Vegetable Crop Management

"Vine Crop Pest Management and Pollinators"

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Wisconsin Crop Management Conference

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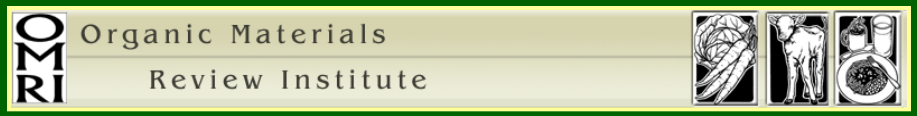
Factors Influencing Insect Pest Management
'Environmental Concerns'

– With increasing affluence reaching the developing world, there will be increasing concerns about pesticide usage and perceived environmental effects.

– This will accelerate the shift to "softer" products and technologies.



Factors Influencing Insect Pest Management
'Food Safety'

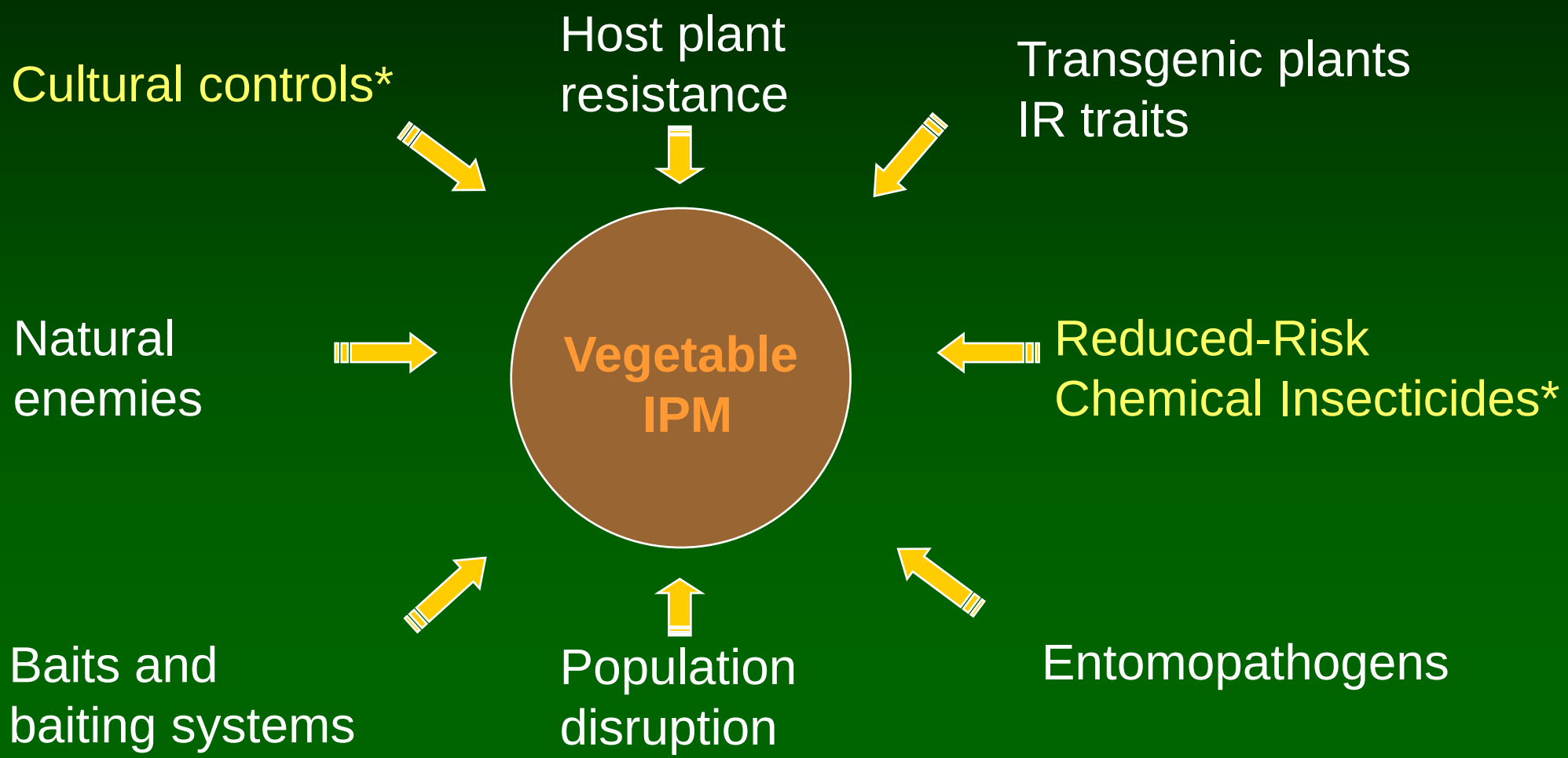
– Major food retailers are setting acceptable residue levels below those set by government regulatory agencies.

