Wireworm Saga: Biology and Management in the San Juan Islands

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***Resilient Gardens in a Changing Climate*, Friday Harbor, WA**

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San Juan County
Washington State University
Extension

Wireworm biology

- Larval form of click beetle
- Numerous species globally
- Live in soil 3-5 years
- Females can lay >100 eggs in a season
- Thrive in sod
- Feed on living plant material
- Attracted to CO_2 from germinating seeds and growing roots
- Larval activity increases **>50F** (10C)
- Soil temp **>77F** (25 C) can drive wireworms deeper in soil
- Travel vertically in soil profile depending on environmental conditions

Photo: Wim Van Herk

A. Lineatus

Damage

- Susceptible crops
  - Small grains
  - Corn
  - Beans
  - Root crops: Carrots, Potatoes, Radish, Beets…
  - Transplants: Lettuce, tomatoes, strawberries…
- Damage to root crops reduces marketability
- Direct seeded crops and transplants killed by feeding
- Growers in San Juan County have reported complete crop loss due to wireworm damage

Photo: VirginiaTech

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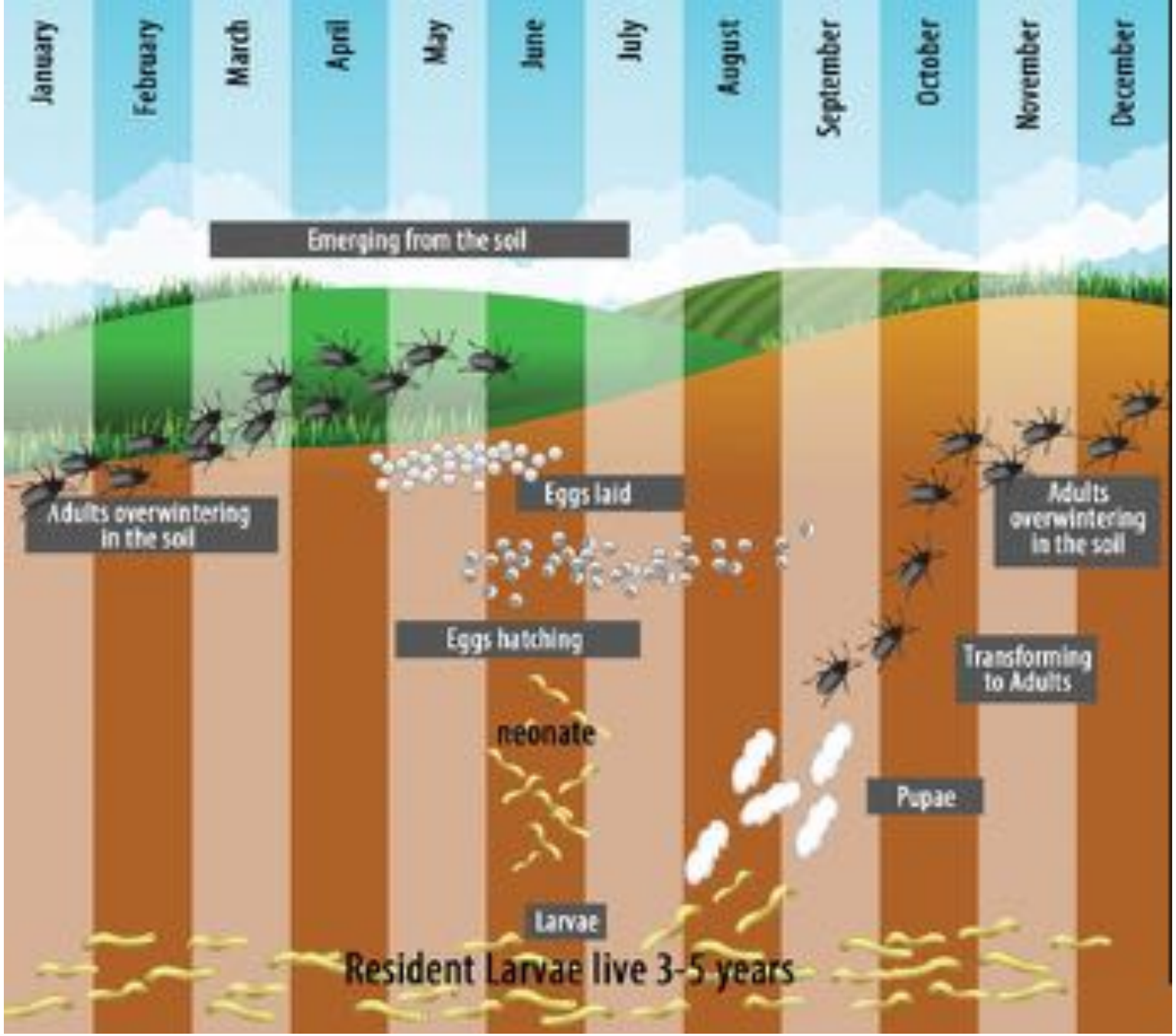


