STEROL BIOSYNTHESIS INHIBITOR (SBI) WORKING GROUP

Minutes from WG meeting on January 20th, 2023 and update on April, 20th, 2023

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

Participants of the SBI WG Meetings

ADAMA	Martin Huttenlocher(partly)
BASF	Martin Semar Gerd Stammler Anna Huf (excused)
Bayer CropScience	Frank Goehlich (excused) Andreas Mehl Juergen Derpmann
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FMC	Gaelle Huet Henry Ngugi (excused)
Sumitomo	Yuichi Matsuzaki Ippei Uemura (excused)
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Venue of the January meeting: Frankfurt, Hotel Lindner; Teams (online)
Venue of the April meeting: 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

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

Presentation of monitoring data 2022: BASF, Bayer, Corteva, FMC, Syngenta

- In 2022, monitoring was carried out in Austria, Belgium, Bulgaria, 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 2022 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. The field performance of DMI-containing fungicides was good when used according to the manufacturers and FRAC recommendations.

- In 2021, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Sweden, The Netherlands, Turkey, Ukraine, and the United Kingdom.

- In 2020, disease pressure was low to moderate with very dry conditions in some countries. DMIs field performance was good when used according to the manufacturers and FRAC recommendations. No general field resistance has been reported.

- In 2020, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine and United Kingdom

- In 2020, the sensitivity of populations was overall stable on European level with EC_{50} sensitivity values in the range of previous years.

- Overall, as already reported in 2019, DMI EC50 sensitivity 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 *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.

- In 2019, the sensitivity of the populations was overall stable on 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 EC50 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 EC50 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 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.

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

DMIs

Presentation of monitoring data 2022: Bayer, Corteva

- In 2022, monitoring was carried out in Czech Republic, Denmark, Germany, France, Italy, Latvia, Lithuania, Poland and United Kingdom

- Sensitivity data presented for 2016 to 2022 confirmed that the situation was overall stable within the range of variability detected during the last 20 years.

- In 2021, monitoring was carried out in France, Germany, Hungary, Italy, Poland, Spain and the United Kingdom

- In 2020, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Poland and United Kingdom.

- In 2019, monitoring was carried out in Czech Republic, France, Germany, Poland, and United Kingdom.

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

- 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.

Amines

Presentation of monitoring data 2022: Bayer,

- Field performance of amine-based products was good.

- In 2022, monitoring was carried out in Czech Republic, Denmark, Germany, France, Italy, Lithuania, Poland and the United Kingdom
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- In 2020 monitoring was carried out in Czech Republic, Denmark, France, Germany, Poland, Slovakia and United Kingdom.

- Sensitivity data presented confirmed that the situation in 2022 was stable remaining in the range of variability seen over more than 25 years in monitoring carried out by other FRAC member companies.

1.1.3. Wheat brown rust (*Puccinia triticina*)

Presentation of monitoring data 2022: BASF, Bayer,, Syngenta

- In 2022, monitoring was carried out in Belgium, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, Slovakia, Spain, and the United Kingdom

- In 2020, brown rust disease pressure was low to moderate in most of the countries in Europe.

- Monitoring in 2020 has been carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Poland, Romania, Slovakia, Spain and United Kingdom.

- Sensitivity data from 2022 for wheat brown rust showed that sensitivities were in the range of those of the last 20 years as observed in monitoring from other FRAC member companies.

1.1.4. Eyespot (*Tapesia* spp, *syn. Oculimacula* spp.)

Presentation of monitoring data 2021: Bayer, Syngenta

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

- An analysis of samples from France, Germany, Latvia, Lithuania, Poland, Russia, Spain, Ukraine and United Kingdom from 2020 was presented.

- In 2020, the same range of sensitivity as in previous years was observed in all countries.

- 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, 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, syn. Drechslera tritici-repentis)*

Presentation of monitoring data 2021: 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.

1.1.6. Yellow rust (*Puccinia striiformis*)

Presentation of monitoring data 2022: Bayer, Sumitomo, Syngenta

- In 2022, monitoring was carried out in France, Germany, Italy, Netherlands, Poland, Romania, Spain and the United Kingdom
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- In 2021, monitoring was carried out in Belgium, Czech Republic, France, Germany, Italy, Poland, and Romania.

