New York Western Bean Cutworm Field Corn Monitoring Program
Progress Report (2010-2017)

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The Pest Problem

Western bean cutworm (*Striacosta albicosta* [Smith]) attacks corn (*Zea mays* L.; including field, sweet and popcorn) and dry beans (*Phaseolus vulgaris* L.), feeding on developing kernels or beans inside husks and pods, respectively. Western bean cutworm (WBC) infestations can cause significant yield losses and may facilitate subsequent colonization by pathogens, furthering damage and impacts. WBC moth, egg mass and larva images are shown below (Fig 1, 2 and 3).

Figure 1. WBC Moth

Figure 2. WBC egg mass

Figure 3. WBC Larva in corn ear

Western bean cutworm (WBC) is native to North America, but has historically been restricted to the Great Plains and westward. Over the past decade, WBC has expanded its range through the Midwest into the northeastern United States and Canada. As WBC has moved eastward, its caterpillars have caused economic damage, particularly in Michigan and Ontario, where growers have reported 8-10% losses in dry beans and 40% losses in field corn. WBC moths were first discovered in Pennsylvania and New York in 2009 and Vermont in 2011. Pheromone trapping was initiated in NY and PA in 2010 and in VT in 2011 in collaboration with scientists from Penn State University and University of Vermont to gain knowledge about WBC populations and better assess their potential risk to corn and dry bean acres in the Northeast. The trapping network has revealed western bean cutworms are becoming more widely distributed and populations are increasing, posing a potential risk to dry beans and the over 3.5 million acres of corn grown in NY, PA, and VT. In 2016 WBC larval damage was documented in several fields in northern NY including research trials in Jefferson County (Mike Hunter, pers. communication). In 2017 Northern and Western NY had many fields were over threshold for western bean cutworm. In 2017 we caught more moths in the pheromone traps than any other year. It is almost double the highest previous year (35,710 moths and 101 traps).

Monitoring Procedure:

WBC male moths are trapped using a green "universal" bucket trap hung on posts at the edge of corn or dry bean field sites (Fig. 4). Traps contain the WBC pheromone lure that mimics a female scent to attract male moths. In addition, an insecticide strip is placed in the trap to kill the moths once inside. WBC trapping was initiated the second week of June and continued until early September. Traps were checked weekly and number of moths collected recorded. Moth capture data was entered in PestWatch (www.pestwatch.psu.edu) and shared with the local and regional agricultural community through timely newsletters.

Figure 4. Bucket trap used to collect WBC moths

2010-2017 Results

A volunteer-based WBC pheromone trap monitoring network has been in place in NY since 2010. This report summarizes 2017 WBC collection data from several sources including Cornell Cooperative Extension coordinated field corn, sweet corn and dry bean pheromone monitoring networks and data provided by private agricultural consultants and agribusinesses. NY WBC populations have increased annually since 2010 as indicated by the average and maximum range in number of WBC moths captured per location (Table 1). A total of 19, 476 WBC moths were collected in 2016 less than the 20,844 collected in 2015, compared to 11,353 collected in 2014, and more than 3 times the 6,110 WBC moths collected in 2013. In 2017 we caught more moths in the pheromone traps than any other year. It is 14,866 more moths than the highest pervious year (35,710 moths) Location and relative moth counts for 2017 trap sites are shown in Figure 5. On average, higher WBC counts continue to be captured in northern and western counties with the majority of high trap counts occurring in locations north of the NYS thruway (Interstate 90). Moth wings are covered with fine scales that can rub off over time with use. The relatively undamaged wing condition of many of the WBC moths captured indicate local WBC populations are becoming established in many areas.

Table 1. New York Western Bean Cutworm 2010 – 2017 Collection Data Summary*

	2010	2011	2012	2013	2014	2015	2016	2017
No. Counties	29	37	44	39	41	39	40	40
No. Traps	54	67	88	89	96	91	101	101
Avg. No. WBC / Trap	13	23	42	66	117	266	193	361
Range in Totals	0 - 99	0 - 165	0 - 344	0 – 853	0 – 1019	0 – 1688	0 – 1662	0-2464
Peak Flight	2-Aug	2-Aug	25-Jul	21-28-Jul	3-Aug	2-Aug	31-Jul	8-Aug

*Data compiled from WBC trap catch information provided by field corn, sweet corn, and dry bean monitoring networks across NY.

