

NCCC46/NC205 Special Interim Joint Meeting, October 23-24, 2012, Minneapolis, MN

Meeting Minutes, Report and Agenda

OCTOBER 23 – 1:00 to 5:00pm and OCTOBER 24 – 8:30am to 5:00pm

Theme: *Communication about Bt corn IRM between growers and public-sector scientists.*

EPA resistance definitions, regulatory response to unexpected damage and resistance, BPPD IRM team conclusion from the 2010 resistance monitoring review, and EPA's most recent regulatory decision regarding a 10% RIB with Cry3Bb1 (see J. Martinez' one-page document) were discussed.

Unexpected damage threshold for single PIPs is > 1 on the Iowa State University 0-3 node-injury scale, and pyramided PIPs is > 0.5 . EPA is moving away from diet bioassays to whole corn plant assays, realizing the challenges associated with diet based assays.

EPA acknowledged injury in the field above threshold for CRW is grounds for declaring resistance. However, cases still need to be confirmed by assay, most likely by the Gassmann whole plant assay. While still unclear whether EPA can act on field-observed resistance without the confirmation assays, now that resistance is declared by EPA scientists, they are in a position to recommend a remediation directive to the decision makers within EPA. [See "BPPD IRM Team review of Monsanto's 2010 corn rootworm monitoring data, unexpected damage reports for Cry3Bb1 expressing Bt corn and academic reports of Cry3Bb1 field failures as well as corn rootworm resistance", October 11, 2011. Monsanto submission numbers: MRIDs 486050-1 and 486050-02]. What this remediation looks like and whether the recommendations make it up the decision chain remains to be seen. Any remediation directive is too late for 2013 planting and growing season because most seeds sales are done, and inventory is moving out of warehousing.

A conflict was identified between the need to collect beetles for resistance testing and the perceived need to "beetle bomb" (spraying adult beetles) with insecticides.

Grower/crop consultant perspectives and needs re: Bt corn IRM and rootworm:

MN Farmer Case 1. Farmer has been growing corn on corn for 40 years because he is a hog producer and has blowing soil. Two years ago VT3 corn went down and insecticide treated refuge stood fine. There was some CRW injury in SmartStax planted in same field the following year. Crop Advisor confirmed that the refuge requirement was followed. YieldGard and VT3 at outset was planted followed by 6 plus years of repeated use. Farmer started with block refuge, moved to strips, but general impression was that neither refuge configuration was useful for CRW IRM. Injury reporting back to the company was disconnected (not wanting to assign blame), so in 2009 there was no follow-up, and no adult populations collected. Damage was noticed after tassel, using lodging as an indicator.

MN Farmer Case 2. Soybeans were planted in 2009, and VT3 corn with refuge in 2010, 2011 and in 2012 had a problem. At one of 3 sites did root digging in third year corn, did not collect beetles. High yield is the over-riding goal. DeKalb genetics (linked to VT3 hybrids) is outperforming other genetics so market share is up over 70%. The Herculex gene is more challenging, as its expression seems not to be consistent across hybrids, and the base genetics in the hybrids using this gene is perceived to be inferior to DK. The follow-up by the technology provider on product failure required by the EPA appears slow at best, and in many cases non-existent.

MN Farmer Case 3. Corn on corn has been grown for 45-50 years – citing erosion on hills when beans are grown as the main reason. In 2011 grew VT3 with failure followed by SmartStax with insecticides (using liquid Force). Refuge was not “exactly” followed. (Seems to be a common theme). A major seed inventory recall by DK due to a germ test failure created serious seed supply issues impacting availability of appropriate refuge corn seed.

Field scouting stopped when transgenes arrived. Growers get trapped in product bundles, where seed (including seed coatings) pesticides and other inputs are bought together in bundle programs. These bundles are initiated by technology providers who market seed and pesticides, but enhanced at the dealer level.

Refuge compliance was not the issue, because there is a common belief that the refuge for prescribed for CRW are ineffective. Generally those with big planters are less likely to plant refuge because of logistics.

Different pressures to grow corn on corn include commodity price, local demand and infrastructure for corn due to livestock and ethanol industry, erosion concerns with soybeans, problems with soybean yield potential especially due to white mold. One producer who was quite concerned about sustainable production and crop rotation and doing things “responsibly” acknowledging that even on his farm, 1,000 acres out of 1,200 are corn on corn.

The cost of technology fees was questioned. For example, for CRW protection farmers still seem to be paying the fees for a technology that has failed. What is the value of these fees? In a few short years continuous corn growers have moved from paying \$10/acre for an insecticide to \$80/acre for traits plus insecticides to protect against rootworm. Many producers, upon advice from technology providers, dealers and consultants, are now applying insecticide on corn with CRW traits. Many producers are investing in new equipment to apply liquid insecticide (mainly Force), citing a quick (within one year) capital return after VT3 failure. Liquid application seems to be a better fit with the larger planters that are already tooled for liquid fertilizer applications.

