–2016. The annual control areas of pests, diseases, weeds and rodents in 2017–2022 were within 499.7 million ha to 539.30 million ha, and the annualised control area over the five years of 2017–2022 was down by 7.90% from the 572.15 million ha in 2012–2016. The average annual retrieved loss of grains was 102.48 tonnes in 2012–2022, accounting for 15.88% of the annualised total yield during the decade.

Table 1.1-1 Occurrence area, control area and yield loss of pests, diseases, weeds and rodents in China, 2012–2022

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
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	28.61	682.85	18.31%	4.19%
2022	404.80	539.73	159.15	27.46	686.53	23.18%	4.00%
Average	438.53	547.50	102.48	19.50	645.69	15.88%	3.03%

Source: NATESC & NBS

1.2 Occurrence of pests and diseases on three major crops in China, 2017–2022

Based on the analysed results of the pest and disease base numbers before winter, crops and meteorological conditions, and other influencing factors, the NATESC outlined the occurrence of major crop pests and diseases in China in 2022, showing a lessened hit by pests and diseases on three main crops (wheat, rice and corn), compared with the results in the previous year:

- The total occurrence area of pests, diseases, weeds and rodents for three major crops under control was 348.34 million ha, breaking down to 92.40 million ha of wheat, 154.60 million ha of rice and 101.33 million ha of corn, seeing no large-scale outbreak of pests, diseases or weeds.
- Overall loss ratio of crop pests, diseases and weeds was down 0.19 percentage point to 4% on the rate of 2021.
- Retrieved loss from pests and diseases on wheat was between 18.40 million tonnes to 36.50 million tonnes in 2017–2022, with the average ratio of retrieved loss to 18.29% yield on an annualised basis; on rice, ranged from 32.34 million tonnes to 48.33 million tonnes, averaged to 17.76%; and on corn, averaged to 12.11%.
- In the last five years, 96% of corn field in China detected pests and diseases was under protection and control. The average annual control area for corn was 82.42 million ha in 2017–2022, and the average annual occurrence area of pests and diseases totaled 85.42 million ha.

Table 1.2-1 Occurrence area, control area and yield loss of wheat pests and diseases in China, 2017–2022

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
2017	75.60	101.40	21.56	3.42	134.24	16.06%	2.55%
2018	69.90	93.20	20.35	3.71	131.44	15.48%	2.83%
2019	62.20	88.80	18.40	2.55	133.60	13.77%	1.91%
2020	68.00	98.90	20.04	2.65	134.25	14.93%	1.97%
2021	N/A	N/A	36.50	N/A	138.78	26.30%	N/A
2022	-	92.40	31.92	-	137.72	23.18%	-
Average	68.93	94.94	24.80	3.08	135.01	18.29%	2.32%

Source: NATESC & NBS

Table 1.2-2 Occurrence area, control area and yield loss of rice pests and diseases in China, 2017–2022

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
2017	100.30	152.60	35.21	4.18	212.68	16.56%	1.97%
2018	91.60	139.80	32.34	3.78	212.13	15.25%	1.78%
2019	89.40	137.10	34.55	3.84	209.61	16.48%	1.83%
2020	94.70	146.00	35.17	4.01	211.86	16.60%	1.89%
2021	N/A	133.30	40.99	N/A	221.46	18.51%	N/A
2022	-	154.60	48.33	-	208.50	23.18%	-
Average	94.00	143.90	37.77	3.95	212.71	17.76%	1.87%

Source: NATESC & NBS

Table 1.2-3 Occurrence area, control area and yield loss of corn pests and diseases in China, 2017–2022

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
2017	92.00	89.50	22.75	6.38	259.07	8.78%	2.46%
2018	86.90	89.30	21.33	5.33	257.17	8.29%	2.07%
2019	85.20	86.80	21.91	5.21	260.78	8.52%	2.03%
2020	85.90	88.50	22.08	5.04	260.67	8.47%	1.93%
2021	58.40	57.10	42.00	N/A	272.73	15.40%	N/A
2022	86.14	101.34	64.26	-	277.20	23.18%	-
Average	82.42	85.42	32.39	5.49	264.60	12.11%	2.12%

