Role of Consultants in Preserving Insecticidal Technology

November 8, 2012 | Tunica, MS

Chris Sansone, Ph.D.
Global Regulatory Affairs Manager - IRM
Agenda/Content

- Integrated technology pipeline
- Threats
- Successes and failures
- Consultant role
BioScience –
our growth strategy

An integrated approach to crop protection
Integrated Crop Platforms – focusing on our customer’s needs

Cotton: A complete offering for customers & more value per seed bag sold

Shifting the focus to integrated cotton products and solutions
A Strong Trait Pipeline

Cotton
- GlyTol (Herbicide Tolerant)
- GlyTol + Liberty Link (Dual Herbicide Tolerance)
- GlyTol + Liberty Link + Bollgard® II (Dual Herbicide Tolerance, Dual Insect Resistance)
- WideStrike (Insect Resistant)
- GlyTol + Liberty Link + TwinLink (Dual Herbicide Tolerance, Dual Insect Resistance)
- GlyTol + Multiple Insect Resistance

Oilseeds
- Winter hybrid oilseed rape (Europe)**
- Canola hybrids (Herbicide tolerant) – Australia
- Yield enhancement**
- InVigor + Genuity™ Roundup Ready® (Dual Herbicide Tolerance)
- Oil Quality**
- Submergence Tolerance**
- Brown plant hopper + Gall Midge Resistance**
- Salinity Tol.**
- Liberty Link (Herbicide Tolerant)

Rice

Soybeans
- GlyTol + HPPD (Dual Herbicide Tolerance)
- GlyTol + HPPD + Liberty Link (Triple Herbicide Tolerance)

Expected Launch*

|------|------|------|------|------|------|------|

* Product launches are subject to regulatory approvals

WideStrike™ is a trademark of Dow AgroSciences LLC,
Genuity™, Roundup Ready® and Bollgard® II are trademarks of Monsanto Company.
Resistant Weed Species

Source: Ian Heap
Resistant Arthropod Species

553 Arthropod Species are resistant, 306 agriculturally important

Resistant Plant Disease Species

Tarnished plant bug

Constant battle

- Multiple MOA resistance
  - OP’s
  - Pyrethroids
  - Cyclodienes
  - Carbamates
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<th>Field-Relevant</th>
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<td></td>
<td>Cry1Ab maize in South Africa</td>
<td><em>Busseola fusca</em></td>
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<td>Cry1F maize in Puerto Rico</td>
<td><em>Spodoptera frugiperda</em></td>
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<td>Cry1Ac cotton in Gujarat India</td>
<td><em>Pectinophora gossypiella</em></td>
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<td>Cry3Bb1 corn in Iowa</td>
<td><em>Diabrotica virgifera virgifera</em></td>
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<td>Cry1Ab maize in USA</td>
<td><em>Ostrinia nubilalis</em></td>
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<td><em>Diatraea grandiosella</em></td>
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<td><em>Heliothis virescens</em></td>
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<td><em>Helicoverpa zea</em></td>
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Timothy Dennehy
Lessons from 17 Years of Bt Crop Use….

- High dose/refuge strategy can effectively delay resistance
- Pyramids of toxins reduce resistance risk/refuge size
- Functionally monophagous pests present the greatest challenges
Lessons learned (cont.)

- Polyphagous pests must be managed at the agro-ecosystem level in intensive agricultural systems
- Small and very large farms pose the greatest challenges with compliance with IRM and refuge requirements
- Resistance must be defined in the both the laboratory and the field
Lessons learned (cont.)

- Objective of IRM is to delay resistance, not prevent it
- Sustainable Bt crops = IPM + IRM + research pipeline
The high dose/refuge strategy can effectively delay resistance

Example: Pink bollworm in Southwestern USA

- Monophagous pest
- High resistance risk
- Very high Bt cotton deployment rates
- Major gene/intensive resistance isolated in 1997
- 70-80% compliance with planting of 5%/20% refuges
- Intensive monitoring: bioassays and molecular
The high dose/refuge strategy can effectively delay resistance

…..if refuges are adequate.

_Cases of field-relevant resistance_

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✓ All cases with low/no compliance with refuge requirements
Gujarat, India. Pink bollworm emergency hole on single-gene (Cry1Ac) cotton
EPA Requirements for TwinLink

**BCS must** ....

Monitor resistance, including:

- Surveying and testing insects for potential resistance
- Collection of information from growers about events that may indicate resistance.

*If a substantiated resistance incident occurs, Bayer CropScience must report this to EPA, do follow-up investigations and submit and execute a plan to remediate the problem.*
Unusual Damage in TwinLink Field

- **Confirmed presence of target pests**
  - Damage within expected limits
    - Inform grower
      - Review treatment threshold recommendations
      - **<END>**
  - Damage exceeds expected levels
    - Test for presence of TL proteins
      - Mixed test results: greater than 2% 'negative' plants present
        - Pattern of damage in field does not correspond with distribution of non-Bt plants
          - Possible resistance event
            - Contact Chris Sansone
            - Collect and test
            - **<END>**
        - Pattern of damage in field corresponds with distribution of non-Bt plants
          - Mixed seed issue: movement of larger larvae from non-Bt to Bt
            - Discuss with grower
            - **<END>**
    - **<END>**
  - All plants negative for TL proteins
    - Confirmation absence of TL genes w/ PCR
      - If absent, Advise grower that field is not TwinLink
        - Contact TD Mgr
        - **<END>**

- **Damage not attributable to target pest**
  - Damage by insects
    - Advise grower to spray on threshold.
    - **<END>**
  - Not due to insects
    - Contact seed producer
    - **<END>**

*Responsibilities and Reporting Expectations*

- **Test for presence of TL proteins**
  - Damage exceeds expected levels
    - Damage by insects
      - Advise grower to spray on threshold.
      - **<END>**
    - Not due to insects
      - Contact seed producer
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  - All plants negative for TL proteins
    - Confirmation absence of TL genes w/ PCR
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        - Contact TD Mgr
        - **<END>**

*Possible resistance event*

**Contact Chris Sansone**

**Collect and test**

**<END>**

*Timothy Dennehy*

*Bayer CropScience*
Responding to Unusual Insect Damage in TwinLink Cotton

Responsibilities and Reporting Expectations

Unusual Damage in TwinLink Field

Confirmed presence of target pests

Damage within expected limits

Damage exceeds expected levels
  Report to Chris Sansone

Damage by insects
  Advise grower to spray on threshold.
  <END>

Damage not attributable to target pest

Not due to insects.
  Contact seed producer
  (END)
Integrated Pest Management

- System or strategy
- Utilizes all methods of pest suppression
- Tactics used are compatible
- Maintain pests below economically damaging level
  - Should be environmentally sound
Consultant Role with Insecticides
Consultant Role with Insecticidal Proteins

- Refuge
  - Size and placement
  - Adoption
  - Grower compliance

- Insect resistance management
  - Resistance monitoring
  - Cultural controls and other IPM tactics
  - Natural enemies
Consultant Role with IPM

From: P. Ellsworth, University of Arizona
LET’S GET THINGS DONE AND ...

PROPEL FARMING’S FUTURE

• Stay up to date
• Understand the broader issues
• Educate your ‘clients’
  ✓ Producers, universities, industry
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