"No detectable residues" will be a competitive advantage for food retailers.

– Older insecticides that do not meet these requirements are not being re-registered, resulting in increased use of novel insecticides (bio-pesticides).

Wisconsin Vegetable Pest Management

Options for Insect Pest Management – *More than ever before!*



Research Objectives

- To determine combinations of best management practices to mitigate losses associated with key insect pests of cucurbits including seed corn maggot and cucumber beetles.

- To document the native and domestic pollinator species present in cucurbit crops, and evaluate the impact of selected pest management strategies on pollinators.

Seed corn maggot: Management

Cultural

- Prevent egg laying with row cover
- Speed up germination:

  pre-sprout, mulch, warm soil
- Avoid green manure

Biological

- Predacious soil beetles
- Fungal epidemics

Chemical

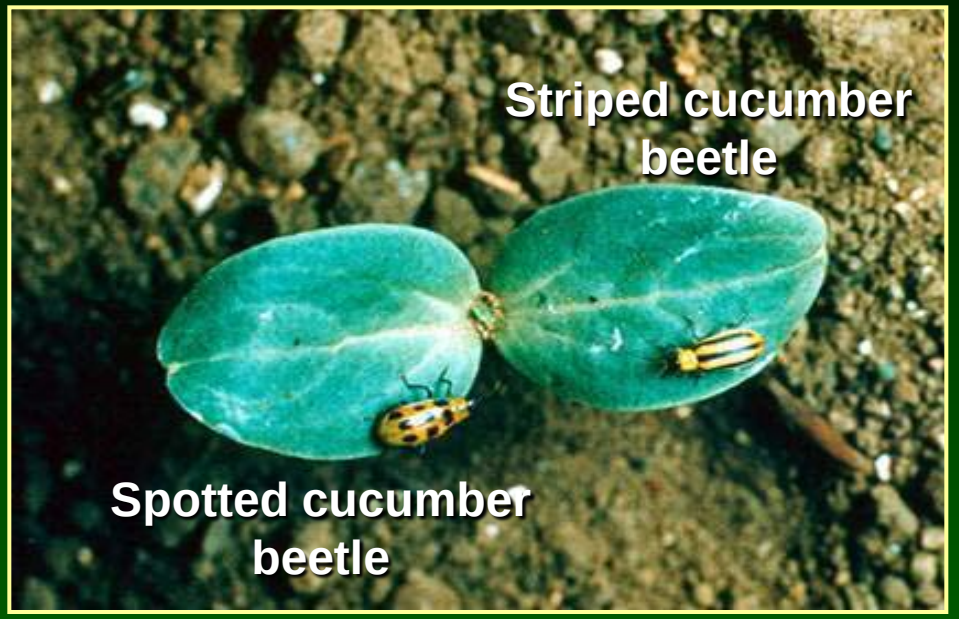
- In-furrow, insecticides (neonicotinoids*, bifenthrin)
- Commercial seed treatments (Lorsban 50W)

*Not registered for target

Striped and Spotted Cucumber Beetles

Lifecycle

- **Adult beetles ca. 1 cm length and 3-4 mm wide**
- **Striped cucumber beetles overwinter in protected areas as adults and become active in mid-spring (late Apr).**
- **Appear early, lay eggs at the base of cucurbits, and have 2 generations / year**
- **Striped is most severe – because it overwinters here!!**



Cucumber Beetle & Seed Maggot Seed Treatment and In-Furrow Trials, 2009

Cultural

- Row cover early
- Transplants
- Trap crops on plastic mulches

Locations / Crops

- Sparta, WI – pumpkin
- Cashton, WI – cucumber
- Westby, WI – cantaloupe
- Tomah, WI – watermelon

