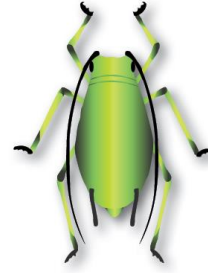




Agriculture and  
Agri-Food Canada

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Agroalimentaire Canada



Canada



# Coming to an app store near you: Cereal Aphid Manager App!

Soils and Crops March 6<sup>th</sup>, 2018 Saskatoon, Sk.

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@TylerWist1

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# The trouble with aphids in cereals?

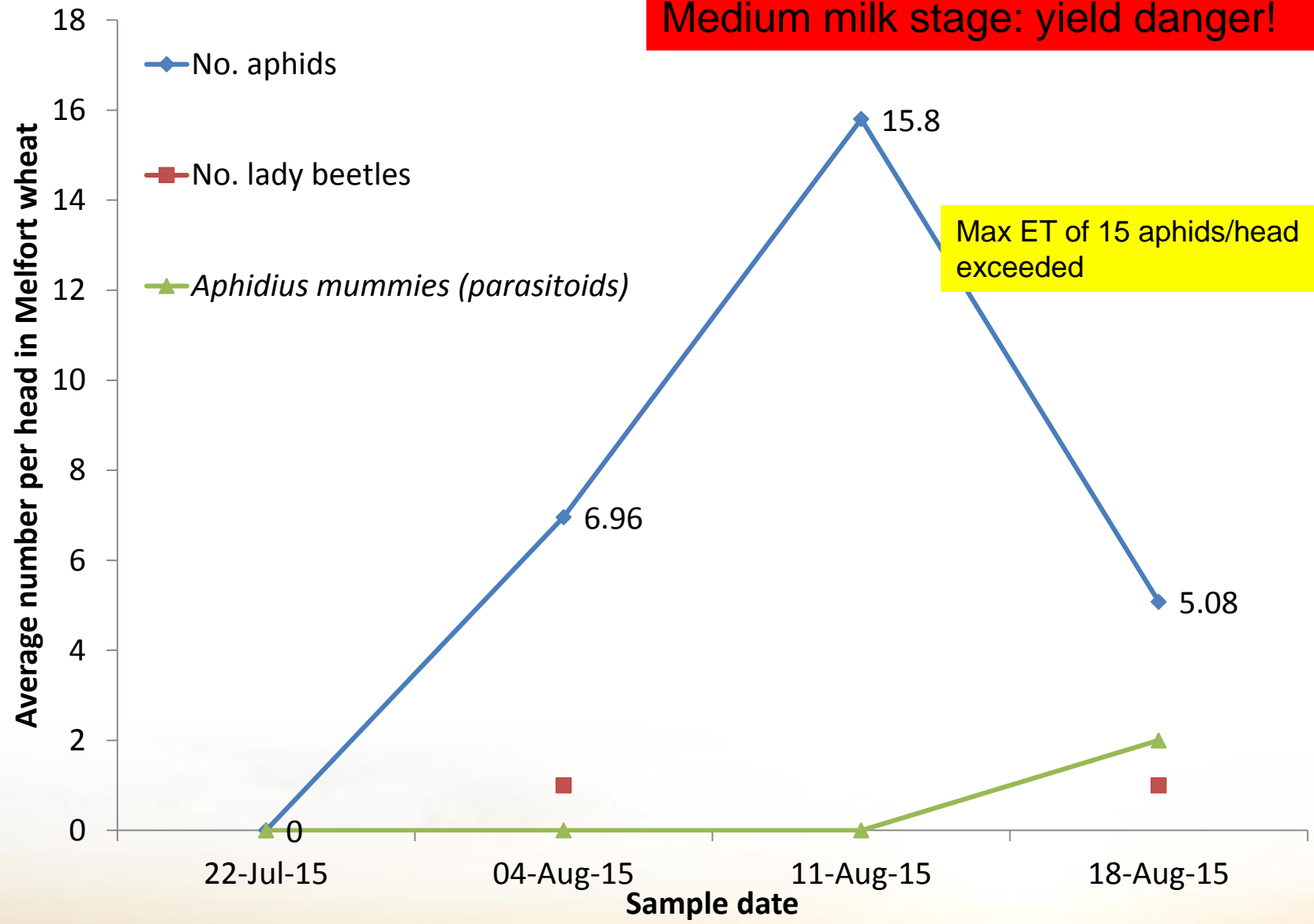
All female, “Born pregnant”, birth live clones,  
~60 in lifetime, Plantegenest et al. 1996 Eur. J Entomol)



