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Action thresholds for canola insects

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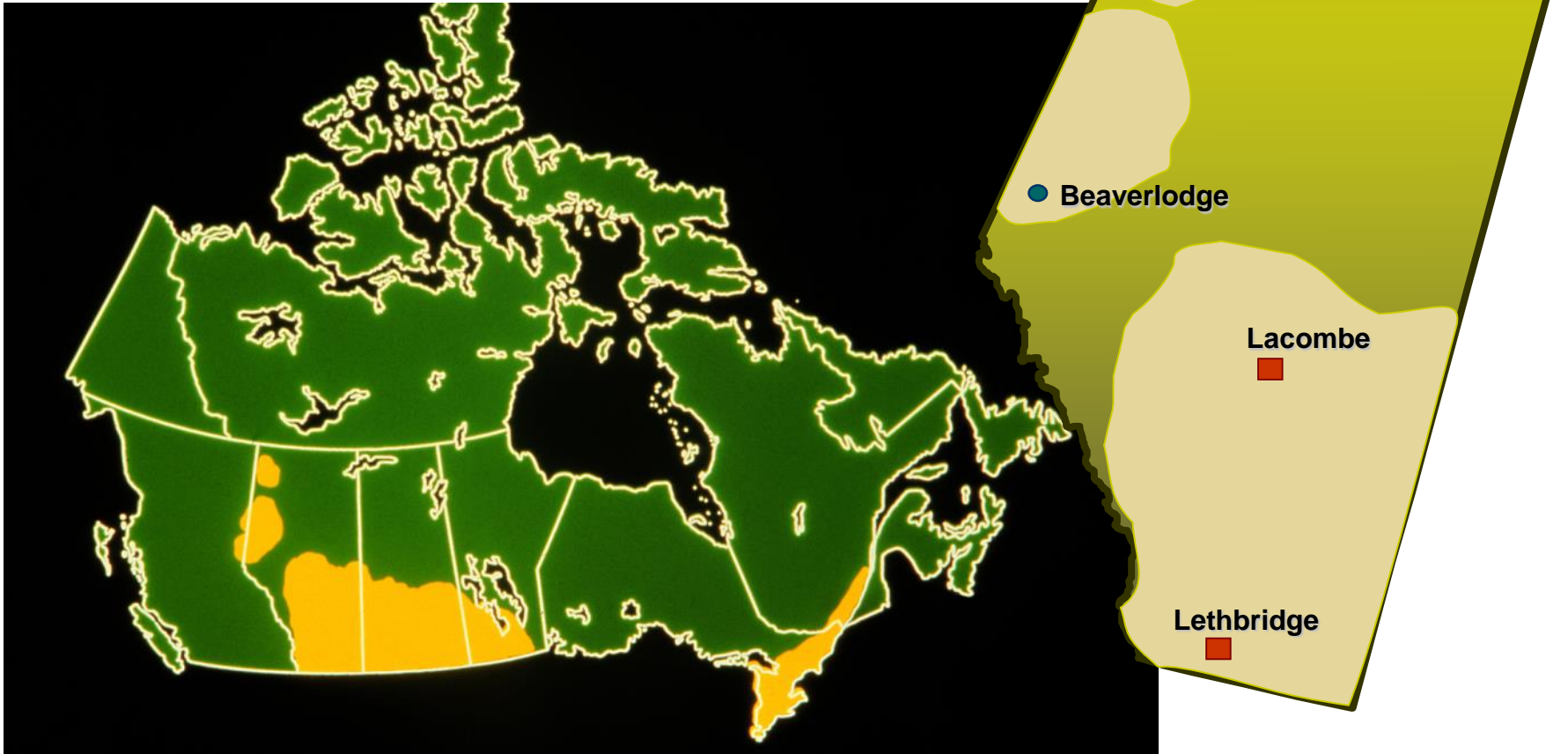
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Canada 

Outline

- Canola growing regions of Canada and Alberta
- IPM components and thresholds
- Overview of intermittent pests
- Three key insects:
 - Flea beetles: seedling stage
 - Cabbage seedpod weevil: (flower-pod)
 - Lygus bugs: bud to pod
- take home messages

Canola production in Canada and Alberta



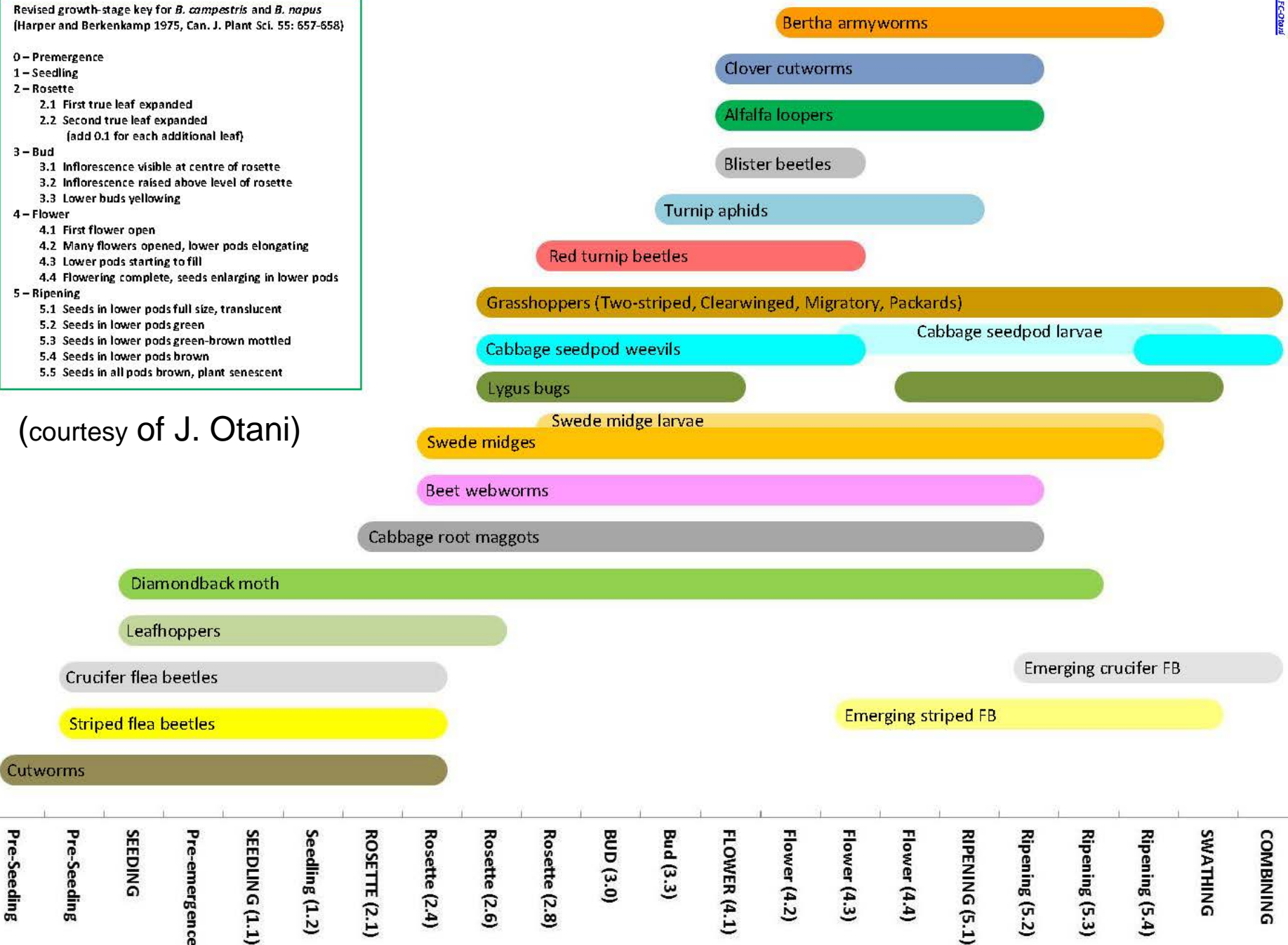
~ 20 M acres in 2015
Farmers like it: profitable
Some bugs like it..

