STEROL BIOSYNTHESIS INHIBITOR (SBI) WORKING GROUP

Minutes from WG meeting on January 19th, 2024

Protocol of the discussions and recommendations of the SBI working group of the Fungicide Resistance Action Committee (FRAC)

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Venue of the January meeting: Frankfurt, Hotel Lindner; Teams (online)
Hosting organization: FRAC/Crop Life International

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Anti-Trust Guidelines (from FRAC Constitution) were shown before meetings started.

1. DMIS AND AMINES: CEREALS

1.1. WHEAT

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.1.1. Septoria Leaf Blotch (*Zymoseptoria tritici / Mycosphaerella graminicola*)

Presentation of monitoring data: ADAMA, BASF, Bayer, Corteva, FMC, Sumitomo, Syngenta

- In 2023, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and United Kingdom.

- Overall, the sensitivity of European populations monitored in 2023 stayed in the range observed in previous years. Slight shifts in sensitivity of populations have been observed depending on the individual active ingredient and regions. In general, the field performance of DMI-containing fungicides was good when used according to the manufacturers and FRAC recommendations.

In regions with limited options in fungicides classes and/or a common practice of significantly reduced rates DMIs are at higher risk and performance might be impacted.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2020 to 2022, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine, and the United Kingdom. Most of the above listed countries were covered by the monitoring programs every year, but not all.
  Already in 2020, the sensitivity of populations was overall stable on the European level with EC_{50} sensitivity values being in the range of previous years, and as in 2019, DMI EC_{50} values were somewhat higher in the UK and Ireland than observed on the European continent where a gradient can be observed from North-West to South-East.

- In 2019, the sensitivity of the populations was overall stable on the European level with EC_{50} sensitivity values slightly higher compared to 2018 in some geographies but overall, in the range of previous years.

- In 2018, the sensitivity of the populations was overall stable on the European level.

- In 2016 and 2017, the sensitivity of populations was overall stable on a European level with regional differences also based on different disease epidemics. In regions with lower sensitivity in 2015, the sensitivity of the populations was stable and, in some areas, even partially increased.

- In 2015, depending on the individual active ingredient and regions slight shifts of sensitivity of populations have been observed. Highest EC_{50} values were observed in areas of elevated disease pressure and sub-optimal use of azoles in spray programs (e.g., reduction of rates in comparison to the manufacturer's recommended rate and inappropriate use of effective mix-partners).

- After the slight increase in the frequency of less sensitive isolates from 2002 to 2004, the situation had stabilised between 2005 and 2008. In 2009, a trend to slightly higher EC_{50} values were observed in important cereal growing areas (France, Germany, Ireland, United Kingdom); this trend has slowed down in 2010 to 2012 and was stable in 2013. 2014 sensitivity was in the same range as 2011.

In *Z. tritici*, different DMI haplotypes can lead to varying levels of sensitivity depending on the chemical structure. As DMIs are generally cross-resistant, resistance management approaches should be the same for all DMIs.

1.1.2. Powdery mildew (*Blumeria graminis* f.sp. *tritici*)

DMIs

Presentation of monitoring data: Bayer, Corteva, Sumitomo

- In 2023, monitoring was carried out in France.

- Sensitivity data presented for 2016 to 2023 confirmed that the situation was overall stable within the range of variability detected during the last 20 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2019 to 2022, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Latvia, Lithuania, Poland, Spain,

and United Kingdom. Most of the listed countries were covered by the monitoring programs every year, but not all.

- Differences in the sensitivity are significantly a.i. and regionally dependent. Higher resistance factors were observed only for particular DMIs, especially in France, Germany, and UK, but also to a lesser extend in Belgium.

- A limited monitoring in New Zealand in 2019 showed sensitivity ranges comparable to European populations.

Amines

Presentation of monitoring data: Bayer

- Field performance of amine-based products was good.

- In 2023, monitoring was carried out in Czech Republic, Denmark, Germany, France, Italy, Lithuania, Poland, and the United Kingdom

- Sensitivity data presented confirmed that the situation in 2023 was stable remaining in the range of variability seen over more than 25 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2020 and 2022, monitoring was carried out in Czech Republic, Denmark, France, Germany, Italy, Lithuania, Poland, Slovakia, and the United Kingdom. Most of the listed countries were covered by each monitoring program, but not all.

1.1.3. Wheat brown rust (*Puccinia triticina*)

Presentation of monitoring data: BASF, Bayer, Syngenta, Sumitomo

- In 2023, monitoring was carried out in France and Germany (limited number of samples).

- Data from 2023 for wheat brown rust showed that sensitivities were in the range of those of the last 20 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2020 and 2022, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, Slovakia, Spain, and the United Kingdom. Most of the listed countries were covered by each monitoring program, but not all.

1.1.4. Eyespot (*Oculimacula* spp.)

Presentation of monitoring data: Bayer, Syngenta

- In 2021, monitoring is carried out in Germany, Italy, Latvia, Poland, Slovakia, and Ukraine.

- The same range of sensitivity as in previous years was observed in all countries.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- An analysis of samples from France, Germany, Latvia, Lithuania, Poland, Russia, Spain, Ukraine, and United Kingdom from 2020 was presented, and the same range of sensitivity observed in all countries as in previous years.

- In 2019, still comparable sensitivity ranges and medians were observed in all monitored countries without any geographical variations.

- The 2018 data showed a homogenous and sensitive situation in all countries.

- Between 2003 and 2012 there was no change in the sensitivity of W and R types, and a stable situation had been observed during that time. In 2013, some sensitivity change has been observed in the United Kingdom, but not in France or Germany. In 2014 further sensitivity decrease has been observed in the United Kingdom, and for the first time also in France and Germany. However, overall, resistance factors still remain low, and performance was not affected.

1.1.5. Tan spot (*Pyrenophora tritici-repentis*)

Presentation of monitoring data: Syngenta

- From 2019 to 2021, a limited monitoring was carried out in countries like Czech Republic, Finland, Hungary, Lithuania, Romania, Slovakia, Sweden, and the United Kingdom.

- In these three years of monitoring, a stable and sensitive situation was observed.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.1.6. Yellow rust (*Puccinia striiformis*)

Presentation of monitoring data: BASF, Bayer, Sumitomo, Syngenta

- In 2023, monitoring was carried out in France, Germany, Poland, and the United Kingdom.