The first monitoring in 2015 showed high sensitivity and low diversity, and from 2016 to 2022 a stable situation was reported

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

Presentation of monitoring data 2021: Bayer, Syngenta

- In 2021, monitoring was carried out in Belgium, Bulgaria, Czech Republic, France, Germany, Italy, Romania, Russia, Spain, Ukraine and the United Kingdom.
- In 2020, monitoring was carried in France & UK.
- In 2019, monitoring was carried out in Belgium, France, Germany, Hungary Italy, Sweden, Ukraine and United Kingdom.
- In general, a stable sensitivity situation has been reported for the past eight years.

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

Presentation of monitoring data 2019: Bayer, Sumitomo: 2021 and 2022:

- In 2021 and 2022, monitoring was carried out in France, United Kingdom and Germany.
- In 2019, monitoring was carried out in France.
- 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.

1.1.9. Glume blotch (*Stagonospora nodorum*)

Presentation of monitoring data 2020 & 2021: 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

1.1.10. Loose wheat smut (*Ustilago nuda* f.sp. *tritici*)

Presentation of monitoring data 2021: 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

1.2. BARLEY

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

DMIs

Presentation of monitoring data 2022: Bayer

- In 2022, monitoring was carried out in Estonia, France, Germany, Hungary and Italy.
- In 2021, monitoring was carried out in Germany, France, Hungary, Italy, Poland, and the United Kingdom
- Monitoring was carried out in Czech Republic, Denmark (2016), France, Germany, Latvia, Sweden (2016), Ukraine, and United Kingdom. Results from 2018 & 2020 monitoring in France, Germany and United Kingdom were presented by Bayer.
- In 2022, DMI products performed well. The sensitivity of the populations stayed in the range observed for more than 17 years.

Amines

Presentation of monitoring data 2022: Bayer

- In 2022, monitoring was carried out in Estonia, France, Germany, Hungary and Italy.
- In 2020, monitoring was carried out in France, Germany, and United Kingdom.
- The sensitivity of the populations stayed in the range observed in monitoring programs from other FRAC member companies for more than 20 years

1.2.2. Scald (*Rhynchosporium commune*)

Presentation of monitoring data 2022: BASF, Syngenta

- In 2022, monitoring was carried out in Czech Republic, France, Germany, Ireland, Italy, Poland, Spain and the United Kingdom

- In 2021, monitoring was carried out in Denmark, France, Germany, Hungary, Ireland, Italy, Poland, Spain and United Kingdom

- In 2020, monitoring was carried out in Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, The Netherlands, Poland, Slovakia, Spain and United Kingdom

- Stable situation. The sensitivity of the populations stayed in the range observed in Europe in the previous 17 years.

1.2.3. Net blotch (*Pyrenophora teres /Drechslera teres*)

Presentation of monitoring data 2022: Bayer, Syngenta

- In 2022, monitoring was carried out in Bulgaria, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Sweden and the United Kingdom.

- Overall, the sensitivity of populations monitored in 2022 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 EC50 values were observed.

- In 2021, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Russia, Slovakia, Spain, Sweden, The Netherlands, Ukraine, and the United Kingdom.

- In 2020, monitoring was carried out in Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and United Kingdom.

- Overall, the sensitivity of populations monitored in 2021 stayed in the range observed in previous years, without any 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 2022: BASF, Syngenta

- In 2022, monitoring was carried out in Austria, Czech Republic, France, Germany, Ireland, Italy, Netherlands, Poland, Spain, 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

- In 2020, monitoring was carried out in Denmark France, Germany, Hungary, Ireland, Italy, Lithuania, Poland, Slovakia, Spain, Sweden, Switzerland, and United Kingdom.

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

In 2022, the results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy

- low to moderate frequencies in Spain
- moderate to high frequencies of resistance in The Netherlands
- high frequencies of resistance in Austria, Czech Republic, Ireland, Poland, France, Germany, Sweden, Switzerland and the United Kingdom.
- Despite the high frequency of resistance in several countries, DMIs continue to contribute to disease control and remain an important tool for resistance management.