A disconnect in communication (and perhaps trust) between farmer, seed company, and university has occurred, and producers are left without third party, less biased information on performance and value, let alone stewardship. Growers are confused about rotation effectiveness and chemical insecticide options.

Block and strip refuge suitability and performance were openly questioned by several producers

and crop consultants, as well as committee members.

One consultant said that in his area DeKalb seed corn had 90% market share comprised of VT3 followed by SmartStax. There was concern that the Herculex trait is doing all the lifting against CRW in SmartStax, and now it's a RIB exposing even more acres to VT3 selection and perhaps cross resistance.

National Corn Growers Association said there is huge pressure to grow more corn on corn. The global supply trend in corn is shrinking, demand is growing because of ethanol, livestock and growing Asian demand. Can't have a sudden shift. Strong economic pressures for growers to plant corn on corn.

Mike Gray indicated entomologists are not surprised. Blair Siegfried indicated agriculture is losing ground on benefits of less insecticides initially realized with Bt CRW hybrids.

2012 updates on fields with >1.0 node injury-score and reportson beetle populations collected for resistance bioassay were presented (10 min. per state: IA, IL, MN, NE, SD).

Iowa (Gassmann): Some suspected problem fields for 34/35. Intensive corn/livestock, a history of Cry3Bb1, and clustering of fields with a similar background exists. Increased chemigation and adult management appears to be increasing. We are on a technology treadmill.

Minnesota (Ostlie): Resistance genes seem to be easily selected, ubiquitous, and at a relatively high frequency.

Nebraska (Meinke): Three years of selection seems to be a pattern. Bt technology is shifting the CRW population to WCR. Increased beetles = greater dispersion.

South Dakota (French): Random mating may be compromised by reduced fitness of males.

Illinois (Gray): Reported greater than expected damage in SmartStax.

Jeannette Martinez says EPA insect resistance management scientists will make a recommendation for a particular remedial action area. EPA decision makers may or may not implement the recommendation.

Discussion/work around IRM definitional issues: What are goals for IRM that we would like to see advanced? For example, delay the evolution of resistance, avoid field failures caused by resistance, maximize economic value of Bt corn for farmers, maintain low demand for other CRW insecticides, other goals? What information do growers, consultants, and seed companies generate routinely? What sources of information are generated from unexpected damage reports and how can this information be used to guide the IRM process? Improved understanding of definitions of unexpected damage, suspected resistance, and confirmed resistance is needed. Working definition of confirmed resistance used by EPA, industry and public sector scientists was discussed (Goal to work toward).

Density dependent mortality in western corn rootworm and its impact on the evolution of resistance and the contributions of mathematical models to enhance our understanding of resistance evolution to Bt-toxins by western corn rootworm was discussed.

An issues paper publication proposal on insect resistance to Bt technology and IRM (outline, authorship, involvement/ collaboration with industry) (See Tom Hunt /Blair Siegfried's 1-page ms. concept) was discussed. A standardized corn rootworm resistance bioassay for beetles from fields with unexpected damage to Bt rootworm-protected corn (2012 growing season) was discussed.

Enhancing communication about resistance between growers and public-sector scientists is needed. A protocol for grower focus groups in IA, IL, MN, NE, IN will be developed.

IRM – who are our clients?

Pat Porter: We will inherit what happens in the southern U.S. corn production region. Bt soybeans will affect refuge in cotton, will affect CEW refuge.

Rick Hellmich: Split IRM discussion into high vs. non-high dose events.

EPA (Jeannette Martinez): Unexpected damage is based on node-injury root ratings plus toxin presence and expression. Expression is a problem. There exists different company protocols, sampling, varying expression in the roots, hybrids, and temporal aspects of expression.

Early detection? What portion of the field should be sampled.

Gassmann: Early problems were in smaller portion of the fields, now it's a more field-wide level. Possibly use strip plots?

Field and trait history, trap crop effect, adults, lodging and root ratings as final proof.

Root ratings - How many plants? 20 gene checked plants, randomly selected in the area affected 20 m away from the field edge minimum was suggested.

A CRW assay costs \$8,000 to \$10,000 per population to collect and test.

Definition of resistance discussion: Heritable genetically based response to selection. There is a higher gene frequency in a population, a decrease in pest susceptibility, disassociated from yield. Diapausing strains should be used as susceptible controls.

How do IRM and IPM interact? Reduce resistance gene frequency and reduce spread.

Switching toxin to SmartStax at low refuge may encourage evolution of resistance. Expression of Cry34/35Ab1 in a SmartStax may be lower, and therefore accelerate evolution.