High popns = 12/tiller (ET), cereals  
< soft dough reduce yield

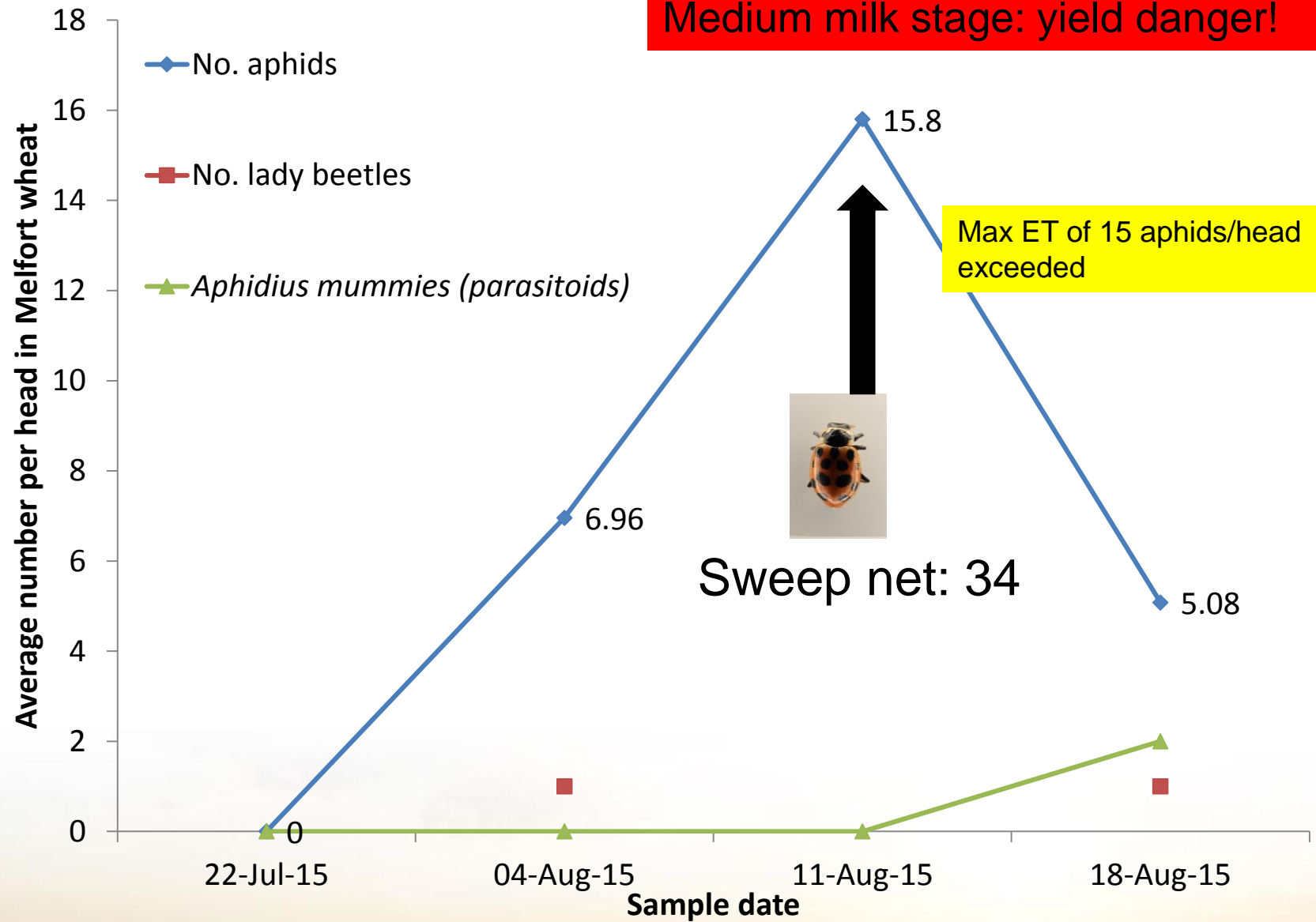


Medium milk stage: yield danger!





Medium milk stage: yield danger!



# Dynamic Action Threshold (DAT)

## Conventional action threshold (CAT)

The number of aphids that in one week will



12-15 aphids/head Johnston and Bishop 1987

## Economic Threshold (ET)

And trigger an insecticide treatment

The CAT does not account for controlling pressure of natural enemies

...recommendations are often to “look around for natural enemies and mummies” ...with no quantification or measure of their impact (my personal opinion)

**Dynamic Action Threshold (DAT)** incorporates suppressing effects of predators and parasitoids as Natural Enemy Units (**NEUs**)

(Hallett et al. 2014)