SEASONAL CANOLA SCOUTING CHART

Revised growth-stage key for *B. campestris* and *B. napus*
(Harper and Berkenkamp 1975, Can. J. Plant Sci. 55: 657-658)

- 0 – Premergence
- 1 – Seedling
 - 2 – Rosette
 - 2.1 First true leaf expanded
 - 2.2 Second true leaf expanded
(add 0.1 for each additional leaf)
- 3 – Bud
 - 3.1 Inflorescence visible at centre of rosette
 - 3.2 Inflorescence raised above level of rosette
 - 3.3 Lower buds yellowing
- 4 – Flower
 - 4.1 First flower open
 - 4.2 Many flowers opened, lower pods elongating
 - 4.3 Lower pods starting to fill
 - 4.4 Flowering complete, seeds enlarging in lower pods
- 5 – Ripening
 - 5.1 Seeds in lower pods full size, translucent
 - 5.2 Seeds in lower pods green
 - 5.3 Seeds in lower pods green-brown mottled
 - 5.4 Seeds in lower pods brown
 - 5.5 Seeds in all pods brown, plant senescent

(courtesy of J. Otani)



Pre-Seeding Pre-Seeding SEEDLING Pre-emergence SEEDLING (1.1) Seedling (1.2) ROSETTE (2.1) Rosette (2.4) Rosette (2.6) Rosette (2.8) BUD (3.0) Bud (3.3) FLOWER (4.1) Flower (4.2) Flower (4.3) Flower (4.4) RIPENING (5.1) Ripening (5.2) Ripening (5.3) Ripening (5.4) SWATHING COMBINING

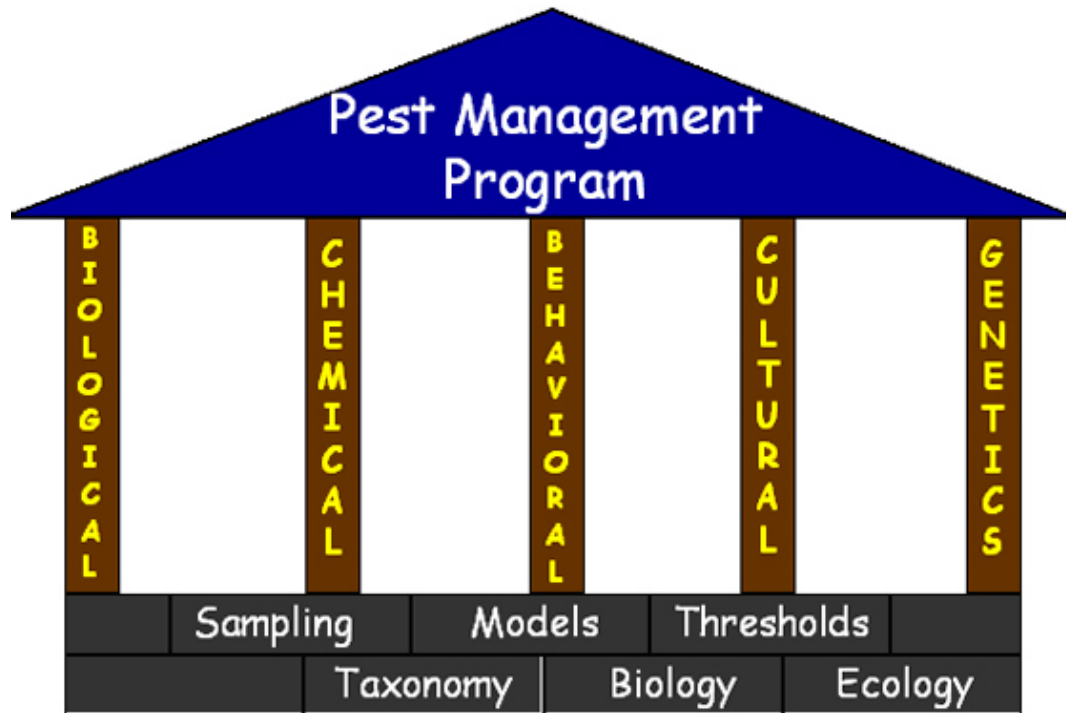
IPM strategies

- What is IPM?
 - Integrated Pest Management...but
 - Currently IPM = monitoring, identifying and spraying according to thresholds
 - Need to put the “I” back into IPM - integration of various management strategies

Management strategies

- *Semiochemicals*
- *Sterile insect releases*
- *Transgenics*
- **Biological control**
- **Cultural**
- **Host plant resistance**
- **Chemical**
 - **Action (economic) thresholds**

Threshold context



http://www.bestapples.com/varieties/varieties_ipm.aspx

Seminal article:

Stern, V. M., R. F. Smith, R. van den Bosch, and K. S. Hagen. 1959. The integrated control concept. *Hilgardia* 29:81101.

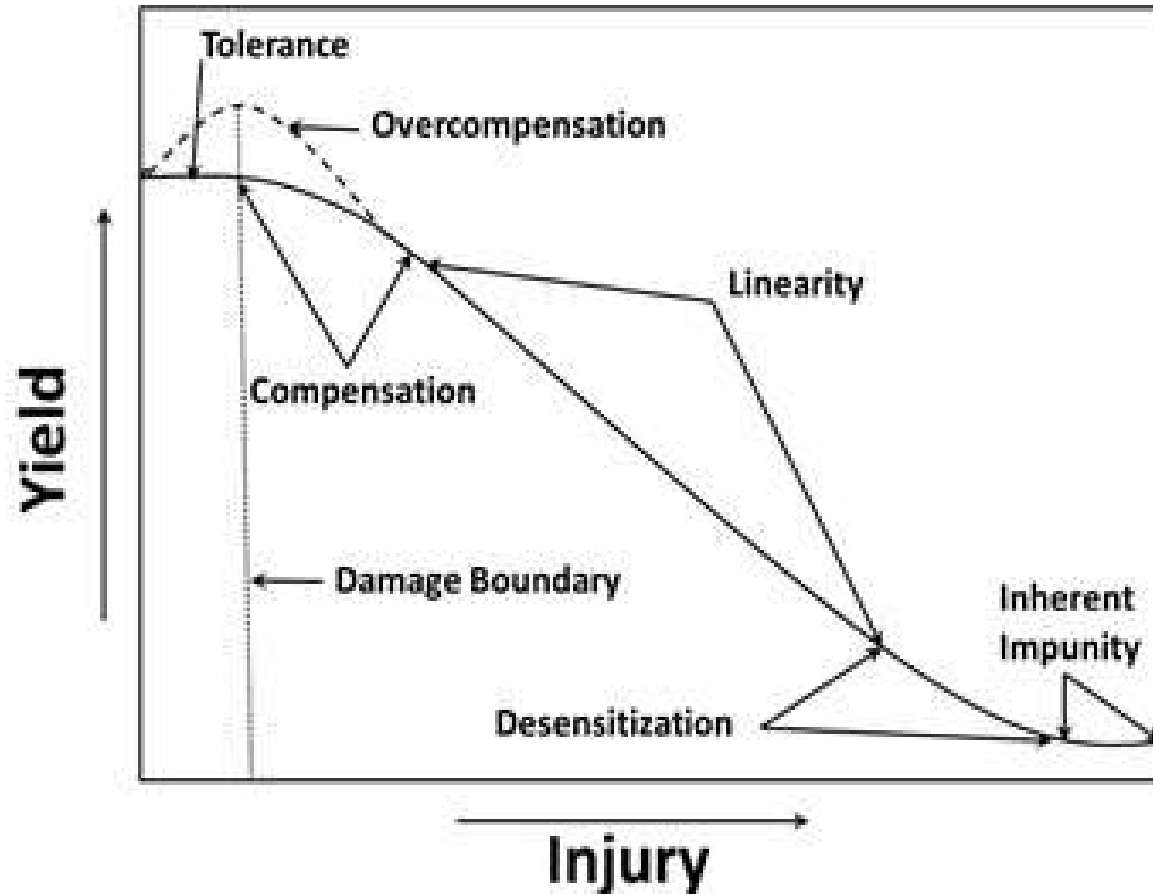
Definitions

- **Injury:** The physical harm to a commodity caused by the activity of a pest (e.g., bud, flower seed punctures from lygus feeding)
- **Damage:** The value (in dollars) lost to the commodity as a result of pest injury (e.g., seed weight, green seed)
- **Not all injury results in damage**
 - *E.g. bud/flower blasting from weevils or lygus*