Chemical

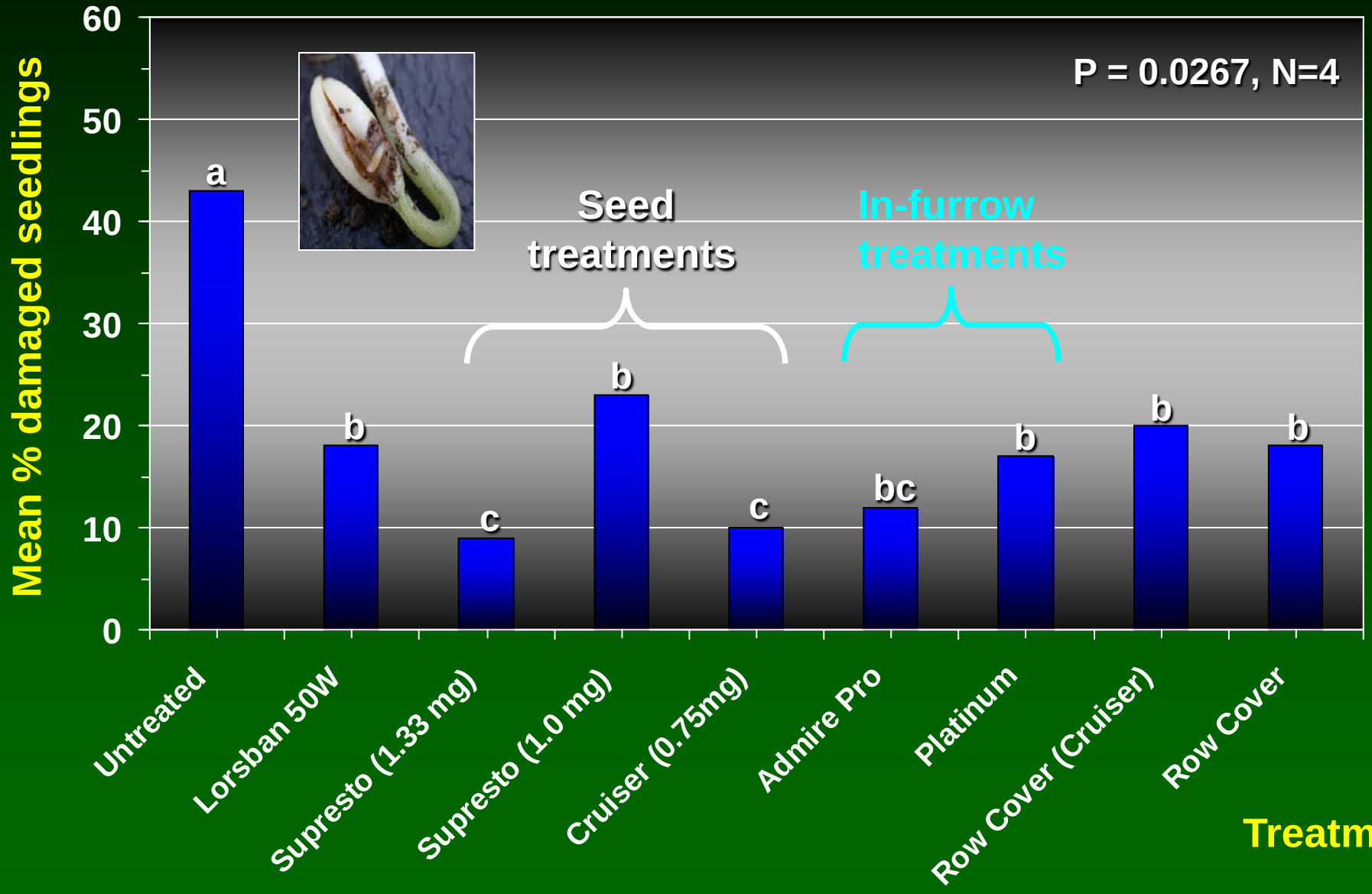
- At-plant , in-furrow systemic (neonicotinoids)
- Seed treatments (new technologies)

