Western Bean Cutworm

Tracey Baute, Entomologist – Field Crops

OMAFRA-Ridgetown
WBC Range Expansion

Grey – Original Range
Yellow – Expansion since 2000

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Larval Behaviour in Corn vs Beans

• WBC behave differently in corn vs. beans

• In corn, you can see all stages of the insect during the day
  – Easily find eggs on leaves or larvae in ear later in the season

• In beans, only young larvae active during the day. Mid to late instars active at night, moving plant to plant each night to feed. Hide in ground during day
  – Very difficult to find any life stage on the plant prior to pod feeding/holes appearing
ONE GENERATION PER YEAR
Pupation and Moth Emergence

- Larvae drop to the ground in fall to make pre-pupal chamber
- Stay all winter in pre-pupal stage
- Pupate in soil in May and June
- Moths begin to emerge from pupae in Ontario soils in early July (UGRC, 2011-2013)

- Emergence occurs earlier upwind from Ontario since traps begin to catch moths in early June
- Emergence is staggered, given that trap catches continue for over three months
Migrant and Resident Populations

• Carried in via weather fronts from neighbouring states, prior to our resident population emerging

• Resident moths also fly and get carried across Ontario, into Quebec, NY and Atlantic provinces (PEI and Nova Scotia confirmed in 2017)
Adult Moths

- Moths present in Ontario from June until early September, with avg. peak flight in late July
- Females emerge first, reach sexual maturity in 4-6 days and mate approx. 3 times
- Lay 3-400 eggs in lifespan
- Average lifespan of males and females is 7 and 9 days, respectively
Moths fly at night but you might find them resting in the leaf axils during the day.

MSU research found that the bulk of moths were flying around between 1 am – 3 am.
WBC Moth Identification

- Approximately 2 cm in length
- White band along wing margins
- Full moon and boomerang markings on each wing
- Wing folds over the other, almost lining up with each other at the tip
Realistic encounter with WBC moths – in traps

Moths lose the scales on their wings after a few days in the trap—so no markings
Preferred Corn Stage

J. Smith et al. 2017

Crop Growth Stage

Mean number of WBC egg masses per 100 plants

V (Vegetative Stages)  VT1 (Tassel can be felt inside whorl but has not emerged yet)  VT2 (Tassel peaking out of whorl)  VT3 (Full tassel spike extension)  VT4 (Full tassel emerged and branches extended)

Dry beans preferred, or late planted corn
Corn Growth Stage is Key

- If there is no tassel inside the whorl, the newly hatched larvae die within a day or two
- Eggs laid on young corn plants will die
- Focus on fields that at least have a tassel developing inside the whorl
- Cues for adults from tassel and silk tissue?
- Variable growth stages in fields complicate scouting
WBC Eggs

- Egg masses have an average of 50-84 eggs
- Longitudinal striations like cantaloupe
- Pearly-white when fresh
- Hatch in 5 to 7 days (temp. dependant)
- Peak egg laying shortly after peak flight
Assessing age of egg mass

Day 1  2  3  4  5  6  7

Pearl white  Light tan  Dark tan  Purple  Hatch

C. DiFonzo, MSU
• On corn – eggs laid on upper surface of leaf, usually on the top 3 to 4 leaves of plant (near tassel)
• If silks present, some eggs may be laid on corn husk (though not common)

• On dry beans – eggs laid on underside of the leaves, deeper in the crop canopy
• Very difficult to find, compared to eggs in corn
Larvae

• Goes through 6 instars in approx. 30 days
• ~2 mm (1st) to ~34 mm (6th) in length
• Initially feed on their eggshell, then can only survive on tassel and pollen (flower), silks or kernels (pod and seeds) – little to no leaf feeding
• Not cannibalistic – can have multiple per ear
• Actively move from plant to plant
Newly hatched WBC larvae.
• 1st instar larvae have spots
• Climb to the tassel unless ear already present
• Spend 1 to 2 days on tassel before moving to ear

• 2nd to 4th instar WBC larvae have stripes
• Gap between prolegs and true legs cause it to walk like an inchworm
• Head to the ear, feed on silks then enter via silk channels
Last Instars

Two distinct bands behind head

5\textsuperscript{th} and 6\textsuperscript{th} instars
Larval dispersal

Infestations can be spotty!