Source: NATESC & NBS

2 Review on control of pests and diseases on major crops in China, 2022

- Overall occurrence area of pests, diseases, weeds and rodents in 2022

According to the National Agro-tech Extension and Service Centre (NATESC), totaling 404.80 million ha of occurrence area of pests, diseases, weeds and rodents was recorded in 2022. Among them, three major crops (wheat, rice and corn) faced varied levels of occurrence of pests and diseases in China in 2022, accounting for 86% of the total.

2.1 Occurrence of major pests and diseases on wheat in China

The control area of pests, diseases, weeds and rodents on wheat in 2022 was 92.40 million ha, retrieving about 32 million tonnes of wheat from potential threats. The occurrence of pests, diseases, weeds and rodents on wheat in China was moderate overall in 2022, despite some serious hits by pests and diseases in some regions.

The autumn of 2022 with high temperatures and precipitation in the most parts of China's winter wheat-growing areas, saw the good growth of wheat. But Chinese winter wheat varieties feature low resistance to diseases such as wheat scab, wheat stripe rust, powdery mildew, wheat sheath blight and stem rot, etc. NATESC expects a serious occurrence of major crop pests and diseases in China for 2023, especially for *Spodoptera frugiperda*, rice planthopper and rice leaf roller, *Chilo suppressalis*, wheat scab and aphid, etc.

Wheat scab: Varied fungi have deep-rooted in wheat-growing regions in the middle-lower reaches of the Yangtze, Jiang-Huai and Huang-Huai rivers and started to spread eastward and northward in recent years, as Chinese farmers have started to grow corn and/or rice crops in a rotation on most wheat-growing areas, supporting reproduction and accumulation of the wheat scab-related fungus.

Wheat stripe rust: The disease affected 57,267 ha of crop areas in the northwestern part of China in 2022, up by 23.1% from 2021, the year recording a mild occurrence of wheat stripe rust, but down 66.4% compared with the 2016–2020 average. It happened specifically in 37 counties of 12 cities/states in Gansu, Qinghai, Shaanxi and Ningxia provinces/regions. 5 counties of Sichuan, Guizhou and Yunnan provinces detected regional wheat stripe rust 9–18 days earlier than the first detection in the same period of the previous year.

Powdery mildew: The disease occurred on 192,867 ha of wheat-growing areas in 2022, up by 55.5% year on year but down by 30.8% compared with the 2016–2020 average, with an average diseased leaf rate of 4.9%. It was often founded in autumn seedlings in wheat-growing regions in the Northwest, the Southwest, Huang-Huai region, etc. Heavy occurrence of powdery mildew was recorded in the summer wheat fields in the eastern and southern parts of Gansu with an average diseased leaf rate of 6.6% once maximising to 60%, followed by Tongguan and Yintai of Shaanxi Province and Shanxi Province with the average diseased leaf rates of 3%–4.8% and 2.6%, respectively. However, Shaanxi Province's overall average diseased leaf rate was merely 0.18%. The sporadic occurrence of the disease in Sichuan Province and northern Henan Province in 2022 was similar to the one in 2021 and milder than that of the previous years.

Wheat sheath blight: The disease occurred on 436,933 ha of wheat areas in Huang-Huai region and North China in 2022, up by 6.9% year on year but down by 5.7% compared with the 2018–2020 average. The national average diseased plant rate was 1.4% in 2022, lower than the 2.8% of 2021—the average diseased plant rates in Shandong, Henan, Hebei and Shanxi provinces were 1.8%, 1.4%, 1.0% and 0.8%, respectively, all lower than the rates of 2021 and before; the highest yearly record was made in Yongnian of Hebei Province, reaching 6.5%.