Pheromone trap data has documented WBC moth activity, peak flight and has enhanced timing of field monitoring for egg masses and larvae. Timing and intensity of WBC moth flights have varied slightly annually with peak flights occurring between the last week of July and the first week of August (Figure 6). This consistent timing of moth flight activity is being used to evaluate accuracy of a Midwestern US WBC moth degree-day emergence prediction model (Hanson et al) for its application in the northeast.

Monitoring and Management:
WBC moths prefer pre-tassel corn for their egg laying site and egg masses may be found on the upper surface of leaves at or near the tassel whorl. Young WBC larvae may feed on leaf surfaces but quickly move to corn ears where they can be found feeding on silks or kernels. By contrast, in dry beans WBC lay their egg masses on the undersurface of leaves and larvae feed on pods at night and hide in the soil during the day making them very difficult to detect. Midwestern experience suggests crops at risk be monitored closely for WBC activity when accumulated trap catches approach 100 moths or more. Midwestern and Ontario WBC corn monitoring guidelines recommend carefully searching for egg masses on 10 corn plants in a row in 10 areas of the field.

Our NY management guidelines are based on Midwestern states and Ontario recommendations. When possible plant corn early, use short season hybrids to get past pre-tassel stages before peak flight (typically end of July). Bt corn hybrids Vip 3A (Agrisure Viptera) hybrids have been recommended as having efficacy against western bean cutworm. Bt Corn with Cry1F (e.g. Herculex 1, Xtra, Optimum AcreMax1, SmartStax) have shown to have no resistance to WBC.

A WBC degree-day model using 50 F base temperature has been used in the Midwest to predict WBC flights. This model predicts 25% WBC moth emergence at 1319 DD accumulation, 50% at 1422 DD accumulation and 75% at 1536 DD accumulation. Preliminary evaluation of the model suggests this model, though not perfect, has relative utility for use in the NY. An improved WBC degree-day model was recently published (Hanson et al 2015) that could be evaluated to predict WBC flights in NY. In the meantime, local WBC pheromone trap data, if available, provides the best information to time WBC monitoring activities to assess risk and need for control. Prioritize fields for monitoring dependent on plant stage, recalling pre-tassel corn is highly attractive to WBC for egg laying. Follow threshold guidelines: field corn 5% of plants with egg masses; sweet corn – processing 4%, fresh market 1%; and dry beans – 1st signs of pin feeding, watch nearby corn for signs of WBC activity.

Midwestern and Ontario entomologists recommend a foliar insecticide spray if 5% of non-Bt corn or transgenic corn without protection against WBC have WBC egg masses on them. Ontario recommends timing an insecticide foliar spray application for just after egg hatch when small larvae are present at the top of the plant. Egg hatch occurs a day or two after the egg masses turn purple (typically 5-7 days after being freshly laid). (See more at: http://fieldcropnews.com/2013/07/western-bean-cutworm-thresholds-for-high-risk-fields-in-ontario/#sthash.crBkKtBo.dpuf). A summary of Bt trait family products effective against WBC can be found at Handy Bt Trait Table (http://www.msuent.com/assets/pdf/28BtTraitTable2016.pdf). WBC efficacy concerns have been mounting this season against Cry1F Bt containing hybrids (e.g. Herculex 1, Xtra, Optimum AcreMax1, SmartStax). In 2016 https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2016/10/17/companies-push-back-herculex-trait-2 see below. Currently Vip 3A (Agrisure Viptera) hybrids are the only hybrids recommended as effective against western bean cutworm.

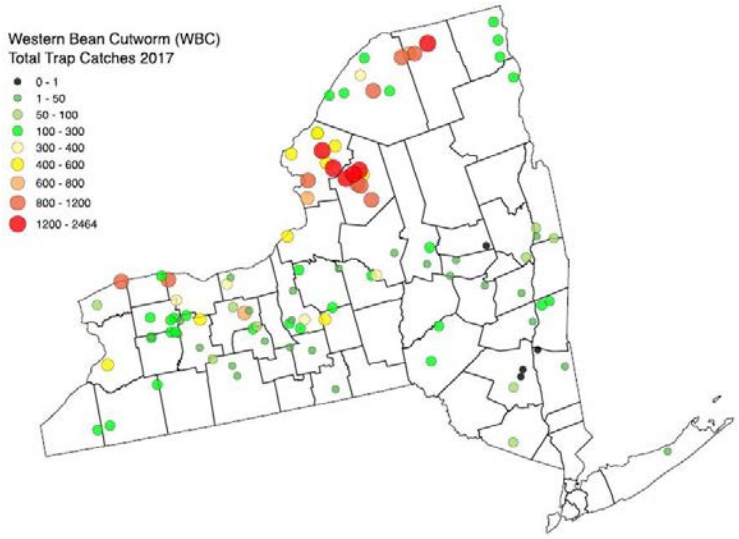
There are a number of factors that can impact the severity of damage from Western Bean Cutworm. These may include the size and survival of over-wintering WBC population; type of