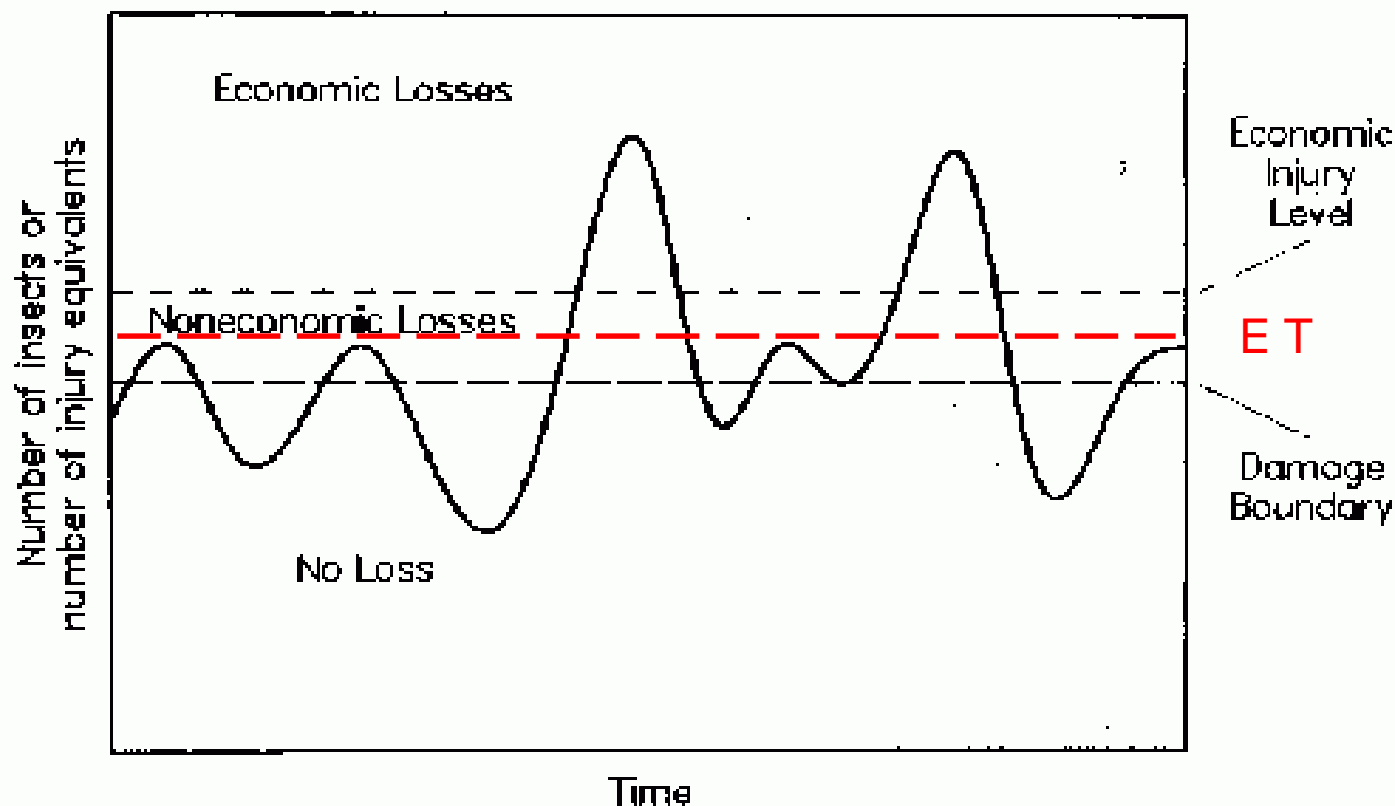
Definitions (cont'd)

- **Damage curve:** The relationship between injury (pest numbers) and yield.
- **Economic injury level:** The smallest number of pests (or injury) that will cause yield losses equal to the pest management costs.
- **Economic threshold:** The density of a pest (or level of injury) at which control measures should be initiated to prevent an increasing pest population from reaching the EIL.

Relationship of crop injury and yield is not fully linear



Relationship of the Economic Injury Level and the Economic (Action) Threshold



Other thresholds

- Nominal or subjective
 - e.g. 25% cotyledon damage for flea beetles
 - Diamond back moth: 20-30 per sq ft at flower
- Dynamic Action Thresholds
 - Includes natural enemies
 - Only known for soya bean aphids in USA and Ontario

Flea beetles - \$\$ major canola pest \$\$

- most widespread, consistent pest of canola
 - found throughout Canada and USA
- In some years cost over \$100 M in control and damage
 - including chemical costs
 - Feeding damage

Flea beetles - biology



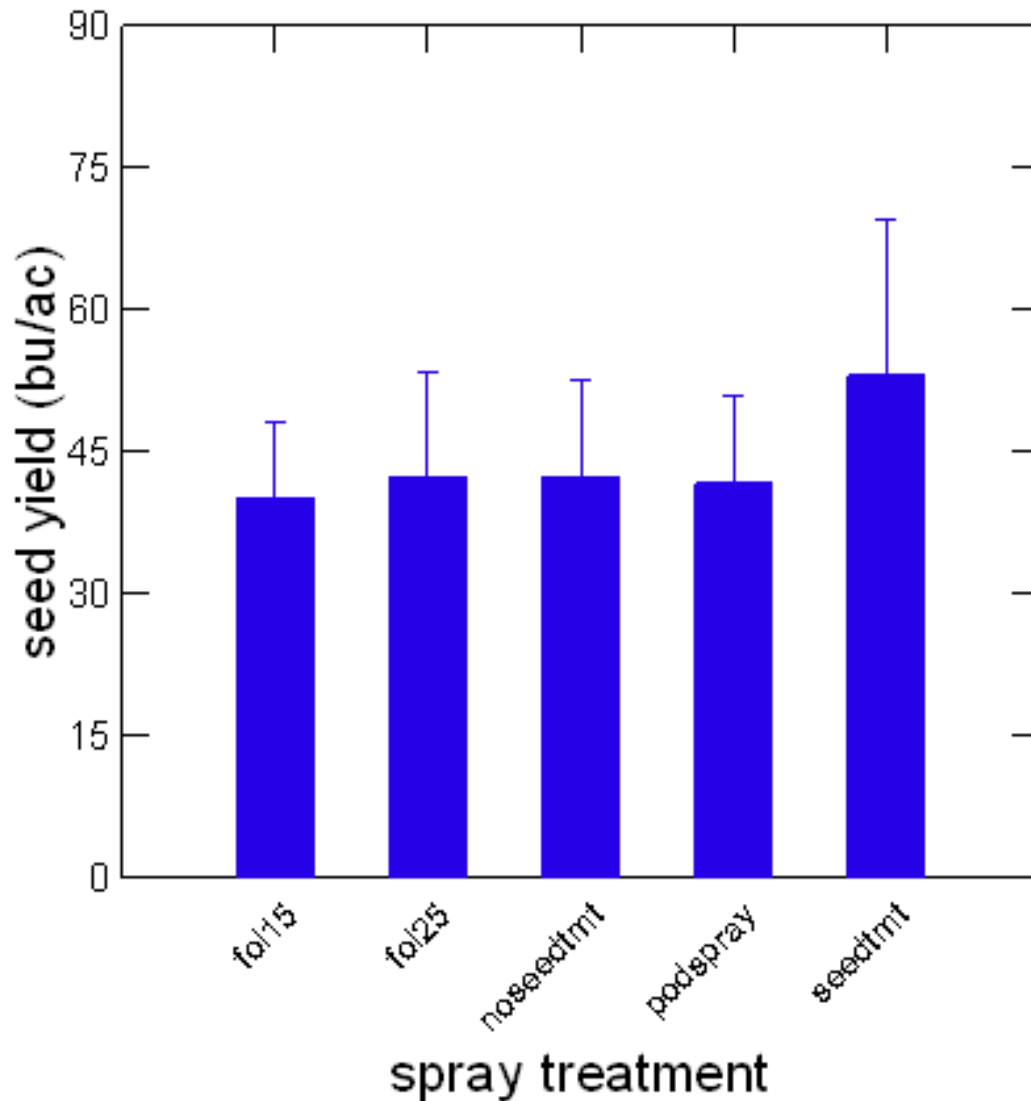
- two species: striped and **crucifer**
- adults overwinter in tree shelters, field margins
- peak activity = damage during hot spring days
- often along edges
- larvae feed on roots
- new adults in July/Aug

Flea beetles - damage



- Canola and oriental/brown mustard most susceptible
- yellow mustard tolerant
- Neonicotinoids protect against crucifer but not striped
- Nominal economic threshold for canola 25 % defoliation used in Canada
- 15-20% in Conrad area
 - Tangtrakulwanich, Reddy et al 2014
- **Kalispell area?**

Current study to validate thresholds



2015 results from Vauxhall, AB
- low damage

No significant differences
But numerically large (10 bushels!)

Seed treatment = Helix Xtra

Few flea beetles at Lethbridge site
and no differences

Sites in Beaverlodge and Manitoba
Will add Saskatoon in 2016

PI: Alejandro Costamagna (U of MB)

IPM - non chemical

- lower damage under reduced tillage
- select large seed - seedling vigor
- plant at higher seeding rates
- in Southern AB plant early
- border management?