https://www.potatoesincanada.com/crop-protection/wireworms-on-the-rise-15364

Introduced European species

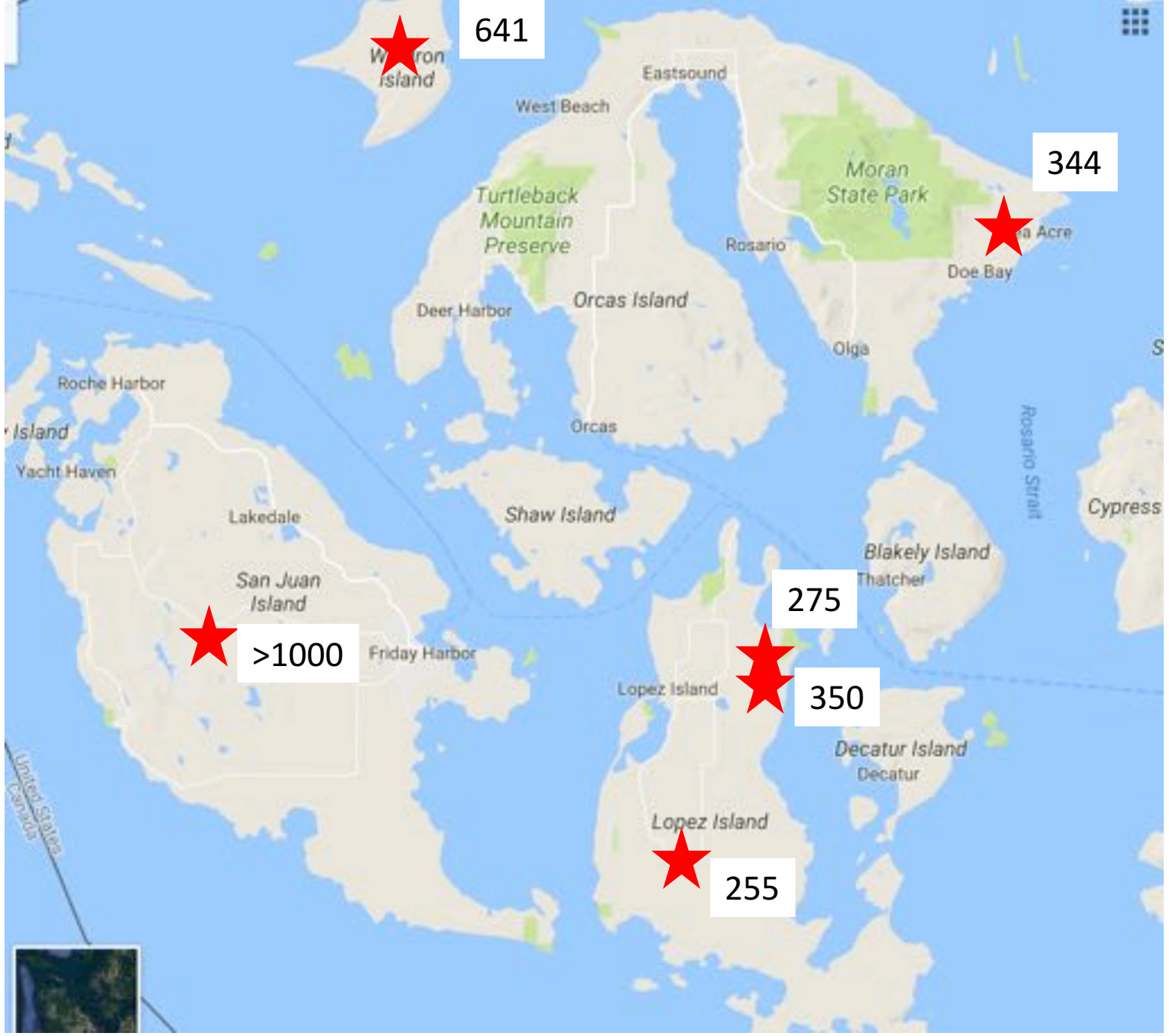
- *A. lineatus and A. obscurus* introduced to British Columbia in 1900's from Europe
- First identified in Whatcom County in 1997
- Reported in numerous western Washington Counties from 2000-2005
- Very damaging species with wide host range
- Reports of wireworm damage increasing in past 10 years in San Juan County