Cucumber Beetle & Seed Maggot Seed Treatment and In-Furrow Trials, 2009

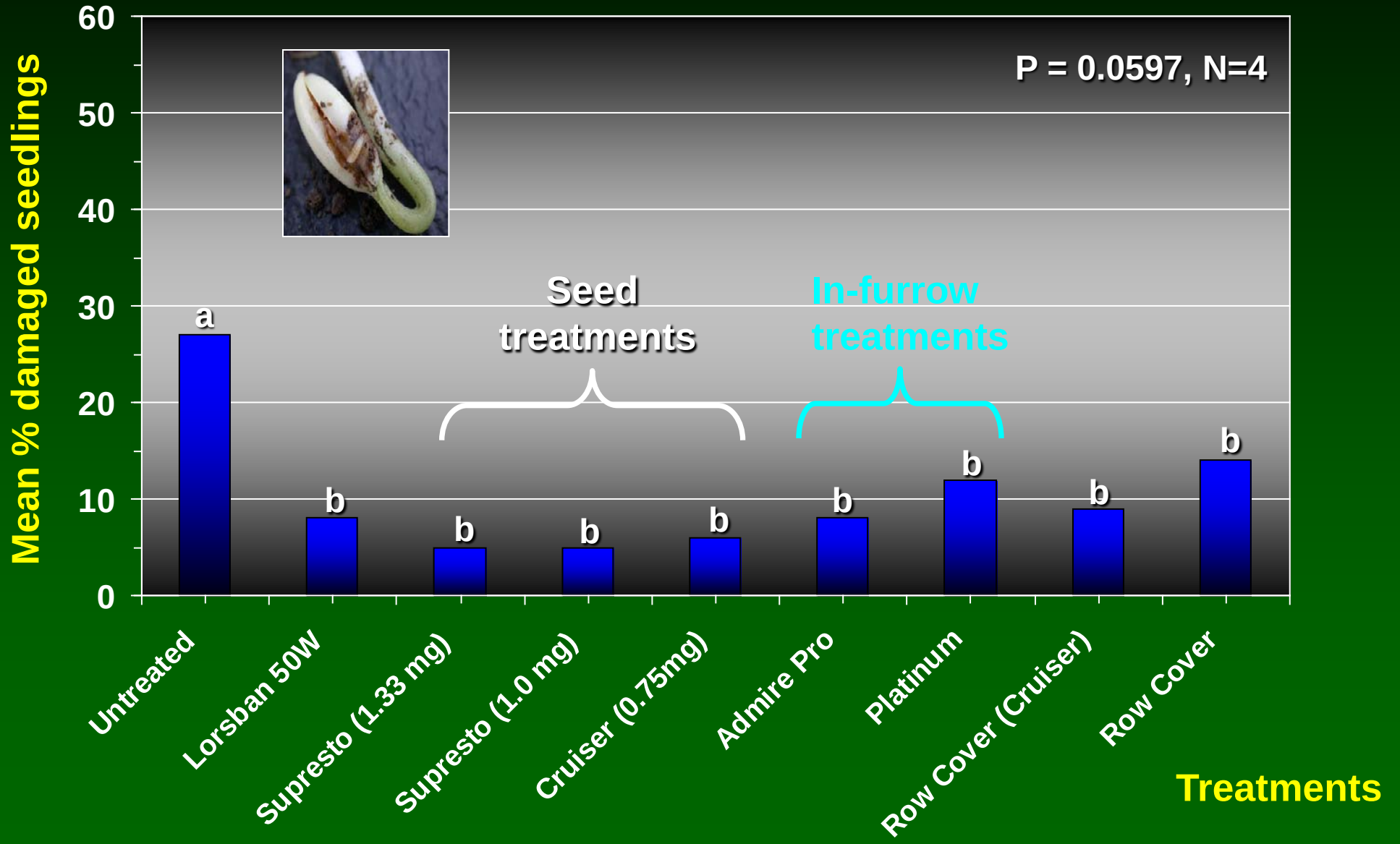
Treatment	Insecticide	Rate	Application Type
1	Untreated control	N/A	N/A
2	Lorsban 50W	2.0 oz / cwt	Seed
			Bayer CropScience
3	clothianadin + imidacloprid	1 mg + 0.33 mg a.i. / seed	Seed
4	(Supresto**)	0.75 + 0.25 mg a.i. / seed	Seed
5	imidacloprid (AdmirePro®)	10.5 fl oz / acre	In-furrow
			syngenta
6	thiamethoxam (Cruiser®)	0.75 mg a.i. / seed	Seed
7	(Platinum®)	11.0 fl oz / acre	In-furrow
8	row cover + thiamethoxam	0.75 mg a.i. / seed	Seed
9	row cover	N/A	N/A

