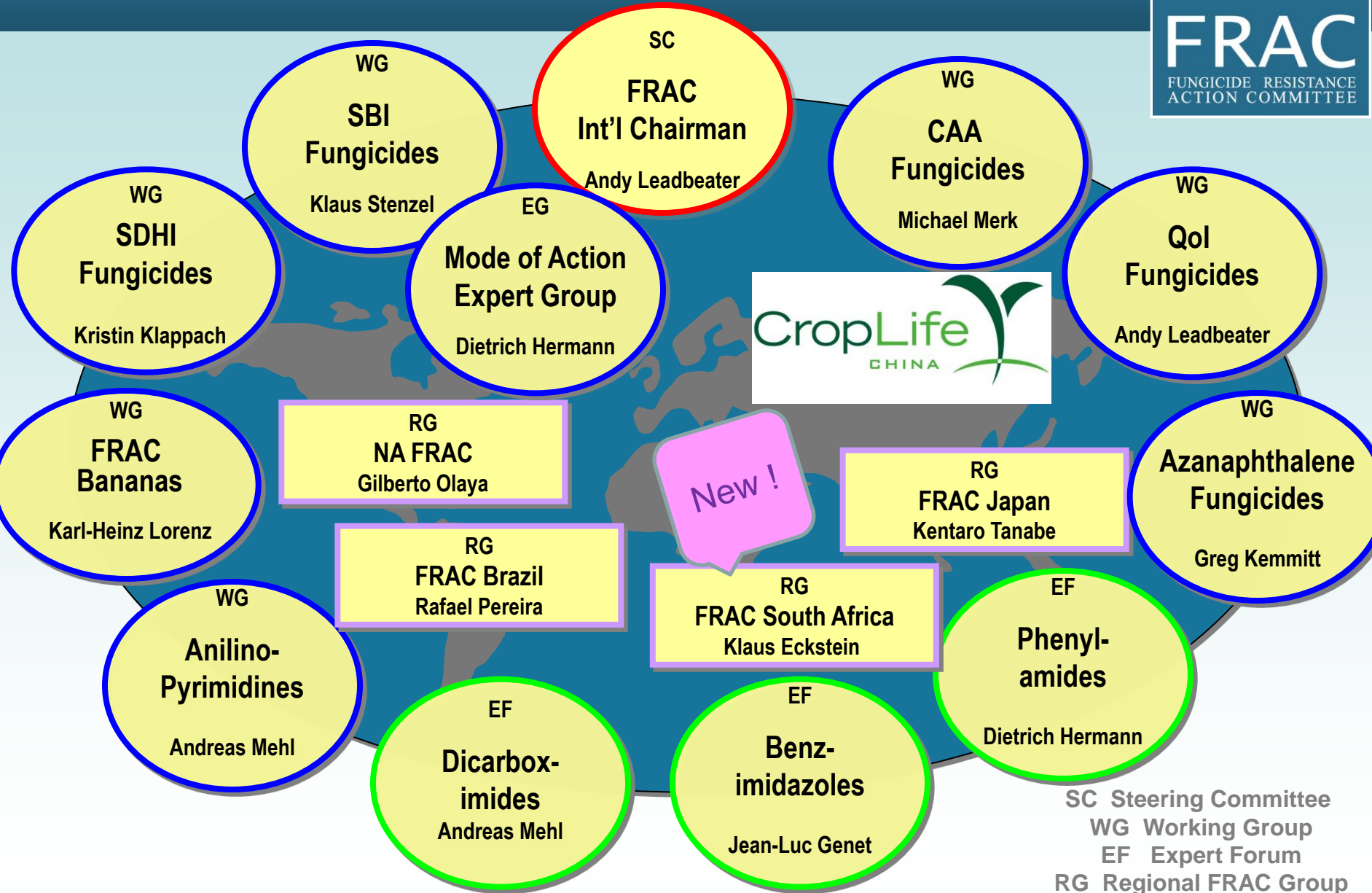


# 2013 FRAC Update

## EPPO Resistance Panel

Wageningen, 26 September 2013

# Organisation of FRAC



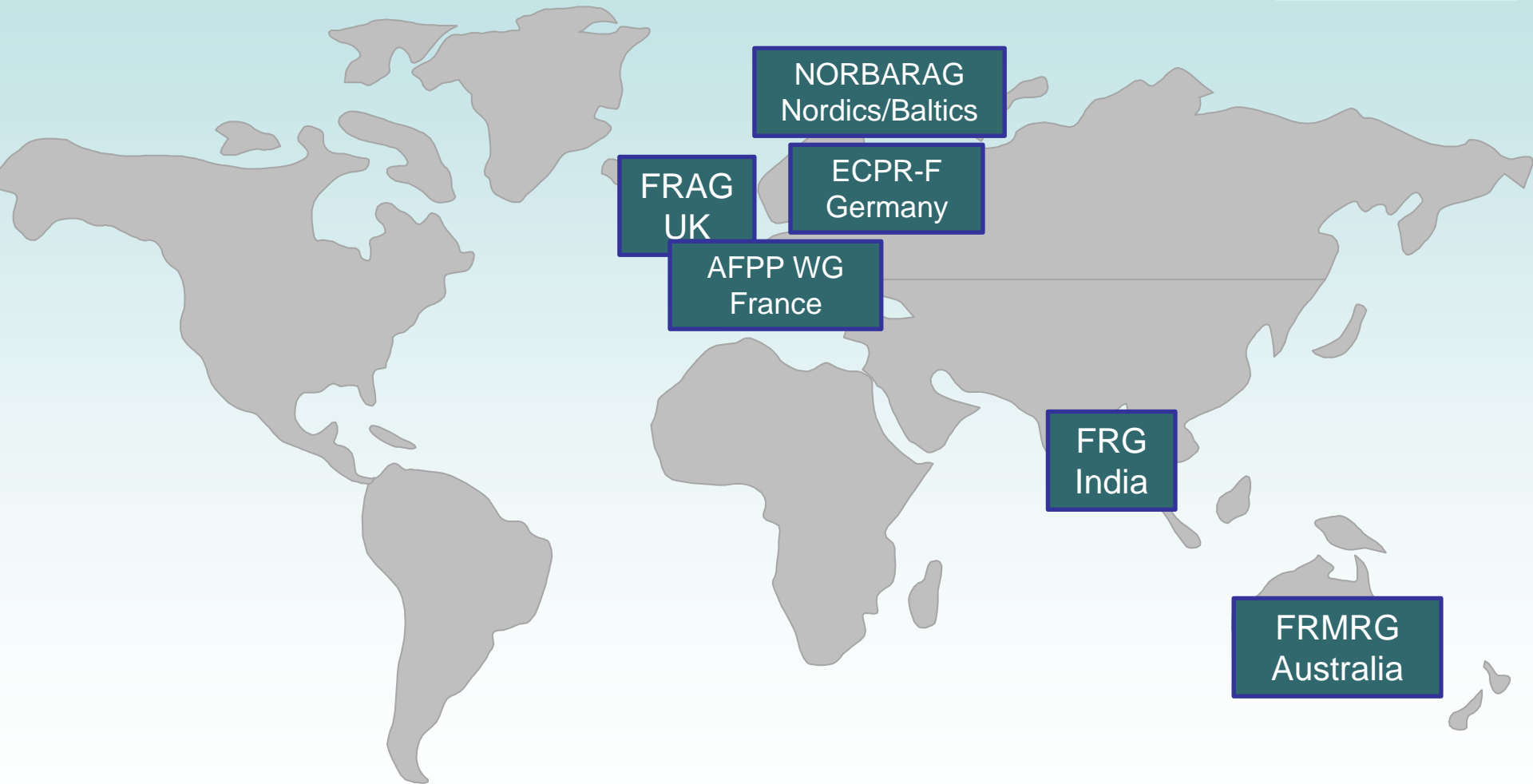
SC Steering Committee  
 WG Working Group  
 EF Expert Forum  
 RG Regional FRAC Group

# FRAC Organisation Changes



- The FRAC mode of action expert forum is now operational
- Lisa Hoffman (DuPont) elected as communication officer replacing R. Gold (BASF)
- Phil Russell has retired as FRAC secretary and will be replaced shortly
- Sumitomo invited to attend meetings of the SBI Working Group (fenpyrazamine)
- Belchim invited to attend the CAA Working Group (valiphenalate, previously Isagro)
- ISK invited to attend meetings of the SDHI working Group (Isofetamid)

