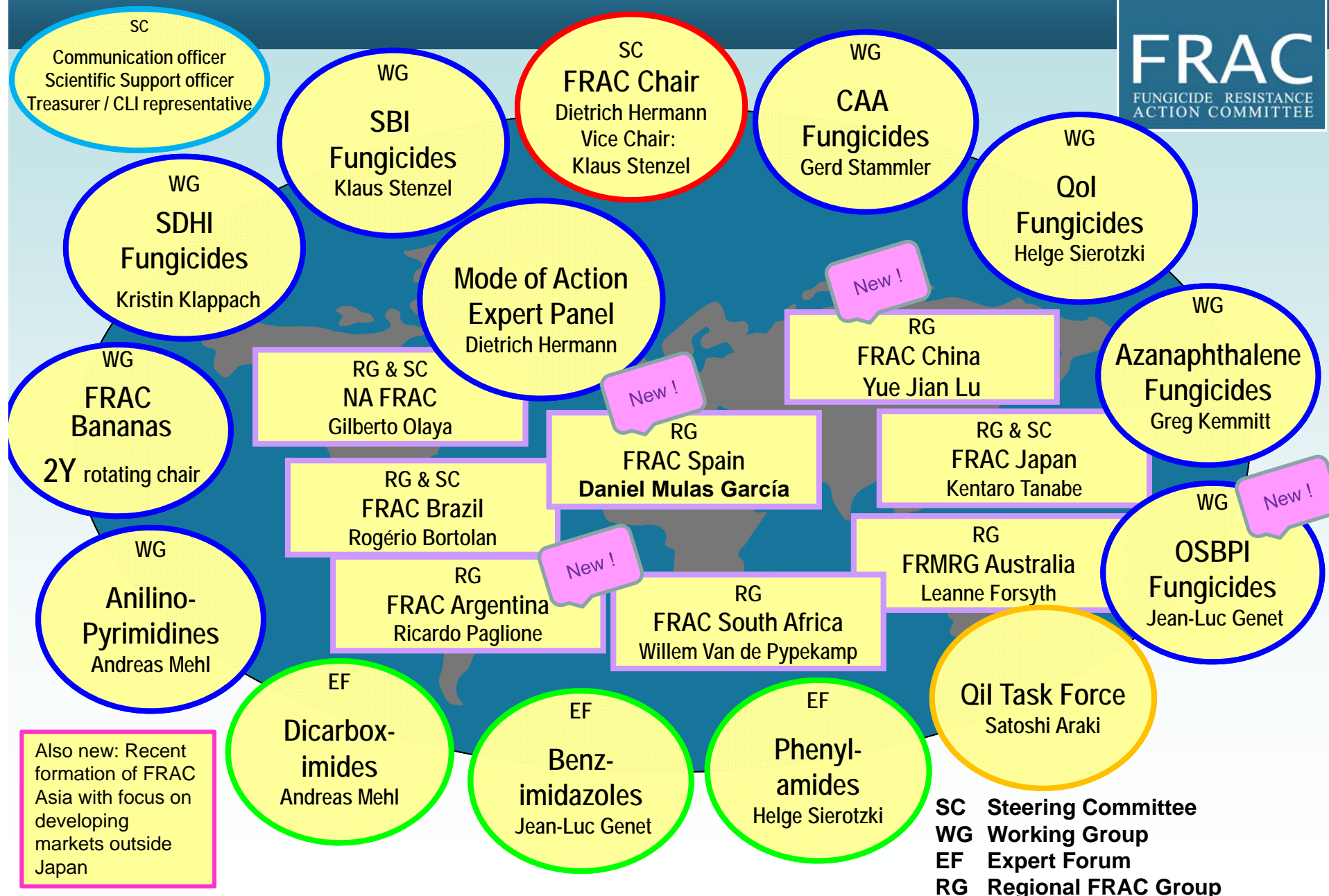


# 2017 FRAC Update

EPPO Resistance Panel

Berlin, 19 September 2017

# Organization of FRAC - What's New?



# FRAC Steering Committee 2017

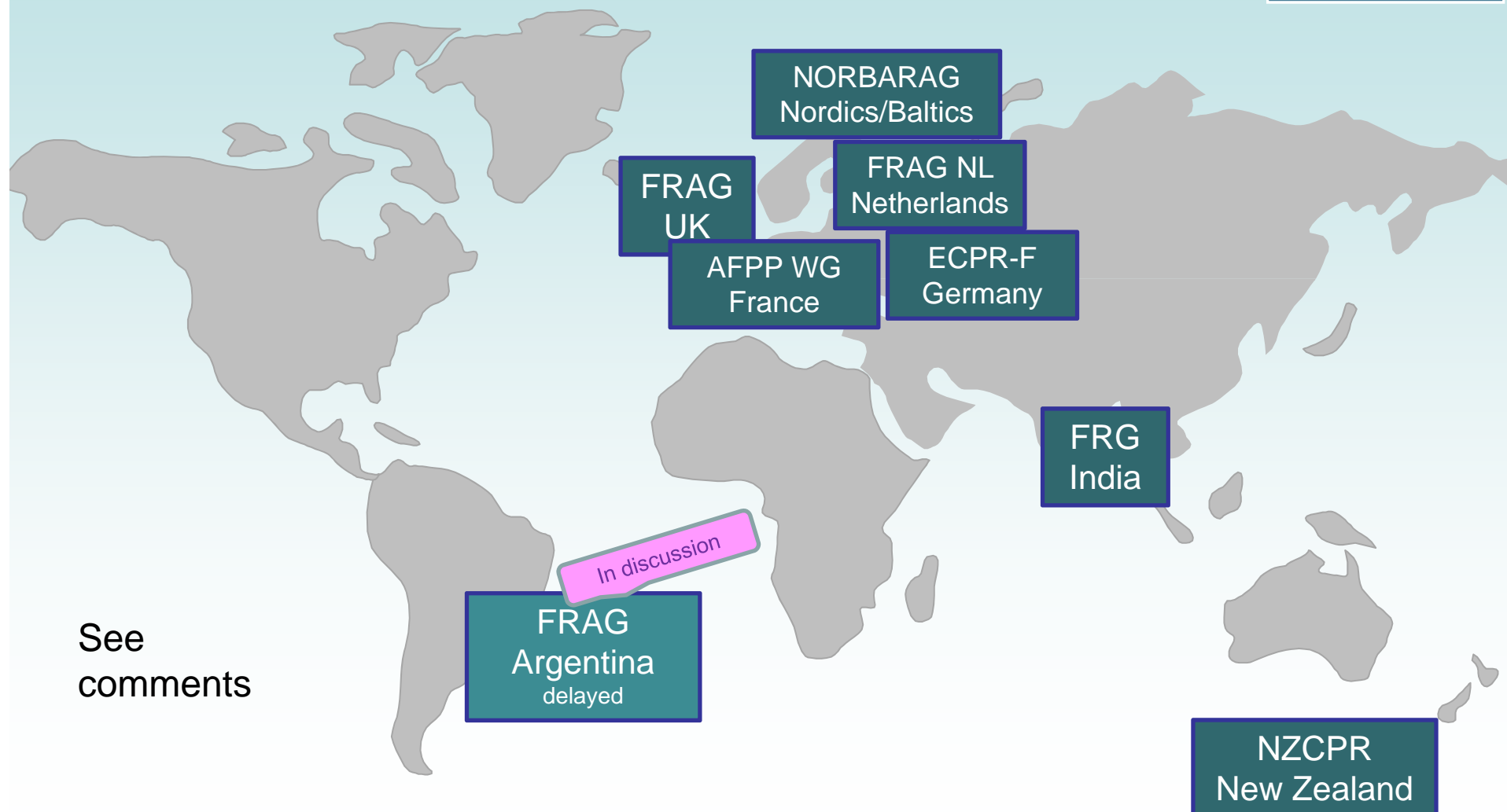


Dr. D. Hermann	Syngenta	Chairman FRAC, Chairman MoA Expert Panel
Dr. K. Stenzel	Bayer	Vice Chairman, Chairman SBI Fungicides WG
Mr. D. McKenzie		Scientific Support Officer
Dr. J. Derpmann	Bayer	Communication and Website Officer
Dr. G. Kemmitt	Dow Agrosciences	Chairman Azanaphthalene WG; FRAC-MoA Poster
Dr. A. Mehl	Bayer	Chairman Anilinopyrimidines WG & Banana WG Dicarboximide Expert Forum
Dr. G. Stammler	BASF	Chairman CAA Fungicides WG
Dr. K. Klappach	BASF	Chairwoman SDHI Fungicides WG
Dr. H. Sierotzki	Syngenta	Chairman QoI-WG & Phenylamides Expert Forum
Mr. J.-L. Genet	DuPont	Chairman OSBPI-WG & Benzimidazoles Expert Forum
Dr. K. Tanabe	Nippon Soda Japan	Representative Japan FRAC, Qil Task Force
Dr. G. Olaya	Syngenta USA	Representative North America FRAC
Mr. R. Bortolan	Bayer Brazil	Representative Brazil FRAC