- The first monitoring in 2015 showed high sensitivity and low diversity, and from 2016 to 2023 a stable situation was reported.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2021 and 2022, monitoring was carried out in Belgium, Czech Republic, France, Germany, Italy, Netherlands, Poland, Romania, Spain, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

1.1.7. Snow Mould (*Microdochium nivale & M. majus*)

Presentation of monitoring data: Bayer, Syngenta

- In 2023, due to low disease pressure, only limited monitoring was carried out in Italy, Romania, and Hungary.

- In general, a stable sensitivity situation has been reported for the past ten years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2019 to 2021, monitoring was carried out in Belgium, Bulgaria, Czech Republic, France, Germany, Hungary, Italy, Romania, Russia, Spain, Sweden, Ukraine, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

1.1.8. Fusarium Head Blight (*Fusarium graminearum, F. culmorum*)

Presentation of monitoring data: Bayer, Sumitomo

- In 2021 and 2022, monitoring was carried out in France, United Kingdom, and Germany.
- For the past 10 years, a stable sensitivity situation was observed.
- Different intrinsic activity was reported for other Fusarium species such as *F. poae, F. tricinctum, F. kyushuense*, as known from previous research work.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2019, monitoring was carried out in France.

1.1.9. Glume blotch (*Parastagonospora nodorum*)

Presentation of monitoring data: Syngenta

- In 2020 & 2021, a limited monitoring was carried out in countries like Czech Republic, Germany, Hungary, Latvia, and Sweden.
- A very narrow sensitivity range with high sensitivity levels was observed in both years

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.1.10. Loose wheat smut (*Ustilago tritici*)

Presentation of monitoring data: Syngenta

- In 2020 & 2021, a limited monitoring was carried out in countries like Bulgaria, Germany, Poland, Spain, and Sweden,
- A high level of sensitivity and a narrow range of sensitivity was observed in both years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.2. BARLEY

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.2.1. Powdery Mildew (*Blumeria graminis* f.sp. *hordei*)

DMIs

Presentation of monitoring data: Bayer

- In 2023, monitoring was carried out in Austria, Czech Republic, France, Germany, Hungary, and Italy (limited data available).
- DMI products performed well. The sensitivity of the populations stayed in the range observed for almost 20 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- Between 2016 and 2022, monitoring was carried out in Czech Republic, Denmark, Estonia, Germany, France, Germany, Hungary, Italy, Latvia, Poland, Sweden, Ukraine, and the United Kingdom. Country origin of samples was varying from year to year, and monitoring was most regularly carried out in France, Germany, and the United Kingdom.

Amines

Presentation of monitoring data: Bayer

- In 2023, monitoring was carried out in Austria, Czech Republic, France, Germany, Hungary, and Italy (limited data available).
- The sensitivity of the populations stayed in the range observed in monitoring programs from other FRAC member companies for more than 20 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2020 and 2022, monitoring was carried out in Estonia, France, Germany, Hungary, Italy, and United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

1.2.2. Scald (*Rhynchosporium secalis*)

Presentation of monitoring data: BASF, Syngenta

- In 2023, monitoring was carried out in France, Germany, Denmark, Hungary, Spain, and the Netherlands.

- Stable situation. The sensitivity of the populations stayed in the range as observed in Europe for 20 years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2020 and 2022, monitoring was carried out in Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, The Netherlands, Poland, Slovakia, Spain, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

1.2.3. Net blotch (*Pyrenophora teres*)

Presentation of monitoring data: Bayer, Syngenta

- In 2023, monitoring was carried out in Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Russia, Spain, Sweden, and the United Kingdom.

- Overall, the sensitivity of populations monitored stayed in the range observed in previous years, without any major geographical differences across the main European barley production countries. A few populations with higher EC_{50} values were observed.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2020 and 2022, monitoring was carried out in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, The Netherlands, Ukraine, and the United

Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.
Overall, the sensitivity of populations showed no major geographical differences across Europe.

- In 2019, like 2017, lower sensitivities have been frequently detected in major French regions and in a single location in North-Eastern Germany. In the other European regions monitored sensitivity ranges were stable.

- The monitoring of the last 20 years showed a certain level of fluctuations of the sensitivity level in the regions over the years. In 2018, the situation stabilized again in all countries including France and Germany, thus being comparable to the long-term monitoring results.

- In 2017 in France significant shifts of sensitivity of populations have been observed. Highest EC_{50} values were observed in areas of elevated disease pressure, often coupled with a reported reduced variety-resistance at significant cultivation areas, and sub-optimal use of azoles in spray programs (e.g., reduction of rates in comparison to the manufacturer's recommended rate and inappropriate use of effective mix-partners).

- In general, over the past years a significant fluctuation in sensitivity levels between the years was detected. In 2017 in single locations in Germany there have been seen some shifting which needs to be observed in the next season. The monitoring in the other countries showed a stable situation in 2017 within the regular fluctuation.

1.2.4. Ramularia leaf spot (*Ramularia collo-cygni*)

Presentation of monitoring data: BASF, Syngenta

- In 2023, monitoring was carried out in Croatia, Denmark, France, Germany, Hungary, Ireland, Italy, Poland, Romania, Spain, Slovenia, Switzerland, and the United Kingdom. The results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy
- low frequencies of resistance in Spain
- moderate frequencies of resistance in Hungary, Croatia, Slovenia (variable), Denmark
- high frequencies of resistance in Austria, Czech Republic, Switzerland, Germany, France, Ireland, Poland, Romania (limited data), and United Kingdom.

- Isolates were detected showing significant loss of sensitivity. Relevant CYP51-mutations explaining the effects have been identified (I325T, I328L, Y403C/Y405H).

Despite the high frequency of resistance in several countries, DMIs continue to contribute to disease control and remain an important tool for resistance management.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2022, monitoring was carried out in Austria, Czech Republic, France, Germany, Ireland, Italy, Netherlands, Poland, Spain, Sweden, Switzerland, and the United Kingdom. The results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy
- low to moderate frequencies of resistance in Spain
- moderate to high frequencies of resistance in The Netherlands
- high frequencies of resistance in Austria, Czech Republic, France, Germany, Ireland, Switzerland, Poland, Sweden, Switzerland, and the United Kingdom.