# Outreach to other national groups



# List of FRAC International member companies



- BASF
- Bayer Crop Science
- Cheminova
- Dow
- DuPont
- Isagro
- KI Chemical
- Makhtheshim
- Syngenta

**Note:** Several other companies are represented in regional groups

# Update from Working Groups 2013

- **Septoria**
  - A few outliers with higher EC50 values in lab tests detected since 2009, slightly increasing in 2012
  - Increasing number of combinations of cyp51 mutations some of which can influence sensitivity
- **Other cereal diseases**
  - No significant changes
- **Asian soybean rust**
  - The performance of DMI's used alone was reduced especially under curative application timings and/or extended spray intervals
  - Sensitivity shifts have been observed with a trend to stabilize in season
  - Recommendations unchanged (mixture only)
- **Oilseed rape diseases (Sclerotinia, Phoma):**
  - No change
- **Sugarbeet Cercospora**
  - Stable situation in last 3 years in central Europe.
  - Broad range of sensitivity leads to assumption that shift took place in the past
  - Field performance can be affected when solo DMI's are used
- **Apple and grape diseases**
  - Within normal sensitivity fluctuations
- **Potato/tomato Alternaria**
  - Monitoring started in 2012 in Europe; homogenous sensitivity of both pathogens
- **Other:**
  - FRAC involved in assessing the relevance of DMI Agricultural uses in the development of triazole resistance in *Aspergillus fumigatus*, a human pathogen

- **Cereals**

- **Wheat Septoria:** Stable
- **Wheat rusts:** fully sensitive.
- **Barley rust:** sensitive; occasional isolates with slightly higher EC50 values detected in France and UK; resistance factors are low and the mutations normally associated with QoI resistance were not found; the practical relevance of these findings is currently not known.
- **Rhynchosporium:** no resistance found in 2012
- Other diseases: no change

- **Other crops**

- **Grape powdery mildew:** further spread of resistance; mixtures recommended as well as strict alternation of solo products
- **Potato early blight:** *A. solani* fully sensitive in Europe; G143A mutation found in some *A. alternata* isolates
- **OSR Sclerotinia:** fully sensitive; two suspicious isolates were found in Germany which are being further investigated
- **Sugarbeet Cercospora:** fully sensitivity; one suspicious isolate in France being investigated
- **Potato late blight, Asian soybean rust; corn Setosphaeria:** fully sensitive
- Other diseases: no change

- **New cases of resistance**

- **Corynospora asiicola** (Brazil): G143A mutation
- **Pyricularia oryzae** (Japan): G143A mutation



- **Grape downy mildew**
  - No significant change, some fluctuations, performance not affected
  - Recommendations unchanged: 4 applications & <50% of total number of applications, always in mixture
- **Potato late blight**
  - No resistance detected; recommendations unchanged
- **Cuke downy mildew**
  - Some resistant isolates detected in Spain, Israel and USA
  - Recommend no more than 2 consecutive applications
  - Mixtures recommended in areas with confirmed resistance

- **Grapes botrytis:** frequency of resistant isolates remains low in Europe; performance unaffected
- **Strawberry botrytis:** heterogenous and fluctuating situation, overall decrease in the frequency of resistant isolates
- **Apple scab:** low frequency of resistant populations
- Recommendations amended in 2012:
  - Where 7 or more Botrytis treatments are required per crop and season, a maximum of three applications with AP-containing products is recommended **and not more than two consecutive applications.**



- **Wheat Septoria:** All sensitive except one isolate from a trial site in France; low resistance factor; target site mutation T79N in the SDH-C subunit ; field performance unaffected
- **Pyrenophora teres:** All sensitive except 2 isolates from Germany; low resistance factor; target site mutation H277Y in the SDH-B subunit; field performance unaffected
- Resistance continues to be found in **Botrytis cinerea** and more rarely in OSR **Sclerotinia**
- **Alternaria:** Potato *A. solani* fully sensitive; mutations found in the SDH gene of *A. alternata*; field performance unaffected; No resistance found in other *Alternaria* species
- First case of resistance in **cucumber powdery mildew** in Belgium and Italy
- All other pathogens monitored in 2012 were fully sensitive
- Agreement within the group that mixtures of SDHIs do not provide an antiresistance strategy and must be treated as a solo SDHI for resistance management