In 2021, the results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no resistance in Italy
- low frequencies of resistance in Spain & 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, the results from bioassay and molecular analysis focusing on the most relevant mutations are:

- no to low frequencies of resistance in Italy, Switzerland, and Spain
- no to high frequencies of resistance in France
- 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 & Italy

- no to low frequencies in Slovenia and Croatia
- low frequencies of DMI resistance allele were detected in Switzerland and Slovakia
- in Austria, low to moderate frequencies were observed
- moderate to high frequencies in Belgium, Germany and Sweden
- high frequencies in Ireland, United Kingdom and France

In 2018 the results are:

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

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

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

1.2.5. *Puccinia hordei*

Monitoring was carried out in 2014, 2018 and 2019 in Denmark, France, Germany, Sweden, and United Kingdom in 2014, 2018 and 2019 by Bayer. In 2021, monitoring was carried in France, Germany and Poland by Bayer.

- In this six-year interval, a very stable situation with a narrow range of sensitivity was observed.

1.2.6. Smut diseases (*Ustilago* spp.)

Presentation of monitoring data in 2022: Syngenta

In 2022, monitoring was carried out in Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Lithuania, Poland, Romania, Spain and the United Kingdom

Presentation of monitoring data from 2015-2022: Syngenta

- A very stable situation with a narrow range of sensitivity was observed in this six-year interval, with exception of a few UK isolates from 2018.

- In 2021, monitoring was carried out in Austria, Bulgaria, Denmark, France, Germany, Hungary, Italy, Latvia, Lithuania, Romania, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom.

  In 2020, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Romania, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

- 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 & 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* / *Drechslera graminea*)

Presentation of monitoring data 2019- 2022: Syngenta

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

- The sensitivity range was very narrow and high levels of sensitivity were observed.

1.3. 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.

1.4. 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.

2. DMIS AND AMINES: INDUSTRIAL CROPS

2.1. SOYBEAN

2.1.1. Asian soybean rust (*Phakopsora pachyrhizi*)

Presentation of monitoring data from season 2021/22: 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 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.

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.

2.1.2. Target Spot (*Corynespora cassiicola*)

DMIs

Presentation of monitoring data from season 2021/22: 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 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

- In season 2021/22, a monitoring was carried out by Syngenta in six Brazilian regions. A stable sensitivity situation was observed in comparison to previous seasons.
- In season 2020/21, a 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. simanense*)

- In season 2021/22, an initial monitoring was carried out by Syngenta. Data showed high level of sensitivity across sampled regions in Brazil.

2.1.5. Phomopsis seed decay (*Diaporthe* spp.)

- In season 2021/22, an initial monitoring with a limited number of samples was carried out by Syngenta. The data showed high level of sensitivity across sampled regions in Brazil.

2.1.6. Septoria Brown Spot (*Septoria glycines*)

DMIs

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

2.2. OILSEED RAPE

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

Presentation of monitoring data for season 2021/22: BASF,

- In 2021/22, monitoring was carried out in Czech Republic, France, Germany, Poland and Romania

- The monitoring data showed a stable sensitivity range as in previous years.In 2020/21, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Latvia, Lithuania, Poland, Romania, and the United Kingdom.

- In 2019/2020, monitoring was carried out in, Czech Republic, Finland France, Germany, Hungary, Ireland, Latvia, Lithuania, Poland, Romania, Slovakia, Sweden and United Kingdom.

- In 2018/19, monitoring was carried out in Czech Republic, France, Finland, Germany, Hungary, Poland, Romania, Slovakia, and United Kingdom. Data showed a stable sensitivity range as in the last 10 years.

- For recommendations see General Recommendations.

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

Presentation of monitoring data for 2016: BASF, Bayer, Syngenta; for 2017: Bayer, BASF, Syngenta; for 2018: BASF, Bayer, Syngenta, for 2019: Bayer, BASF, Syngenta; for 2020: BASF, Corteva, Syngenta; for 2021: BASF, Corteva, (FMC, Syngenta; for 2022: BASF , FMC, Syngenta

- All monitoring data from 2016 - 2022 showed a stable and narrow sensitivity range with no geographical differences.

- In 2022, monitoring was carried out in Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Lithuania, Poland, Romania and United Kingdom, Sweden, Latvia, Estonia.

- In 2021, monitoring was carried out in Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Lithuania, Poland, Romania, Sweden, The Netherlands, Ukraine and United Kingdom.

- In 2020, monitoring was carried out in Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Ukraine and United Kingdom.

- Monitoring was carried out in 2019 in Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Latvia, Poland, Romania, Slovakia and Ukraine. Disease pressure was moderate.