Aphid: The pest afflicted 634,600 ha of autumn wheat seedling areas in China in 2022, up by 36.2% year on year but down by 37.8% compared with the 2016–2020 average. In the infected wheat-growing areas in Jiangsu, Gansu, Hubei, Shanxi, Shaanxi and Hebei provinces, the average pest number was 1.2–8.0 aphids per 100 plants, higher than the number counted in 2021. In Anhui and Shandong provinces, the average numbers were 15.6 and 2.1 aphids per 100 plants, with the yearly decreases of 31.3% and 73.8%, respectively.

Brown wheat mite: The pest hit 812,333 ha of wheat-growing areas in Huang-Huai region, Jiang-Huai

region, North China and Northwest China in 2022, 49.5% and 2.1% higher than the same period in 2021 and the 2018–2020 average.

Wheat midge: China reported less wheat midge in 2022 than the previous year, even in the frequently hit areas in Huang-Huai-Hai region and the Northwest.

2.2 Occurrence of major pests and diseases on rice in China

In China, different kinds of rice crop show vary degrees of resistance to pests and diseases. The main varieties growing in South China, Southwest China and Northeast China have better resistance to rice blast, than those growing around the lower reach of Yangtze River. In 2022, the occurrence of the major rice pest (*Chilo suppressalis*) increased.

Chilo suppressalis (data collected before winter by the NATESC):

- In Jiangxi Province, the average number of *Chilo suppressalis* per ha in 2022 was 200,000, 1.3 times higher than the average in 2012–2021, with the highest recorded in Yongxiu, Leping, Fengcheng and Xiajiang countries in 2022 being 1.5 million–2.2 million *Chilo suppressalis* per ha;
- In Hunan Province, the average pest number per ha was 130,575, increased by 28.0% and 110% from the same period of 2021 and the 2012–2021 average respectively;
- In Hubei, the average pest number per ha was 79,500, increased by 61.8% and 80.4% over the same period of 2021 and the 2012–2021 average, respectively.
- In eastern South China, most part of Southwest China, northern Jiang-Huai region and southern Northeast China, the average pest number per ha ranged from 22,500–54,000. In particular, areas along the river basins in Anhui Province, was recorded 105,000–510,000 *Chilo suppressalis* per ha, expected to encounter heavy-to-extreme pest occurrence in 2023.

Rice sheath blight, rice blast, rice false smut: These rice diseases are expected to happen moderately or heavily in China in 2023, considering their continuous occurrence in regions for years.

2.3 Occurrence of major pests and diseases on corn in China

China has a wide span of corn production areas. The *Spodoptera frugiperda* year-round breeding regions in the southwest and South China that grow corn crops all year round, and in the migration pathway along Jiang-Huai region and southern parts of the Yangtze River and the Huang-Huai-Hai region that produce spring, summer and autumn corn, are frequented by the pest. In 2022, the county's regional corn production experienced different levels of occurrence of major pests and diseases.

Armyworm: The third-generation armyworm occurred much more mildly in 2022, in an area of 746,667 ha nationwide, down 60% from the averaged occurrence area of recent years. From Sept. to Nov. 2022, the number of the pest founded in the country as a whole was at a low level, regardless of the YoY growths of 25% and 30% recorded in Yizhou District of Guangxi Zhuang Autonomous Region and Xingping City of Shaanxi Province, respectively.

Corn borer: According to NATESC's pre-winter survey, the average live corn borer population continued to be low in Northeast China and North China, and had increased in Huang-Huai region. Most concentrated in Shandong, Henan and Jiangsu provinces, and some distributed in Heilongjiang, Liaoning, Shanxi and Guizhou provinces, Tianjin Municipality and others. Compared with the 2019–2021 average, the number of live corn borer per 100 corn plants was about 30% lower in Northeast China and North China in 2022 and about 20% higher in most part of Huang-Huai region.

2.4 Occurrence of major pests and diseases on rapeseed in China

As of 29 Dec., 2022, the autumn rapeseed crops growing in the middle and lower reaches of the Yangtze River have shown fast growth, leading to a week resistance to the major pests and diseases such as aphid, *Sclerotinia*, downy mildew.