Flea beetles - summary

- Currently managed with seed treatments
- Works for crucifer but not striped
- Monitor during cotyledon stage, especially during hot spring days
 - Edges have more damage
 - 10-20 seedlings in five spots,
 - edge and into crop

Flea beetles - summary

- Early seeding recommended in southern Alberta
- Seed at higher densities, large seed and reduce tillage
- Border management, trap crops need research
- Biocontrol? Conservation of predators

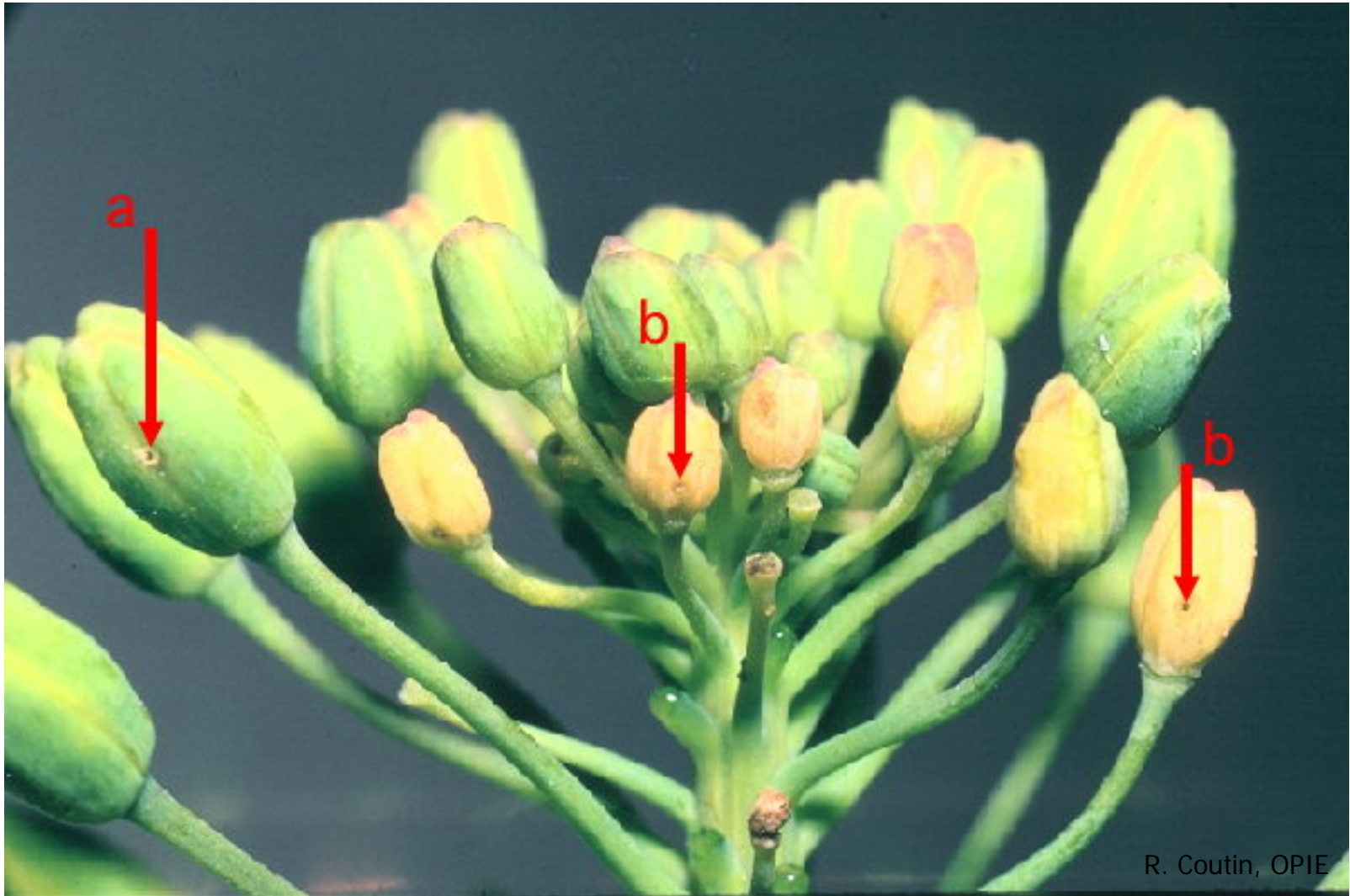


Photo by D. Johnson

Adult on canola flower bud



Bud damage by cabbage seedpod weevil



R. Coutin, OPIE

Female preparing oviposition hole



S. Carré, INRA

Cabbage seedpod weevil egg



S. Carré, INRA

Larva of cabbage seedpod weevil



L. Dossall, AAFRD

Mature cabbage seedpod weevil larva exiting pod



S. Carré, INRA

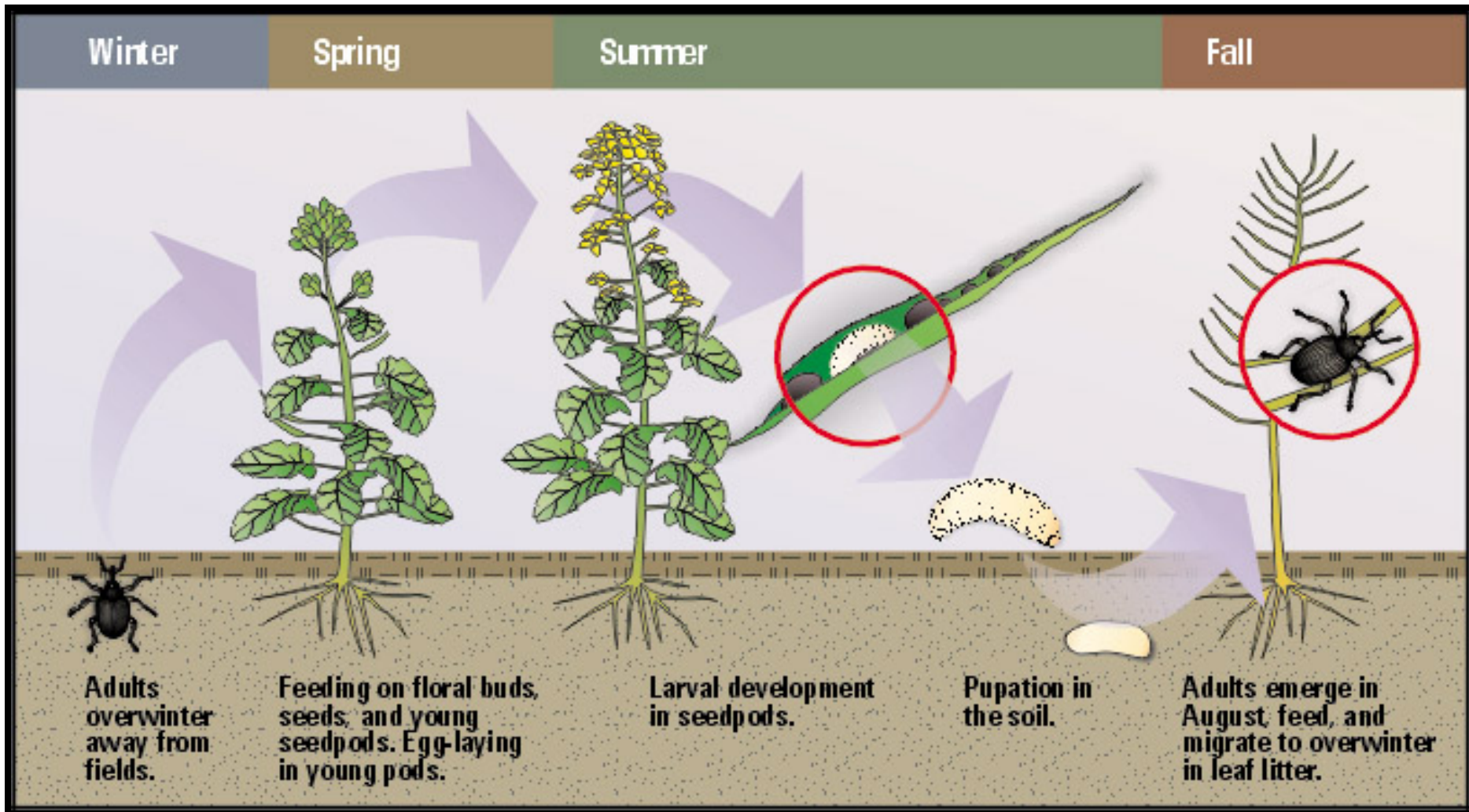
Exit hole produced by larva







Cabbage Seedpod Weevil Life History



Monitoring & Thresholds

- Sampling methods
 - Sweeping considered acceptable monitoring tool
 - Pan traps used for seasonal activity
- Economic threshold
 - Nominal: 3-6/sweep in Pacific North West
 - 2-3 / sweep in Alberta
- Damage
 - Less than 20 % pods with exit holes, below ET
 - Sub-sampling of main, mid and bottom branches ok
-