**Note: not currently registered

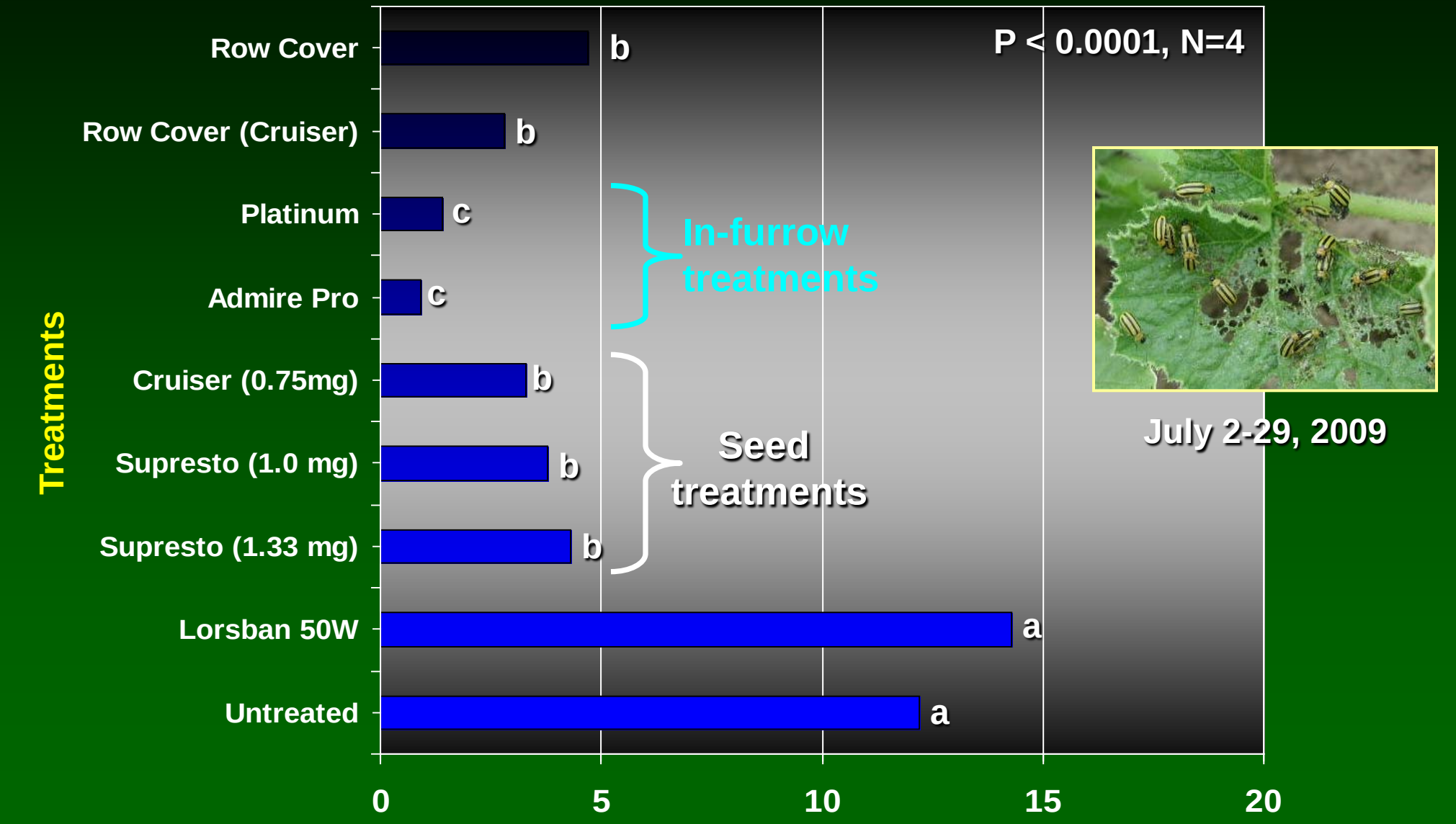
Percent Pumpkin Seedlings Damaged by Seedcorn Maggot Sparta, WI 2009



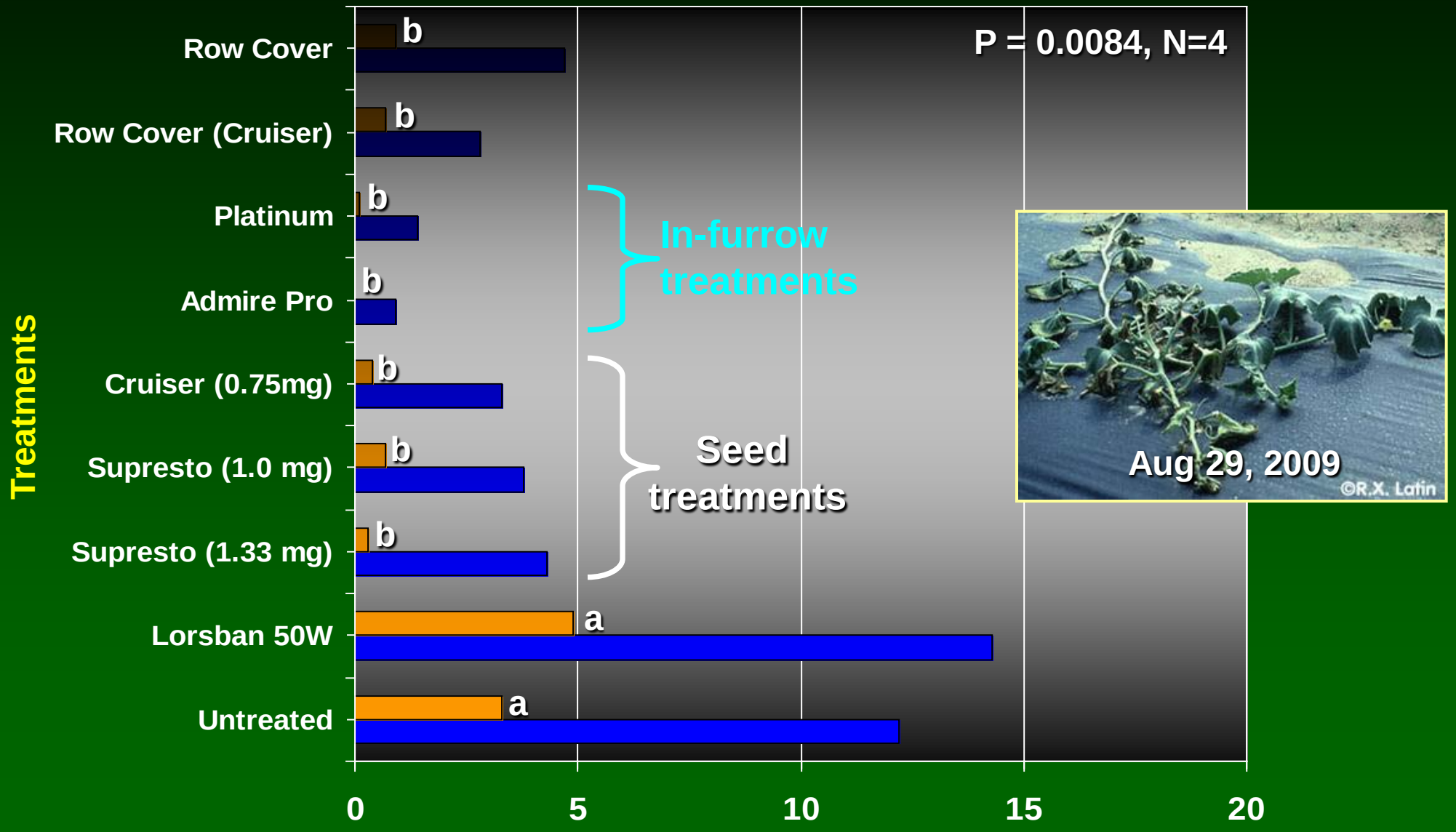
Percent Cucumber Seedlings Damaged by Seedcorn Maggot Cashton, WI 2009