10 feet across rows

12 feet within row
YIELD AND QUALITY IMPACT
Corn Impact

• Mostly ear tip feeding unless more than one larvae per ear
• Research studies have shown that one larva/plant can result in 3.7 – 15 bu/acre loss
• Opens the ear up to ear mould and mycotoxin development
WBC & Mycotoxins

(A) WBC Damage (cm²)

(B) Mycotoxin accumulation (ng/g)

Legend:
- Total DON
- Fumonisins
- Moniliformin

Bt Trait: Viptera, SSX, HX1, Non-Bt, YGCB
WBC and Mycotoxin

- Injury by WBC can increase risk of DON accumulation, however hybrid tolerance to Fusarium and environmental conditions play a predominate role.
- Prioritize hybrid selection based on tolerance to ear rot pathogens (eg. Fusarium) and mycotoxins.
Dry Bean Impact

- 1\textsuperscript{st} and 2\textsuperscript{nd} instars do a small amount of foliar and flower feeding (no economic impact)
- By 3\textsuperscript{rd} instar, exclusively feeding on pods and only at night
- Hide out in the soil during the day
Bean Yield and Quality

• 1st report of bean injury in Ontario was in 2014
• MSU small plots work indicates up to 15% yield reduction
• 2-5% “picks” can occur, whole loads rejected
• Added cost to grower for sorting, cleaning reduced quality and downgrading
TRAPPING AND SCOUTING
WBC Traps

• Set up traps in June, monitor until late August
• One per corn field, two per dry bean field, along the prevailing wind side
• 50 metres apart
• Bucket should be 4 feet from ground
• Check at least weekly
• Change pheromone lure every 3 weeks
• Lures stay in freezer when not in use
Trapping for WBC

• Indicate moth presence in a region
• Indicate when peak flight and peak egg laying likely
• Trap counts do not determine if threshold has been reached (only catching males)
• Very important for areas outside the original hot spots to trap
• >2500 trap locations over 10 years, captured over 858,000 WBC moths in Ontario!
July 17th – 24th

www.cornpest.ca
## 2017 Ontario WBC Trap Catches

<table>
<thead>
<tr>
<th>Week</th>
<th>Date Range</th>
</tr>
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<tbody>
<tr>
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<tr>
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Average Regional WBC Trap Catches 2017

**Average # of Moths per Trap**

Week 1 - May 29 - June 4
Week 2 - June 5-11
Week 3 - June 12-18
Week 4 - June 19-25
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Week 6 - July 3 - 9
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Week 12 - Aug 14 - 20
Week 13 - Aug 21-27
Week 14 - Aug 28 - Sept 3
Week 15 - Sept 4 - 10

**Region 1** – Essex

**Region 2** – CK, Lambton, Middlesex, Elgin, Oxford, Haldimand/Norfolk, Brant, Huron

**Region 3** – Perth, Wellington, Waterloo, Bruce, Dufferin, Peel

**Region 4** – Grey, Simcoe, Halton, Niagara, Durham, Northumberland, Prince Edward, Lennox & Addington, Ottawa, Prescott & Russell, Stormont, Dundas and Glengarry
Blue - Some egg laying taking place but unless tassel present, larvae will die. Premature to spray. Majority of eggs still to come during and after peak flight.

Yellow - Shortly after peak moth flight is peak egg laying. Target fields in the ideal growth stage and scout for eggs to determine threshold.
THRESHOLDS AND MANAGEMENT
Scouting in Corn for WBC

- If traps are catching moths, focus on fields in the pre-tassel to full tassel stages
- Scout 10 plants in ideal growth stage, in 10 areas of the field (100 plants each time)
- Scout every 5 to 6 days, for at least 3 weeks
- Count the # of plants with egg masses
- Accumulate # of plants over the 3 week period
- Be area of variable growth stages in each field. Focus scouting in the areas of the field in the ideal stages
Walk corn rows with plants between you and the sun. Eggs leave shadows!
Chris DiFonzo recommends a face shield to enable fast walking through corn fields while looking up.
Adjusted WBC Corn Threshold

• Previous threshold and timing were:
  – 5% of plants scouted with egg masses and/or small larvae (decreased from 8% in Nebraska)
  – spray at full tassel when majority of egg masses have hatched
Adjusted WBC Corn Threshold

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• Modified threshold for Great Lakes
  – cumulative 5% threshold – when 5% of the plants over a two or three week period have had egg masses and/or small larvae
  – even lower threshold likely needed, if growing a Fusarium susceptible hybrid
Adjusted WBC Spray Timing for Corn