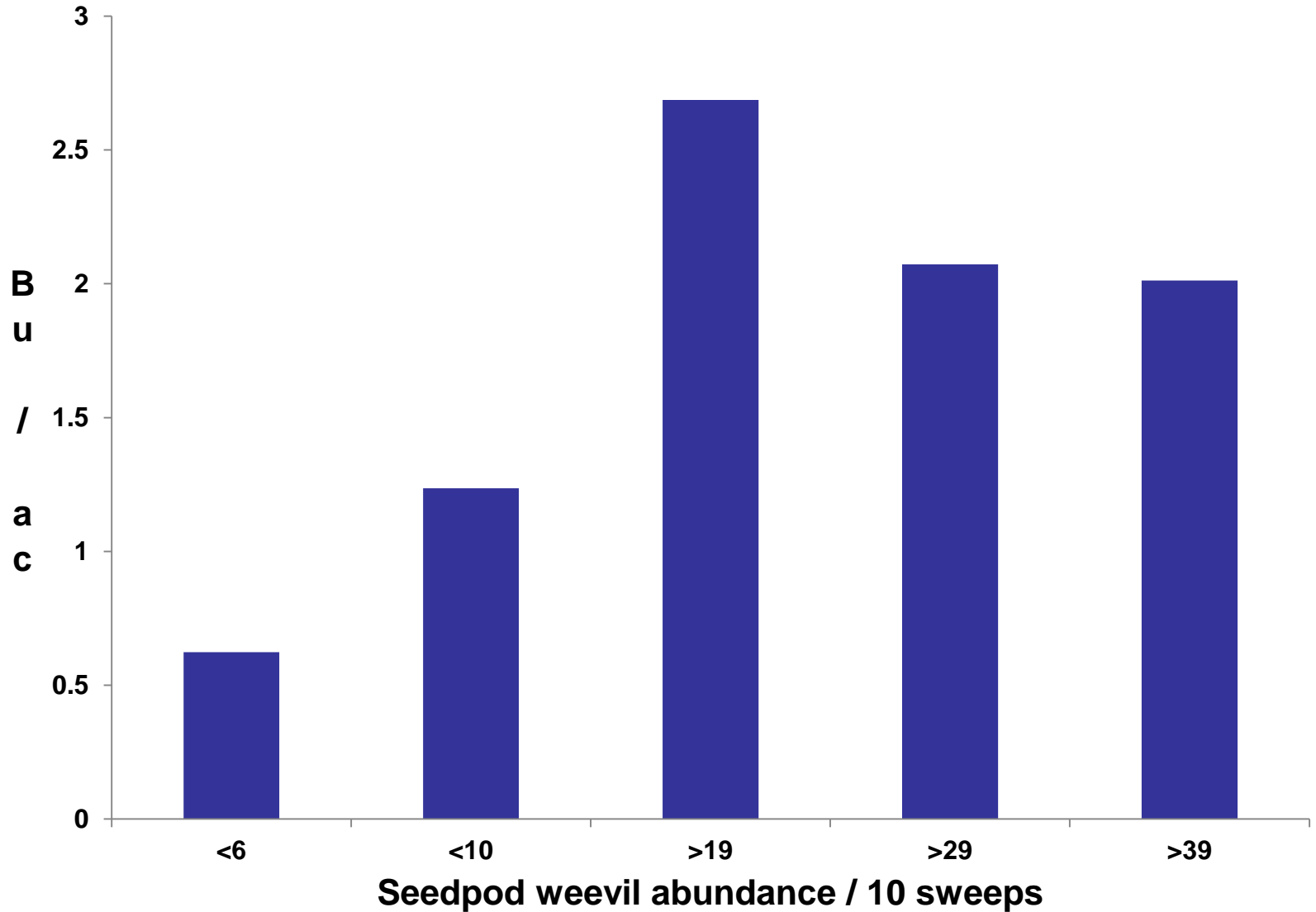
Monitoring with a sweep net

- Early flower to early pod
 - Like 1 inch pods to lay eggs
- 10 sweeps starting at edge towards middle
- Sample border and into the crop (inverted “W” pattern)



- Remove foliage after shaking it into net
- Close net at mid point
- Count weevils as they exit the net
- Repeat at 2-4 sites per field

Yield difference between sprayed and check strips Southern Alberta canola commercial farm study (2010-2013)



Trap cropping

- Concentrate and control insects in small area away from main crop
- most insects have preferences for a host or growth stage
- e.g. CSW attracted to flowering canola
- CSW naturally aggregated along borders during early flower



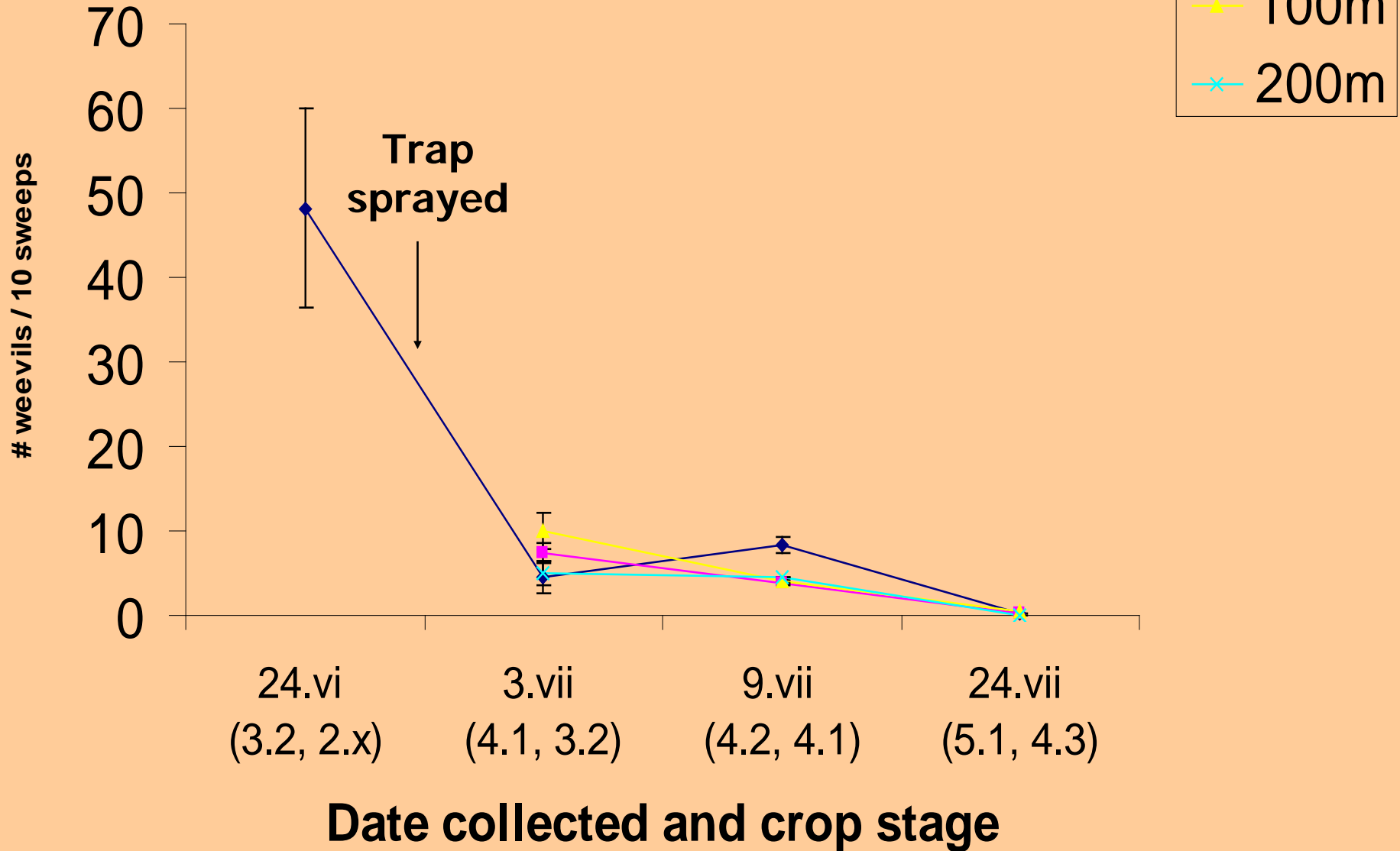
E. Kokko AAFC

Trap crop field - Coalhurst

- Trap - Fall planted, 23 Nov 2001
- Invigour 2573, 80 ft border
- Main crop planted mid May
- Invigour 2573