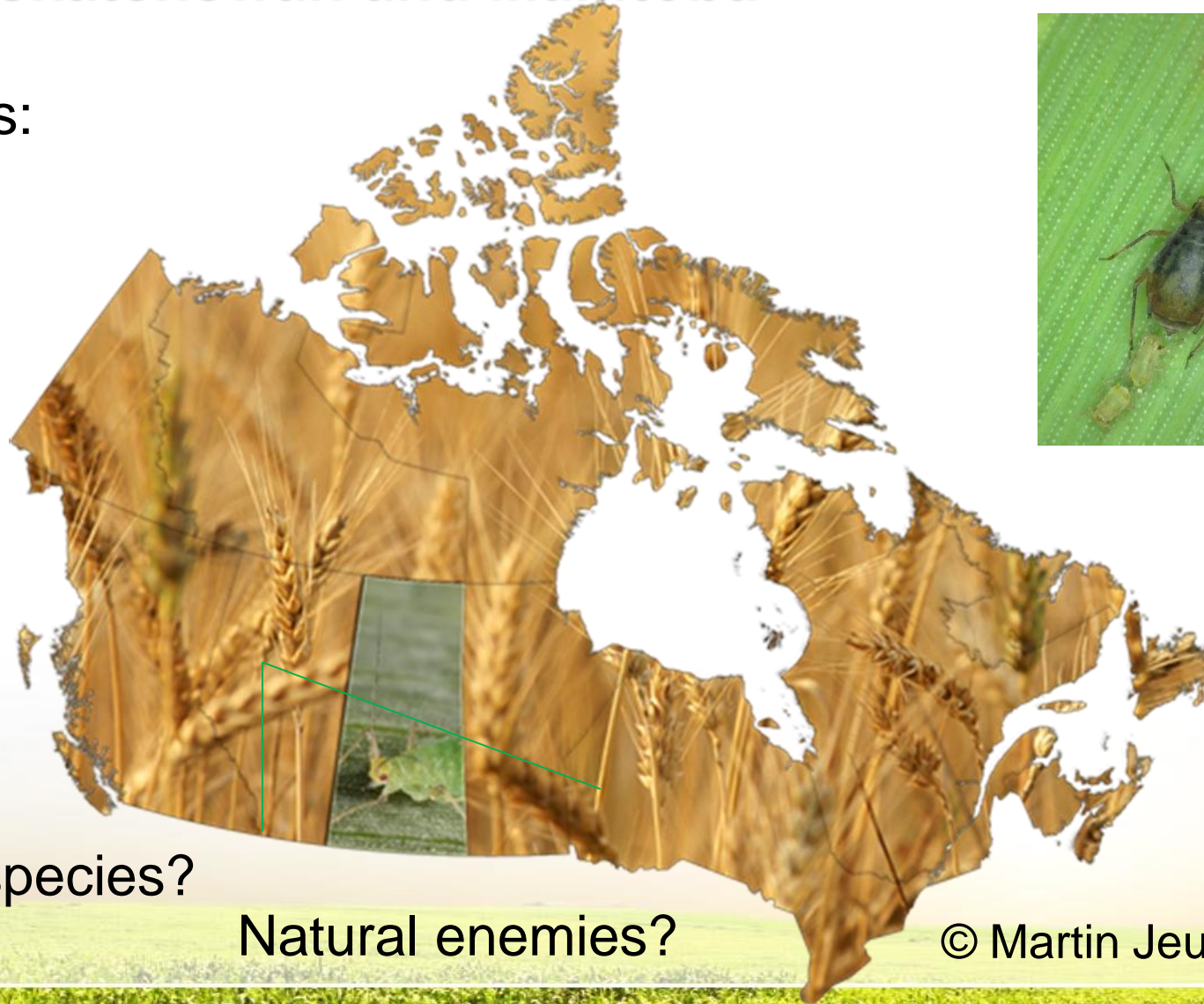
$$\text{NEU} = (n_i V_i)$$





# Survey: Saskatchewan and Manitoba

Surveys:  
2012,  
2013,  
2015,  
2016,  
2017



Aphid species?

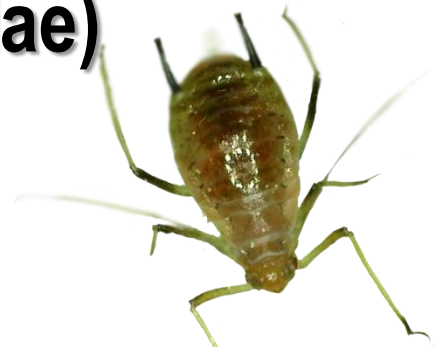
Natural enemies?

