Global Herbicide Resistance Action Committee

CropLife INTERNATIONAL

Global HRAC Member Companies.

HERBICIDE RESISTANCE ACTION COMMITTEE

Our Members:	Our Staff:
BASF **Bayer Crop Science** **Corteva** **FMC** **Syngenta Crop Protection** **Sumitomo Chemical Company** **UPL**	**Chair** *Rex Liebl - BASF* **Secretary/Treasurer** *Roland Beffa – Bayer* **Communications Lead** *Chandra Aradhya, Bayer*

HERBICIDE RESISTANCE ACTION COMMITTEE

Working Groups:

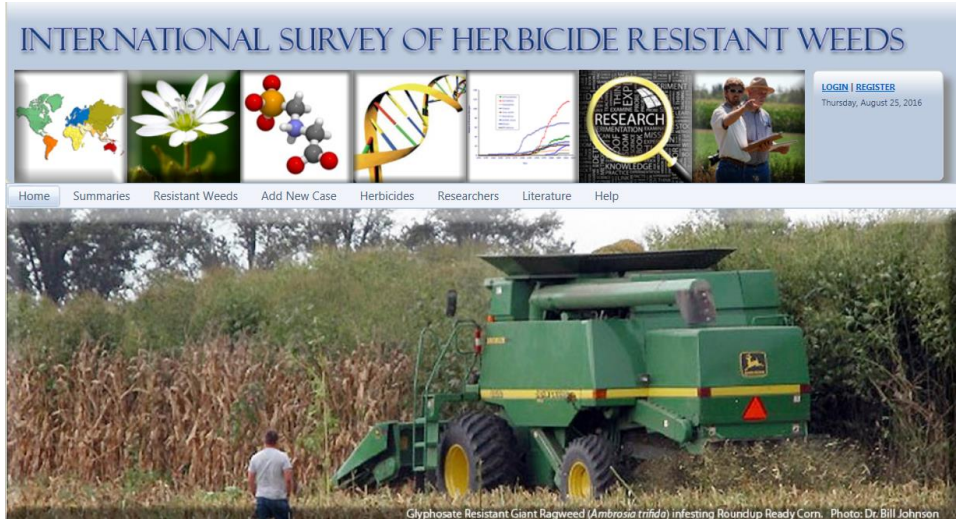
Auxin	HPPD	Communications weedscienc.org hracglobal.com	Issues Engagement	MOA Classification	PPO
TBD	Roland Beffa	Chandra Aradhya	Harry Strek	Rex Liebl	John Pawlak

Key objectives for Working Groups:

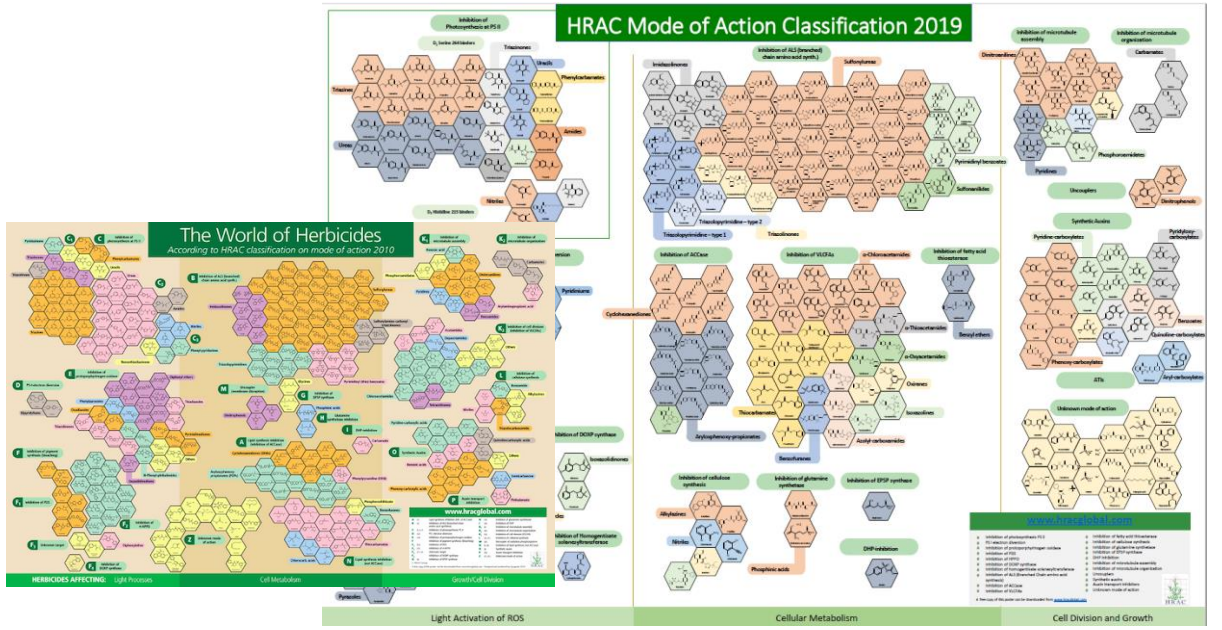
- Consolidate and communicate information for specific MOAs
- Monitor research
- Support intellectual dialogue
- Customize BMPs for a given MOA
- Address specific resistance topics (e.g. Monitoring)