Trap crop study



Current Management Recommendations

- Monitor weevils at early flower stage (3.3-4.1)
- Sample 5 spots (10 sweeps per spot) along the edge and 5 along middle
- Spray at early flower if more than 4 csw/sweep
- May only need to spray the borders
- Pyrethroid has higher efficacy than OP
- Avoid peak pollinator activity
- Stay tuned for more on economic thresholds
- Consider trap crops, especially for larger square fields or if moderate number of weevils

Common lygus bugs of canola in Alberta

L. keltoni



L. lineolaris



L. borealis



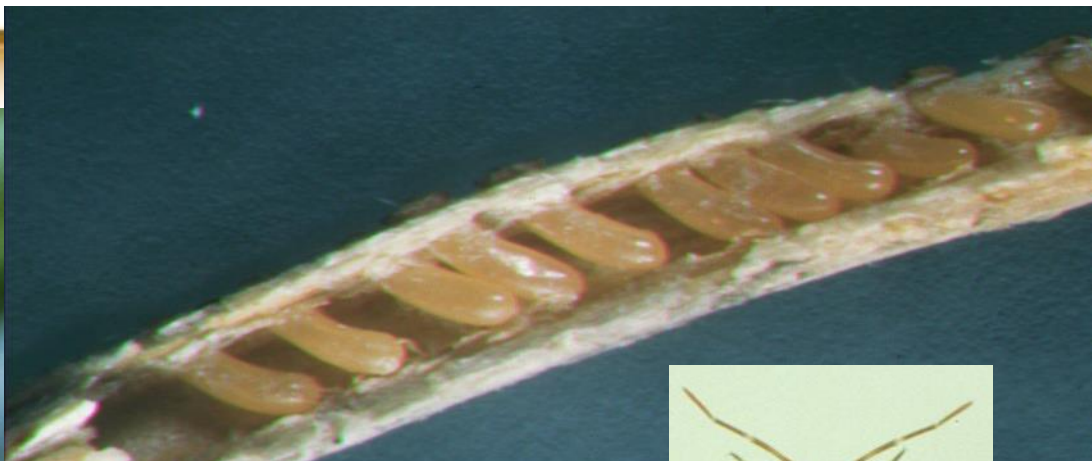
L. elisus



Lygus (Miridae) native plant bugs
tarnished plant bug attacks over 300 plants
from Alaska to Central America