- Monitoring was carried out in 2018 in Bulgaria, Czech Republic, France, Germany, Hungary, Poland, Romania, Slovakia, and United Kingdom. Disease pressure was low to moderate.

- Monitoring was carried out in 2017 in Czech Republic, Denmark, France, Germany, Latvia, Lithuania, Poland, Sweden, and United Kingdom. Disease pressure was low to moderate.

- Monitoring was carried out in 2016 in Czech Republic, France, Germany, Lithuania, Poland, Slovakia, and United Kingdom. Disease pressure was low to moderate.

- For recommendations see General Recommendations.

2.2.3. Light leaf spot (*Pyrenopeziza brassicae*)

Presentation of monitoring data for 2020, 2021 and 2022: BASF

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

2.3. SUGAR BEET

2.3.1. Leaf spot (*Cercospora beticola*)

Presentation of monitoring data for 2018 and 2019: BASF, Bayer, Syngenta (DMI & Amines); for 2020: Syngenta, for 2021: Bayer; for 2022: Syngenta, BASF, Bayer (ongoing)

DMIs

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

- Overall, as in previous years European populations of *C. beticola* showed 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.

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

- In 2019, monitoring was carried out in Austria, Belgium, France, Germany, Italy, Poland, Romania, Slovakia, Spain, Switzerland and The Netherlands. 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 2018, monitoring was carried out in Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Switzerland, the Netherlands, Turkey, Ukraine, and United Kingdom. A stable sensitivity situation was observed as in the last 6 years.

- In 2017, monitoring was carried out in Austria, Czech Republic, France, Germany, Greece, Lithuania, Netherlands, Poland, Romania, Russia, Slovakia, Serbia, and United Kingdom. A stable situation was observed as in the last 5 years.

Amines

- In 2020, monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, Spain, Switzerland & the Netherlands. The monitoring revealed a stable situation with a small range of sensitivity and without geographic variations.

- Monitoring in 2019 was carried out in Austria, Belgium, France, Germany, Italy, Poland, Romania, Slovakia, Spain, Switzerland and The Netherlands. The monitoring revealed a stable situation with a small range of sensitivity and without geographic variations.

- Monitoring in 2018 was carried out in Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Poland, Romania, Russia, Slovakia, Spain, Switzerland, the Netherlands, Ukraine, and United Kingdom.

- Monitoring in 2017 was carried out in Austria, Czech Republic, France, Germany, Greece, Lithuania, Netherlands, Poland, Romania, Russia, Slovakia, Serbia, and United Kingdom.

- For recommendations see General Recommendations.

2.4 RICE

2.4.1. Narrow brown spot (*Cercospora oryzae*)

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

2.4.2 *Rhizoctonia solani*

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

2.5 COTTON

2.5.1. Ramularia leaf blight *(Ramularia gossypii, R. areola; Mycosphaerella areola)*

DMIs

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

- FMC monitoring is still ongoing

Amines

- In 2017/18, 2018/19, 2019/20 and 2021/22, monitoring was carried out by BASF in Brazil. The results showed a sensitive situation with EC_{50} values being in a similar range over the three seasons.

2.5.2. Target spot (*Corynespora cassiicola*)

DMIs

- 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

2.6.1 Sclerotinia stem rot (*Sclerotinia sclerotiorum*)

DMIs

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

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

2.7 Pea

2.7.1. Ascochyta blight (*Ascochyta pisi, A. pinodes, A. pinodella*)

DMIs

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

2.8 Beans

2.8.1 Sclerotinia stem rot (*Sclerotinia sclerotiorum*)

DMIs

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

3. DMIS AND AMINES: OTHER CROPS

3.1. GRAPE VINE:

3.1.1 Powdery mildew (*Erysiphe necator*)

Monitoring data for **DMIs** were presented by BASF (2021), Bayer (2017,2018, 2021), Corteva (2017, 2018, 2019, 2021), and Syngenta (2017, 2018, 2019, 2020).

- 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.

- Exclusive frequency measurements of single cyp51 mutation are not sufficient to describe the sensitivity situation in *Erysiphe necator* populations towards DMIs.

- In 2021, monitoring was carried out in Austria, Croatia, France, Germany, Greece, Italy, Hungary, Portugal, Spain, Switzerland, and Turkey.