- In 2021, monitoring was carried out in Austria, Croatia, Czech Republic, Denmark, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden, and United Kingdom. The results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy
- low frequencies of resistance in Spain and Croatia.
- moderate frequencies of resistance in Austria and The Netherlands.
- moderate to high frequencies of resistance in Czech Republic, France, Germany, Ireland, Sweden, and the United Kingdom.
- high frequencies of resistance in Denmark.

  On the European continent, a gradient in terms resistance frequencies can be observed from north to south. Overall, the frequency of relevant CYP51-mutations was comparable to 2020. The field performance of DMI-containing products remains still relatively good in 2021.

- In 2020, monitoring was carried out in Denmark France, Germany, Hungary, Ireland, Italy, Lithuania, Poland, Slovakia, Spain, Sweden, Switzerland, and United Kingdom. The results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy
- no to low frequencies of resistance in Italy, Switzerland, and Spain.
- no to high frequencies of resistance in France.
- moderate frequencies of resistance in Austria and The Netherlands.
- moderate to high frequencies of resistance in Germany and Sweden.
- high frequencies of resistance in Czech Republic, Denmark, France, Hungary, Ireland, Lithuania, Slovakia, and United Kingdom.

- In 2019, the results are:

- no isolates/samples with the above-mentioned mutations were detected in Spain and Italy.
- no to low frequencies of resistance in Slovenia and Croatia.
- low frequencies of DMI resistance alleles were detected in Switzerland and Slovakia.
- in Austria, low to moderate frequencies were observed.
- moderate to high frequencies of resistance in Belgium, Germany, and Sweden.
- high frequencies of resistance in France, Ireland, and the United Kingdom.

- In 2018, the results are:

- no isolates with the above-mentioned mutations were detected in Italy, Spain, Sweden, and Switzerland.
- no to high frequencies of resistance in Denmark.
- low to moderate frequencies of resistance in single samples from Austria, France, and Hungary.
- low to high frequency of resistance in Germany.
- moderate to high frequencies of resistance in Belgium, Ireland, Latvia, Netherlands, and the United Kingdom.

- Data from 2017 showed high frequency of resistant strains in Denmark, Ireland, and the United Kingdom, moderate frequency in Estonia, low to moderate frequency in Sweden, and no resistant strains in Finland.

- In 2016, a broad sensitivity range has been identified, with very high frequency of highly resistant strains in southern Germany, with moderate frequency in Denmark, Ireland, Belgium, Northwestern Germany, and with low frequency in France, Austria, Sweden, and the United Kingdom. No detection of resistance in Estonia.

1.2.5. *Puccinia hordei*

Presentation of monitoring data: Bayer, Syngenta

- In 2023, monitoring was carried out in Denmark, France, Germany, Sweden, and the United Kingdom, in 2021 in France, Germany and Poland, as well as in 2019, 2018 and 2014 in Denmark, France, Germany, Sweden, and in the United Kingdom.

- In the last decade, a very stable situation with a narrow range of sensitivity was observed.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

1.2.6. Smut diseases (*Ustilago* spp.)

Presentation of monitoring data: Syngenta

- In 2023, monitoring was carried out in Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, and the United Kingdom.

- A very stable situation with a narrow range of sensitivity was observed for six years, with exception of a few UK isolates from 2018.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- During 2020 and 2022, monitoring was carried out in Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

- In 2018, from specific locations in the United Kingdom product performance issues were reported. Monitoring results from the UK from 2018 revealed a number of strains with higher EC_{50} values. All UK samples analysed in 2019 and 2020 were in a range of sensitivity comparable to 2016 & 2017.
  It should be considered that particular dry and warm climate conditions might negatively affect the performance of products in 2018, favouring the disease development in terms of speed and severity.

1.2.7. Barley stripe disease (*Pyrenophora graminea*)

Presentation of monitoring data: Syngenta

- In 2023, a limited monitoring was carried out in Finland and Poland.

- The sensitivity range was comparable to previous years.

Please refer for the crop specific recommendations for cereals in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- From 2019 to 2022, a limited monitoring was carried out in Germany, Hungary, Poland, United Kingdom, and Sweden.

2. DMIS AND AMINES: INDUSTRIAL CROPS

2.1. SOYBEAN

Please refer for the general recommendations for use and the recommendations for Asian soybean rust to section 5. at the end of the minutes (link).

2.1.1. Asian soybean rust (*Phakopsora pachyrhizi*)

Presentation of monitoring data: BASF, Bayer, Corteva, FMC, Sumitomo, Syngenta

Monitoring still ongoing (BASF)

DMIs

- A sensitivity baseline has been established in Brazil based on 2005/6 data. Extensive monitoring was carried out since 2007/8 across the country.

- In 2022/2023, the monitoring in Brazil showed in general a stable sensitivity situation similar to previous years. In some Brazilian regions, few samples showed slightly lower sensitivity.

Please refer for the recommendations for Asian soybean rust in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2021/2022, the monitoring in Bolivia, Brazil and Paraguay showed in general a stable sensitivity situation similar to previous years. In some Brazilian & Paraguayan regions, single samples showed lower sensitivity.

- In 2020/21, the monitoring in Brazil, Paraguay and Bolivia showed in general a stable sensitivity situation similar to previous years. In some Brazilian regions a tendency towards lower sensitivities was observed.

- In 2019/20, across tested Brazilian and Paraguayan regions the observed sensitivity levels were on the same level as in previous years.

- In 2018/19, in some Brazilian regions a tendency towards lower sensitivities with higher variability was observed. In other regions, the sensitivity of populations was stable compared to previous years.

- In 2017/18, monitoring showed in general a stable situation as in the last years, but locally some slight shift was observable in western parts of Brazil. Despite this situation it is recognized that a regional variability in performance of DMI mixtures has been observed.

- Sensitivity shifts have been observed with a trend to stabilize in season 2010/11. This has to be seen in connection with the recommendation of an azole use in mixtures only and the introduction of a crop-free period. This

trend continued in the following seasons until season 2013/14. In 2014/2015 slight shifts in sensitivity has been observed compared to 2013/14. In 2015/16 and 2016/17 the sensitivity level was on the same level as in previous years.