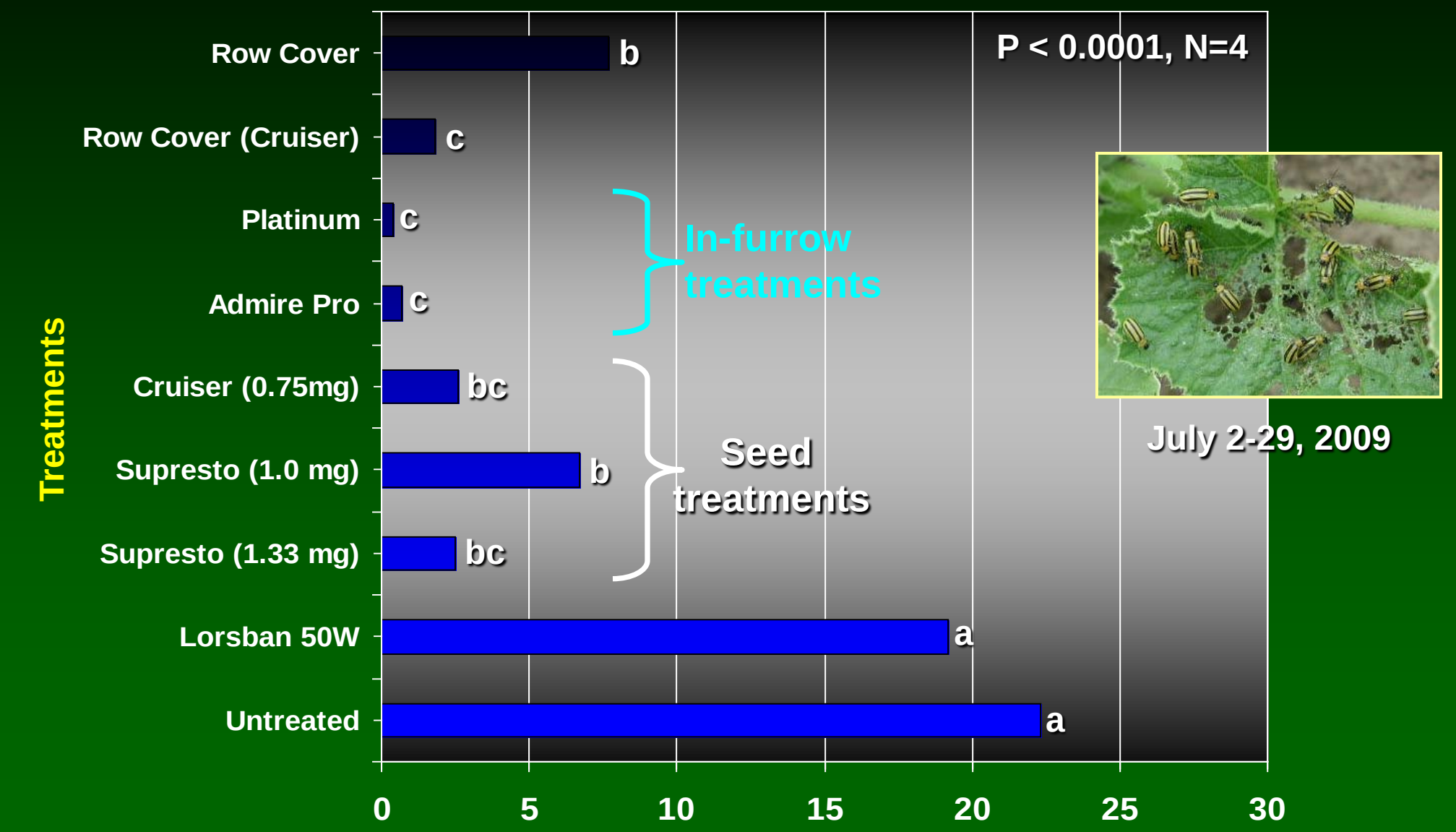
Adult Cucumber Beetles per Pumpkin Plant
Sparta, WI 2009