Mike Caprio: Density dependent mortality in Bt and non-Bt patches was discussed. Using

insecticides needs to occur on both habitats.

Brigette Tenhumberg: Discussed modeling issues.

Wade French: Don't use non-diapausing strain. Will use 6 control strains.

David Andow will lead production of Nature of Biotech document.

Eileen will lead production of JIPM article.

Gassman method officially recognized as NCCC46/NC205 CRW resistance standard method.

Agenda – NCCC46/NC205 Joint Meeting, October 23-24, 2012

The Commons Hotel, 615 Washington Avenue S.E., Minneapolis, MN

OCTOBER 23 – Tuesday AFTERNOON

Time	Topic	Speaker/Facilitator
1:00	Introduction to the meeting and agenda	<i>Eileen Cullen and Tom Hunt, NCCC46 and NC205 Meeting Co-Chairs</i>
1:10	Welcome and introductory remarks	<i>Abel Ponce de Leon, Univ. of Minnesota Senior Associate Dean, CFANS Assoc. Director, MN Ag Experiment Station</i>
1:20	Participant introductions	
1:30	Local arrangements and hotel information, registration fee, reimbursement procedure	<i>David Andow, University of Minnesota, Minneapolis Local Arrangements Chair</i>
1:40	EPA resistance definitions, regulatory response to unexpected damage and resistance, BPPD IRM team conclusion from the 2010 resistance monitoring review, and EPA's most recent regulatory decision regarding a 10% RIB with Cry3Bb1 <i>(see J. Martinez' one-page document)</i>	<i>Jeannette Martinez, Ecologist EPA Office of Pesticide Programs – Biopesticides and Pollution Prevention Division</i>
2:10	Q/A and discussion	<i>Tom Hunt</i>
2:20	Grower/crop consultant perspectives, and needs re: Bt corn IRM and rootworm: <ul style="list-style-type: none"> - What are growers experiencing in the field? - What information do growers, consultants and seed companies generate routinely? - What are grower information needs, and from which sources? 	<i>Ken Ostlie/Eileen Cullen (moderators)</i> <i>Invitees from Minnesota:</i> <i>-Individual grower(s)</i> <i>-Crop consultant(s)</i> <i>-MN Corn Promotion Board/grower</i> <i>-IPM Specialist perspective (Bruce Potter?)</i>
3:10	<i>Afternoon break</i>	

3:30	National Corn Growers Association perspectives re: Bt corn IRM	<i>Nathan Fields, NCGA Lead Staff, Trade & Biotechnology Working Group</i>
3:50	Q/A and discussion	<i>Eileen Cullen</i>
4:00	2012 Updates on fields with >1.0 node-injury-score, and beetle populations collected for resistance bioassay (10 min. per state: IA, IL, MN, NE, SD)	<i>Aaron Gassmann, Iowa State University Joe Spencer and Mike Gray, Univ. of Illinois Ken Ostlie, University of Minnesota Lance Meinke, University of Nebraska Billy Fuller and Wade French, South Dakota State Univ. and USDA ARS</i>
4:50	Q/A and Discussion	<i>Tom Hunt</i>
5:00-6:00	Opportunity for informal conversation, between growers/consultants and EPA.	<i>Jeanette Martinez, EPA OPP-BPPD Grower and consultant guests.</i>

OCTOBER 24 – Wednesday MORNING

7:00 Breakfast meeting proposed for NCCC46/NC205 members funded by AES Director, Hatch and other sources to conduct 2012-13 grower focus groups. NE, IA, IL, MN, IN (others interested are welcome)

Meeting location TBD in Mpls. among those interested at the end of Tuesday afternoon. (Breakfast at the hotel)

Time	Topic	Speaker/Facilitator
8:30	<p>Discussion/work around IRM definitional issues</p> <ul style="list-style-type: none"> - What are goals for IRM that we would like to see advanced? <p><i>For example,</i></p> <ul style="list-style-type: none"> Delay the evolution of resistance Avoid field failures caused by resistance Maximize economic value of Bt corn for farmers Maintain low demand for other CRW insecticides Other goals? <ul style="list-style-type: none"> - What information do growers, consultants, and seed companies generate routinely? - What sources of information are generated from unexpected damage reports and how can this information be used to guide the IRM process? - Improved understanding of definitions of unexpected damage, suspected resistance, and confirmed resistance. - Working definition of confirmed resistance used by EPA, industry and public sector scientists. (Goal to work toward). 	David Andow (moderator)