# Outreach to other national groups

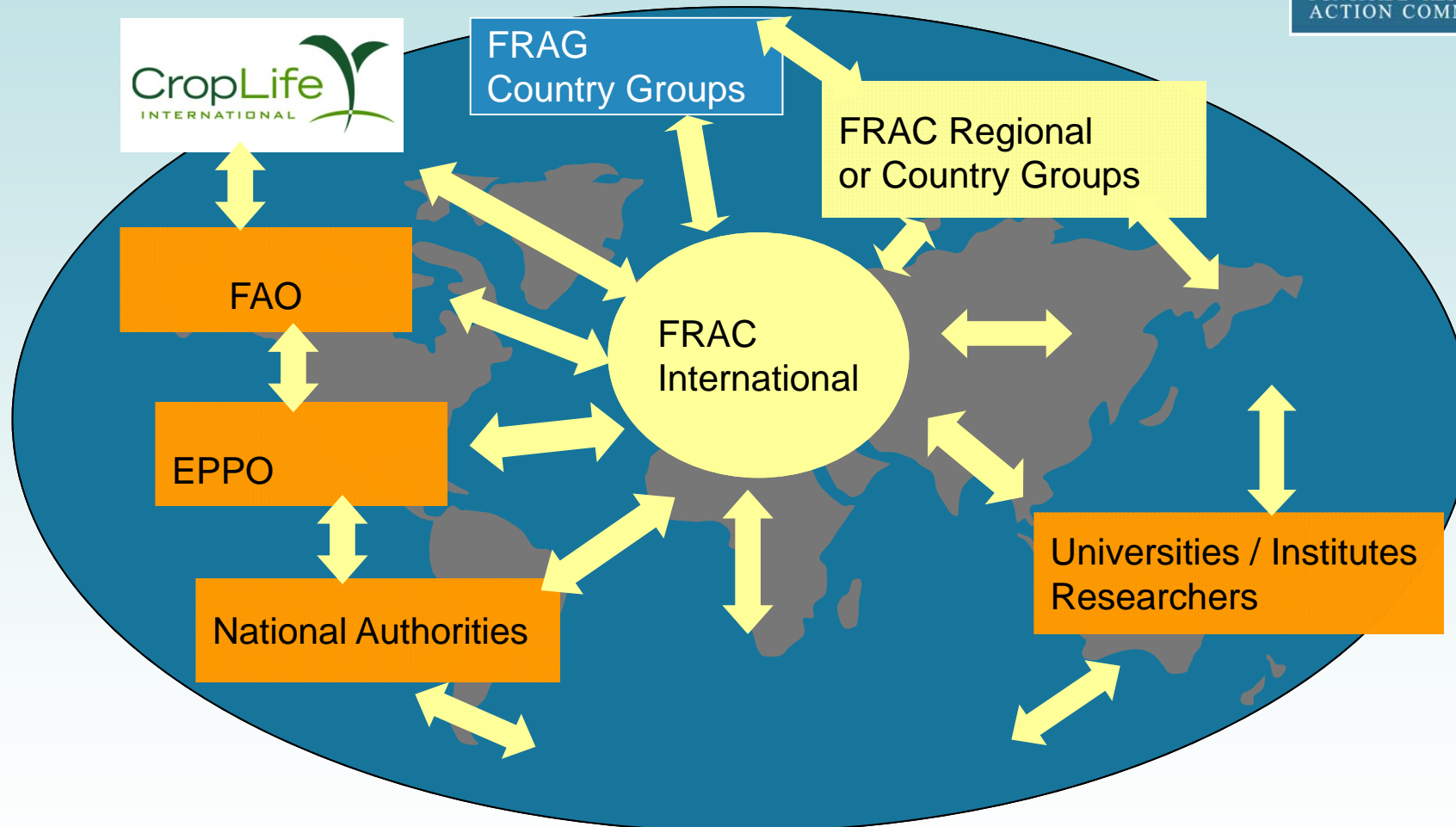


National fungicide resistance action groups are led by representatives of national institutes and regulatory authorities, with industry representation.