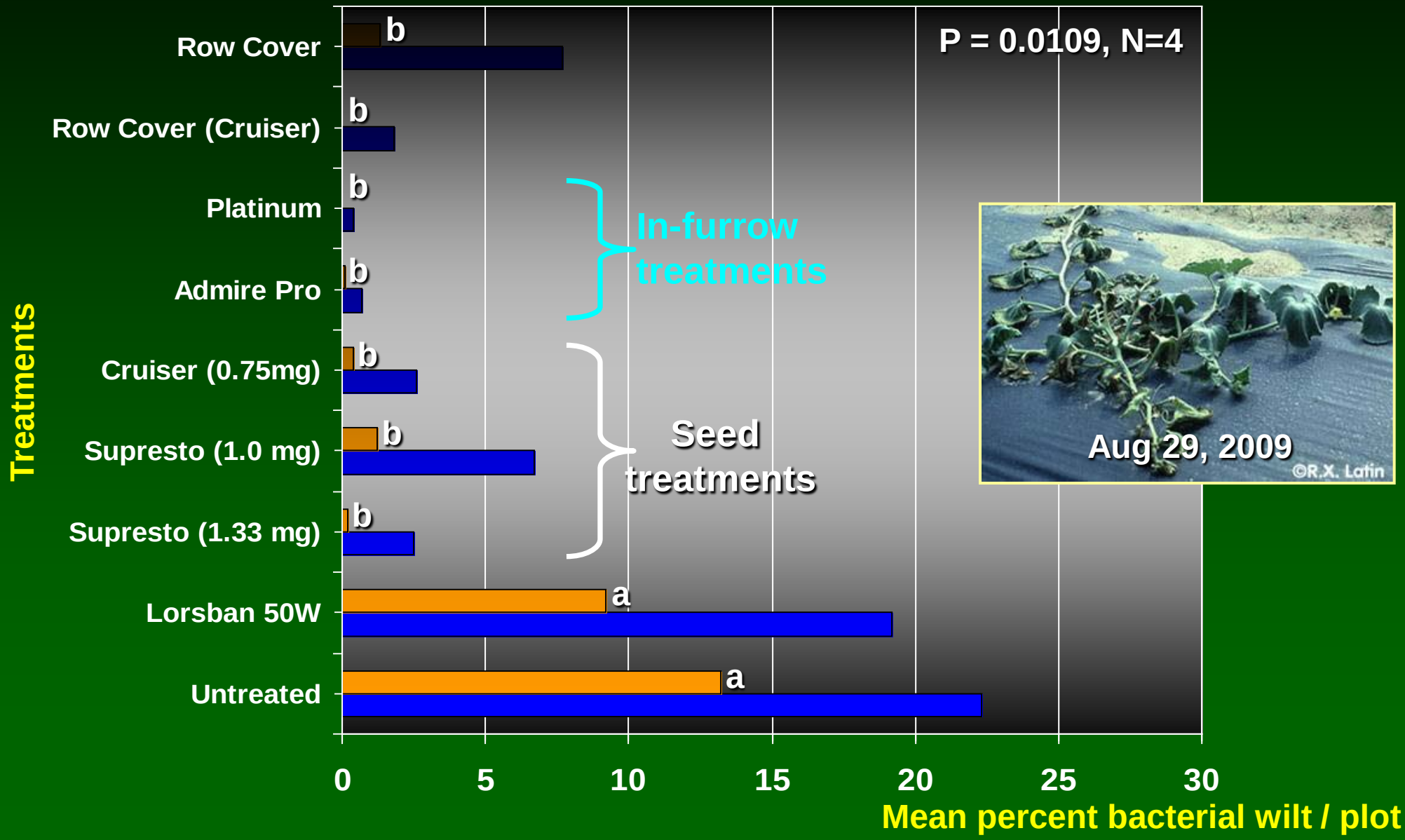
Percent Bacterial Wilt / Pumpkin Plot
Sparta, WI 2009



Adult Cucumber Beetles per Cucumber Plant
Cashton, WI 2009



Percent Bacterial Wilt / Cucumber Plot
Cashton, WI 2009



Cucumber Beetle & Seed Maggot 2009 Summary

- Neonicotinoid seed treatment and in-furrow uses have activity against seedcorn maggot and cucumber beetles
- Lorsban 50W seed treatments effectively controlled seedcorn maggot, but provided no control of cucumber beetles or bacterial wilt
- Neonicotinoid in-furrow uses consistently reduced cucumber beetle populations and lowered final incidence of bacterial wilt in all crops
- Similar patterns in cucumber seed corn maggot and cucumber beetle control were observed in cantaloupe and watermelon.