Bt gene if a Bt trait hybrid is being used; synchronization between corn silking date and timing of moth flight; use of insecticide sprays for 2 generation European corn borer or other late season ear worms; number of WBC egg masses & survival of young larvae (hot and dry conditions cause mortality); competition/predation/parasitism/diseases including: European corn borer, corn earworm or fall armyworm larvae in the ear or presence of *Trichogramma* egg parasites, nuclear polyhedrosis viruses or entomopathogenic fungi affecting egg or larval stages and environmental factors influencing ear mold development.

Recent observations of note:
Ontario entomologists have reported field corn production areas with above threshold levels of WBC since 2013 and a number of dry bean fields in southwest Ontario had noticeable pod damage in 2015 for the first time. (J. Smith and T. Baute (University Guelph, Ridgetown and OMAFRA). In 2013, heavy populations of WBC in some western Ontario "hotspot" areas were reported causing significant damage SmartStax and Herculex hybrids (Cry1F Bt hybrids). (http://fieldcropnews.com/2014/07/does-spraying-bt-corn-for-western-bean-cutworm-make-sense) There have been similar reports of high WBC populations challenging Cry1F Bt hybrids in areas of the Midwest. WBC populations were reported causing economic damage in Ontario province in 2014 and 2015. Ontario entomologists suspect more WBC were seen outside its typical range due to later planting dates outside the hot-spot areas that were attractive to female moths looking for pre-tassel corn to lay their eggs. 2014 was the first year Ontario had multiple fields of edible dry beans with easily visible WBC damage (http://fieldcropnews.com/2014/09/scout-for-western-bean-cutworm-and-ear-mould-now/).

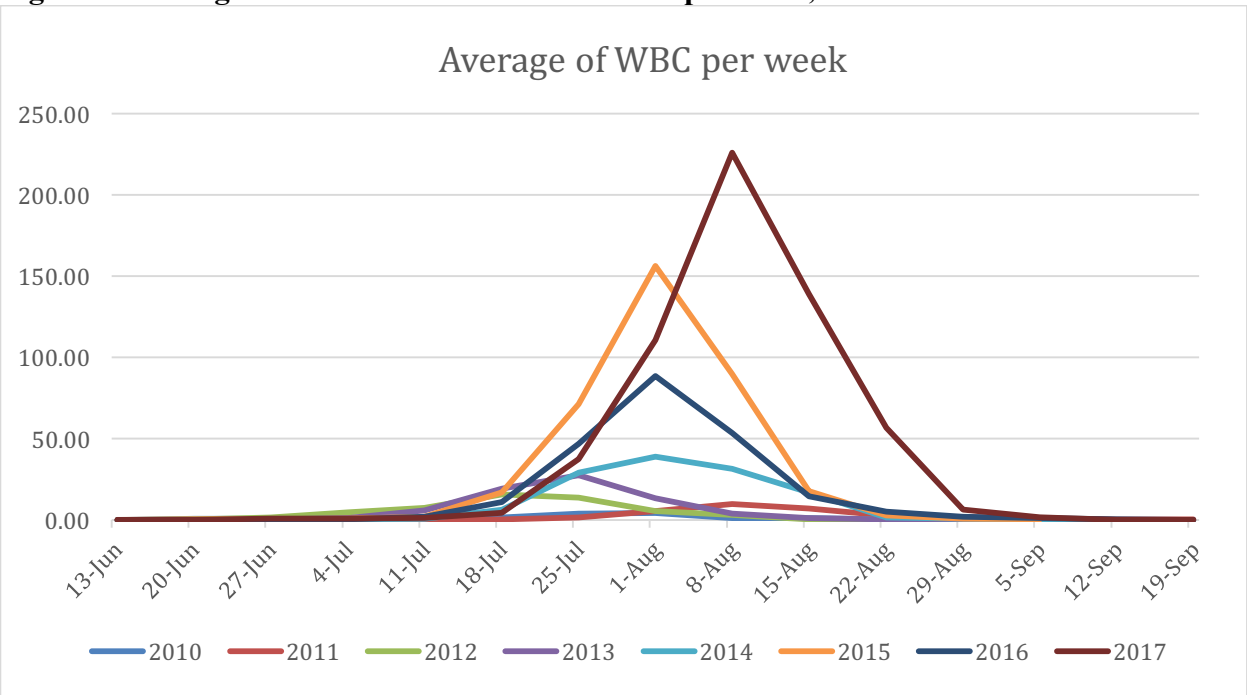
In 2016 northern NY field corn trials 18 – 21% of Cry1F plants had WBC larval damage (Mike Hunter, CCE of Jefferson County, Watertown, NY, personal communication). In 2017 northern NY field corn trials 2 – 21% of Cry1F plants had WBC larval damage (Mike Hunter, CCE of Jefferson County, Watertown, NY, data). It is clear that the Cry1F plants are not resistant and should not be recommended for controlling this pest.

