



## **STEROL BIOSYNTHESIS INHIBITOR (SBI) WORKING GROUP**

**Annual Meeting 2014 on December 05, 2014, 08:30 –15:30  
Protocol of the discussions and recommendations of the SBI  
working group of the Fungicide Resistance Action Committee  
(FRAC)**

### **Participants of the SBI WG Meeting on December 05, 2014**

BASF	Martin Semar Gerd Stammler
Bayer CropScience	Frank Göhlich Andreas Mehl Klaus Stenzel
Dow	Greg Kemmitt
ADAMA	Martin Huttenlocher
Syngenta	Andy Leadbeater Helge Sierotzki Steve Dale (as deputy for Elizabeth Shaw)

### **Members of the WG SBI not participating**

Du Pont	Nilton Picinato
Sumitomo	Rei Matsunage
Syngenta	Elizabeth Shaw

**Venue of the meeting:** Lindner Congress Hotel, Frankfurt  
**Hosting organization:** FRAC

**Anti-Trust Guidelines (from FRAC Constitution) were shown before the Meeting started**

## **1. DMI AND AMINES : CEREAL DISEASES**

### **1. 1. WHEAT**

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

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

- Disease pressure in 2014 in Europe was high as it was in 2013. The epidemics started strongly after dry period in some parts of Europe.
- DMIs field performance was good when used according to the manufacturers and FRAC recommendations. No general field resistance has been reported.
- Monitoring was carried out in United Kingdom, Ireland, Germany, France, Italy, Netherlands, Belgium, Switzerland, Spain, Poland, Austria, Czech Republic, Hungary, Romania, Slovakia, Ukraine, Latvia, Denmark, and Sweden. Monitoring analysis still ongoing for Estonia and Lithuania.
- After the slight increase in the frequency of less sensitive isolates from 2002 to 2004, the situation has stabilised between 2005 and 2008. In 2009 a trend to slightly higher EC<sub>50</sub> values was observed in important cereal growing areas (United Kingdom, Ireland, Germany, France), this trend has slowed down in 2010 to 2012 and was stable in 2013. 2014 sensitivity is in the same range as 2011. Populations with highest EC<sub>50</sub> values were observed in areas of high disease pressure and pronounced use of azoles e.g. northern France, United Kingdom, Ireland, northern Germany and parts of Benelux.
- Outliers with higher EC<sub>50</sub> values in lab tests were detected since 2009. A number of combinations of cyp51 mutations and overexpression have been identified and some of them can influence sensitivity.

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

In 2014 the disease pressure was moderate across Europe.

#### **DMIs**

Presentation of monitoring data: Bayer CropScience

- DMI field performance was good.
- Monitoring was carried out in United Kingdom, Germany, France, Belgium, Sweden, Denmark, Poland, Czech Republic, Austria, and Hungary.
- Sensitivity data presented confirmed that the situation was overall stable within the range of variability detected during the last 20 years. Differences in the sensitivity can be detected in dependence on the region.

## **Amines**

Presentation of monitoring data: BASF, Bayer CropScience

- Field performance of amine based products was good.
- Monitoring was carried out in United Kingdom, Ireland, Germany, France, Belgium, Poland, Czech Republic, Hungary, and Italy.
- Sensitivity data presented confirmed that the situation 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: Bayer CropScience, BASF

- Brown rust disease pressure was moderate in most of the countries in Europe.
- Good field performance of DMLs against rust has been maintained.
- Monitoring has been carried out in United Kingdom, Germany, France, Belgium, Poland, Hungary, and Italy.
- Sensitivity data from 2014 for wheat brown rust showed that the sensitivities in 2014 were in the range of those of the last ten years.

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

Presentation of monitoring data: Bayer CropScience

- Sensitivity data have been presented for W and R types. Between 2003 and 2012 there was no change in the sensitivity of both types, stable situation had been observed during the last 9 years. 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*)**

No monitoring was carried out during 2014.