# SDHI Seed Treatments



- **Autumn-sown cereals:**
  - No implications on guidelines for the use of foliar SDHI fungicides as long as the SDHI seed treatment is directed against seed and soil borne diseases or 'low risk' foliar pathogens
  - Otherwise, the SDHI seed treatment is counted as one of the total number of recommended SDHI applications per crop - unless other modifiers are applied.
    - Mixing partners in the seed treatment having a different MoA and providing satisfactory disease control when used alone on the target disease
    - Alternation (i.e. the first foliar spray following the seed treatment does not contain an SDHI)
    - Dose rate in the seed treatment (i.e. dose rate adjusted to cover only seed/ soil borne diseases)
- **Spring-sown cereals:**
  - No implications on guidelines for the use of foliar SDHI fungicides as long as the SDHI seed treatment is directed against seed and soil borne diseases or 'low risk' foliar pathogens
  - Otherwise the SDHI ST is counted as one of the total number of recommended SDHI applications per crop.
- **Other crops:**
  - Recommendations are to be produced at a later date

- Wheat powdery mildew
  - Isolates with reduced sensitivity primarily found in the East Anglia area of the UK and in Northern Germany however  $EC_{50}$  values of the least sensitive isolates remain low
  - Field performance remains good
  - No changes to current resistance risk management recommendations
- Grape powdery mildew
  - No significant change of overall EU wide sensitivity of the *E. necator* population was recorded in 2012
  - Performance remains good when used in rotational spray programs
  - No changes to current resistance risk management recommendations

# FRAC codes



## FRAC Code List <sup>®</sup>\*2012: Fungicides sorted by mode of action (including FRAC Code numbering)

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
A: nucleic acids synthesis	A1: RNA polymerase I	PA – fungicides (PhenylAmides)	acyclalanines	benalaxyl benalaxyl-M (=kiralaxyl) furalaxyl metalaxyl metalaxyl-M (=mefenoxam)	Resistance and cross resistance well known in various Oomycetes but mechanism unknown.  High risk. See FRAC Phenylamide Guidelines for resistance management	4
			oxazolidinones	oxadixyl		
			butyrolactones	ofurace		
	A2: adenosin-deaminase	hydroxy-(2-amino-) pyrimidines	hydroxy-(2-amino-) pyrimidines	bupirimate dimethirimol ethirimol	Medium risk Resistance and cross resistance known in powdery mildews. Resistance management required.	8
	A3: DNA/RNA synthesis (proposed)	heteroaromatics	isoxazoles	hymexazole	Resistance not known.	32
isothiazolones			octhilone			
A4: DNA topoisomerase type II (gyrase)	carboxylic acids	carboxylic acids	oxolinic acid	Bactericide. Resistance known. Risk in fungi unknown. Resistance management required.	31	
					Resistance common in many	

N

Lists commercial fungicides according to their mode of action and resistance target bactericides are also included.

Fungicides in the same group are cross-resistant

Fungicides in different groups are NOT cross-resistant

# FRAC Classification Update



- **Pyrimorph** added to group F5 (CAA)
- **Isofetamid** added to group C2 (SDHI)
- **Tolfenpyrad** included in group C1 (respiration, complex 1 inhibitor)
- **Fenpyrazamine** included in group G3 (SBI class III inhibitor) alongside fenhexamid
- **Ethaboxam** reclassified from group U5 to B3 (beta-tubulin assembly inhibitor), alongside zoxamide
- **Fluoroimide**: reclassified as 'M' (multisite) in the 2013 update
- **Chinomethionat, Quinomethionate** included as 'M' (multisite)
- **Fenaminstrobin** (previously fenaminostrobin) added to group C3 (QoI)
- Several biologicals added to the FRAC code list



# Other FRAC activities



- FRAC Pathogen Risk list updated
- New version of the FRAC Mode of Action poster available
- List of fungicide-resistant pathogens updated
- Updates to FRAC monitoring methods
- Participation to several venues:
  - 17<sup>th</sup> Reinhardsbrunn Symposium on Modern Fungicides and Antifungal compounds, April 21-25, 2013
  - ICPP (10th International Congress on Plant Pathology), Beijing, China, August 2013
  - IUPAC Meeting, San Francisco, 13-15 August 2013
- FRAC has been invited to participate to Crop Life International IPM meetings