© Martin Jeuland

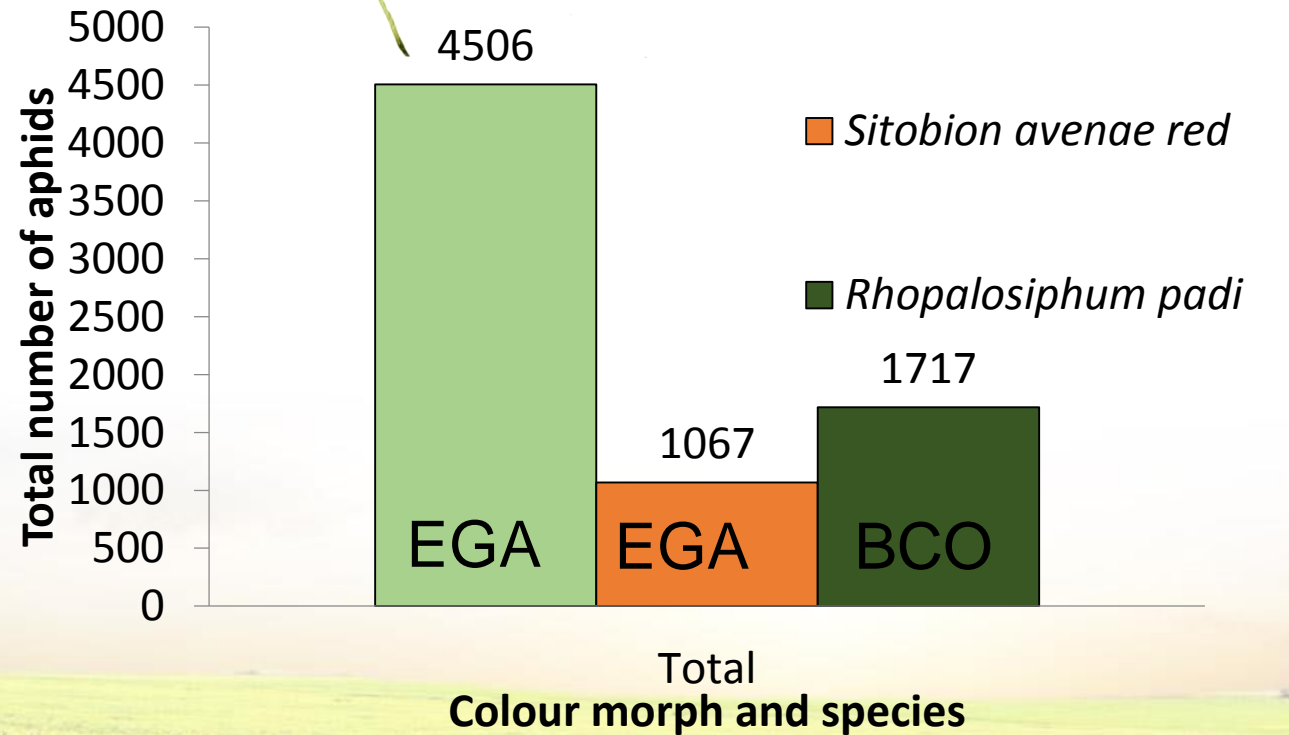


# Cereal aphids in cereal crops: (Homoptera: Aphididae)

- English grain aphid (EGA)  
*Sitobion (Macrosiphum) avenae* (F.)
- Birdcherry-oat aphid (BCO)  
*Rhopalosiphum padi* (L.)



2016





# Predators: Ladybeetles



*Coccinella septempunctata* (Linnaeus)  
Adult eats 48 aphids/day = Voracity (V)  
Larvae eats 72 aphids/day (Rautapaa, 1976)



*Hippodamia tredecimpunctata* Linnaeus

Larval V= $\sim$ 59 aphid/day, Adult: 26/day (Malyk, 1971; Michels and Flanders, 1992)





# Predators: Green lacewings (larvae)



*Chrysoperla carnea* (Stevens)

*Chrysopa oculata* Say

V= $\sim$ 30 aphids per day

(Aqueel et al., 2014; Burke and Martin, 1956; Simpson and Burkhardt, 1960)



# Predators: Minute Pirate Bugs

*Orius tristicolor* (White)

V of larvae = 8aphids/day

V of adults = 11 aphids/day (Hallett et al. 2014)





# Predators: Damself Bugs



*Nabis americana*

V nymphs = 19 aphids/day

V adults = 19 aphids/day

(Simpson and Burkhardt, 1960)



# Parasitoids: *Aphidius avenaphis* (Fitch)

2015, 2016, 99% *A. avenaphis*  
60% hyperparasitism  
60:40 female:male



*Dendrocerus bicolor*



*Asaphes suspensus*

$V = 7$  aphids per day  
(Wist, unpublished)





# Cereal aphid DAT equation

$$N_t = \sum_{i=1}^t [((N_0 e^r - 100NEU_i) + (N_0 - 100NEU_i) e^r) / 2]$$

- predicts how many aphids are removed per day
- The equation that runs the app's predictive function



*Aphidius colemani* (Aphidiinae)



# Home screen



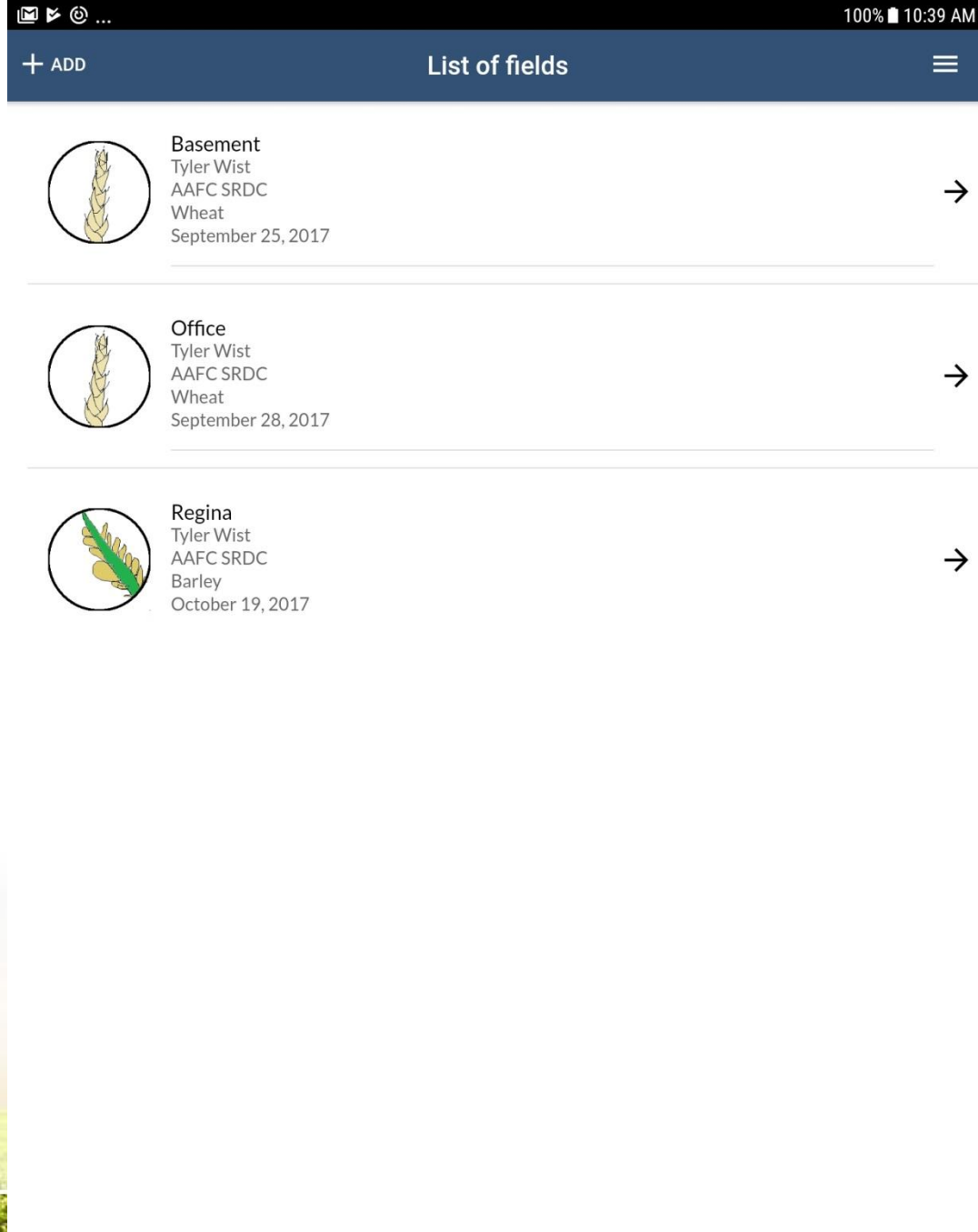
App as a tool:  
Scouting, education,  
reducing insecticides,  
Protecting beneficials