## 1.2. BARLEY

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

In 2014, disease pressure was moderate in Europe.

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

#### **DMIs**

Results from 2014 monitoring were presented by Bayer CropScience:

- 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).

#### **Amines**

Results from 2014 monitoring were presented by Bayer CropScience:

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

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

### **1.2.2. Scald (*Rhynchosporium secalis*)**

Presentation of monitoring data: BASF, Bayer CropScience, Syngenta

- Disease pressure was moderate in Europe in 2014.
- Field performance of DMIs was good.
- Monitoring was carried out in Ireland, United Kingdom, Germany, France, Denmark, Poland, Slovakia, Latvia, and New Zealand. Monitoring analysis for Estonia and Netherlands ongoing.
- Stable situation. The sensitivity of the populations stayed in the range observed in the previous 10 years.

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

Presentation of monitoring data for 2014: Bayer CropScience

- Disease incidence was moderate in 2014.
- Field disease control was good.
- Monitoring was carried out in Ireland, United Kingdom, Germany, France, Belgium, Denmark, Poland, and Czech Republic.
- The sensitivity of the populations in 2014 stayed in the range observed since more than 10 years.

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

Monitoring analysis for 2014 is still ongoing.

## **1.3. GENERAL RECOMMENDATIONS FOR CEREALS (DMIs AND AMINES)**

**(changes for the 2015 season are in bold)**

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

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. 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 in situations of high disease pressure it is **essential** to adhere to dosages and spray timings as recommended by manufacturers. Highly 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 may contribute 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: INDUSTRIAL CROPS**

### **2.1. SOYBEAN:**

#### **Asian soybean rust (*Phakopsora pachyrhizi*)**

Presentation of monitoring data: Bayer CropScience, FRAC Brazil, 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.
- The performance of DMIs used alone was reduced.
- 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.
- Despite this stable situation it is recognized that a variability in performance of DMI mixtures has been observed which likely is related to other factors.

#### **Recommendations for Asian soybean rust:**

Refer to the general recommendations for SBI's.

In addition to ensure robust disease control it is essential to

- Apply DMI fungicides always in mixtures with effective non-cross resistant fungicides. Refer to manufacturers recommendations for rates.
- Apply preventively or as early as possible in the disease cycle
- 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 disease pressure and resistance risk e.g. avoiding multiple cropping.

### **2.2. Target Spot (*Corynespora cassiicola*)**

No monitoring has been carried out in 2013/14.

## **2.2. OILSEED RAPE**

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

Presentation of monitoring data for 2013/14: BASF

- Monitoring was carried out in France, Germany, and Austria.
- Monitoring data from 2006 to 2014 showed a stable sensitivity range as in the last years.
- For recommendations see General Recommendations.

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

Presentation of monitoring data for 2013: BASF

- Monitoring was carried out in France, Germany, Denmark, Czech Republic.
- Monitoring data from 2013 showed a stable sensitivity range as in the last years. Studies on 2014 samples are ongoing.
- For recommendations see General Recommendations.

## **2.3. SUGAR BEET**

### **Leaf spot (*Cercospora beticola*)**

Presentation of monitoring data for 2014: Syngenta

- Monitoring was carried out in Germany, France, Austria, Italy, and Poland. Further monitoring analysis still ongoing.
- Stable situation in the last three years in the central European countries observed.
- The broad range of sensitivity leads to the assumption that a shift took place before routine monitoring was set up.
- Single isolates with slightly increased ED50 values were detected in Italy and Germany but seem to not increase over time.
- Field performance can be affected when solo DMI's are used.
- For recommendations see General Recommendations.

### 3. DMI AND AMINES: OTHER CROPS

#### **3.1. GRAPE VINE:**

##### **Powdery mildew (*Erysiphe necator*)**

Monitoring data for **DMIs** were presented by Bayer CropScience (2014), Dow (2013) and Syngenta (2014). Monitoring analysis for 2014 is still ongoing.