See  
comments

# FRAC – Outreach, Influence and Politics



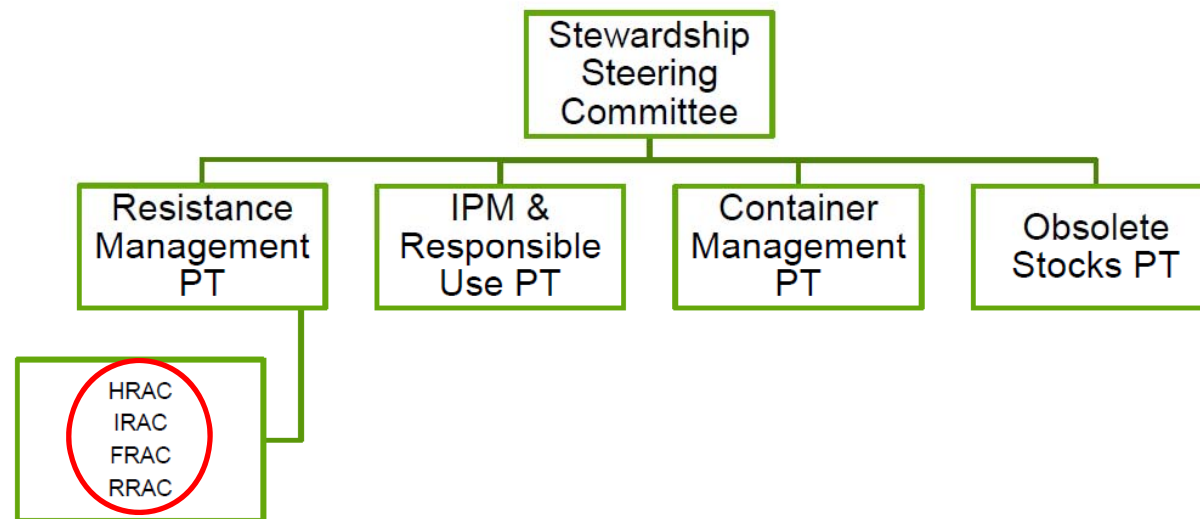
# CLI Resistance Management Project Team