Beta test  
2017



# Setting up a field



# Starting out



80% 11:11 AM

← New Observation Set ×

Date and Time Oct 11, 2017 05:11 PM

Observer\* Tyler Wist ▾

Zadok Growth Stage\* 8a - Early Dough Development ▾

Note: If the crop stage is at or above 8b - Late Dough Development, there is no risk to cereal crops from aphids. Making an observation set is not necessary.

All mandatory fields are identified by an \*

SUBMIT





# Scouting pattern

## Aphid counts



← Observation Set EDIT



At 3/3/2018, 12:18:58 PM  
For Saskatoon

**Warning**  
This crop is past the risk of further damage from aphids.

In Progress



Walk to a point in the field that represents the highlighted spot in the W formation, about 30m away from the nearest point.

Observation Points In Set

- 1 Add Observation Point
- 2 Add Observation Point
- 3 Add Observation Point
- 4 Add Observation Point
- 5 Add Observation Point

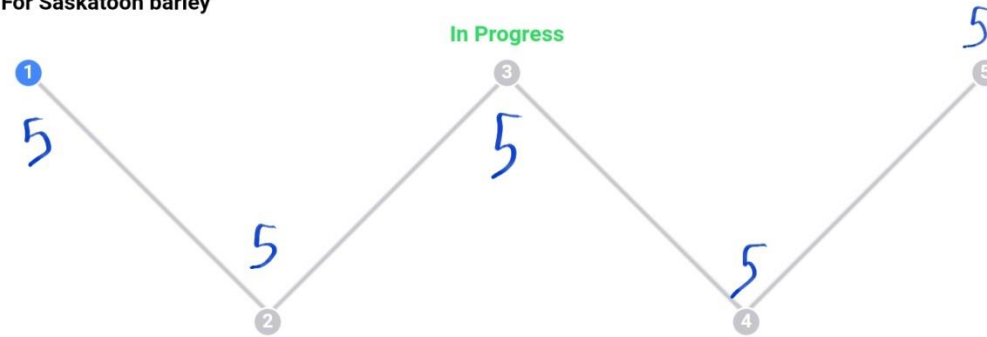
Canada

The screenshot shows a mobile application interface for agricultural scouting. At the top, there's a navigation bar with a back arrow, the title "Observation Set", and an "EDIT" button. Below this is a status bar showing the time as 12:19 PM and 94% battery. The main content area features a sun-and-field icon, a timestamp "At 3/3/2018, 12:18:58 PM", and the location "For Saskatoon". A prominent blue warning box states: "Warning: This crop is past the risk of further damage from aphids." Below the warning, the status "In Progress" is displayed in green. A diagram illustrates a W-formation with five numbered points (1-5) connected by lines. A blue circle highlights point 3. Below the diagram, a text instruction reads: "Walk to a point in the field that represents the highlighted spot in the W formation, about 30m away from the nearest point." Underneath, a list titled "Observation Points In Set" contains five entries, each with a number and the text "Add Observation Point". The bottom of the screen features the "Canada" logo. The background of the entire page is a blurred image of a green field.

# Scouting pattern Aphid counts



At 3/3/2018, 12:43:58 PM  
For Saskatoon barley



Walk to a point in the field that represents the highlighted spot in the W formation, about 30m away from the nearest point.