2.1.2. Target Spot (*Corynespora cassiicola*)

DMIs

Presentation of monitoring data: BASF, Bayer, FMC, Syngenta

- First studies were carried out with isolates from season 2013/14 and 2014/15 by BASF. These initial studies showed high sensitivity to DMIs.

- In season 2022/23, monitoring was carried out in Brazil. A stable sensitivity situation was observed in comparison to previous years. Genetic analysis did not detect any new or known relevant target site mutation.

Historical data:

- In season 2021/22, monitoring was carried out in Brazil. A stable sensitivity situation was observed in comparison to previous years.

- In season 2020/21, monitoring was carried out by BASF and Syngenta. A stable sensitivity situation was observed in comparison to previous years.

- In seasons 2019/20 and 2018/19, monitoring was carried out by BASF and Syngenta. A stable sensitivity situation was observed in comparison to previous years.

- Monitoring analysis from season 2016/17 and 2017/18 was presented by Syngenta. A stable sensitive situation was observed.

2.1.3. Cercospora leaf blight (*Cercospora* spp.)

DMIs

Presentation of monitoring data: Syngenta

- In season 2021/22, monitoring was carried out in six Brazilian regions. A stable sensitivity situation was observed in comparison to previous seasons.

Historical data:

- In season 2020/21, monitoring was carried out by Syngenta in Brazil. A stable sensitivity situation was observed in comparison to 2019/2020.

- In season 2019/20, an initial monitoring was carried out by Syngenta. Data showed high level of sensitivity across sampled regions in Brazil.

2.1.4. Anthracnose (*C. gloeosporioides & C. siamense*, involved in stem and pod rot anomalies)

Presentation of monitoring data: Syngenta

- In seasons 2021/22 and 2022/23, monitoring data showed a high level of sensitivity across sampled regions in Brazil.

2.1.5. Phomopsis seed decay (*Diaporthe* spp., involved in stem and pod rot anomalies)

Presentation of monitoring data: Syngenta

- In season 2021/22 and 2022/23, monitoring data showed high level of sensitivity across sampled regions in Brazil.

2.1.6. Septoria Brown Spot (*Septoria glycines*)

DMIs

Presentation of monitoring data: BASF

- In the years 2021 and 2022, an initial monitoring was carried out in Slovakia and Romania (2021). Data showed high level of sensitivity.

2.2. OILSEED RAPE

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

2.2.1. Phoma leaf spot and stem canker, blackleg *(Plenodomus lingam / Plenodomus biglobosus)*

Presentation of monitoring data: BASF

- In 2022/23, monitoring was carried out in Austria, Czech Republic, France, Germany, Poland, Sweden, Romania, and the United Kingdom.

- The monitoring data showed a stable sensitivity range as observed in the last 15 years.

For recommendations see General Recommendations.

Historical information:

- Between seasons 2018/19 and 2021/22, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, Poland, Romania, Slovakia, Sweden, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

2.2.2. Sclerotinia stem rot, white mould (*Sclerotinia sclerotiorum*)

Presentation of monitoring data: BASF, FMC, Syngenta, in previous years as well by Bayer and Corteva

Preliminary data:

- All monitoring data from 2016 to 2023 showed a stable and narrow sensitivity range with no geographical differences.

- In 2023, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Sweden, and United Kingdom.

For recommendations see General Recommendations.

Historical information:

- Between 2016 and 2022, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Sweden, Ukraine, and United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

2.2.3. Light leaf spot (*Pyrenopeziza brassicae*)

Presentation of monitoring data: BASF

- Monitoring programs since 2020 in Denmark or United Kingdom showed a stable sensitivity distribution.

2.3. SUGAR BEET

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

2.3.1. Leaf spot (*Cercospora beticola*)

Presentation of monitoring data: BASF, Bayer, Syngenta

DMIs

- In 2022, monitoring was carried out in Austria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Lithuania, Poland, Romania, Spain, Switzerland, and the United Kingdom.

- Overall, as in previous years, European populations of *C. beticola* showed a stable sensitivity range.

Based upon the broad range of sensitivity observed in previous years, it is assumed that a shift took place before routine monitoring was set up.

Historical data:

- In 2020, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Netherlands, Poland, Romania, Spain, and Switzerland. Overall, a stable sensitivity situation was observed as in previous years.

- In 2019, monitoring was carried out in Austria, Belgium, France, Germany, Italy, Netherlands, Poland, Romania, Slovakia, Spain, and Switzerland. A stable sensitivity situation was observed as in previous years.
  Single isolates with increased EC_{50} values were already detected in France and Germany in previous years but remain stable at a low frequency.

- In 2017 and 2018, monitoring was carried out in Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Spain, Switzerland, Turkey, Ukraine, and the United Kingdom. A stable sensitivity situation was observed as in the last 5 to 6 years. Most of the listed countries were covered by the monitoring programs in each year, but not all.

For recommendations see General Recommendations.

Amines

- In 2020, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Netherlands, Poland, Romania, Spain, and Switzerland.

- The monitoring revealed as in the past years a stable situation with a small range of sensitivity and without geographic variations.

For recommendations see General Recommendations.

Historical data:

- Monitoring between 2017 and 2019 was carried out in Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy,

Lithuania, Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Spain, Switzerland, Ukraine, and the United Kingdom. Most of the listed countries were covered by the monitoring programs each year, but not all.

2.4 RICE

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

2.4.1. Narrow brown spot (*Cercospora janseana*)

Presentation of monitoring data: Syngenta

- Initial sensitivity studies performed 2017 with limited number of strains indicated high and homogenous sensitivity in Indonesia.

2.4.2 *Rhizoctonia solani*

Presentation of monitoring data: Syngenta

- Monitoring was carried out in China in 2015, 2016 and 2017. The monitoring indicated a stable and sensitive situation.

2.5 COTTON

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

2.5.1. Ramularia leaf blight *(Ramulariopsis gossypii)*

DMIs
Presentation of monitoring data: Syngenta

- In 2017/2018, a monitoring was carried out in Brazil. The observed sensitivity range was comparable to the results from the baseline of 2011. Single isolates with higher EC_{50} values were detected in 2018.