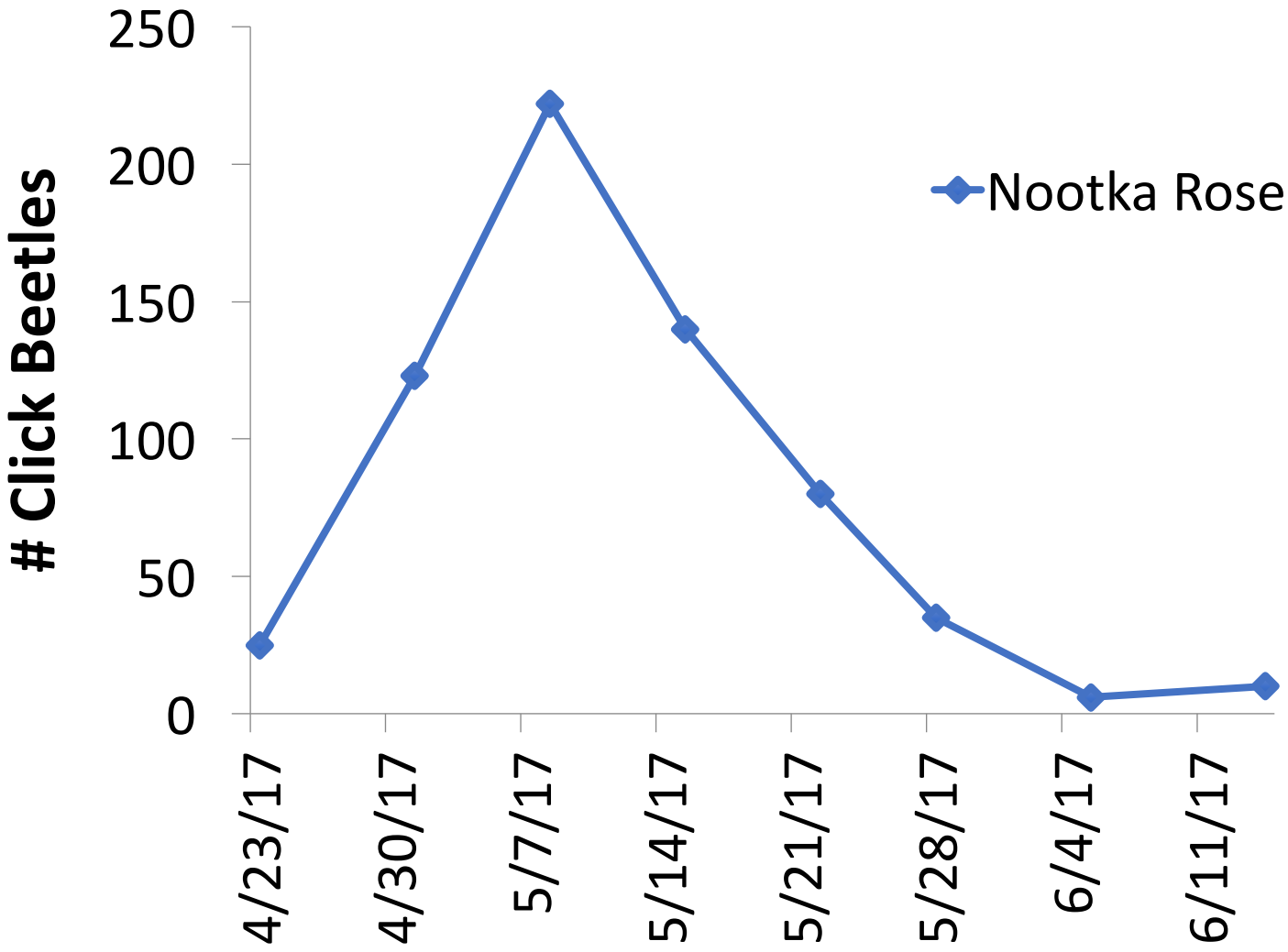
2017 San Juan County Click Beetle Survey