Observation Points In Set




- 1 Add Observation Point
- 2 Add Observation Point
- 3 Add Observation Point
- 4 Add Observation Point
- 5 Add Observation Point





# Aphid counts



	English grain aphid
Count 25	<input type="button" value="x"/> <input type="button" value="-"/> <input type="button" value="+"/>
	Birdcherry-oat aphid
Count 1	<input type="button" value="x"/> <input type="button" value="-"/> <input type="button" value="+"/>
	Greenbug
Count 0	<input type="button" value="x"/> <input type="button" value="-"/> <input type="button" value="+"/>

NEXT TILLER



# Aphid counts



Tiller # 1 (1/25)

English grain aphid

Count 25

Birdcherry-oat aphid

Count 1

NEXT TILLER

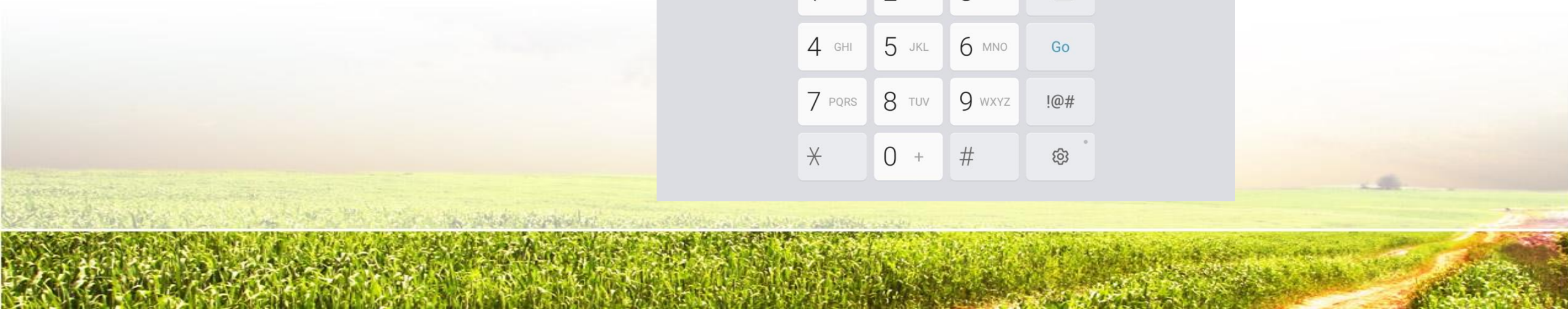
Canada

1 2 ABC 3 DEF

4 GHI 5 JKL 6 MNO Go

7 PQRS 8 TUV 9 WXYZ !@#

\* 0 + #

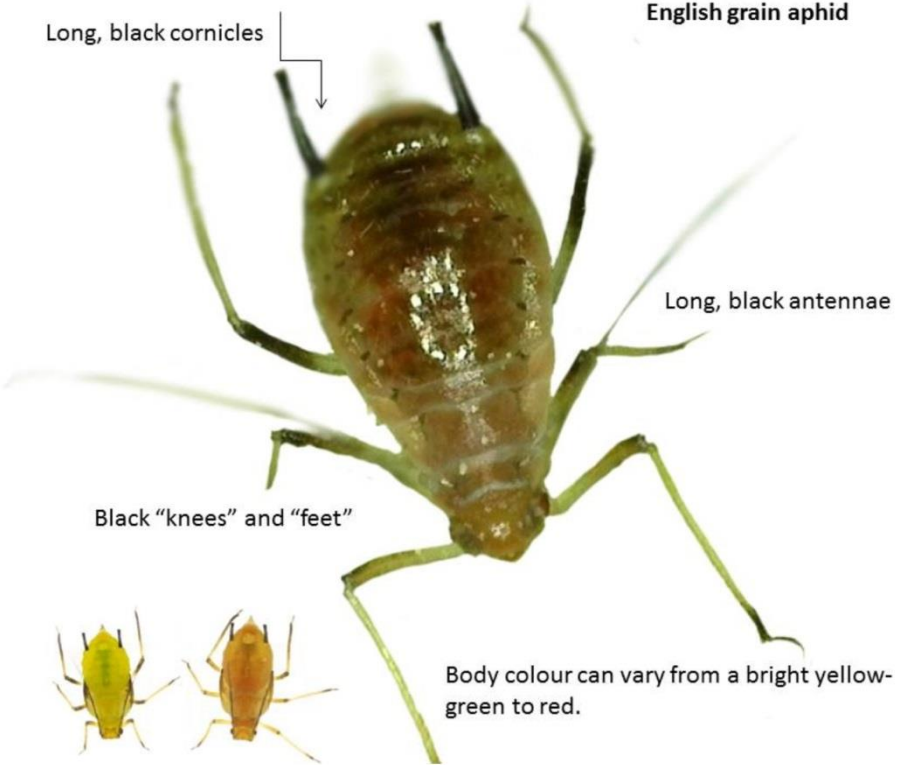




# Aphid counts




*Zoom screen!*



# Natural enemies




← Natural Enemy Observation ☰




Seven-spotted ladybeetle – adult

Count 0




Seven-spotted ladybeetle – larva

Count 0



Thirteen-spotted ladybeetle – adult

Count 0



Thirteen-spotted ladybeetle – larva

Count 0

NEXT POINT

Canada





# Natural enemies



← Natural Enemy Observation ☰

Green lacewing – larva

Count 0 [X] [-] [+]

Damselbug

Count 0 [X] [-] [+]

Minute pirate bug

Count 0 [X] [-] [+]

Brown aphid mummy

Count 0 [X] [-] [+]

Black aphid mummy

NEXT POINT

Canada



# Recommendation



← Results ☰

**In Saskatoon barley**  
Recommendation for 3/3/2018

---

Economic Threshold

Four aphid economic thresholds and their recommendations based upon your field scouting are provided. You choose which recommendation to follow based on your tolerance to aphid pests. The economic threshold of 12 aphids per head is recommended for Western Canada and is highlighted

5 aphids per tiller  
Sample another 25 tillers.