- FMC monitoring is still ongoing.

Amines
Presentation of monitoring data: BASF

- In seasons 2017/18 to 2019/20 and 2021/22, monitoring was carried out in Brazil. The results showed a sensitive situation with EC_{50} values being in a similar range over these four seasons.

2.5.2. Target spot (*Corynespora cassiicola*)

DMIs
Presentation of monitoring data: BASF, BAYER, FMC and Syngenta

- In 2022/23, monitoring was carried out in Brazil. The results showed a sensitive situation with EC_{50} value being in a similar range over the six years since the monitoring started.

Historical data:

- In 2021/22, monitoring was carried out by BASF, BAYER, FMC, and Syngenta in Brazil. The results showed a sensitive situation with EC_{50} value being in a similar range over the five years since the monitoring started.

- In 2019, monitoring was carried out by BASF in Brazil. The results showed a sensitive situation with EC_{50} value being in a similar range as in 2018.

- In 2018, BASF and Syngenta performed a monitoring in Brazil. The results showed a sensitive situation with a narrow range of sensitivity.

2.6 Sunflower

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

2.6.1 Sclerotinia stem rot (*Sclerotinia sclerotiorum*)

DMIs

Presentation of monitoring data: Syngenta

- In 2022, monitoring was carried out in Romania and France. Data showed a narrow sensitivity range with EC_{50} values comparable to *S. sclerotiorum* in oilseed rape and cabbage.

Historical data:

- In 2019, initial monitoring was carried in Bulgaria, Romania, and Slovakia by BASF. Data showed a narrow sensitivity range with EC_{50} values comparable to *S. sclerotiorum* in oilseed rape.

2.6.2 Black Stem disease (*Plenodomus lindquistii*)

Presentation of monitoring data: BASF

DMIs

- In 2022, initial monitoring was carried out with samples from Romania. Data showed a narrow sensitivity range.

2.7 Pea

Please refer for the general recommendations for use to section 5. At the end of the minutes (link).

2.7.1. Ascochyta blight (*Ascochyta pisi, Didymella pinodes, D. pinodella*)

DMIs

Presentation of monitoring data: BASF

- In 2022, monitoring was carried out in France. Data showed a narrow sensitivity range.

Historical data:

- In 2021, initial monitoring was carried out in France and Spain by BASF. Data showed a narrow sensitivity range.

2.8 Beans

Please refer for the general recommendations for use to section 5. At the end of the minutes (link).

2.8.1 Sclerotinia stem rot (*Sclerotinia sclerotiorum*)

Presentation of monitoring data: Syngenta

DMIs

- In 2022, monitoring was carried out in Belgium, France and the Netherlands. Data showed a narrow sensitivity range with EC_{50} values comparable to *S. sclerotiorum* in oilseed rape and cabbage.

Historical data:

- In 2020, for the first-time monitoring on beans and green beans was carried out in France, and in 2021, samples from France and Belgium were analyzed. All isolates collected showed a narrow sensitivity range and high sensitivity (low EC_{50} values).

3. DMIS AND AMINES: OTHER CROPS

3.1. GRAPE VINE:

Please refer for the crop specific recommendations for grape vine in combination with the general recommendations for use to section 5. At the end of the minutes (link).

3.1.1 Powdery mildew (*Erysiphe necator*)

Monitoring data for **DMIs** were presented by BASF, Bayer, Corteva, and Syngenta

- In 2023, monitoring was carried out in Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Italy, Hungary, Portugal, Spain, Slovakia, Slovenia, Romania, Switzerland, and Turkey.

- Sensitivity monitoring based on bioassays showed a stable and homogeneous distribution in the range of the previous year.

Exclusive frequency measurements of a single cyp51 mutation, such as Y136F, are not sufficient to describe the sensitivity situation in *Erysiphe necator* populations towards DMIs.

Please refer for the crop specific recommendations for grape vine in combination with the general recommendations for use to section 5. At the end of the minutes (link).

Historical information:

- In 2021, monitoring was carried out in Austria, Croatia, France, Germany, Greece, Italy, Hungary, Portugal, Spain, Switzerland, and Turkey. Generally, population sensitivity can vary significantly between locations and years within individual countries. In 2021, a shift to lower sensitivities was observed in some samples. Variable resistance factors were observed.

- Between 2017 and 2020, monitoring was carried out in Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, and Turkey. Most of the listed countries were covered by the monitoring programs each year, but not all.

Monitoring data for **amines** for were presented by: Bayer

- In 2022, monitoring was carried out in Austria, Hungary, Germany, France, Italy, Portugal, and Spain.

- Stable situation in the European countries with low resistance factors towards amines with only small regional fluctuations close to the baseline.

Please refer for the crop specific recommendations for grape vine in combination with the general recommendations for use to section 5. At the end of the minutes (link).

Historical data:

- In 2019, monitoring was carried out in Austria, Croatia, Germany, Italy, Portugal, and Spain, as well as in 2020 in Austria, France, Germany, Hungary, Italy, Spain, and Switzerland.
  A stable situation in the European countries with low resistance factors towards amines was observed, with only small regional fluctuations close to the baseline.

3.2. STONE AND POME FRUIT

Please refer for the crop specific recommendations in pome- and stonefruit in combination with the general recommendations for use to section 5. At the end of the minutes (link).

3.2.1. Scab on APPLE (*Venturia inaequalis*)

Presentation of monitoring data: BASF, Bayer, and Syngenta

- Overall, the sensitivity in European populations remains unchanged since around a decade. A few outliers with lower sensitivity levels were observed.

- In 2022, monitoring was carried out in Belgium, Bulgaria, Croatia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovenia, and Spain.

Please refer for the crop specific recommendations in pome- and stonefruit in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical information:

- Between 2018 and 2021, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, Denmark, France, Germany, Greece, Hungary, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland, and Turkey.

3.2.2. Powdery mildew (*Podosphaera leucotricha*) on APPLE

Presentation of monitoring data: Syngenta, BASF

- In 2023, monitoring was carried out in Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Latvia, Portugal, Poland, Romania, and Spain.
  Monitoring was started across Europe in 2010. No change in sensitivity since then was observed.