Global HRAC Initiatives and Activities

- Disseminate information on resistant weeds:
  - The International Survey of Herbicide Resistant Weeds
  - HRAC Website
  - Seminars and Symposia
- Build recommendations:
  - Working groups
  - Testing protocols
- Mode of Action Classification:
  - Poster
  - Online tool
  - Coordination with other entities



www.weedscience.org



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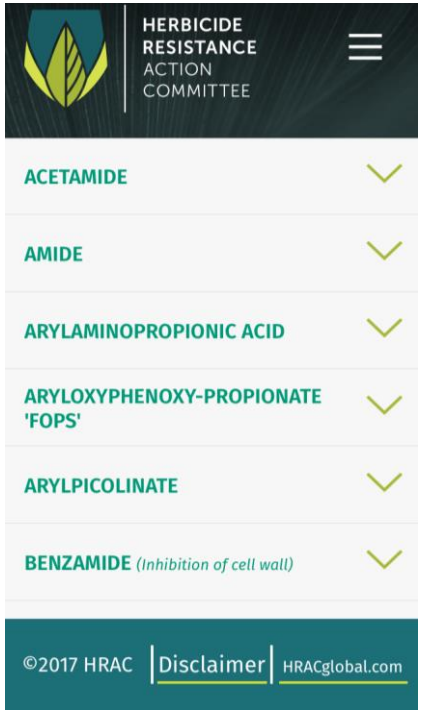
2018 Accomplishments & 2019 Activities

- Continued engagement with local/regional HRACs
- MOA Classification Working Group – major updates and revisions completed
- Herbicide MOA app
- PPO Working Group initiated
- Auxin Working Group sponsored review paper
  - ✓ One of the “top download papers” of the year
- Review of resistance testing methods near completion
- Survey of HRAC stakeholders completed
- Updating to weedscience.org website
- Joined International Weed Genomic Consortium as member and sponsor.



MOA mobile app


Review

SCI

Received: 23 August 2017 Revised: 5 December 2017 Accepted article published: 13 December 2017 Published online in Wiley Online Library:

(wileyonlinelibrary.com) DOI 10.1002/ps.4823

Weed resistance to synthetic auxin herbicides

Roberto Busi,[a] Danica E Goggin,[a] Ian M Heap,[b] Michael J Horak,[c] Mithila Jugulam,[d] Robert A Masters,[e*] Richard M Napier,[f] Dilpreet S Riar,[e] Norbert M Satchivi,[e] Joel Torra,[g] Phillip Westra[h] and Terry R Wright[e]

Auxin Resistance Review

weedscience.org Revision

- **Update and modernize homepage design and navigation**
- **Expand search capabilities**
  - Filters for specific searches
  - Ability to download
- **Additional databases proposed**
  - Non-target site resistance database
  - Weed genomic data e.g. Int Weed Genomics Consortium data
  - Others to be defined
- **Revised website scheduled for release September 19, 2019**

Website survey results

Regional/Country HRAC Objectives and Actions

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- Education materials, seminars, symposia
- Research collaborations
- Collection of information on resistant weeds
- Development of Best Management Practices

Mode of Action Classification Update

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Background

HRAC sponsored a Working Group comprised of senior herbicide chemists and agronomists at Corteva, Bayer Crop Science, Syngenta and BASF to update the HRAC mode of action classification including "The World of Herbicides" poster.