10 aphids per tiller  
Sample another 25 tillers.

**Recommended action**  
12 aphids per tiller  
Sample another 25 tillers.

15 aphids per tiller  
Sample another 25 tillers.

**ADD NEW OBSERVATION SET**

**Set #: 1 At 12:43:58 PM**

Total Aphids: 366

Average aphids per tiller (observed): 14.6

**Summary (based on 1 / 1 sets):**

Observer(s): Tyler Wist

Total Aphids: 366

English grain aphid: 360 (98.4%) *90%*

Birdcherry-oat aphid: 5 (1.4%)

Greenbug: 1 (0.3%)

Average aphids per tiller (observed): 14.6

Average aphids per tiller (in 7 days): 46.4 → *Predicted number in 7 days*

Total Natural Enemies: 2

.....

Aphids can arrive any time during the growing season. Therefore, you should continue inspecting fields regularly until late dough stage, when aphids can no longer affect yield.

**Canada**

*after 25 the app always makes you keep sampling.*

*→ Predicted number in 7 days*





# Recommendation



78% 2:48 PM

← Results

5 aphids per tiller  
Spray now, aphid numbers are high enough. To increase certainty, sample another 25 heads

10 aphids per tiller  
Spray now, aphid numbers are high enough. To increase certainty, sample another 25 heads

**Recommended action**  
12 aphids per tiller  
Spray now, aphid numbers are high enough. To increase certainty, sample another 25 heads

15 aphids per tiller  
Sample another 25 tillers.

**Set #: 1 At 10:27:55 AM**  
Total Aphids: 390  
Average aphids per tiller: 15.6

**Set #: 2 At 10:37:15 AM**  
Total Aphids: 424  
Average aphids per tiller: 17.0

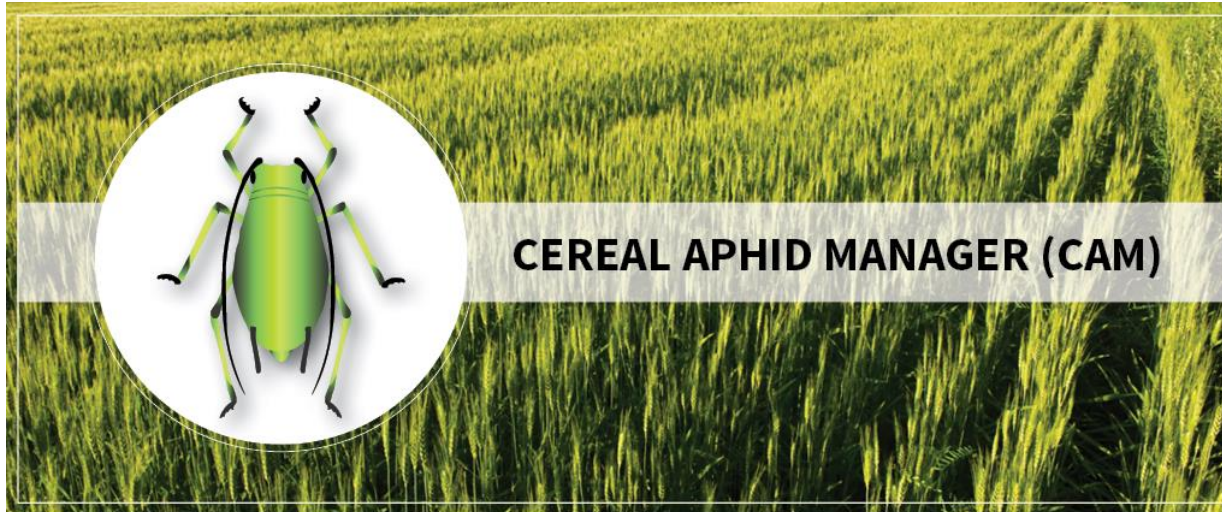
**Summary (based on 2 / 2 sets):**  
Observer(s): Tyler Wist  
Total Aphids: 814  
Average aphids per tiller: 16.3  
Total Natural Enemies: 35  
Seven-spotted ladybeetle – adult : 7  
Seven-spotted ladybeetle – larva : 7  
Thirteen-spotted ladybeetle – adult : 3  
Thirteen-spotted ladybeetle – larva : 3  
Green lacewing – larva : 3  
Damselbug : 3  
Minute pirate bug : 3  
Brown aphid mummy : 3  
Black aphid mummy : 3

Aphids can arrive any time during the growing season. Therefore, you should continue inspecting fields regularly until late dough stage, when aphids can no longer affect yield.