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

Historical information:

- Between 2017 and 2022, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, France, Germany, Greece, Hungary, Spain, Italy, Netherlands, Türkiye, Hungary, Latvia, Lithuania, Poland, Portugal, Romania, Slovenia, and Spain, but some of the listed countries were not covered by the monitoring programs each year.
  No change in sensitivity comparing 2022 to 2010 was observed.

3.2.3. Brown rot on stonefruit (*Monilinia* spp.) – ALMOND, APRICOT, CHERRY, NECTARINE, PEACH, PLUM

Presentation of monitoring data: Syngenta and BASF

- In 2023, monitoring was carried out in Belgium, Bulgaria, France, Germany, Greece, Hungary, and Spain. Crops sampled were apricots, cherry, nectarine, other *Prunus* species and pome fruits.

- Until now, a narrow and homogenous distribution of sensitivity is detected across all crops, countries, and species.

Please refer for the crop specific recommendations in pome- and stonefruit in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical information:

- In 2021, monitoring was carried out in Croatia, Czech Republic, Belgium, Bulgaria, France, Germany, Greece, Hungary, Italy, Poland, Romania, Spain. Crops sampled were apricots, cherry, nectarine, and other *Prunus* species.

- In 2020, monitoring was carried out in Greece, France, Hungary, and Spain. Crops sampled were almond, nectarine and cherry.

- In 2018 & 2019, monitoring was carried out in Belgium, Bulgaria, Croatia, France, Germany, Hungary, Italy, Poland, and Spain.

3.2.4. *Stemphylium vesicarium* on PEARS

Presentation of monitoring data: Syngenta

- Overall, a homogenous and stable situation in terms of sensitivity was observed.

- In 2021, monitoring was carried out in Belgium, Italy, and Portugal.

Please refer for the crop specific recommendations in pome- and stonefruit in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical information:

- Between 2018 and 2020, monitoring was carried out in Belgium, Hungary, Italy, Netherlands, Portugal, and Spain. Most of the listed countries were covered by the monitoring programs each year, but not all.

3.3. TOMATO / POTATO

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

3.3.1. *Alternaria solani*, *Alternaria alternata* and *Alternaria linariae*

Presentation of monitoring data: Bayer, Syngenta

- A homogenous sensitivity of all studied *Alternaria* species was observed in 2023, comparable to previous years.

- In 2023, monitoring was carried out in Belgium, Germany, Finland, France, Netherlands, Latvia, Poland, Sweden, and Switzerland.

  Isolates with mutation-combinations (L143F + G446S or G462S) were found. Resistance factors were very low and fitness penalties were observed.

Historical information:

- Between 2019 and 2022, monitoring was carried out on potatoes and/or tomatoes in Austria, Belgium, Bulgaria, Croatia, Denmark, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, and Sweden. Most of the listed countries were covered by the monitoring programs each year, but not all.

3.3.2. *Oidium neolycopersici*

Presentation of monitoring data: Syngenta

- Monitoring in 2018 showed a comparable sensitivity range as monitored since 2015, with no variations between countries.

3.3.3. Leaf mold (*Fulvia fulva)*

Presentation of monitoring data: Syngenta

- In 2019, initial monitoring studies were carried out in China, and indicated a high and homogenous sensitivity.

3.3.4. Silver scurf (*Helminthosporium solani*)

Presentation of monitoring data: Syngenta

- In 2022, potato crops grown in Belgium, Germany, France, Hungary, Italy, Netherlands, Spain, and United Kingdom were monitored.

- A stable sensitivity range was observed in European countries since 2012.

Historical data:

- In 2019 and 2020, a few isolates showed slightly lower sensitivity levels.

3.4. CUCURBITS

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

3.4.1. *Podosphaera xanthii*

Presentation of monitoring data: BASF and Syngenta

- In 2022, monitoring was carried out in France, Greece, Italy, Portugal, Spain, and Turkey.

- No change of sensitivity has been observed from 2011 to 2022, and no variations between countries and samples collected from cucumbers, melon, pumpkin, or zucchini were monitored.

Historical information:

- In 2020, monitoring was carried out in Belgium, Bulgaria, France, Hungary, Greece, Italy, Poland, Serbia, and Spain. Crops sampled were cucumber, melon, and zucchini.

- In 2018 and 2019, monitoring was carried out in Belgium, France, Greece, Italy, Netherlands, Poland, and Spain. Most of the listed countries were covered by the monitoring programs in each year, but not all.

3.4.2. Gummy Stem blight (*Stagonosporopsis cucurbitacearum*)

Presentation of monitoring data: Syngenta

- Monitoring started in 2017 and continued in 2018 and 2019 in Belgium and Spain, as well as in two Spanish locations in 2021.

- In general, a stable sensitivity situation was observed. Compared to previous years, single isolates with higher EC_{50} values were reported in 2021.

3.5. OTHER VEGETABLES

Please refer for the general recommendations for use to section 5. at the end of the minutes (link).

3.5.1. *Alternaria* species on BROCCOLI, CABBAGE, CARROTS, CAULIFLOWER

Presentation of monitoring data: BASF, Syngenta

- In 2023, monitoring was carried out in Belgium and Netherlands (limited data).

- Monitored species was *Alternaria dauci* on carrots, and no indication of decreased sensitivity has been observed.

Historical data:

- In 2022, monitoring was carried out in France. Monitored species were *Alternaria alternata* on cabbage and carrots, without any indication of decreased sensitivity across all crops, countries, and species.

- In 2019, monitoring was carried out in Belgium, Croatia, France, Greece, Hungary, Italy, Poland, Portugal, and Spain. Monitored species were *Alternaria alternata*, *A. brassicae, A. brassicicola and A. dauci* on broccoli, cabbage, and carrots, without any indication of decreased sensitivity across all crops, countries, and species.

3.5.2. *Stemphylium vesicarium* on ASPARAGUS

Presentation of monitoring data: Syngenta

- In 2018, a stable sensitivity as in the previous years was observed in the United Kingdom; single isolates with higher EC_{50} values were already detected but remained stable at a low frequency.

3.5.3. *Stemphylium botryosum* on SPINACH

- Initial sensitivity studies performed in 2018 by Syngenta with limited number of strains indicated high and homogenous sensitivity in the USA.

