Global HRAC & EHRAC Update

EPPO Resistant Panel

Lyon, October 14th & 15th, 2016
New Global HRAC Website (www.hracglobal.com)

- Organized information
- Better search capabilities
- New content
Initiatives and Activities

- Disseminate information on resistant weeds:
  - International Survey
  - HRAC Website
  - Seminars and Symposia
- Build recommendations:
  - Working groups
  - Testing protocols
- Mode of Action Classification:
Information and Education

- Providing information and tools to combat resistant weeds:

GLOBAL CLASSIFICATION LOOKUP

<table>
<thead>
<tr>
<th>Chemical Family or Active Ingredient</th>
<th>Classification Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ HRAC</td>
</tr>
<tr>
<td></td>
<td>✓ WSSA</td>
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</table>

<table>
<thead>
<tr>
<th>Chemical Family</th>
<th>Active Ingredient</th>
<th>HRAC</th>
<th>WSSA</th>
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</thead>
<tbody>
<tr>
<td>Acetamide</td>
<td>dichlorodiphenyl</td>
<td>Group K3</td>
<td>Group 15</td>
</tr>
<tr>
<td>Acetamide</td>
<td>imidazolinone</td>
<td>Group K3</td>
<td>Group 15</td>
</tr>
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</table>

Information on herbicide Site of Action and classification
## Recent Resistant cases in EU

<table>
<thead>
<tr>
<th>Date Last Updated</th>
<th>Species</th>
<th>Country</th>
<th>First Year</th>
<th>Site of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 1, 2016</td>
<td><em>Alopecurus myosuroides</em></td>
<td>Spain</td>
<td>2015</td>
<td><strong>Multiple Resistance: 3 Sites of Action</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ACCase inhibitors (A/1)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ALS inhibitors (B/2)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>PSII inhibitor (Ureas and amides) (C2/7)</td>
</tr>
<tr>
<td>January 20, 2016</td>
<td><em>Chenopodium album</em></td>
<td>Finland</td>
<td>2015</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>February 4, 2016</td>
<td><em>Atriplex patula</em></td>
<td>Belgium</td>
<td>2015</td>
<td>Photosystem II inhibitors (C1/5)</td>
</tr>
<tr>
<td>February 2, 2016</td>
<td><em>Echinochloa crus-galli var. crus-galli</em></td>
<td>Spain</td>
<td>2015</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>December 20, 2015</td>
<td><em>Digitaria sanguinalis</em></td>
<td>France</td>
<td>2015</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>July 3, 2015</td>
<td><em>Senecio vulgaris</em></td>
<td>France</td>
<td>2009</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>June 29, 2015</td>
<td><em>Sorghum halepense</em></td>
<td>Spain</td>
<td>2015</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>April 1, 2015</td>
<td><em>Matricaria recutita (= M. chamomilla)</em></td>
<td>Poland</td>
<td>2014</td>
<td>ALS inhibitors (B/2)</td>
</tr>
<tr>
<td>March 31, 2015</td>
<td><em>Papaver rhoes</em></td>
<td>Poland</td>
<td>2014</td>
<td>ALS inhibitors (B/2)</td>
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</table>
European working groups: Spain

Maize:
Confirmation of resistance populations of Sorghum in the North east of Spain. Samples taken and analyzed has confirmed resistance by non– target site and by target site mutation. Study is still in progress.
Resistance to *Echinochloa crus-galli* confirmed.

Cereals:
R-Papaver: Intensity provide a good control
R-Ryegrass: recommendation of prosulfocarb seems to work well
*R-Alopecurus*: identify in the North of Spain with population resistant to HRAC group A (fop, dim, dem) and B (Sulfonylureas)
*R-Sinapis arvensis*: resistance to HRAC group B, ALS confirmed
*R-Rapistrum rugosum* resistance to HRAC group B, ALS confirmed

Fruit Trees
R- *Lolium* and *Conyza* resistant to glyphosate

Rice:
Important problem on *Echinochloa, Cyperus, Leptochloa*.
FMC has present Command (Clomazon), registered in early post---emergence control of *Echinochloa* resistant at 60-70 %. Clomazon in Pre-emergence shows better efficacy 80-90%. Product is volatile so should be used carefully to avoid damage to adjacent crops
European working groups: Spain
European working groups: France

As reported previously the field testing protocol has been finalized and approved. This Document is specifically aimed at farmers using a single and double rate application of the herbicide in comparison with a standard. It is to be used to establish a suspicion of resistance not confirm it. If a suspicion is established then seed samples are taken and tested using current methodologies.
European HRAC Activities
ECPA/Rothamsted proposed European founded project under 2020

The aim of the project is to form a consortium composed of research Institutes and agri-food chain stakeholders to work toward implementing a long term sustainable resistance management strategy at the EU level. The project is focused on Insect and disease resistance management (90% of the project) and weed resistance management (10% of the project. In addition the focus of the project is on vegetables and fruits.

Actions:
• Implement the relevant top 2 or 3 weeds in the table “Criteria set of Biotic threats” for each crop. Define for each crop the 3 main relevant countries in Europe, and add the most important weeds to be controlled with a resistance risk evaluation. The crops have been defined for pests and LOLSS will be one of the top weed for many crops.
## European HRAC Activities

Sharing resistance monitoring processes/methodologies and in-vitro in-vivo resistance methods

**European Guidelines to conduct herbicide resistance tests**

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THANKS