Canada

# Government of Canada Branding

- Follows the “look and feel” of a Government of Canada document



Canada

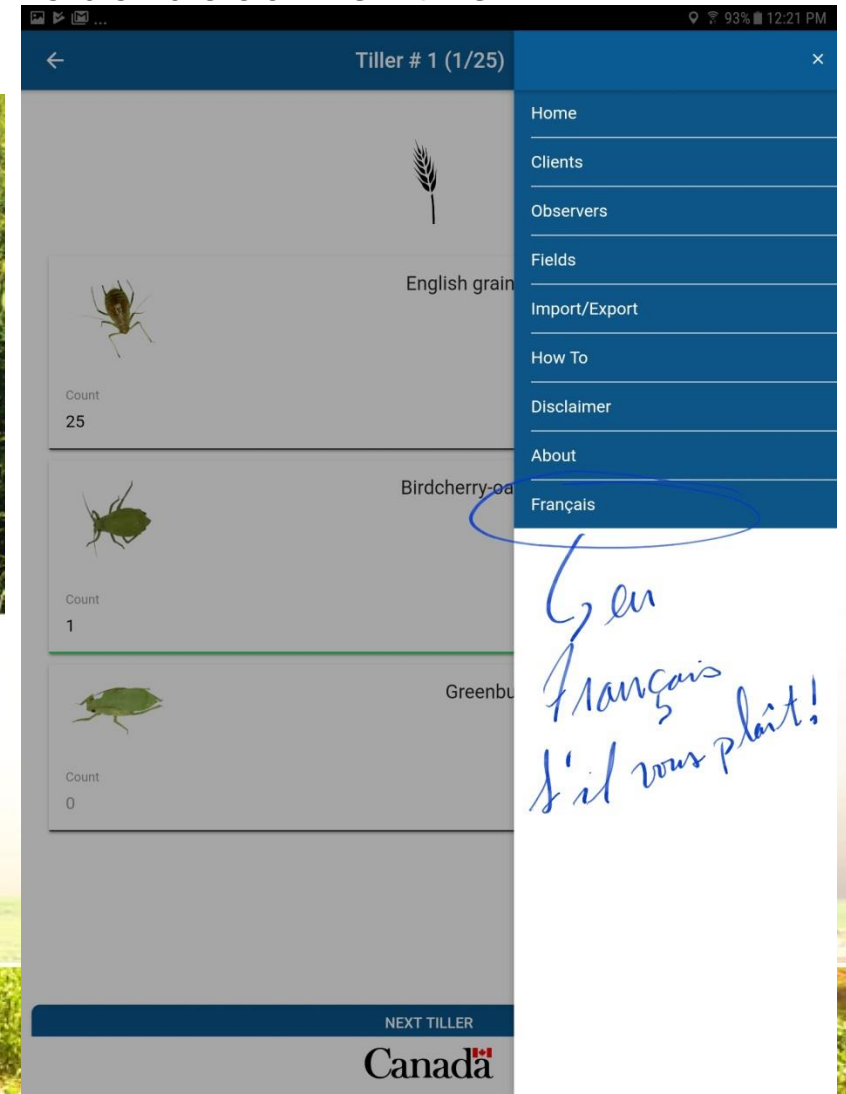


# Government of Canada Branding

- Follows the “look and feel” of a Government of Canada document: en français



Canada





# CAM will be available soon



- End of March 2018 launch date
- Apple and Android operating systems
- FREE download from the Apple store and Google Play



# Acknowledgments

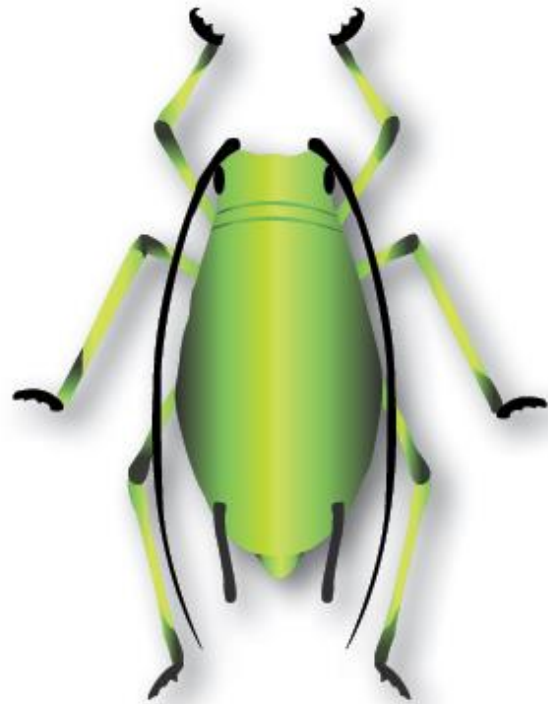
- Project funding from Pesticide Risk Reduction Centre of the Pest Management Centre c/o Cezarina Cora (PRR15-040)
- A multitude of summer students
- Techs of the Wist lab at AAFC Saskatoon
- Elham Karimi, Team Lead Application Services NCR ISB
- AAFC Saskatoon



@TylerWist1



# Thank you and Questions



Canada 

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@TylerWist1  
@FieldHeroes

FIELD  
HEROES



**THINK BENEFICIALS  
BEFORE YOU SPRAY**