• Pre-tassel to full tassel stage has been too early
  – Prolonged moth flight and egg laying
• WBC only feed on tassel, silks and kernels – can’t live on tassel tissue for long
• All WBC larvae will head to the ear when present
• Instead, spray when fresh silks are present, targeting the ear zone (ground application only?)
• Can tankmix with fungicide for ear mould protection at the same time
Products Registered on Corn in Canada

- **Matador or Silencer (pyrethroid)**
  - 83 – 187 mL/ha
  - 14 days pre-harvest interval silage, 21 days for field corn

- **Coragen (diamide)**
  - 250 – 375 mL/ha
  - 14 day pre-harvest interval

- **Delegate (spinosyns)**
  - 120 – 210 grams/ha
  - 28 days pre-harvest for stover, 14 days for forage

- **Voliam Xpress (pyrethroid + diamide)**
  - 500 mL/ha
  - 7 days pre-harvest interval

- **ROTATE** chemistries – high risk of resistance with WBC
Transgenic Corn Options

- Cry 1F (Herculex or SmartStax) no longer provides protection against WBC
- Only hybrids with Vip3A (Viptera) provides control
Non-Bt

Avg ear damage: 5.7 cm² (12.4%)
Yield: 105 bu/ac
DON: 10.5 ppm
FUM: 1.3 ppm

SSX RIB

Avg ear damage: 7.1 cm² (12.6%)
Yield: 116 bu/ac
DON: 12.8 ppm
FUM: 0.7 ppm
Plant Corn Early, Harvest Early

- Plant as early as possible so that field is not in the ideal growth stage near peak flight
- Impact on yield is not as significant as impact to grain quality
- Recommend harvesting as early as possible, if damage is easily found in fall to avoid ear mould development
- Select hybrids that are less susceptible to ear moulds and vomitoxin development
- Consider ear mould protection versus foliar disease protection if DON has been your issue – different timing and products
Dry Bean Scouting is Different

• Very difficult to impossible to find eggs or larvae
• Fields most at risk once corn is past full tassel stage
• Monitor with traps to know if WBC are present and when peak flight occurs for your region
• Scout adjacent corn field to find WBC eggs and larvae
• If adjacent corn field reached threshold, bean field likely needs protection too
Dry Bean Scouting Guidelines

• Wait until pods are present
• Scout 10 plants in 10 areas of the field during early pod stages
• Pod feeding usually 10 to 20 days after peak flight
• Look at each pod on the plant for signs of pod “grazing” or actual small holes
• If only surface feeding, look for any other possible culprits (eg. loopers, slugs, etc)
Original Nebraska Thresholds For Dry Beans

Threshold: 1-2 larvae per foot of row
But scouting is very difficult

Trapping: add up # of moths trapped

Milk Jug Trap

Count # moths until peak catch

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Count # moths until peak catch

C. DiFonzo, MSU
Dry Bean Threshold?

• Not for Ontario yet
• If during scouting, early pod feeding is found, a spray is likely necessary
  – Good chance if one hole is found, there are many more that you don’t see
• Michigan also suggests that bean trap sites that have caught more than 150 moths in a trap will likely need to be sprayed when pods present
Spray Timing in Beans

- Spray when early pod feeding has been found
- Easier to control in dry beans
- WBC exit pod before dawn to hide in soil each day
- When they enter new pod the next night, they will be exposed to the insecticide on the surface of the pod
- Spraying before pods are present (just after corn has been sprayed) is too early and not effective

J. Barclay, HDC
Products Registered on Dry Beans in Canada

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  • 83 – 187 mL/ha
  • 14 days pre-harvest interval

• Coragen (diamide)
  • 250 – 375 mL/ha
  • 1 day pre-harvest interval

• Voliam Xpress (pyrethroid + diamide)
  • 500 mL/ha
  • 7 days pre-harvest interval

• ROTATE chemistries
• Cygon/Lagon does not work on caterpillars
Natural enemies

• Egg parasitoids
• Pathogens
• Predators
WBC Resources

• Field Crop News – up to date, in-season activity
• WBC Trap Network – www.cornpest.ca
  – Interactive Maps
  – Trapping Instructions
  – Infosheets for Dry Beans and Corn
• Twitter @TraceyBaute, @JocelynLSmith, @JenniferBruggem and @MegnMoran
• Pest Manager App
Thanks to Our Research Collaborators and Sponsors Over the Years