Aphid: Prior to the winter of 2022, aphids were widely detected across 53,333 ha of autumn rapeseed-

producing area in Southwest China, the concentration of which rose, compared to the same period of the previous year.

Sclerotinia: The *Sclerotinia*-infected fields saw a moderate or above level of occurrence in 2022. The disease has spread widely to major rapeseed-growing areas in Southwest China, the middle-lower reaches of the Yangtze River and regions south of the Yangtze River for consecutive years. In 2017–2022, the annual occurrence area of *Sclerotinia* averaged above 2.67 million ha nationwide.

Downy mildew: In 2022, Hubei Province had an average downy mildew-diseased leaf rate of 20.8%, with a maximum of 68% in Xianfeng County; Sichuan Province, average of 10%, with a maximum of 63% in Nanchong City; Yunnan Province, average of 10.71%, with a maximum of 22% in Weixi County. In 2017–2022, the annual occurrence area of downy mildew averaged 1.23 million ha.

3 Forecasts of Class-I crop pests and diseases in China in 2023

China's State Council released the regulation on the prevention and control of pests and diseases affecting crops, which came into effect on 1 May, 2020. In particular, China classifies crop pests and diseases into three classes by the characteristics of crop pests and diseases and their degree of harm to agricultural production. The Class-I crop pests (mainly 9 kinds of pests) and diseases (mainly 8 kinds of diseases) in China refer to crop pests and diseases that occur in a particularly large area or may cause significant losses to agricultural production throughout the year.

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 the Class-I crop pests and diseases will occur heavily in 2023, with an occurrence area of 134.67 million ha, an increase of 29.5% compared with that in 2022, threatening more than 175 million tonnes of annual yield on grain crops such as wheat, rice, corn and potato, etc.

Class-I crop pests are wheat aphid, rice planthopper, rice leaf roller, *Chilo suppressalis*, *Spodoptera frugiperda*, armyworm, corn borer, *Loxostege sticticalis*, migratory locust, etc. Class-I crop diseases are wheat scab, wheat stripe rust, wheat sheath blight, rice blast, rice sheath blight, southern corn rust and northern leaf blight, as well as potato late blight, etc.

Besides, potato beetle, codling moth, citrus greening disease, and pear fire blight that are categorised as plant quarantine pests and diseases have a possibility of spreading.

3.1 Forecasts of major pests and diseases on wheat

In recent years, the attacks of wheat pests and diseases, especially of the Class-I ones, have come severely and frequently, affecting the yield and quality of Chinese wheat. The 2023 estimates on the occurrence area of the selective wheat pest and diseases, reach 31.33 million ha, increases of 49.4% on 2022 and 11.3% on the 2017–2021 average, respectively. Here, the selective three diseases refer to wheat scab, wheat stripe rust and wheat sheath blight and one pest refer to wheat aphid.

Wheat scab

The occurrence area of wheat scab is projected to cover 6.00 million ha with the control area of over 20 million ha for 2023. The disease may pose heavy hit on the wheat-growing regions in the most parts of Hubei Province and Anhui Province, northern part of Zhejiang Province, mid-southern Jiangsu Province, southern part of Henan Province. Other wheat-growing regions such as northern part of Jiangsu Province, mid-northern Henan Province, southern part of Shandong Province, Guanzhong region of Shaanxi Province, northern and eastern parts of Sichuan Province will mark moderate or heavy occurrence of wheat scab.

Wheat stripe rust

The occurrence area of wheat stripe rust is projected to reach 2.67 million ha for 2023, up by 33.33% YoY. The disease may happen seriously in wheat-growing regions of the most parts of Hubei Province, southern part of Henan Province and Gansu Province, and moderately in other wheat-growing areas of Southwest, Northwest and Huang-Huai-Hai region.