## Stewardship Committee



### New Structure

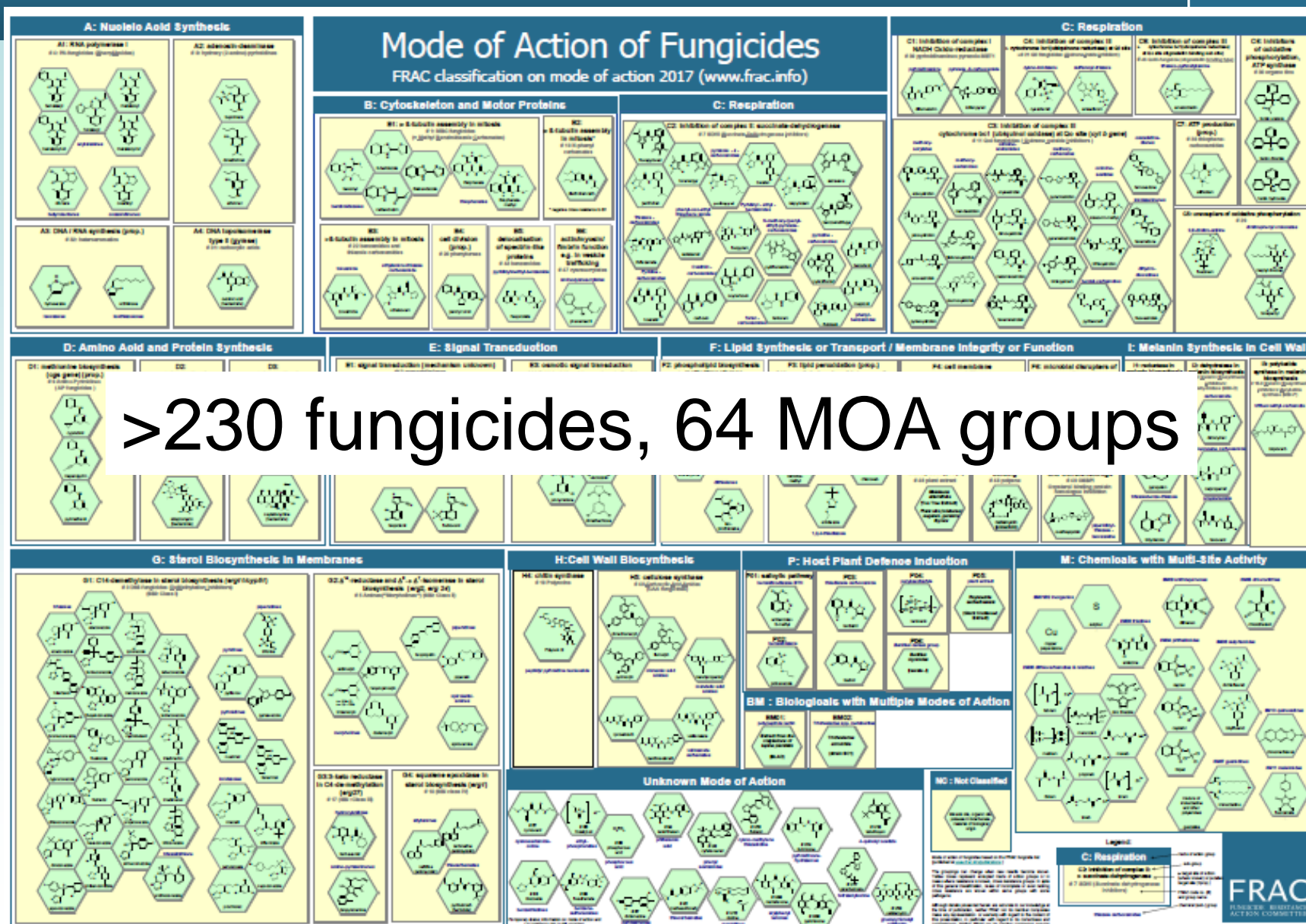


**Deals with resistance to both fungicides and traits**



# FRAC Mode of Action Poster 2017 ([www.frac.info](http://www.frac.info))

AC  
RESISTANCE  
COMMITTEE



# FRAC Database for Mutation Information



- Work in progress
- Designed to serve as basis for more interactive formats of working group summaries and recommendations in the future.
- Draft contains a list of about 150 entries
- Additional information (e.g crop, resistance factor) will be added



# FRAC MoA APP (in development)



Draft can be seen at:  
[frac.intraspin.com](http://frac.intraspin.com)

FRAC	?	▼
A	Nucleic acids synthesis	▼
B	Cytoskeleton and motor proteins	▼
C	Respiration	▼
D	Amino acids and protein synthesis	▼
E	Signal transduction	▼
F	Lipid synthesis and membrane integrity	▼
G	Sterol biosynthesis in membranes	▼
H	Cell wall biosynthesis	▼
I	Melanin synthesis in cell wall	▼
P	Host plant defence induction	▼
n/a	Unknown mode of action	▼

FRAC	?	▼
A	Nucleic acids synthesis	^
A1	RNA polymerase I	GROUP 4 ^
	PA – fungicides (PhenylAmides)	^
	acylalanines	▼
	butyrolactones	^
	<i>ofurace</i>	
	oxazolidinones	▼

# Update from Working Groups 2016

- **Demethylation Inhibitors (DMI)**

- Wheat Septoria

- In 2016 the DMI 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.

- Barley Ramularia

- DMI field performance in 2016 was variable in dependence on regions with some failures of control in some areas in Bavaria. Some isolates were detected in 2015 showing loss of sensitivity. Relevant CYP51-mutations explaining the effects have been identified.

- Soybean Rust

- In 2015/16 stable situation for DMIs.

- **Keto-Reductase Inhibitors (KRI)**

- Grape Botrytis

- Moderate level of resistance in DE, low in FR, very low in IT, ES, AT. High frequency of resistant strains in Chile in 2015 and 2016.

- Strawberry Botrytis

- Sensitivity clearly increased with moderate resistance level in the UK, low levels in France and Germany.

# QoI Working Group



- The QoI sensitivity situation across the board is more or less stable.
- Six new pathogens have been added to the monitoring program:  
*Peronospora destructor* (onion), *Bremia lactucae* (lettuce), *Sclerotinia sclerotiorum* (pea & bean), *Rhizoctonia solani* (soybean & potato)
- Rice blast recommendations were added. Use of mixtures where QoI resistance has been reported.

