STEROL BIOSYNTHESIS INHIBITOR (SBI) WORKING GROUP

Minutes from Annual Meeting on December 14, 2018, 08:00 - 16:00, TeleConference on March 27th, 11:00 - 12:00 & June 6th, 15:00 - 16:00 Protocol of the discussions and recommendations of the SBI working group of the Fungicide Resistance Action Committee (FRAC)

Participants of the SBI WG Meetings

	Annual Meeting Dec 14th	**Telco March 27th**	**Telco June 6th**
ADAMA	Martin Huttenlocher		
BASF	Martin Semar Gerd Stammler	Martin Semar Gerd Stammler	Martin Semar Gerd Stammler
Bayer	Frank Goehlich Andreas Mehl Klaus Stenzel	Andreas Mehl Andreas Goertz	Andreas Mehl Andreas Goertz
Corteva	Greg Kemmitt		
FMC	Henry Ngugi		
Sumitomo	Yuichi Matsuzaki Yves Senechal Ippei Uemura	Ippei Uemura	
Syngenta	Irina Metaeva Stefano Torriani (excused) Birgit Forster Gina Swart	Irina Metaeva Stefano Torriani Birgit Forster Helge Sierotzki Paolo Galli	Stefano Torriani Birgit Forster Helge Sierotzki Paolo Galli
FRAC Brazil	Luis Demant (chairman)		

for ASR discussion
via Skype

Venue of the annual meeting: Lindner Congress Hotel, Frankfurt
Hosting organization: FRAC/Crop Life International

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

1. DMI AND AMINES: CEREAL DISEASES

1.1. WHEAT

1.1.1. Leaf spot (*Mycosphaerella graminicola / Septoria tritici*)

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

- Disease pressure was low in most of the European countries but regionally variable in 2018.

- DMIs field performance was good when used according to the manufacturers and FRAC recommendations. No general field resistance has been reported.

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

- 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 was 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 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).

- In 2016 and also in 2017 the sensitivity of the populations was overall stable on an 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 2018 the sensitivity of the populations was overall stable on the European level.

- 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*)

Disease pressure in 2018 was low across Europe.

DMIs

Presentation of monitoring data: Bayer

- DMI field performance was good.

- Monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Poland, Sweden, and United Kingdom.

- Sensitivity data presented for 2016 to 2018 confirmed that the situation was overall stable within the range of variability detected during the last 20 years.

- 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 from 2018: Bayer

- Field performance of amine based products was good.

- In 2018 monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Poland, Sweden, and United Kingdom.

- Sensitivity data presented from 2018 confirmed that the situation in 2018 was stable remaining in the range of variability seen over more than 25 years.

1.1.3. Wheat brown rust (*Puccinia triticina*)

Presentation of monitoring data in 2018: Bayer

- Brown rust disease pressure was moderate to high in most of the countries in Europe.

- Good field performance of DMIs against rust has been maintained.

- Monitoring in 2018 has been carried out in Belgium, Denmark, France, Germany, Sweden, and United Kingdom.

- Sensitivity data from 2018 for wheat brown rust showed that the sensitivities were in the range of those of the last 20 years.

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

Presentation of monitoring data for 2018: Syngenta.

- Field performance was good.

- An analysis of samples from France, Germany, Poland, Ukraine, and UK from 2018 was presented.

- 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.

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

1.1.5. Tan spot (*Pyrenophora tritici-repentis, syn. Drechslera tritici-repentis*)

Monitoring was carried out in 2018: Syngenta

- Monitoring data from 2018 in Czech Republic, Germany and Italy showed a stable sensitivity range with no geographic variations.

1.1.6. Yellow rust (*Puccinia striiformis*)

Presentation of monitoring data from 2018: Bayer

- Disease pressure was moderate.

- Monitoring was carried out in France, Germany, Latvia, and United Kingdom.

- The first monitoring in 2015 showed high sensitivity and low diversity, and for 2016, 2017 and 2018 a stable situation within the range of typical but minor DMI sensitivity fluctuations was reported.

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

No new monitoring data for 2018.

Presentation of monitoring data from 2014 to 2017: Syngenta

- Monitoring was carried out in Belgium, Denmark, Finland, France, Germany, Italy, Latvia, Lithuania, Poland, Russia, Sweden, Ukraine, and United Kingdom.

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

1.2. BARLEY

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

No monitoring was carried out in 2017, monitoring data presented for 2018.

In 2018, disease pressure was low in Europe.

DMIs

Monitoring was carried out in Czech Republic, Denmark (2016), France, Germany, Latvia, Sweden (2016), Ukraine, and United Kingdom. Results from 2018 monitoring were presented by Bayer:

- DMI products performed well.

- The sensitivity of the populations stayed in the range observed for more than 15 years.

Reduced sensitivity was reported in barley powdery mildew in western and eastern Australia (ACNFP/Curtin University) in 2014.