Figure 5. Western Bean Cutworm trap location and accumulated moth capture for 2017.



Pheromone trapping 2010 – 2017 documented WBC moth activity. This information is being related to a growing degree model to help fine-tune crop monitoring activities. The peak WBC flight in 2017 was recorded the week of August 8 (Figure 6).

Figure 6. Average Western Bean Cutworm moths per week, New York 2010 – 2017.

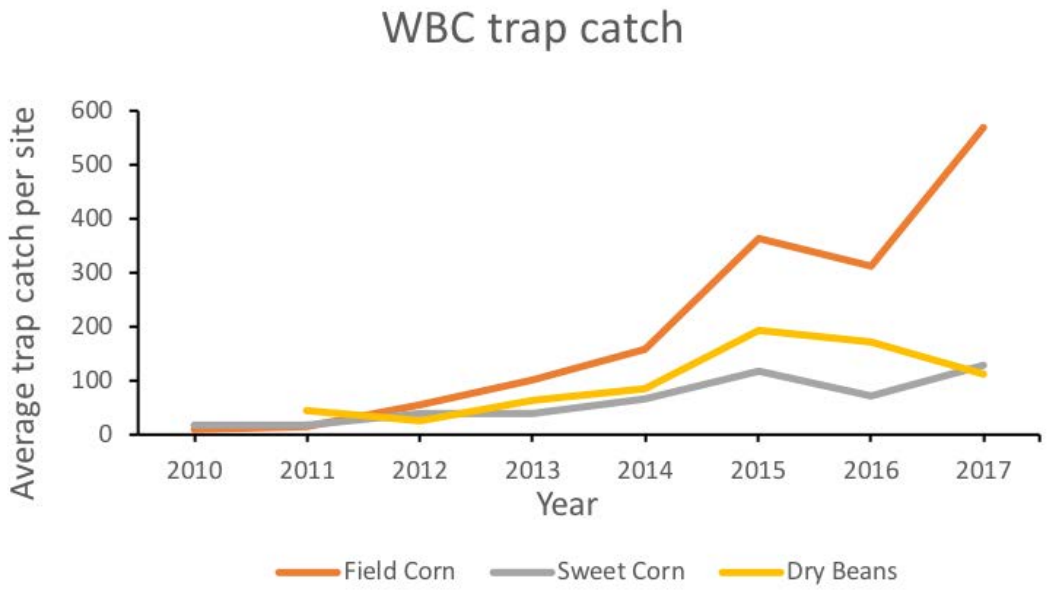


(includes field corn, sweet corn and dry beans)

The range of accumulated WBC moths captured per trap in New York by year (2010 – 2017) are shown in figure 7. In 2010, the majority of accumulated trap catches in NY were less than 25 per trap. WBC trap catches have increased every year since. WBC "hotspots" occurred in northern and western NY locations monitored in 2016 and 2017. Statewide, 5 sites caught less than 10 WBC moths, while 63% of traps caught more than 100 moths per trap. The highest WBC trap count in 2017, 2464 WBC moths were collected in a Jefferson county location much more than last year's highest trap count of 1662 WBC moths collected from a Franklin county location. Accumulated New York WBC trap catch data by 2017 location are shown in Table 2.