Wheat sheath blight

The occurrence area of wheat sheath blight tends to stay at around 8.00 million ha in 2023. The disease may occur heavily in Henan Province, Shandong Province and most parts of Anhui Province, north-central Jiangsu Province, southern part of Hebei Province.

Wheat aphid

The occurrence area of wheat aphid is estimated to rise to 14.67 million ha for 2023, nudging up by 4.76% YoY. Specifically, the pest occurrence will be a heavy or severe strike to wheat-growing area in Huang-Huai-Hai region. On the other hand, moderate to heavy occurrence will be seen on wheat-growing area of Jiang-Huai region, Southwest China and Northwest China.

Table 3.1-1 Forecasts on occurrence area of wheat pest and diseases in China in 2019–2023E, million ha

No.	Pests and diseases	2019	2020	2021	2022	2023E
1	Wheat aphid	14.67	14.00	13.33	14.00	14.67
2	Wheat sheath blight	N/A	8.00	8.00	8.00	8.00
3	Wheat scab	10.00	6.00	6.00	6.00	6.00
4	Wheat stripe rust	2.00	4.00	4.00	2.00	2.67

Note: 2023E stands for 2023 estimates.

Source: NATESC

3.2 Forecasts of major pests and diseases on rice

The 2023 estimates on the occurrence area of the three major rice pests (rice planthopper, rice leaf roller and *Chilo suppressalis*) and two major diseases (rice blast and rice sheath blight), reach 67.33 million ha, increases of 25.1% on 2022 and 8.9% on the 2017–2021 average, respectively, taking into account factors like the base population of rice pests and diseases, rice varieties, planting methods, and climate conditions in winter and spring.

Rice planthopper

The occurrence area of rice planthopper is projected to reach 20.00 million ha in 2023, with a year-on-year decrease of 3.23%. Around 10.00 million ha of field nationwide will be affected by *Sogatella furcifera*, heavily in the western and eastern part of South China, and the eastern Southwest China. Approximate 10.00 million ha of field nationwide will be hit by brown planthopper, heavily in South China, southern parts of the Yangtze River, the middle and lower reaches of Yangtze River and the southern part of China. These two pests will make a moderate occurrence in other rice-growing regions in the south than the regions mention above.

Rice leaf roller

The occurrence area of rice leaf roller is projected to be 13.33 million ha in 2023, with a year-on-year decrease of 9.09%. Heavy occurrence will be seen in the eastern part of South China, southern parts of the Yangtze River, the lower reaches of Yangtze River, and the moderate occurrence will be in southern China in general.

Chilo suppressalis

The occurrence area of *Chilo suppressalis* is projected to expand to 14.66 million ha in 2023, up 10% YoY. It is estimated that there would be an outbreak of *Chilo suppressalis* in double cropping rice filed in southern parts of the Yangtze River and the middle reaches of Yangtze River; and heavy occurrence in northern part of Southwest China and South China and moderate occurrence in other rice-growing regions.

Rice sheath blight

The occurrence area of rice sheath blight is projected to reduce to 15.33 million ha in 2023, with a year-on-year decrease of 4.17%. Heavy occurrence will be seen in the middle and western parts of South China, southern part of the Yangtze River, northern part of Southwest China, the middle and lower reaches of Yangtze River, Jiang-Huai regions.

Rice blast

The occurrence of rice blast is projected to be moderately in 2023, affecting an area of 3.87 million ha, down by 3.33% YoY. Heavy rice blast will hit areas in Northeast China, hilly regions of South China, areas along the Yangtze River and Huaihe River.

Table 3.2-1 Forecasts on occurrence area of rice pests and disease in China in 2019–2023E, million ha

No.	Pests and diseases	2019	2020	2021	2022	2023E
1	Rice planthopper	20.00	20.00	23.33	20.67	20.00
2	Rice sheath blight	16.67	17.33	16.67	16.00	15.33
3	<i>Chilo suppressalis</i>	12.00	14.00	14.00	13.33	14.67
4	Rice leaf roller	14.67	14.00	16.00	14.67	13.33
5	Rice blast	4.67	4.33	4.33	4.00	3.87

Note: 2023E stands for 2023 estimates.