- Pheromone traps specific to *A. lineatus* and *A. obscurus*
- Traps designed to attract male click beetles
- Deployed to 6 locations (3 Lopez, 1 San Juan, 1 Orcas, 1 Waldron)
- Monitored from April to June

Preliminary Survey Results

- *Agriotes lineatus* widespread in San Juan County
- Did not observe *Agriotes obscurus*
- Sites range from 250 to >1,000 adult males

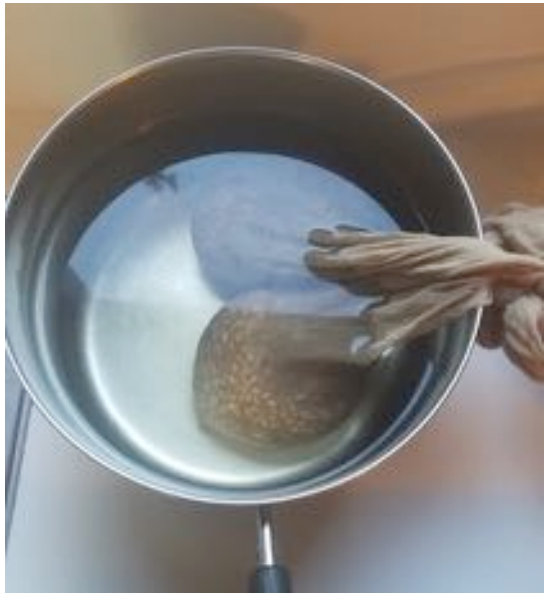



Click Beetles
250
200
150
100
50
0
4/23/17
4/30/17
5/7/17
5/14/17
5/21/17
5/28/17
6/4/17
6/11/17
Nootka Rose

Management

- Monitoring
- Field selection
- Cultivation
- Resistant cultivars
- Trap cropping

Monitoring: Bait Trap



Soak 1 cup wheat in nylon stocking for ~24 hrs

Bury ~5 inches deep

Flag

Dig up 1 week later

Count wireworms in roots and grain

Reference: WSU FS059E Wireworm Scouting: The shovel Method and the Modified Wireworm Solar Bait Trap

Damage Threshold

Table 1. Wireworm treatment recommendations based on risk of economic damage determined by using the average number of wireworms per bait trap.