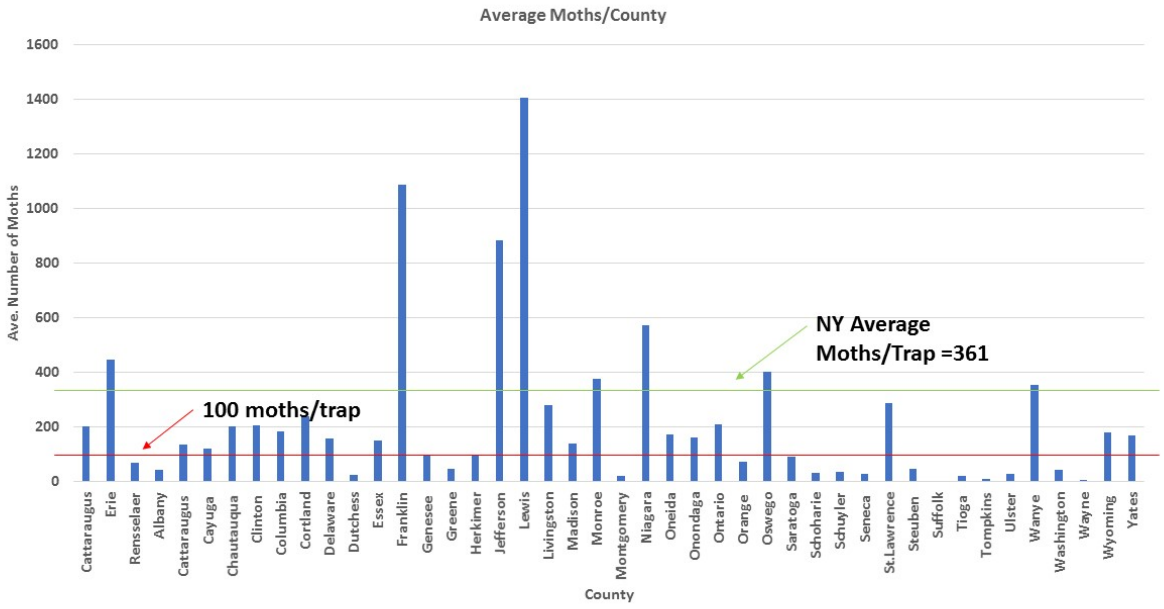
There has been a trend of more WBC moths being captured per location each year as seen in Table 1 and Figure 7. While actual accumulated trap counts ranged from 2 to 2464, the statewide average WBC moth catch per location this year was 361 as compared to last year 193 shown in Table 1 and Figure 8.

Figure 7. New York WBC percent of trap captures within a range (2010 – 2017)



(includes field corn, sweet corn and dry beans)

Figure 8. Average Number WBC Moths Per Trap By County Compared to NY State Average in 2017.



(includes field corn, sweet corn and dry beans)

Table 2: 2017County Moth Trap Data

County	Town	# of Moths
Albany	Feura Bush	42
Cattaraugus	Randolph	203
Cattaraugus	Farmersville	137
Cayuga	Aurora	211
Cayuga	Sherwood	16
Cayuga	King Ferry	139
Chautauqua	Kennedy	202
Clinton	Chazy	169
Clinton	Plattsburgh	208
Clinton	Peru	244
Columbia	Valatie	158
Columbia	Kinderhook	213
Cortland	Scott	404
Cortland	Preble	310
Delaware	Davenport	200
Delaware	Walton	120
Dutchess	Amenia	47
Dutchess	Tivoli	0
Essex	Willsboro	151
Erie	Eden	448
Franklin	Moira	626
Franklin	Malone	1864
Franklin	Dickinson Center	926
Franklin	North Lawrence	926
Genesee	LeRoy	116
Genesee	Pavilion	37
Genesee	Stafford	110
Genesee	S Caledonia	37
Genesee	Pavilion	111
Genesee	Batavia	194
Greene	Athens	49
Herkimer	Little Falls	183
Herkimer	Mohawk	12
Jefferson	Calcium	470
Jefferson	Clayton	564
Jefferson	Ellisburg	629
Jefferson	Hounsfield	824
Jefferson	Pamelia	1492
Jefferson	Philadelphia	481
Jefferson	Plessis	521
Jefferson	Rutland	2464
Jefferson	Plessis	515
Lewis	Croghan	1914
Lewis	Denmark	2364
Lewis	Harrisburg	1823
Lewis	Lowville	861
Lewis	Martinsburg	1160
Lewis	New Bremen	575
Lewis	Turin	1135
Livingston	Avon	533
Livingston	Groveland	25
Madison	Munnsville	138
Monroe	Hamlin	912
Monroe	Hamlin	127
Monroe	Riga	312
Monroe	North Caledonia	148
Montgomery	Canajoharie	27
Montgomery	Fort Plain	31
Montgomery	Amsterdam	1
Niagara	Barker	1093
Niagara	Ransomville	51
Oneida	Marcy	31
Oneida	munnsville	316
Onondaga	Tully	159
Onondaga	Baldwinsville	297
Onondaga	Kirkville	29
Ontario	Hopewell	690
Ontario	Farmington	55
Ontario	Seneca Castle	45
Ontario	Geneva	53
Orange	Florida	72
Oswego	Oswego	402
Rensselaer	Eagle Bridge	70
Saratoga	Clifton Park	90
Schoharie	Schoharie	34