Amines

Results from 2018 monitoring were presented by Bayer:

Monitoring was carried out in Czech Republic, France, Germany, Italy, Latvia, Poland, Ukraine, and United Kingdom.

- Amine products performed well.

- The sensitivity of the populations stayed in the range observed for more than 20 years.

1.2.2. Scald (*Rhynchosporium secalis*)

Presentation of monitoring data: BASF, Bayer, Syngenta

- Disease pressure was extremely low in Europe in 2018.

- Field performance of DMIs was good.

- Monitoring was carried out in Denmark, France, Germany, Ireland, Poland, and United Kingdom.

- Stable situation. The sensitivity of the populations stayed in the range observed in the previous 15 years.

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

Presentation of data for 2018: Bayer, Syngenta

- Disease pressure was generally low in 2018.

- Performance of SBI containing spray programmes was good.

- Monitoring was carried out in Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Poland, Romania, Spain, Switzerland, and United Kingdom.

- In 2017 in France significant shifts of sensitivity of populations have been observed. Highest EC50 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.

- 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.

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

Presentation of monitoring data for 2018: Bayer, Syngenta.

Disease pressure was low in 2018.

- Monitoring was carried out in Austria, Belgium, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Romania, Spain, Sweden, Switzerland, and United Kingdom.

- Field performance can be regionally significantly affected, due to the low disease pressure hard to evaluate in 2018.

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

- 2016: 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.

- First data from 2016 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 other countries the monitoring is still ongoing; the results will be reported later.

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.

Given that there already exist populations in Europe resistant to all main specific modes of actions it is recommended to add precautionary a multi-site to ensure robust disease control and an effective resistance management.

1.2.5 *Puccinia hordei*

Monitoring was carried out in 2014 and 2018 by Bayer in Denmark, France, Germany, Sweden, and United Kingdom.

- Very stable situation with a narrow range of sensitivity in this four year interval.

1.2.6 Smut diseases (*Ustilago* spp.)

In 2018, from specific locations in the UK product performance issues were reported. It remains to be clarified whether this lower performance is due to sensitivity changes or other factors such as a different prevalence of specific *Ustilago* species in the population.

1.3. GENERAL 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. DMI AND AMINES: INDUSTRIAL CROPS

2.1. SOYBEAN:

2.1.1. Asian soybean rust (*Phakopsora pachyrhizi*)

Presentation of monitoring data from season 2018/19: BASF, Bayer, Syngenta

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

- 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.

- 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.

- 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. The monitoring is still ongoing.

- A first monitoring program for Paraguay is under investigation.

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*)

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

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

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

2.2. OILSEED RAPE

2.2.1. Phoma leaf spot and stem canker, blackleg (*Leptosphaeria maculans / L. biglobosa*)

Presentation of monitoring data: BASF (samples from season 2017/18).

- Monitoring was carried out in France, Germany, Poland, and United Kingdom.

- Monitoring data from 2017/18 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: Bayer, Syngenta

- Monitoring was carried out in 2016 in: Czech Republic, France, Germany, Lithuania, Poland, 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 2018 in France, Germany, Hungary, Poland, Romania, and United Kingdom. Disease pressure was low to moderate.

- Monitoring data from the three years showed a stable and narrow sensitivity range with no geographical differences.

- For recommendations see General Recommendations.

2.3. SUGAR BEET

2.3.1. Leaf spot (*Cercospora beticola*)

Presentation of monitoring data for 2017 and 2018: BASF, Bayer, Syngenta (DMI & Amines).

DMIs

- Monitoring in 2017 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.

- 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. A stable sensitivity situation was observed as in the last 6 years.

- Single isolates with increased EC_{50} values were already detected 5 years ago in France and Germany but remain stable at a low frequency.

Field performance can be affected when solo DMI's are used.

The broad range of sensitivity leads to the assumption that a shift took place before routine monitoring was set up.

Amines

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

- 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 showed a sensitive situation with a small range of sensitivity and without geographic variation.

- 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)*

Monitoring carried out 2017 by Syngenta in Brazil.
The data showed sensitivity within the known baseline generated in 2011.

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

2.5.2. Target spot (*Corynespora cassiicola*)

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

3. DMI AND AMINES: OTHER CROPS

3.1. GRAPE VINE:

3.1.1 Powdery mildew (*Erysiphe necator*)

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

- Disease pressure was moderate across Europe in 2017, low in 2018.

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

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

- 2017 and 2018: Sensitivity for DMIs in Europe was stable and generally in the normal range of fluctuation as observed in the previous years.

Generally, population sensitivity can vary significantly between locations and years within individual countries. Exclusive frequency measurements of single *cyp51* mutations are not sufficient to describe the sensitivity situation in *Erysiphe necator* populations towards DMIs.