10:10	Morning break	
10:30	Continue discussion from previous session Put ideas from 8:30-10:10am session into a time line <ul style="list-style-type: none"> - At what points in time can actions be taken that might delay resistance evolution? <ul style="list-style-type: none"> Need to demonstrate that the action can manage resistance evolution for the various registrations Need to evaluate cost to farmers Need to specify information needs, flows, and when the information needs to be available - Research Needs 	David Andow (moderator)
12:00	Lunch –on your own	

OCTOBER 24 – Wednesday AFTERNOON

Time	Topic	Speaker/Facilitator
1:00	Density dependent mortality in western corn rootworm and its impact on the evolution of resistance	<i>Mike Caprio, Mississippi State Univ.</i>
1:15	Contributions of mathematical models to enhance our understanding of resistance evolution to Bt-toxins by western corn rootworm	<i>Brigitte Tenhumberg, University of Nebraska</i>
1:30	Q/A and Discussion	David Andow
1:45	Issues paper publication proposal on insect resistance to Bt technology and IRM (outline, authorship, involvement/ collaboration with industry) <i>(See Tom Hunt /Blair Siegfried's 1-page ms. concept)</i>	<i>Tom Hunt and Blair Siegfried, University of Nebraska</i>
2:30	Standardized corn rootworm resistance bioassay for beetles from fields with unexpected damage to Bt rootworm-protected corn, 2012 growing season.	<i>Aaron Gassmann, Iowa State University and cooperating labs</i>
3:30	Afternoon break	
3:50	Enhancing communication about resistance between growers and public-sector scientists. Grower focus groups in IA, IL, MN, NE, IN	TBD
4:20	Objectives and expected outcomes for NCCC46/NC205 meeting sessions with industry/ABSTC, EPA and grower stakeholders: <ul style="list-style-type: none"> - Jan. 22-23, 2013: New Orleans, LA - Mar. 12-13, 2013: Minneapolis, MN (one page document will be circulated prior to meeting recapping Jan. and Mar. purpose and outline)	Eileen Cullen/Tom Hunt (Moderators)
5:00	Meeting Adjourned	

Presentation Outline for Tuesday October 23rd, 2012 at NCCC46/NC205 Meeting by

Jeannette Martinez, Ecologist

EPA Office of Pesticide Programs – Biopesticides and Pollution Prevention Division

EPA resistance definitions, regulatory response to unexpected Bt damage and resistance, BPPD conclusions from the 2010 Cry3Bb1 resistance monitoring review and recommendations to EPA decision makers, and BPPD risk assessment for the 10% Cry3Bb1 RIB

Outline:

- Disclaimer
- Unexpected damage criteria in Bt corn and suspected resistance for Lepidoptera: no thresholds because most single toxins are high dose and most pyramids effective high dose PIPs. Discussion of steps to be taken by industry when resistance to a Bt corn PIP is suspected
- Resistance definition for Lepidoptera pests of corn and steps taken by industry and EPA after resistance is confirmed
- Generic and uniform remedial action plan in place for all Bt corn registrations (for Lepidoptera and Coleoptera): steps to be implemented by industry until a pest specific remedial action plan has been put in place by EPA
- History of EPA resistance definition for corn rootworm: what approach was chosen by Agency and why
- Unexpected damage for single and pyramided corn rootworm PIPs and suspected resistance in corn rootworm: thresholds for single and pyramided PIPs, and steps to be implemented by industry if resistance is suspected
- Resistance definition for corn rootworm and challenges with interpreting CRW resistance monitoring and/or unexpected damage data; problems with EC/LC data, larval weight, and diagnostic assays for CRW
- Monsanto's implemented best management practices (though regulatory triggers for resistance have not been met): crop rotation, SmartStax, insecticide use with Cry3Bb1, and use of unrelated PIP. Pros and cons of Monsanto's BMPs as seen by BPPD
- Revisit EPA approved generic remedial action plan for Bt corn registrations: what else must be done?
- BPPD IRM team review of Monsanto's 2010 Cry3Bb1 resistance monitoring data and the IRM team's recommendation to EPA's decision makers: resistance in some parts of the CB is real; hypotheses about how resistance emerged; use of Gassmann's on-plant assay; mostly focus annual resistance monitoring on sites of unexpected damage and where "causal factors of resistance" exist. Replace diet bioassay approach for all CRW

PIPs and resistance monitoring (SSA and/or Gassmann's assay); BPPD scientists' request to EPA decision makers to convene SAP to discuss broad issues of CRW resistance

- BPPD risk assessment of 10% RIB with Cry3Bb1: BPPD's independent analysis (w/Caprio collaboration), assumptions, probability analysis, results, conclusions and recommendations to EPA: use of Cry3Bb1 single toxin no longer a durable, long-term strategy and risk to pyramids expressing Cry3Bb1
- Organizational charts of EPA: these slides were added to help anyone understand at what Agency level the IRM team/risk assessors operate(s)