Source: NATESC

3.3 Forecasts of major pests and diseases on corn

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 major corn pests (*Spodoptera frugiperda*, armyworm and corn borer) and two diseases (southern corn rust and northern leaf blight) is estimated to reach 33.33 million ha in 2023, up by 20.8% compared with that of the previous year.

Spodoptera frugiperda

The occurrence area of *Spodoptera frugiperda* is projected to reach 3.33 million ha in 2023, dropping 37.5% YoY. It is estimated that a heavy or severe strike will be on the corn-growing areas in Southwest China and South China, in late summer particularly, a moderate or heavy one in the Jiangnan region and the middle and lower reaches of Yangtze River, a mild or moderate one in the Huang-Huai region.

Corn borer

The occurrence of corn borer is expected to be frequent in China for 2023, reaching 16.67 million ha of area, down 3.85% YoY. The heavy occurrence will be on the summer corn-growing area in Huang-Huai region and a moderate one in Northeast, Southwest and Northwest China.

Armyworm

The occurrence area of armyworm is projected to be 4.33 million ha in 2023, up 8.33% YoY, mainly on corn-growing areas in North China, Northeast China, Northwest China and Southwest China.

Northern leaf blight

The occurrence area of northern leaf blight is estimated to rise to 5.33 million ha in 2023, up by 6.67% YoY. Heavy strikes are likely to take place in most parts of corn-growing regions in Northeast China, while a moderate strike happened in most parts of North China, Southwest China and Northwest China.

Southern corn rust

The occurrence of corn borer is expected to be moderate in China overall for 2023, spreading over 3.66 million ha of area. But Huang-Huai region is at risk of a heavy occurrence on the summer corn-growing area.

Table 3.3-1 Forecasts on occurrence area of corn pests and disease in China in 2019–2023E, million ha

No.	Pests and disease	2019	2020	2021	2022	2023E
1	Corn borer	20.00	19.33	17.33	17.33	16.67
2	Northern leaf blight	4.00	5.00	4.53	5.00	5.33
3	Armyworm	4.33	4.53	5.00	4.00	4.33
4	Southern corn rust	2.66	3.75	4.33	5.33	3.67
5	<i>Spodoptera frugiperda</i>	N/A	6.67	2.67	5.33	3.33

Note: 2023E stands for 2023 estimates.

Source: NATESC

3.4 Forecasts of major pests and diseases on other crops

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 (*Loxostege sticticalis*, migratory locust and potato late blight, etc.) will reach 3.47 million ha, registering a year-on-year decrease by 21.21%.

Loxostege sticticalis

The occurrence area of *Loxostege sticticalis* is projected to be 1.00 million ha in 2023, down 25.0% YoY. Heavy occurrence is to be seen in and around Inner Mongolia Autonomous Region.

Migratory locust

The occurrence of potato late blight is projected to be mild in China in 2023, happening in 800,000 ha of area. Projections for three main kinds of migratory locusts are as follows:

- Oriental migratory locust (*Locusta migratoria manilensis*): Mainly break out along the beach area in lower reaches of Yellow River, Bohai Gulf, as well as area of lakes and reservoirs in North China that suffer frequent waterlogging.
- Asiatic migratory locust (*Locusta migratoria migratoria*): Occur at mixed agricultural and pastoral areas in Xinjiang Uygur Autonomous Region, and pond wetlands in parts of Northeast China.
- Tibetan migratory locust (*Locusta migratoria tibetensis*): Occur primarily in the river valley areas along the Tongtian River (a main stream of the source of Yangtze River, northwest China's Qinghai Province), Chin-sha River (an upper stretch of the Yangtze River), Yalong River (long secondary tributary of the Yangtze River) and Yarlung Zangbo River in Tibet.

