Application and Development of pheromones in modern IPM

ABIM LUCERNE 22-23 October 2007
Vittorio Veronelli
CBC (EUROPE) Ltd.
In agriculture, IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. Effective, less risky pest controls are chosen first, including biopesticides such as pheromones to disrupt pest mating...

In practicing IPM, growers follow this four-tiered approach:

Set Action Threshold:...Before taking any pest control action, an IPM program first develops an action threshold...

Monitor and Identify Pests:...Not all insects, weeds, and other living organisms require control...

Prevention:...As a first line of defense, IPM programs prevent pests from becoming a threat.

Control: Once monitoring, identification, and action thresholds indicate that pest control is necessary and preventative methods are no longer effective or available, the next step is to determine which control method maximizes effectiveness and minimizes risk.

Broadcast spraying of a nonspecific pesticide is a last resort.

source US EPA web site 2007
Can we replace pesticides with pheromones MD?

“….We have evidence that grape moths can be controlled by the application of enough quantities of sex attractants.”

“…the problem of replacing arsenic …would be solved in an elegant way.“

“... During the 1970s and early 1980s, great expectations were voiced as to the potential of pheromones and other semiochemicals for use as effective and environmentally benign methods of insect control.... These expectations were not realized in the short term, and significant credibility problems concerning the practical application of pheromones began to develop. Despite considerable evidence that pheromones were or could be of substantial practical use, there seemed to be some feeling that pheromones would ultimately be regarded as interesting subjects for scientific investigations, with little real value.”

Ridgway et al., 1990.
Pheromones MD experiences

When key factors meet:

- Low population density
- Reliable dispenser system
- Area-wide approach

MD becomes a potential replacement of insecticides
46,000 ha of apple and grapevine
27,000 ha apply MD in 2007

source S. Michele all’Adige Institute
TOTAL INSECTICIDES RESIDUES
GRAPE PROTOCOL – AVERAGE SAMPLES

ppm or mg/Kg


source Mezzacorona Winery
<table>
<thead>
<tr>
<th>year</th>
<th>checked orchards</th>
<th>average harvest damage%</th>
<th>% orchard &lt; 1% damage</th>
<th>average additional spray</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>421</td>
<td>0,5</td>
<td>86,7</td>
<td>1,5</td>
</tr>
<tr>
<td>1995</td>
<td>631</td>
<td>0,8</td>
<td>80,0</td>
<td>0,5</td>
</tr>
<tr>
<td>1996</td>
<td>91</td>
<td>0,5</td>
<td>92,3</td>
<td>0,6</td>
</tr>
<tr>
<td>1997</td>
<td>66</td>
<td>0,4</td>
<td>89,4</td>
<td>0,3</td>
</tr>
<tr>
<td>1998</td>
<td>156</td>
<td>0,9</td>
<td>76,9</td>
<td>0,5</td>
</tr>
<tr>
<td>1999</td>
<td>279</td>
<td>0,6</td>
<td>81,7</td>
<td>1,6</td>
</tr>
<tr>
<td>2000</td>
<td>187</td>
<td>0,3</td>
<td>92,0</td>
<td>0,7</td>
</tr>
<tr>
<td>2001</td>
<td>154</td>
<td>0,3</td>
<td>94,8</td>
<td>0,4</td>
</tr>
<tr>
<td>2002</td>
<td>184</td>
<td>0,7</td>
<td>85,8</td>
<td>0,6</td>
</tr>
<tr>
<td>2003</td>
<td>223</td>
<td>1,1</td>
<td>77,6</td>
<td>0,9</td>
</tr>
<tr>
<td>2004</td>
<td>252</td>
<td>0,8</td>
<td>85,0</td>
<td>0,6</td>
</tr>
<tr>
<td>2005</td>
<td>224</td>
<td>0,5</td>
<td>87,0</td>
<td>0,3</td>
</tr>
<tr>
<td>2006</td>
<td>155</td>
<td>0,4</td>
<td>85,0</td>
<td>0,3</td>
</tr>
</tbody>
</table>

Source: S. B. O. W.
Insecticides Residues in positive samples analysis

Source: Südtiroler Apfelkonsortium

- 2004: 56% negative
- 2005: 67% negative
- 2006: 66% negative

Comparison of EC-MRL and LIDL-MRL concentrations for clorpirifos, diazinone, and fosalone.

- Clorpirifos: 0.04 (2004), 0.04 (2005), 0.07 (2006) ppm
- Diazinone: 0.02 (2004), 0.02 (2005), 0.04 (2006) ppm
- Fosalone: 0.04 (2004), 0.04 (2005), 0.05 (2006) ppm
**MONITORING**
The routine method for checking numerous pest species. Semiochemicals are simple and highly effective tools for detecting and monitoring insect populations. This will continue.

**INSECT CONTROL**
Oriental fruit moth, Codling moth, Grape moths, Clearwing moths, Tomato pinworm, Peachtree borer, Lesser peachtree borer, Leafrollers, Smaller tea tortrix, Pink bollworm, Leopard moth, etc. Large tropical weevils.
Insect pheromones identified: several thousands

Insect pheromones used for monitoring: several hundreds (?)

Insect pheromones used for insect control: Less than hundred

How is it that we appear to have this amazing power to manipulate insect behavior, and yet we have only been able to capitalize on it in relatively few cases?
Pheromone Development projects in 21st century

Driving forces

✓ Economic status of the pest insect
✓ Insect biology and life history
  Is it likely to be controlled by pheromones?
✓ Crop characteristics
✓ Pheromone chemistry
✓ Ease and cost of synthesis
✓ Stability, longevity and formulation in active form
✓ Economics of production and use
✓ Economics of Authorizations and marketing
**Economics of pheromone use**

- **Market analysis**
  is the market large enough to warrant R&D, and ongoing sales?

- **Synthesis**
  Can the pheromone(s) be made cheaply, in large quantity and good chemical purity

- **Formulation**
  stability: shelf and field life, longevity

- **Deployment**
  dispensers/Ha, number of applications per season

- **Registration**
  simplified and relatively inexpensive

- **Indirect costs**
  monitoring, treatment in cases where control breaks down
How can we be most effective in the 21st century?

Work smarter....

- **Recognition of limitations**
  IPM area-wide, not just stand-alone strategies

- **Careful choice of target species**
  Crop, biology, economics, etc.

- **Make better use of our collective experiences and mistakes by sharing a worldwide knowledge of more than 30 years**

*Definition of insanity: doing the same thing over and over and expecting different results.*  
Albert Einstein
Thank you for the attention

ACKNOWLEDGEMENTS
Mauro Varner - Mezzacorona Winery
Claudio Ioriatti - S. Michele all’Adige Institute
Walter Waldner - S. B. O. W.
Jocelyn G. Millar – University of California Riverside