Monitoring data for **amines** for 2018 were presented by Bayer:

- Monitoring was carried out in Croatia, France, Germany, Italy, and Spain.

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

Recommendations:

- 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 for 2017 and 2018: Bayer, Syngenta.

- Disease pressure in both years was moderate across Europe.

  The performance of DMIs was good on this disease when compounds were used according to the manufacturers' and FRAC recommendations within spraying programmes.
- Results from monitoring were available for Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovenia, Spain, and Switzerland.
  In 2018, monitoring was carried out in Belgium, Croatia, France, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Spain, and Switzerland.

- Sensitivity in European populations remains unchanged since 2011.

Recommendations:

- 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 and 2018: Syngenta

- Performance of DMI was good.

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

- In 2018, monitoring was carried out in Belgium, Croatia, Hungary and Italy.
- Monitoring was started in 2010 across Europe. No change in sensitivity comparing 2018 to 2010 was observed.

- See General Recommendations.

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

Samples were analysed in 2018 by Syngenta.

- Monitoring was carried out in Belgium, Bulgaria, Croatia, France, Germany, Hungary, Italy, Poland, and Spain

- A narrow and homogenous distribution of sensitivity was detected across all crops and countries

3.2.4. *Stemphylium vesicarium* on PEARS

Report by Syngenta for 2018:

Monitoring was carried out in Belgium, Italy, Portugal, and Spain.

- Homogenous and sensitive situation.

3.3. TOMATO / POTATO

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

Presentation of monitoring data for 2018: Bayer, Syngenta.

Monitoring was carried out on potatoes in Austria, Belgium, Denmark, Germany, Italy, Netherlands, Spain, Sweden, and Switzerland.

- *A. alternata* and *A. solani* on potato: all strains collected in 2018 are in the same range of sensitivity as in the previous 5 years

Monitoring was carried out on <u>tomatoes</u> in Greece, Romania, and Spain.

- *A. alternata* and *A. solani* on tomato: all strains collected in 2018 are in the same range of sensitivity as in the previous 4-5 years.

- Homogenous sensitivity of both pathogens was observed as in the previous years.

- *A. tomatophila* on tomato: initial sensitivity studies performed in 2018 by Syngenta with limited number of strains indicated high and homogenous sensitivity in USA.

3.3.2. *Oidium neolycopersici*

Monitoring was carried out since 2015 by Syngenta.

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

3.4. CUCURBITS

3.4.1. *Podosphaera xanthii/Sphaerotheca fuliginea*

Presentation of monitoring data for 2018: Syngenta

- Monitoring was carried out in Belgium, France, Italy, Netherlands, Poland and Spain.

- No change of sensitivity has been observed from 2011 to 2018, and no variations between countries and samples collected from cucumbers, melon, watermelon, pumpkin or zucchini were monitored.

3.5. OTHER VEGETABLES

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

Several crops and species were analysed in 2017 for the first time by Syngenta.

- This first monitoring was carried out in Bulgaria, Croatia, Denmark, France, Germany, Italy, Lithuania, Netherlands, Poland, Portugal, Spain, Sweden.

- Monitored species were *A. brassica, A. brassicola, 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 United Kingdom in 2018 by Syngenta.

- Stable sensitivity as in the previous years, single isolates with higher ED50 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.

3.6. CITRUS, STRAWBERRY

3.6.1. Anthracnose (*Colletotrichum acutatum*)

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

3.7. BANANA

3.7.1. Black Sigatoka (*Mycosphaerella fijiensis*)

The conclusions and guidelines of the April 2018 meeting of the FRAC Banana Working Group are available on the FRAC Website (http://www.frac.info/frac/index.htm). The next meeting of the group is planned in 2020.

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

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), and Sumitomo (2016, 2017).

- Disease pressure was moderate across Europe in 2017.

- Monitoring was carried out in Austria, Chile, France, Germany, Italy, and Spain

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

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

- 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 2018, the frequency of resistant isolates was moderate in Germany, moderate to high in Chile, and in Italy all strains analysed were fully sensitive.

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), and Sumitomo (2017).

- In 2017, monitoring was carried out in 2017 in Denmark, France, Germany, Netherlands, Poland, and United Kingdom.

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

- In 2018, monitoring was carried out in Denmark, France, Germany, Norway, Poland, Sweden, and the United Kingdom.

  The frequency of resistant isolates was low in France, Poland, and Sweden, low to moderate in Denmark and Germany, and moderate to high in Norway and the UK.

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

- No monitoring for 2016 and 2017 and 2018.

- Presentation of monitoring data for 2014 and 2015: Bayer

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

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

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

Monitoring was carried out in 2017 by Sumitomo in France, Italy, and Poland

- No resistant isolates were detected.

4.5. Recommendations for the use of KRIs:

- 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 MEETINGS

Next annual meeting is planned for January 24, 2020.