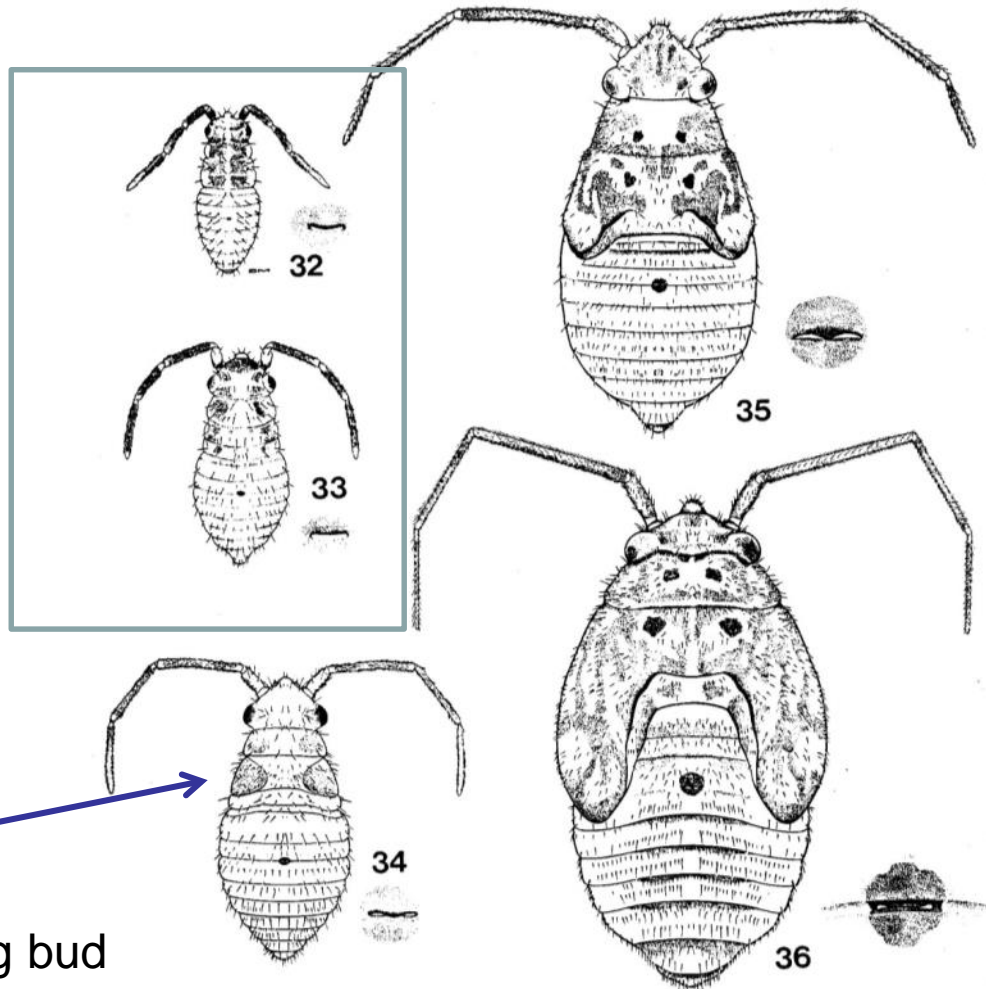


R. Underwood, AAFC



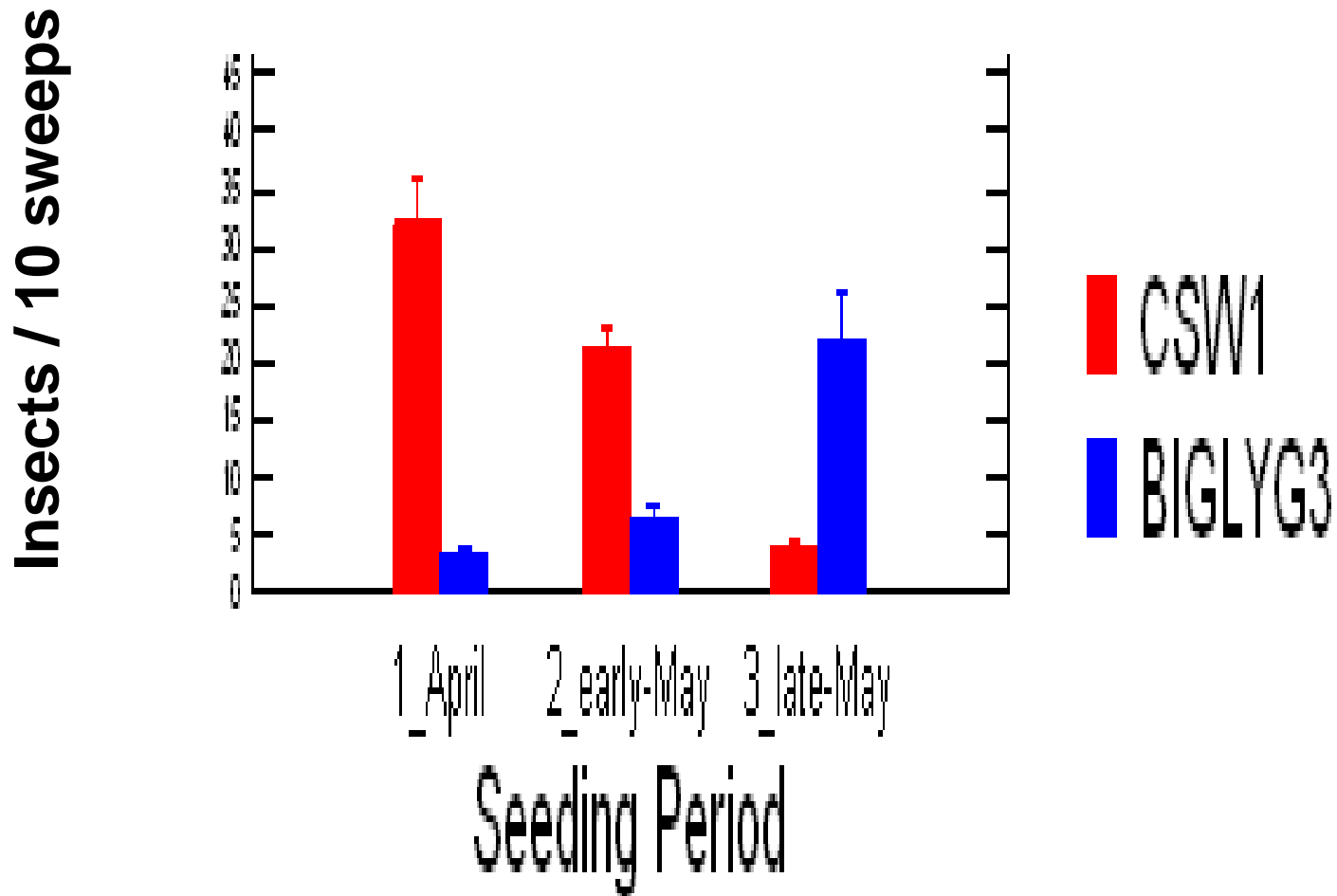
Photos by R. Butts

Small lygus should not damage seeds



Watch for wing bud

Seeding date affects abundance of weevils and lygus

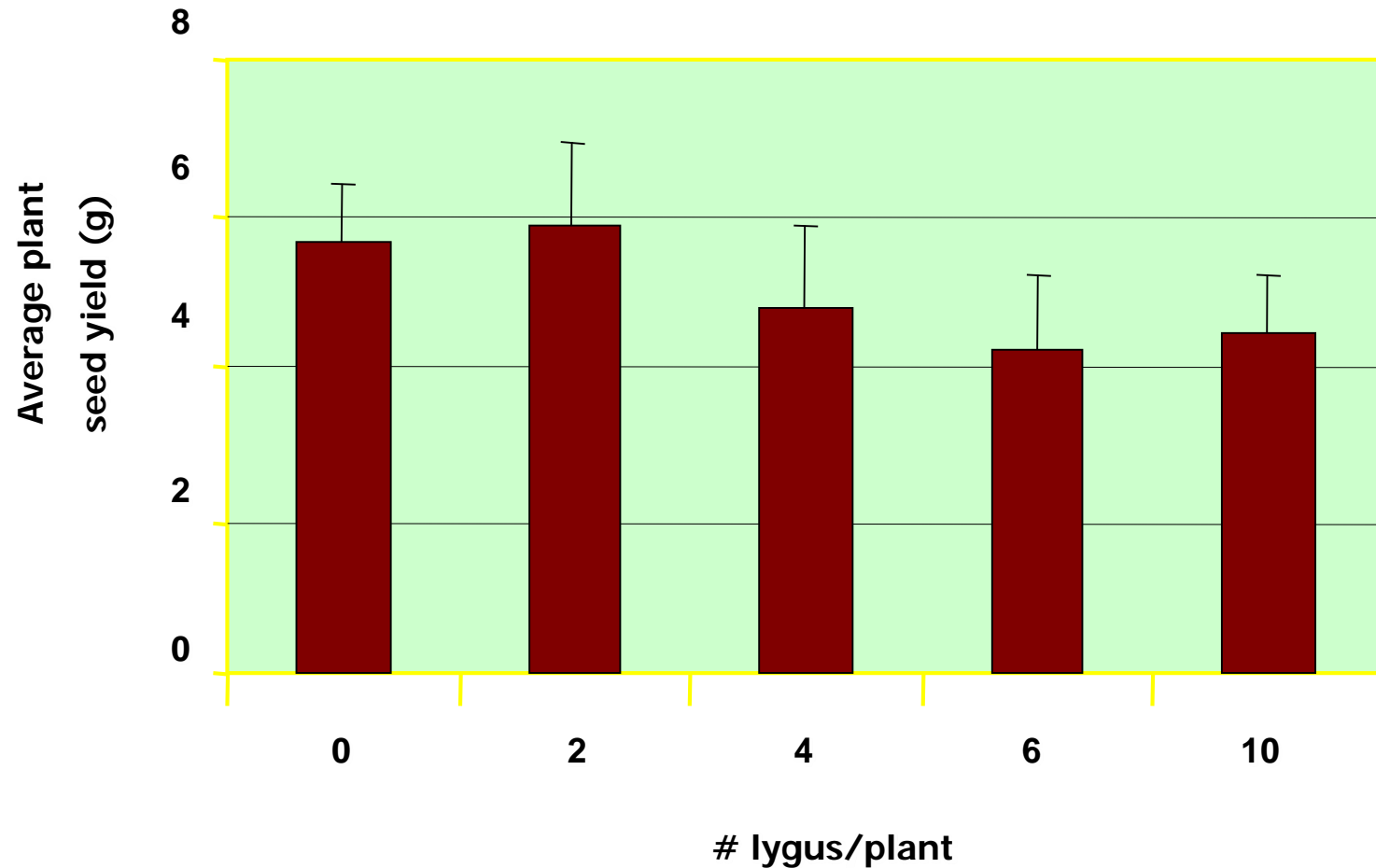


Lygus management

- Insecticides only
- Economic thresholds:
 - 1 per sweep at end of flower to early pod
 - Or 2 per sweep at mid pod
- Developed for conventional cultivars in Manitoba
- Validated in Alberta
- Need to update for new hybrid herbicide tolerant cultivars

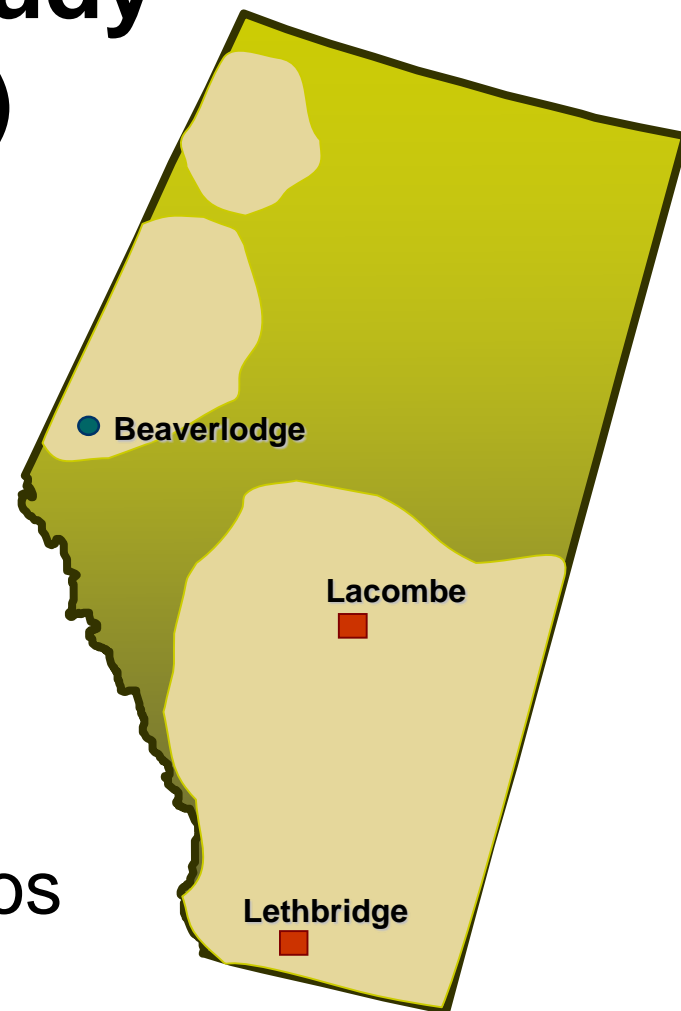


Lygus effects on canola seed weight



Lygus cage study (2012-2015)

- Beaverlodge:
 - Westar, RR and LL
 - 20 adults at late bud stage
- Lethbridge
 - Lygus and weevils
 - Various densities and combos
 - Only LL
 - Added at early flower