- In 2020, monitoring was carried out in Croatia, France, Germany, Italy, Portugal, Slovenia and Spain.

- In 2019, monitoring was carried out in Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Italy, Portugal, Slovenia, Spain, and Switzerland

- In 2018, monitoring was carried out in Austria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Romania, Slovenia, Spain, and Switzerland.

- In 2017, monitoring was carried out in Austria, Croatia, Czech Republic, France, Germany, Hungary, Italy, Portugal, Romania, Slovakia, Spain, Switzerland, and Turkey.

Monitoring data for **amines** for 2019, 2020 & 2022 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.

- In 2019, monitoring was carried out in Austria, Croatia, Germany, Italy, Portugal, and Spain. In 2020, monitoring was carried out in Austria, France, Germany, Hungary, Italy, Spain and Switzerland.

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

SBI – Recommendations for Grape Vine:

- DMI´s 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 SBI's can remain the effective basis for control of *Erysiphe necator* in grape vine, 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.

3.2. STONE AND POME FRUIT

3.2.1. Scab on APPLE (*Venturia inaequalis*)

Presentation of monitoring data by BASF (2021), Bayer (2017, 2018) and Syngenta (2017, 2018, 2019, 2020, 2021), Syngenta (2022)

- 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.

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

- In 2020, monitoring was carried out in Belgium, Croatia, France, Germany, Hungary, Italy, Netherlands, Poland, Portugal, Slovenia, Spain and Switzerland.

- In 2019, monitoring was carried out in Austria, Bulgaria, Croatia, France, Germany, Hungary, Latvia, the Netherlands, Poland, Slovenia, and Spain.

- In 2018, monitoring was carried out in Belgium, Croatia, France, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Spain, and Switzerland.

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.

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

Presentation of monitoring data for 2017, 2018, 2020 & 2022: Syngenta, BASF

- In 2022, monitoring was carried out in Austria, Belgium, Bulgaria, Croatia, France, Germany, Greece, Hungary, Spain, Italy, Netherlands, Türkiye, Hungary, Latvia, Lithuania, Portugal, Poland, Romania and Slovenia. Monitoring was started across Europe in 2010. No change in sensitivity comparing 2022 to 2010 was observed.

- In 2020, monitoring was carried out in Croatia, France, Italy, Poland, Portugal, Slovenia and Spain.

- In 2018, monitoring was carried out in Belgium, Croatia, Hungary and Italy.

- In 2017, monitoring was carried out in Belgium, Croatia, France, Hungary, Italy, and Poland.

- See General Recommendations.

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

Presentation of monitoring data by Syngenta (2018,2019,2020 & 2021).

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

- 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 2021, monitoring was carried out in Bulgaria, Croatia, France, Germany, Hungary, Italy, and Spain. Crops sampled were almond, apricots, cherry, nectarine, peach, plum and sour cherry.

- 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 by Syngenta (2018 - 2021)

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

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

- In 2020, monitoring was carried out in Belgium, Italy, Portugal & Spain.

- In 2019, monitoring was carried out in Hungary, The Netherlands, Portugal and Spain.

- In 2018, monitoring was carried out in Belgium, Italy, Portugal, and Spain.

3.3. TOMATO / POTATO

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

Presentation of monitoring data for 2021, 2022: Bayer, Syngenta.

For *A. solani* and *A. alternata*, a homogenous sensitivity of all three pathogens was observed in 2022, comparable to previous seven years.

- In 2022, monitoring was carried out in Austria, Belgium, Croatia, Denmark, Germany, Netherlands, Norway, Poland and Sweden.
- In 2021, monitoring was carried out in Austria, Bulgaria, Croatia, Denmark, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Portugal, Romania, Spain, and Sweden.

- In 2020, monitoring was carried out on potatoes and/or tomatoes in, Belgium, Bulgaria, Croatia, Denmark, France, Germany, Hungary, Italy, Poland and Serbia.

- In 2019, monitoring was carried out on tomatoes in Croatia, Italy, Portugal, Poland, and Spain.

3.3.2. *Oidium neolycopersici*

Monitoring was carried out by Syngenta since 2015.

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

3.3.3. Leaf mold (*Cladosporium fulvum)*

Presentation of monitoring data 2019: Syngenta

- In 2019, monitoring was carried out in China.
- Initial studies performed in 2019 indicated a high and homogenous sensitivity.