Average Number of Wireworms per Trap	Risk of Economic Damage	Wireworm Treatment Recommendation†
0	Low	No treatment
0–1	Moderate	Possible treatment
1–2	Probable	Treat with recommended rates
2–4	High	Treat with recommended rates
>4	Extreme	Extreme methods‡

† Knowing field history also helps in developing treatment recommendations.
‡ Extreme methods of control include using highest rates allowable of neonicotinoid insecticides, higher seeding rates, and delayed seeding.

Table: WSU FS059E Wireworm Scouting: The shovel Method and the Modified Wireworm Solar Bait Trap

Site Selection and Rotation

- Avoid planting into old pasture and lawn
- Populations typically highest in areas that have been in grass for >10 years
- Rotate with non-host crops, brassica and buckwheat
- Plant in areas with history of cultivation
- Monitor new sites

Cultivation

- Repeated cultivation can reduce wireworm pressure over time
- Larva and adults typically survive cultivation
- Time to disrupt eggs and pupae (July and August)
  - Depths of 3-15 inches below surface

Resistant Varieties

Table 5. Percentage of infected tubers for various potato varieties.

'AC9521'	1%
'VC1009'	1%
'Cherry Red'	3%
'Ozette'	13%
'Yukon Gold'	15%
'Colorado Rose'	16%
'Austrian Crescent'	17%
'Red LaSoda'	17%
'Satina'	20%
'Mountain Rose'	20%
'Nicola'	24%
'POR01PG22'	24%
'Sangre'	27%
'Huckleberry'	28%
'Jacqueline Lee'	30%

Photo: https://blogs.sos.wa.gov/library/index.php/2012/11/the-long-journey-of-ozette-potatoes/

Table: Wireworm Biology and Nonchemical Management in Potatoes in the Pacific Northwest PNW607

Trap Cropping

- Wireworms may be drawn away from market crops by planting a trap or sacrifice crop
- Transplanting strawberries between rows of wheat reduced loss in BC
- Corn and wheat bait reduced population in sweet potato hills
- Wheat has been found to be preferential to carrots
- Results are variable and timing is important

2017 Preliminary Trap Cropping Trial

Study Questions

- Does transplanting lettuce into rows of wheat reduce loss?
- Does transplanting lettuce between rows of wheat reduce loss?