# SDHI Working Group (1)



- **Full sensitivity:** Wheat Brown rust, Yellow rust and Powdery mildew, Barley rust,
- **Septoria**  
H152R detected in UK and IR as in 2015, and additionally in NL and IT for the first time, new mutations detected but associated with low or no impact on sensitivity, overall relatively stable, only slightly broader distribution, no significant increases
- **Barley net blotch**  
Low frequency of resistance in UK, CZ, PL, IT, DK, South FR, South DE; Moderate: North FR, North DE.  
Among the mutations with moderately decreased sensitivity, CG79R and C-H134R are the most frequently detected mutations
- **Barley Ramularia**  
Samples carrying the mutations C-H146R or C-H153R associated with significantly decreased sensitivity were detected in Germany, Ireland, the Netherlands and the UK.
- **Oilseedrape Sclerotinia**  
No to low frequency detected in FR

# SDHI Working Group (2)



- **Grape Botrytis** - 2 new mutations detected in subunit C with low resistance factors in FR and DE
- **Grape Powdery mildew**
  - C-G169D not detected (moderate resistance factors)
  - B- H242R detected in CZ, SK, HU and FR
- **Apple scab** - Full sensitivity in many countries, among them IT and ES which had detections in previous years
- **Asian Soybean rust**
  - For the first time in the season 2015/16 and more frequently in 2016/17 at sites with a history of intensive SDHI-use and very high disease pressure, cases of reduced performance have been detected.
  - Currently, the resistance mechanisms are not fully understood.
  - The initial characterization of populations collected 2015/16 indicated a mutation in the C-subunit at position I86F.
  - The relevance and distribution of this mutation for the reduced SDHI sensitivity partly observed as well in 2016/17 samples is currently under investigation.



# Anilinopyrimidines (AP) Working Group



- **Grapes and strawberries Botrytis**

The situation remains fairly stable while some low frequency of resistance was found in certain vegetables.

- **Apple scab**

Results was stable and in fact slightly reduced.

- **General recommendations** were amended slightly for other crops and now also include use in nurseries.

- **Grape Downy Mildew**  
No significant changes
- **Potato/tomato late blight**  
All samples were sensitive.
- **Lettuce and onion downy mildew** (*B. lactucae* and *P. destructor*)  
Genetic analysis of the *cesA3* gene showed that all samples did not contain any known mutation potentially causing CAA resistance and were therefore classified as sensitive.
- **Guidelines** are unchanged.

# Azanaphthalenes (AZN) Working Group



- **Wheat powdery mildew** - The situation remains stable
- **Grape powdery mildew** - Some reduced sensitivity reported in a number of regions in Europe but generally no complaints.
- Use **recommendations** remain unchanged.

# OSBPI Working Group



- First formal meeting on April 4, 2017 (DuPont and Syngenta)
- FRAC code changed from U15 to 49
- No changes to current recommendations

FRAC Code	Target site and code	Group name	Chemical group	Common name	Comments
49	F9 lipid homeostasis and transfer/ storage	OSBPI oxysterol binding protein homologue inhibition	piperidinyl- thiazole- isoxazolines	oxathiapiprolin	Resistance risk assumed to be medium to high (single site inhibitor). Resistance management required. (Previously U15).

# MoA Code List 2017 (published March): Agreed and implemented updates



- Code 7 – SDHI, Pyraziflumid added, new chemical group: pyrazine-carboxamides
- MoA category F renamed to cover a broader range of modes of action related to membrane / lipids. New description: F: lipid synthesis or transport / membrane integrity or function
  - a. Plant oils (tymol, geraniol, Eugenol) included to code 46
  - b. Natamycin added as code 48.
  - c. Oxathiapiprolin reclassified from U15 into code 49.
- MoA category P6: *Bacillus mycoides* isolate J added as microbial plant defense inducer, code P6
- Multisites (M) renamed into “Chemicals with multi-site activity”
- New category and code introduced for biologicals with multiple modes of action (BM).
  - a. BLAD moved from M12, now BM01
  - b. *Trichoderma atroviride* introduced as BM02

# Updates to FRAC Code List



- BASF: mefentrifluconazole, ipfentrifluconazole (DMI) – 2018
- Dow: Fenpicoxamid (Qil) – 2018
- FMC/Isagro: Fluindapyr – SDHI -> 2018
- The FRAC Code list is being updated with the help of Klaus Tietjen and the MoA expert forum. As a result, some active ingredients will be assigned a different MoA group.