- Disease pressure was moderate to high.
- Performance of DMIs and amines was as expected.
- Monitoring was carried out in Portugal, Spain, France, Italy, Switzerland, Austria, Germany, Hungary, Slovakia, and Romania.
- 2013 and 2014: Sensitivity for **DMIs** in Europe was generally in the normal range of fluctuation as observed in the previous years with regional differences.
- 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 2013 were presented by Bayer CropScience:

- Stable situation in the European countries with low resistance factors towards **amines**.

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. 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. APPLE:**



### **3.2.1. Apple scab (*Venturia inaequalis*)**

Presentation of monitoring data for 2014: Syngenta

- Disease pressure in 2014 was high across Europe.
- The performance of DMIs was good on this disease in 2014 when compounds were used according to the manufacturers' and FRAC recommendations within spraying programmes.
- Monitoring was carried out in Belgium, Netherlands, United Kingdom, Germany, Poland, France, Italy, Spain, Greece, Bulgaria, Romania, Slovakia, Lithuania, and Latvia.
- No sensitivity changes in European populations were observed from 2011 to 2014 within a fluctuation range as in previous years. Proportion of less sensitive isolates is low and stable.

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*)**

Presentation of monitoring data for 2014: Syngenta

- Performance of DMI was good.
- Monitoring was carried out in Netherlands, Belgium, France, Portugal, Italy, Switzerland, Poland, Hungary, and Romania.
- Monitoring was started in 2010 across Europe. No change in sensitivity comparing 2010 to 2014 was observed.
- See General Recommendations.

### **3.3. Tomato/Potato - *Alternaria solani* and *Alternaria alternata***

Presentation of monitoring data: Syngenta

- Monitoring was started in 2012 in Europe. Results for 2014 were presented.

- Monitoring was carried out in Belgium, Netherlands, Germany, United Kingdom, France, Italy, Slovakia, and Italy.
- Homogenous sensitivity of both pathogens was observed in different countries across Europe and no change occurring in 2014.

### **3.4. Cucurbits - *Podosphaera xanthii*/Sphaerotheca fuliginea**

Presentation of monitoring data: Syngenta

- Monitoring was started in 2012 in Italy. Data were reported from 2014.
- No change of sensitivity has been observed from 2012 to 2014.
- Monitoring in 2014 was started in China. All samples were sensitive with a homogenous distribution of sensitivity.

### **3.4. BANANA:**

#### **Black Sigatoka (*Mycosphaerella fijiensis*)**

The conclusions and guidelines of the February 2014 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 for 2016.

## **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.

Presentation of monitoring data: Bayer CropScience

### **4.1. Grey mould (*Botrytis cinerea*) on grape vine**

- Monitoring analysis for 2014 is still on-going.
- Disease pressure was moderate across Europe in 2013 and 2014. Field performance was good.
- In 2013 and 2014 monitoring was carried out in Germany, France, Italy, and Portugal (2013). Resistant isolates were detected in France and Germany, but with stable and low (France) to moderate (Germany) frequency over the last years not affecting the field performance.

### **4.2. Grey mould (*Botrytis cinerea*) on strawberries**

- Monitoring was carried out in 2014 in Germany, United Kingdom, France, Italy, Poland, and Denmark.
- Strong presence of resistant strains in United Kingdom, Germany, Denmark and Italy, whereas in Poland and in France lower frequency of resistant strains have been detected.

#### **4.3. Grey mould (*Botrytis cinerea*) on raspberry**

- Limited monitoring in Norway in 2014 showed high frequency of resistant strains.  
Recommendations for the use of KRIs:

- Use KRIs only protectively.
- Use KRIs only in strict alternation
- 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.

#### **4. NEXT MEETINGS**

Next annual meetings are planned for December 4, 2015 and December 16, 2016.