3.5.4. White mould (*Sclerotinia sclerotiorum*) on LETTUCE

Presentation of monitoring data: Syngenta

- In 2020, for the first-time sensitivity monitoring on lettuce was carried out in Spain. In 2021, samples from France, Italy, and Spain were analyzed.

- All isolates collected showed a narrow sensitivity range and high sensitivity. (low EC_{50} values).

3.5.5. *Stemphylium vesicarium* on ONIONS

Presentation of monitoring data: Syngenta

- In 2021, all isolates monitored from onion collected in Germany and Poland showed EC_{50} values in a range of known sensitivity levels of *S. vesicarium* from other crops.

3.6. CITRUS, STRAWBERRY

Please refer for the general recommendations for use of DMIs to section 5. at the end of the minutes (link).

3.6.1. Anthracnose (*Colletotrichum acutatum*)

Presentation of monitoring data: Syngenta

- Initial sensitivity studies performed in 2017 with limited number of strains indicated high and homogenous sensitivity in USA.

3.7. BANANA

3.7.1. Black Sigatoka (*Pseudocercospora fijiensis*)

In case you are interested in background information for resistance management in bananas, please follow this link: Information on Banana

4. KETO-REDUCTASE-INHIBITORS – KRI (SBI-CLASS III)

This group comprises of Fenhexamid and Fenpyrazamine as inhibitors of the enzyme Keto-Reductase (KRIs). Both are cross-resistant.

4.1. Grey mould (*Botrytis cinerea*) on GRAPE VINE

Presentation of monitoring data: Bayer and Sumitomo

- In 2023, monitoring was carried out in France, Germany, and Italy. The frequency of resistant isolates was low in all studied countries.

Field performance of botryticides is most effective if embedded in sound spray programmes, respecting the individual resistance management recommendations.

Please refer for the disease specific recommendations for control of Botrytis spp. in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2022, monitoring was carried out in France, Germany, Italy, and Spain. The frequency of resistant isolates was low to moderate in in all studied countries, depending on the region.

- In 2021, monitoring was carried out in France, Germany, Italy, and Spain. The frequency of resistant isolates was low in Italy, and low to moderate in France, Germany, and Spain.

- In 2020, monitoring was carried out in France, Germany, Italy, and Spain. The frequency of resistant isolates was low to moderate in France, Italy, and Spain, and moderate in Germany.

- In 2019, monitoring was carried out in Austria, France, Germany, Hungary, Italy, and Spain. The frequency of resistant isolates was low in Austria, Hungary, and Spain, low to moderate in France and Germany, and moderate in Italy.

- In 2018, the frequency of resistant isolates was very low in Hungary and Italy, low in France, moderate in Germany, and moderate to high in Chile.

- In 2017, the frequency of resistant isolates was low in Austria and France, moderate in Germany, and in Italy all strains analysed were fully sensitive.

- In 2016, moderate to high frequencies in Germany, low frequencies in France and very low frequencies in Italy and Spain.

- High frequencies of resistant isolates were detected in Chile (2014, 2015, 2016).

4.2. Grey mould (*Botrytis cinerea*) on STRAWBERRIES

Presentation of monitoring data: Bayer and Sumitomo

- In 2023, monitoring was carried out in Italy and Poland. A low frequency of resistant isolates was detected.

Please refer for the disease specific recommendations for control of Botrytis spp. in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- In 2022, monitoring was carried out in France, Germany, Spain, and Italy. The frequency of resistant isolates was low to moderate in Germany and France. In Italy and Spain, a low to high frequency was detected, dependent on the region.

- In 2021, monitoring was carried out in Poland, Germany, Italy and France. The frequency of resistant isolates was low to moderate in all countries.

- In 2020, monitoring was carried out in France, Germany, Italy, Netherlands, Norway, Poland, Spain, and the United Kingdom. The frequency of resistant isolates was low to moderate in France, Germany, Norway, and Poland, moderate in Italy, Netherlands, and the United Kingdom, and moderate to high in Spain.

- In 2019, monitoring was carried out in Austria, France, Denmark, Italy, Poland, Germany, and the United Kingdom. The frequency of resistant isolates was low in Austria, France, and Denmark, low to moderate in Poland, moderate in Germany, and moderate to high in Italy and the United Kingdom.

- In 2018, monitoring was carried out in Austria, Denmark, France, Germany, Italy, Netherlands, Norway, Poland, Sweden, Spain, and the United Kingdom. The frequency of resistant isolates was low in Austria, France, Poland, and Sweden, low to moderate in Denmark, Italy, the Netherlands and Germany, moderate in Spain, and moderate to high in Norway and the United Kingdom.

- In 2017, monitoring was carried out in 2017 in Denmark, France, Germany, Netherlands, Poland, and the United Kingdom. High presence of resistant strains was observed in the United Kingdom, low to moderate presence in Denmark, Germany, and the Netherlands, and low presence in Austria, France, and Poland.

4.3. Grey mould (*Botrytis cinerea*) on RASPBERRIES

Presentation of monitoring data: Bayer

- Monitoring in 2015 in the Netherlands showed moderate frequency of resistance.
- Limited monitoring in Norway in 2014 showed high frequency of resistant strains.

Please refer for the disease specific recommendations for control of Botrytis spp. in combination with the general recommendations for use to section 5. at the end of the minutes (link).

4.4. Grey mould *(Botrytis cinerea)* on TOMATO

Presentation of monitoring data: Sumitomo

- In 2022, monitoring was carried out in Spain, Italy, and France. Frequency was moderate to high dependent on the region.

Please refer for the disease specific recommendations for control of Botrytis spp. in combination with the general recommendations for use to section 5. at the end of the minutes (link).

Historical data:

- Monitoring was carried out in Spain (2020), Italy and France (2021).
- In previous years, monitoring was carried out in France, Hungary, Italy, the Netherlands, Poland, and Spain. The frequency of resistant isolates in Spain, Italy, and France was low.
- In 2019, monitoring was carried out in France, Hungary, and Italy. The frequency of resistant isolates was low in France and Hungary, and moderate in Italy.

4.6. Brown rot (*Monilinia* spp.) in STONE FRUITS

Presentation of monitoring data: Sumitomo

- In 2022, monitoring was carried out in Spain and Italy.
- A stable sensitivity range was observed as in previous years.