3.3.4. Silver scurf (*Helminthosporium solani*)

Presentation of monitoring data 2020: Syngenta

- In 2020, potato crops grown in Germany, Hungary, Italy, Latvia, Lithuania, Netherlands, Romania, Spain and United Kingdom were monitored.

- A stable sensitivity range was observed in European countries since 2012. In 2019 and 2020, a few isolates showed slightly lower sensitivity levels.

3.4. CUCURBITS

3.4.1. *Podosphaera xanthii/Sphaerotheca fuliginea*

Presentation of monitoring data for 2022: BASF
Presentation of monitoring data for 2018, 2019 & 2020: Syngenta

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

- 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 2019, monitoring was carried out in France, Greece, Italy, and Spain.

- In 2018, monitoring was carried out in Belgium, France, Italy, Netherlands, Poland, and Spain.

3.4.2. Gummy Stem blight (*Didymella bryoniae*)

Presentation of monitoring data 2021: Syngenta

- Monitoring started in 2017 and continued in 2018 &2019 in the countries Belgium and Spain, and two locations in Spain in 2021.

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

3.5. OTHER VEGETABLES

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

Presentation of monitoring data 2018, 2019, 2022: Syngenta

- In 2022, monitoring was carried out in France. Monitored species were *Alternaria alternata* on cabbage and carrots. There is no indication of a 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. There is no indication of a decreased sensitivity across all crops, countries, and species.

3.5.2. *Stemphylium vesicarium* on ASPARAGUS

Monitoring was carried out in the United Kingdom in 2018 by Syngenta.

- Stable sensitivity as in the previous years; single isolates with higher EC50 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 BEANS

Presentation of monitoring data in 2020 & 2021: Syngenta

- In 2020, for the first-time monitoring on beans and green beans was carried out in France. In 2021, samples from France and Belgium were analyzed.
- All isolates collected showed a narrow sensitivity range and high sensitivity (low EC50 values).

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

Presentation of monitoring data in 2020 & 2021: 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 EC50 values).

3.5.6. *Stemphylium vesicarium* on ONIONS

Monitoring was carried out in Germany and Poland in 2021 by Syngenta.

- All isolates monitored from onion showed EC50 values in a range of known sensitivity levels of *S. vesicarium* from other crops.

3.6. CITRUS, STRAWBERRY

3.6.1. Anthracnose (*Colletotrichum acutatum*)

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

3.7. BANANA

3.7.1. Black Sigatoka (*Mycosphaerella 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 Keto-Reductase (KRI). Both are cross-resistant.

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

Presentation of monitoring data: Bayer (2014 – 2018, 2020, 2021, 2022), and Sumitomo (2016, 2017, 2018, 2019, 2020, 2021, 2022).

- In 2022, monitoring was carried out in France, Germany, Italy and Spain. The frequency of resistant isolates was low to moderate in Italy, France, Germany and Spain 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, 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 & 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).

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

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

Presentation of monitoring data: Bayer (2017, 2018, 2019, 2020, 2021, 2022), and Sumitomo (2017, 2018, 2019, 2020, 2021, 2022).

- 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 & 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 United Kingdom. The frequency of resistant isolates was low to moderate in France, Germany, Norway and Poland, and moderate in Italy, Netherlands and United Kingdom, and moderate to high for Spain

- In 2019, monitoring was carried out in Austria, France, Denmark, Italy, Poland, Germany, and United Kingdom

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

- 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 United Kingdom.

- High presence of resistant strains was observed in United Kingdom, low to moderate presence in Denmark, Germany, and Netherlands, low presence in Austria, France, and Poland.

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

- Presentation of monitoring data for 2014 and 2015: Bayer

- Monitoring in 2015 in the Netherlands showed moderate frequency of resistance.

- Limited monitoring in Norway in 2014 showed high frequency of resistant strains.

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

Presentation of monitoring data from 2017, 2018,2019, 2020, 2021 & 2022: Sumitomo

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

- 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

- 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.

4.5. 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.

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

Presentation of monitoring data from 2020 & 2021: Sumitomo, (2022 ongoing)

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

- Generally, a stable sensitivity range was observed. A few isolates are under further investigation possibly indicating lower sensitivity.

5. NEXT MEETINGS

Next virtual WG meeting is planned for September 6th, 2023.