Phase 1

- Update MOA, chem family names, new actives, structures. Changes since the last update in 2010 include the addition of 14 new actives, rationalization of chemical family names, and four new or updated modes of action: inhibition of fatty acid thioesterase (cinmethylin), inhibition of homogentisate solanesyltransferase (cyclopyrimorate), inhibition of solanesyl diphosphate synthase (aclonifen), and inhibition of serine-threonine protein phosphatase (endothall).

Phase 2

- Update MOA code nomenclature – Ongoing, completion anticipated December 2019

International Weed Genomics Consortium - IWGC

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Purpose/Goal

Genomics can significantly contribute to a better understanding of key mechanisms in weed biology, thereby benefiting crop producers and consumers. IWGC Participating Institutions and Sponsoring Members intend to jointly collaborate on obtaining reference weed genomes by sequencing, providing bioinformatic tools, training, and facilitating global discussion and collaborations in weed genomics.

Value of IWGC to HRAC

HRAC has long supported efforts to better understand the evolution of weed resistance to herbicides, specifically our strong support of the International Weed Resistance database. The IWGC represents the next of generation of scientific inquiry to further our knowledge of weed resistance evolution and the opportunity to create new approaches to weed management. The support of IWGC by HRAC will have the following benefits:

a. Take part of the efforts to create the critical mass necessary to sequence, assemble and annotate the genomes of the 10 more important weeds. This effort cannot be insured by any single institution.
b. Establish shared common genomic “alphabet” to facilitate collaborations across multiple organizations, in particular between industry and academia.
c. Provide sequence information about target site isoforms and thus allow a more efficient analysis of target site resistance.
d. Provide sequence information about non target site genes involved in herbicide resistance and allow the generation of new diagnostic tools.
e. Identify high risk resistant weed species and populations.
f. Access to new information on target genes and diversity across weeds.
g. Facilitate the understanding of non-target site resistance evolution.
h. Provide better understanding of multi-resistance.
i. Lead to new options to avoid / delay herbicide resistance
j. Move away from retroactive analysis of herbicide resistance to prediction of the resistance risk.
k. Identify options for new HT traits, especially non-GMO.
l. Improve the International Weed Resistance database with information about the mechanism(s) of resistance of the weed populations and the genetic information related.

European Herbicide Resistance Action Committee

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Eurpean HRAC Member Companies.

Our Members:	Our Staff:
Adama **BASF** **Bayer Crop Science** **Corteva** **FMC** **Gowan** **Nufarm** **Syngenta Crop Protection** **UPL**	**Chair** *Marc Bonnet- UPL* *Géraldine Bailly - UPL* **Secretary/Treasurer** *Alan Porter – Consultant*

Working Groups:

Fact Sheet Resistance Matrix	European Website	MOA Classification – European position	Interaction with Country resistance working groups
Géraldine Bailly Marisa Salas Bernd Sievernich Matt Cordingley Marc Bonnet	Géraldine Bailly Eileen Paterson Alan Porter	Géraldine Bailly Marisa Salas Bernd Sievernich Matt Cordingley Marc Bonnet	Marisa Salas Marc Bonnet Xavier Belvaux

European HRAC Initiatives and Activities

- **Fact sheet resistance matrix**
  - Proposal of alternatives
    - Additional definitions on the scientific aspects (modifiers)
    - Focus on the biology of the key weeds
- **European Website**
  - How to improve communication and flow of information
  - First target are the country resistance teams
- **Mode of Action Classification**
  - European Feedback provided to Global HRAC
- **European country group communication**
  - Discuss with Country Working Groups what are the expectations from EHRAC
  - Joined projects?

Thank You!

Contact us at hracglobal.com