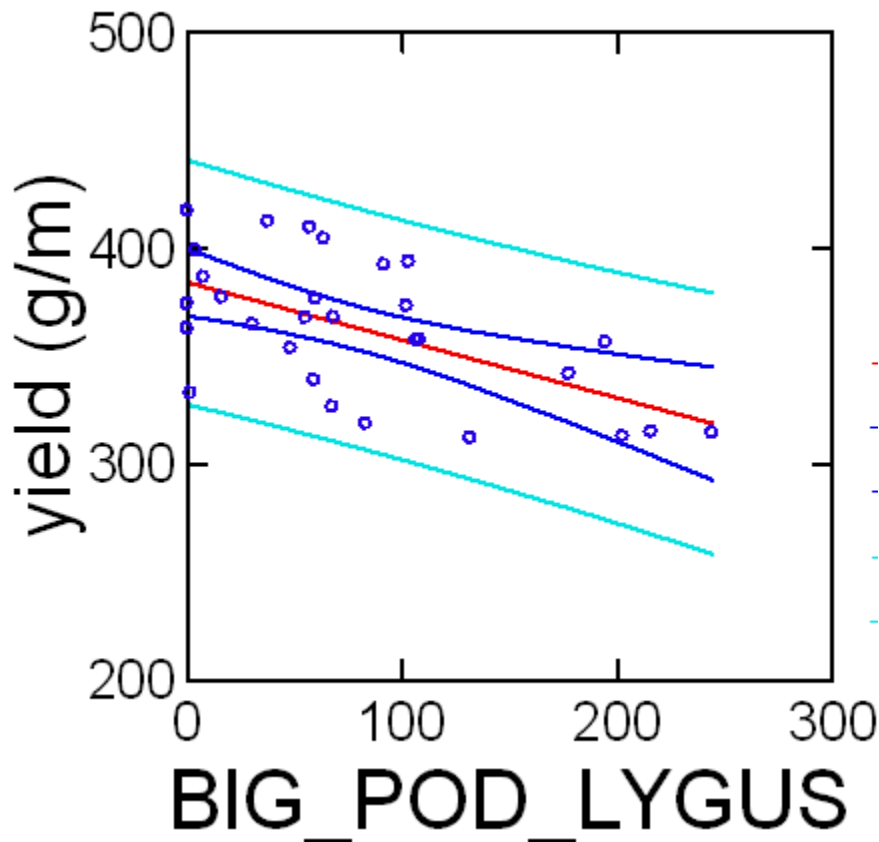
Lacombe study

with Neil Harker et al, 2013-2015

- Lacombe:
 - Westar, RR, LL
 - 0, 4, 10, 20, 40, or 80
 - Added at early flower
 - Lygus species
 - L. keltoni dominant in 2013
 - L. lineolaris in 2014 and 2015
 - Patty added treatment to compare them
 - Hailed made big holes on the cages last year!



Regression of canola yield on lygus for Lacombe, 2013-2014

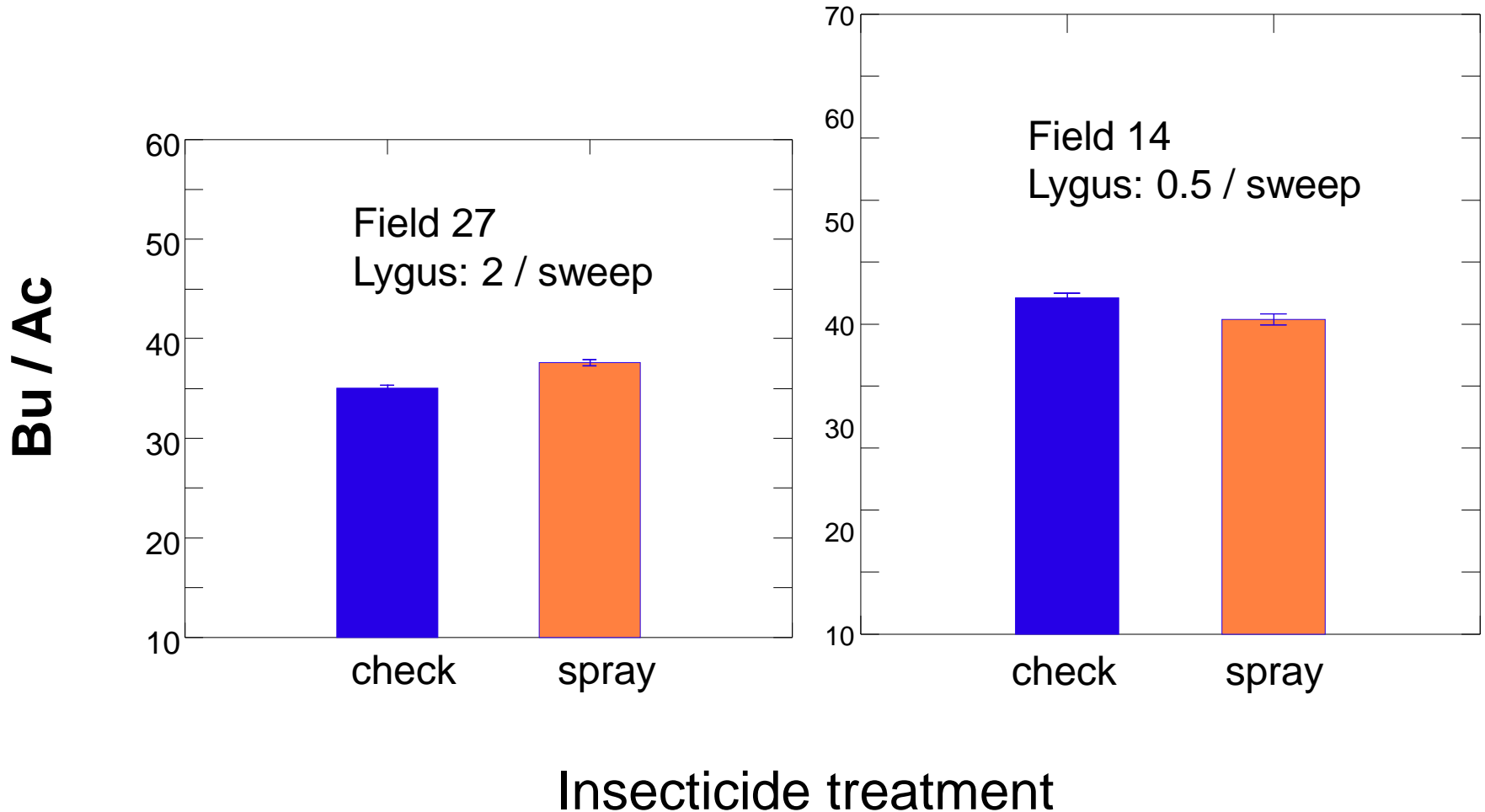


$$R^2 = 0.34^*$$

$$Y = 384.3 - \mathbf{0.27}(x)$$

**ET around 1 to 2 lygus
per sweep!**

2012 combine yields at Riverside lygus effect?

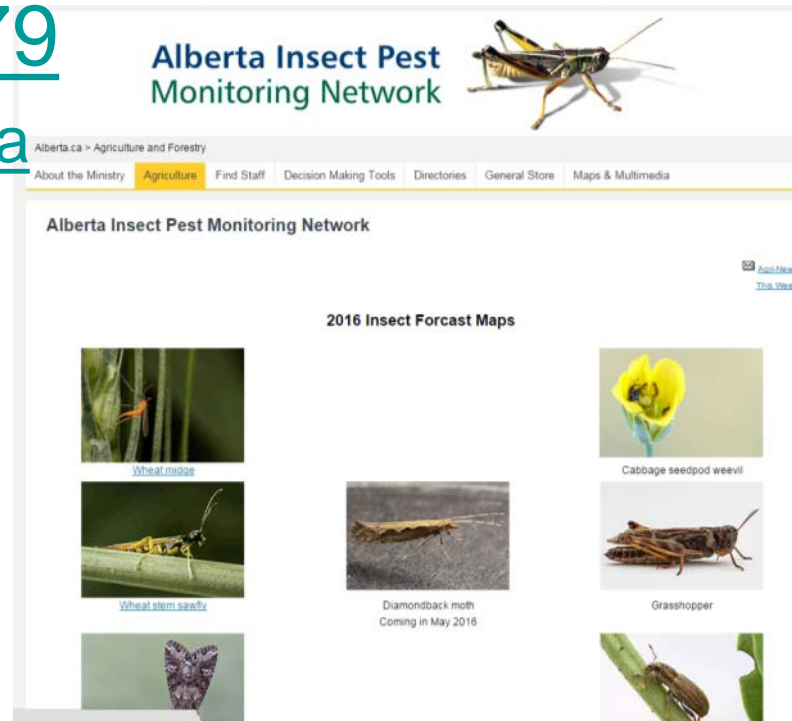


Take home messages

- Scouting and identification of species key to IPM
- Follow economic thresholds, even if nominals
- Only spray if absolutely necessary
- Cultural alternatives? Trap crops?
- Seed early and grow a vigorous crop
 - Better chance to escape insects and tolerate feeding

Other resources

- <http://www.westernforum.org/PPMNMMain.html>
- prairiepestmonitoring.blogspot.ca
- [http://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/prm13779](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/prm13779)
- <http://www.prairiesoilsandcrops.ca>
 - /volume4.php



Acknowledgements

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