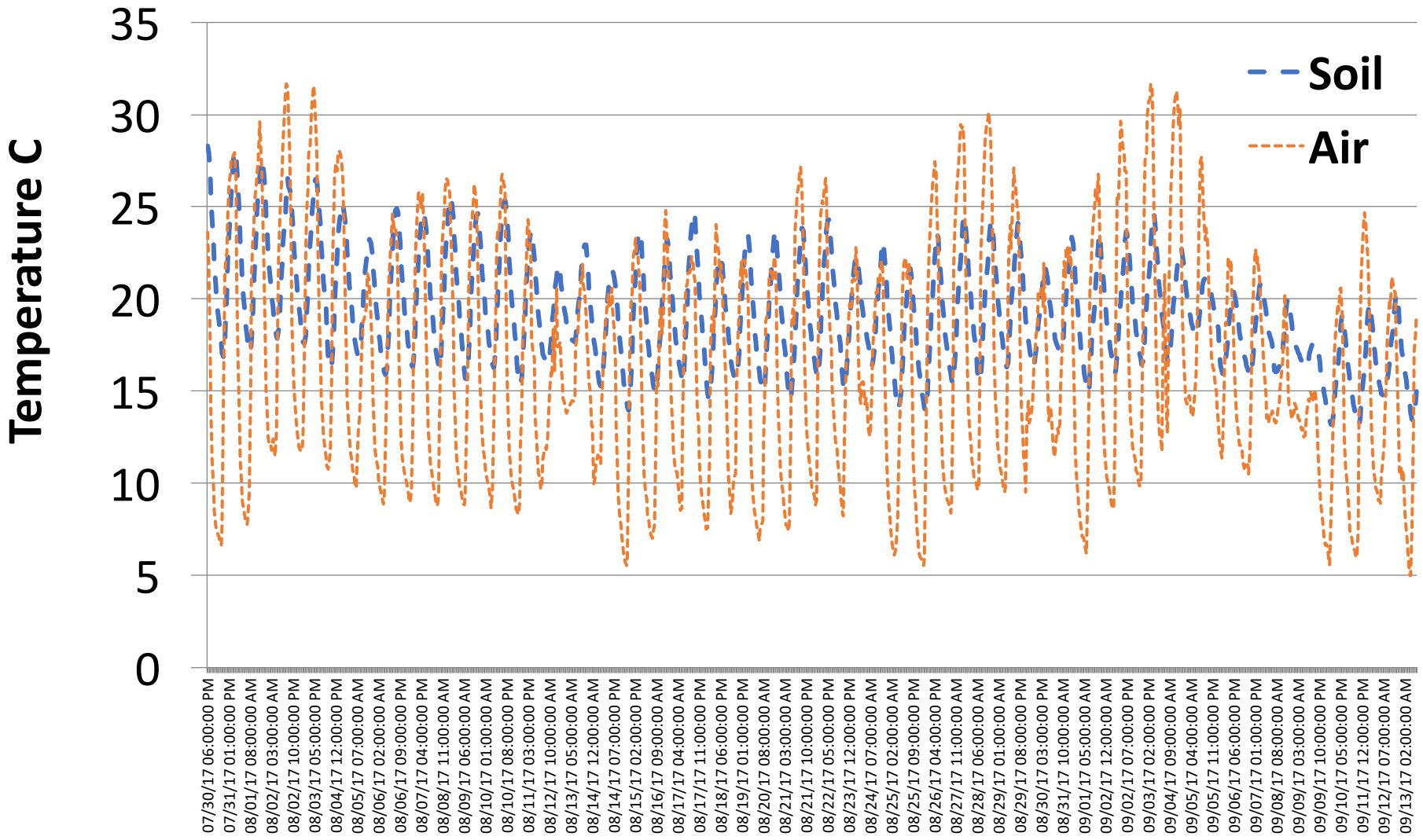
Site: Mama Bird Farm, San Juan Island

- Field was pasture
- Cover cropped with rye vetch two years
- 10 wireworms in bait trap 1 week prior to trial