For recommendations see General Recommendations.

Historical information:

- In 2021, monitoring was carried out in Spain and Italy, as well as in 2020 in France, Italy, and Spain.

5. Review of global guidelines

5.1 SBI – General recommendations for use

The SBI fungicides represent one of the most potent classes of fungicides available to the grower for the control of many economically important pathogens. It is in the best interest of all those involved in recommending and using these fungicides that they are utilised in such a way that their effectiveness is maintained.

The working group concentrates its resources on the major crop/pathogen targets from the point of view of resistance risk. Inevitably many, still important pathogens are omitted. To help in making recommendations for crops and pathogens not directly covered, the following general recommendations can be made:

- Repeated application of SBI fungicides alone should not be used on the same crop in one season against a high-risk pathogen in areas of high disease pressure for that particular pathogen.
- For crop/pathogen situations where repeated spray applications (e.g., orchard crops/powdery mildew) are made during the season, alternation (block sprays or in sequence) or mixtures with an effective non-cross-resistant fungicide are recommended.
- Where alternation or the use of mixtures is not feasible because of a lack of effective or compatible non-cross-resistant partner fungicides, then input of SBI's should be reserved for critical parts of the season or crop growth stage.
- If the performance of SBIs should decline and sensitivity testing has confirmed the presence of less sensitive isolates, SBIs should only be used in mixture or alternation with effective non-cross-resistant partner fungicides.
- The introduction of new classes of chemistry offers opportunities for more effective resistance management. The use of different modes of action should be maximized for the most effective resistance management strategies.
- Users must adhere to the manufacturers' recommendations. In many cases, reports of "resistance" have, on investigation, been attributed to cutting recommended use rates, or to poorly timed applications.
- Fungicide input is only one aspect of crop management. Fungicide use does not replace the need for resistant crop varieties, good agronomic practice, plant hygiene/sanitation, etc.
- Exclusive frequency measurements of single cyp51 mutations are not sufficient to describe the sensitivity situation towards DMIs but can help to better understand the background of sensitivity shifts.

5.2 SBI – Recommendations for cereals (DMIs and amines)

The recommendations for the use of DMI and amine fungicides in mixture or alternation programmes with different mode of action fungicides remain unchanged.

It needs to be emphasized that it is essential for resistance management purposes to follow strictly the manufacturer's and FRAC recommendations.

- Repeated application of DMI or amine fungicides alone should not be used on the same crop in one season against risky pathogens (e.g., cereal powdery mildews, barley net blotch, scald) in areas of high disease pressure for that particular pathogen.
- Reduced rates of DMIs can contribute to accelerate the shift to less sensitive populations. It is critical to use effective rates of DMIs in order to ensure robust disease control and effective resistance management. DMIs must provide effective disease control and be used at manufacturers recommended rates.
- When used in mixture recommended effective rates of the SBI must be maintained.
- Split and reduced rate programmes, using multiple repeated applications at dose rates below manufacturer's recommendations, provide continuous selection pressure and accelerate the development of resistant populations, and therefore must not be used.

To ensure good performance and particularly resistance management in situations of even low disease pressure it is essential to adhere to dosages and spray timings as recommended by manufacturers. Curative applications should be avoided. Application timing has to be appropriate to all mix partners' characteristics. Mixing with a non-cross resistant fungicide at effective dose rates contributes to a more effective disease control and resistance management.

The amine fungicides are effective non-cross-resistant partner fungicides for DMIs on cereals for the control of pathogens included in the label recommendation of each respective product.

5.3 SBI – Recommendations for Asian soybean rust:

Refer to the general recommendations for SBI's.

In addition, to ensure robust disease control and resistance management it is essential to

- Apply DMI fungicides always in mixtures with effective non-cross resistant fungicides (mix partner shall provide control over the spraying interval).
- Refer to manufacturers recommendations for rates. Reduced rates must be avoided.
- Apply preventively or as early as possible in the disease cycle.
- Ensure a proper coverage of the treated crop by appropriate and well calibrated application technology (e.g., to ensure penetration into canopy).
- Apply DMI fungicide containing products always at intervals recommended by the manufacturers and adjusted to the disease epidemics. Avoid extended spray intervals.

	• Good agricultural practices must be considered to reduce source of inoculum, disease pressure and resistance risk, e.g., no multiple cropping, implement and respect soybean-free periods, consider partially resistant soybean varieties, reduce the planting window, give preference to early-cycle varieties and endorse the destruction of volunteers.
	5.4 SBI – Recommendations for Grapevine: • DMIs and amines should be used preventative and curative situations should be avoided. • The existing strategy for effective disease control and resistance management continues to be successful and the use recommendation is a maximum of 4 applications per season per mode of action. The strategy includes the use of mixtures or alternation with non-cross-resistant fungicides. • To ensure that SBIs can remain the effective basis for control of *Erysiphe necator* in grapevine, their use should adhere to the full recommended rate (either alone or in mixture) at the recommended timing and application volume and an accurate treatment of each row.
	5.5 SBI – Recommendations in Pome- and Stonefruit: • DMI fungicides are not recommended for season long use and a maximum of 4 DMI sprays either alone or in mixture is recommended. • DMIs should be used in mixtures or (block) alternations with a non-cross-resistant fungicide. Application of recommended label rates is important. • Preventative applications should always be the first choice with DMIs. Curative applications are only recommended when accurate disease warning systems are available.
	5.6 KRI – Recommendations for control of *Botrytis* spp.: • Use KRIs only protectively. • Use KRIs only in strict alternation, no block application • Solo product as part of alternation programmes: - Spray programmes with a maximum of 3 treatments per season: max. 1 application with KRIs - Spray programmes with 4-5 treatments/season: max. 2 applications with KRIs - Spray programmes with 6 and more treatments: at the maximum one third of all Botryticide-applications • Use in mixtures: - Both partners - if applied alone at the dose used in the mixture - must have sufficient activity against Botrytis.

	- Not more than 50% of all Botryticide-treatments should be made with KRIs-containing mixtures. For sound resistance management, good agricultural practices, including phytosanitary measures and crop protection, should be followed carefully.

5. NEXT MEETING

Next WG meeting is planned for March xx nd, 2024.