Schuyler	Valois	37
Seneca	Weedsport	27
St. Lawrence	Canton	819
St. Lawrence	Colton	124
St. Lawrence	Morristown	163
St. Lawrence	Madrid	356
St.Lawrence	Huevelton	117
St.Lawrence	Waddington	144
Steuben	Avoca	48
Steuben	Wayland	83
Steuben	Kanona	10
Suffolk	Riverhead	2

Tioga	Owego	20
Tompkins	Varna	11
Ulster	Accord	87
Ulster	Hurley	0
Ulster	Stone Ridge	0
Wanye	Walworth	354
Washington	Easton	12
Washington	Greenwich	73
Wayne	Williamson	8
Wyoming	Attica - Nixon ?	238
Wyoming	Attica	36
Wyoming	Covington	269
Yates	Bellona	291
Yates	Penn Yan	47

*101 WBC traps, 35,710 total moths captured. (includes field corn, sweet corn and dry beans)

2017

The weekly WBC pheromone trap survey is expected to continue in the summer of 2018. WBC trap catches are expected to increase, but if so *by how much* and *under what conditions*? Field monitoring for WBC in 2018 is highly recommended - *especially* in areas that had high trap counts in 2016/2017 and fields with sandy soil types that would allow easier burrowing and may affect overwintering survival. WBC trap count updates will be provided during the field season at NYS IPM Weekly Pest Report: http://blogs.cornell.edu/ipmwpr/#, the NY Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/, and the Penn State "Pest Watch" – regional map of WBC trap catches over time: *www.pestwatch.psu.edu/.*

Summary:

Western Bean cutworm populations are widespread across New York and have continued to increase annually. On average, higher WBC counts have been observed in northern and western NY counties, but are increasing across the state in the average number of moths/trap as compared to 2016. The relatively undamaged wing condition of most moths captured indicates WBC populations are becoming locally established, while others continue to be migrants from other sources. In 2017 was there was an increase in economic damage caused by WBC to field corn. Many fields in Northern and Western NY sprayed for WBC this last year! Northern NY had the very high populations of WBC this last season and several fields had damage. In a study by Mike Hunter and Dr. Kitty O'Neil showed that the damage to BT hybrids with the CryF1 gene suffered as much as 28% damage to ears. WBC pheromone trap monitoring efforts are planned for summer 2018

Acknowledgements:

2017 New York WBC Pheromone Trap Monitoring Network*: Thanks to cooperating growers for allowing us to use their fields for sample sites. Special thanks to the following

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Literature Cited:

MacNeil, C., J. Gibbons and K. Waldron. 2016. 2016 REPORT: The Magnitude and Distribution of Western Bean Cutworm, and the Risk to Dry Beans. Summary *Report to New York State Dry Bean Industry Committee*

Hanson, A.A., R. D. Moon, R. J. Wright, T. E. Hunt and W. D. Hutchinson. 2015. Degree-Day Prediction Models for the Flight Phenology of Western Bean Cutworm (Lepidoptera: Noctuidae) Assessed with the Concordance Correlation Coefficient. J Econ. Entomol. 108(4): 1728-1738.

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For more information on WBC catches and distribution, please visit:
NYS IPM:

- Weekly Field Crop Pest Report: http://blogs.cornell.edu/ipmwpr/#
- Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/

Eastern NY Sweet Corn Monitoring Program: http://blogs.cornell.edu/jentsch/sweet-corn/

Pestwatch*:* Sweetcorn *IPM Visualization Tool*: www.pestwatch.psu.edu/sweetcorn/tool/tool.html

Penn State Field Crop News: http://extension.psu.edu/plants/crops/news

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