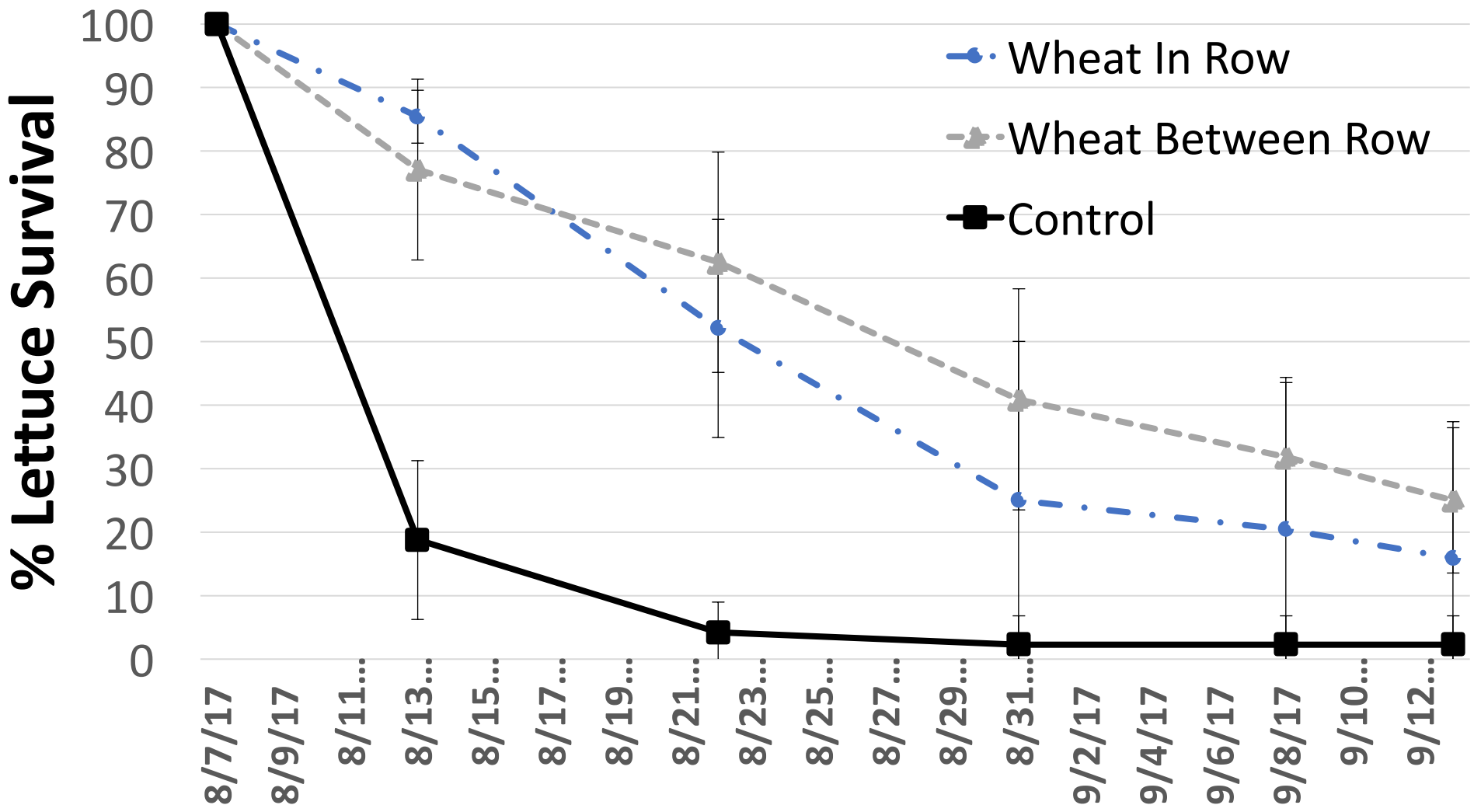
Methods

- Treatments:
  - Control
  - Wheat in-row
  - Wheat between-row
- Plots 8 ft x 4 ft with 12 lettuce transplants
- 4 replicates of each treatment
- Wheat was planted 1 week prior to transplanting lettuce
- Lettuce mortality was recorded every 5-10 days
- 5 week trial
- Soil cores taken to determine wireworm density in and between rows

Mama Bird Farm Temperature 7/30/17 to 9/13/17



Lettuce Transplants with Wheat Trap Crop



Conclusion

- Trap cropping may be suitable for protection crops during early stage of establishment
- May not be economically viable under high wireworm pressure
- May require repeated planting of trap crops
- Doesn’t reduce wireworm population

The Saga Continues…

- Primary species of concern in San Juan County is *A. lineatus*
- Avoid planting into fields that have been in sod for >10 years
- Summer cultivation to disrupt pupae
- Trap cropping may protect transplants during establishment
- Future research
  - Timing of trap cropping
  - Organic insecticides

Thank you

Mama Bird Farm
Lopez Harvest
T&D Farm
Horse Drawn Produce
Nootka Rose
Tap Root
Bob Vernon
Bev Gerdeman
Todd Murray
Angie Shephard

Unless other wised noted all photos by Brook Brouwer

Reference

WSU FS059E Wireworm Scouting: The shovel Method and the Modified Wireworm Solar Bait Trap

https://pubs.wsu.edu/ItemDetail.aspx?ProductID=15457&SeriesCode=&CategoryID=&Keyword=wireworm

PNW607 Wireworm Biology and Nonchemical Management in Potatoes in the Pacific Northwest
https://catalog.extension.oregonstate.edu/pnw607

Pacific Northwest Pest Management Handbooks Irish, Potato - Wireworm

https://pnwhandbooks.org/insect/vegetable/irish-potato/potato-irish-wireworm