Potato late blight

The occurrence of potato late blight is projected to be moderate overall in 2023, affecting 1.67 million ha of area, a year-on-year decrease of 16.67%. But areas in Southwest China, Wuling Mountainous Area, Northwest China and Northeast China will take a serious hit.

3.5 Forecasts of major plant quarantine pests and diseases

For 2023, the overall occurrence area of major plant quarantine pests and diseases, including three pests (red imported fire ant, colorado potato beetle, codling moth), as well as two diseases (citrus greening disease and pear fire blight) is expected to reach 0.63 million ha, down 4.20% compared with the 2022 level.

Red imported fire ant

The occurrence area of red imported fire ant (*Solenopsis invicta*) is estimated to be 410,000 ha in China in 2023. Mild occurrence will be in the most part of Guangdong Province, most part of Hainan Province, most part of Fujian Province, mid-eastern part of Guangxi Zhuang Autonomous Region, southern Jiangxi Province, southern and eastern parts of Yunnan Province, and southern Sichuan Province, in addition to some severe cases in some places among them. Sporadic outbreaks will take place in the most part of Chongqing Municipality, southern Hunan Province, southern Guizhou Province, southern and central parts of Zhejiang Province, and central Hubei Province. There is a high risk of red imported fire ant infecting more crop fields in the middle and lower reaches of Yangtze River and the southwest part of China.

Colorado potato beetle

The occurrence of colorado potato beetle is estimated to reach 10,000 ha of area in China in 2023, down 11.11% YoY, with a high possibility of continuously spreading to the border areas in Northeast China and Northwest China. Mild occurrence will be in northern part of Xinjiang Uyghur Autonomous Region, apart from severe outbreaks in some places in the region. Provinces like Heilongjiang and Jilin that abut Russia may be exposed to invasive pests.

Codling moth

The occurrence area of codling moth is estimated to be 40,000 ha in China in 2023, down 8.33% YoY. Mild occurrence will be in the most parts of Xinjiang Uyghur Autonomous Region, western Gansu Province, eastern Heilongjiang Province, eastern and central parts of Jilin Province, southwest Liaoning Province, northeast Hebei Province, northern Tianjin Municipality, western-central Inner Mongolia Autonomous Region and northern Ningxia Hui Autonomous Region, apart from severe outbreaks in some places in these provinces and regions. There is a high risk of codling moth spreading to the main apple-growing areas in northern Shaanxi Province, northeastern Shandong Province, eastern Gansu Province and central Hebei Province.

Citrus greening disease

The occurrence area of citrus greening disease (Huanglongbing) is projected to reduce slightly, to about 133,000 ha in China in 2023 and the control area is over 1.33 million ha. Moderate occurrence is expected in northeastern part of Guangxi Zhuang Autonomous Region, southern Hunan Province, southern Jiangxi Province, north-central Hainan Province and south-central Yunnan Province, of which the citrus-growing area for navel orange, tangerine and mandarin are at a risk of severe occurrence. Mild occurrence will be in most parts of Fujian Province, most parts of Guangdong Province, northern Yunnan Province. Sporadic outbreaks of the disease may affect the southern part of Sichuan Province and parts of Guizhou Province in a mild manner. But there is a high possibility for citrus greening disease to spread to Chongqing Municipality, Hubei Province, north-central and western parts of Hunan Province, central Jiangxi Province, eastern Sichuan Province, and northern and western parts of Zhejiang Province.

Pear fire blight

The occurrence area of pear fire blight is estimated to reach 40,000 ha in China in 2023, up by 10% YoY and the control area is over 0.28 million ha. Moderate occurrence is expected in most pear-growing and apple-growing areas of Xinjiang Uyghur Autonomous Region, apart from sporadic heavy outbreaks in some places in the region. Moderate occurrence will be seen in counties of Hexi Corridor of Gansu Province. Sporadic outbreaks of Asian pear fire blight will take place in counties of northwestern Zhejiang Province, southern Anhui Province, and northeastern Chongqing Municipality at a mild level. There is a high risk of the fire blight spreading wider among the main producing areas for pear and apple in China.

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