Can we rely on honeybees to pollinate cucurbit crops??

American Farmland Trust's, 2008 FQPA EPA Region 5 Grant Program

"Sustainable Management Solutions for the Cucumber Beetle – Bacterial Wilt Pathosystem in Wisconsin"

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

Influence of Agricultural Practices on Populations of Native Bees

- To identify the most common native bee species that visit and pollinate cucurbit flowers
- Determine periods during season that dominant bee species are most and least prevalent
- To determine how different types of farming practices and pest management practices affect populations of the most common native bee species

Experimental Sites

- Four, conventionally managed cucurbit fields:

  - Westby, WI (Site #1): cucumber - 0.6 ac, (3.9 ac)
  - Warrens, WI: cantaloupe – 0.3 ac, (1.2 ac) / row cover
  - Cashton, WI: cantaloupe – 0.3 ac, (0.5 ac) / row cover
  - Sparta, WI: pumpkin – 7.0 ac, (8.8 ac)

  ✓ in-furrow, drip tape injections – neonicotinoids

- Two, organically managed cucurbit fields:

  - Westby, WI (Site #2): pumpkin – 0.9 ac, (1.7 ac) / row cover
  - Wilton, WI: cantaloupe – 0.6 ac, (2.4 ac) / row cover

  ✓ foliar protectant combinations – pyrethrum / spinosad / kaolin

Results – Bee Cup Survey

- A total of 3,672 total bees collected, and 93.7% included *A. mellifera, P. pruinosa, and B. impatiens*

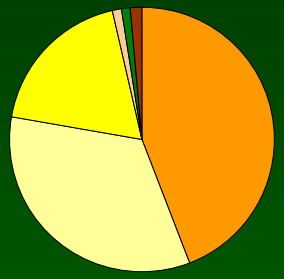
L. leucozonium & *A. sericeus* each constituted ca. 2% captures

Apidae	*Peponapis pruinosa*	Squash bee 38.2% (N=1,314)
	Apis mellifera	Honey bee 44.7% (N=1,538)
	Bombus impatiens	Bumble bee 17.1% (N=588)
	Melissodes bimaculata	Two-spotted miner bee
	Xylocopa virginica	Carpenter bee
Halictidae	*Agapostemon sericeus*	Green sweat bee (N=79)
	Augochloropsis metallica	Metallic green sweat bee
	Lasioglossum leucozonium	Black sweat bee (N=65)
	L. zonulum	Black sweat bee
	Halictus sp.	Black sweat bee
Megachilidae	*Megachile sculpturalis*	Giant resin bee

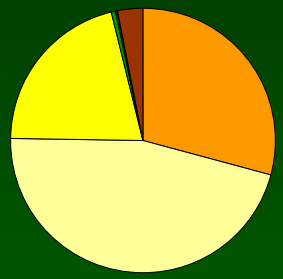
Results – Bee Cup Survey

- **Relative proportions species varied by locations: (P = 0.0271)**
  - **explained by: *A. mellifera, P. pruinosa, and B. impatiens***

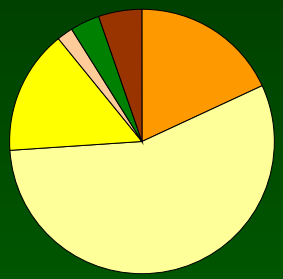
Westby, WI #1
Cucumber
(3.9 acres)



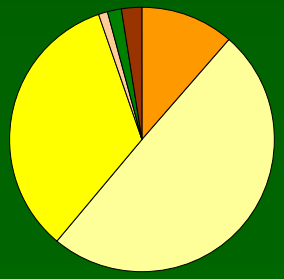
Cashton, WI
Cantaloupe
(0.5 acres)



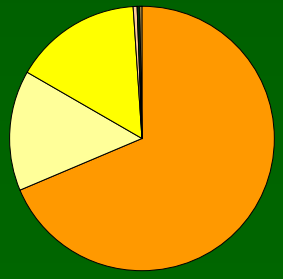
Warrens, WI
Cantaloupe
(1.2 acres)



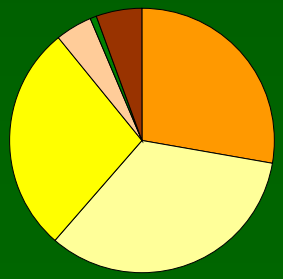
Westby, WI #2
Pumpkin
(1.7 acres)



Sparta, WI
Pumpkin
(8.8 acres)

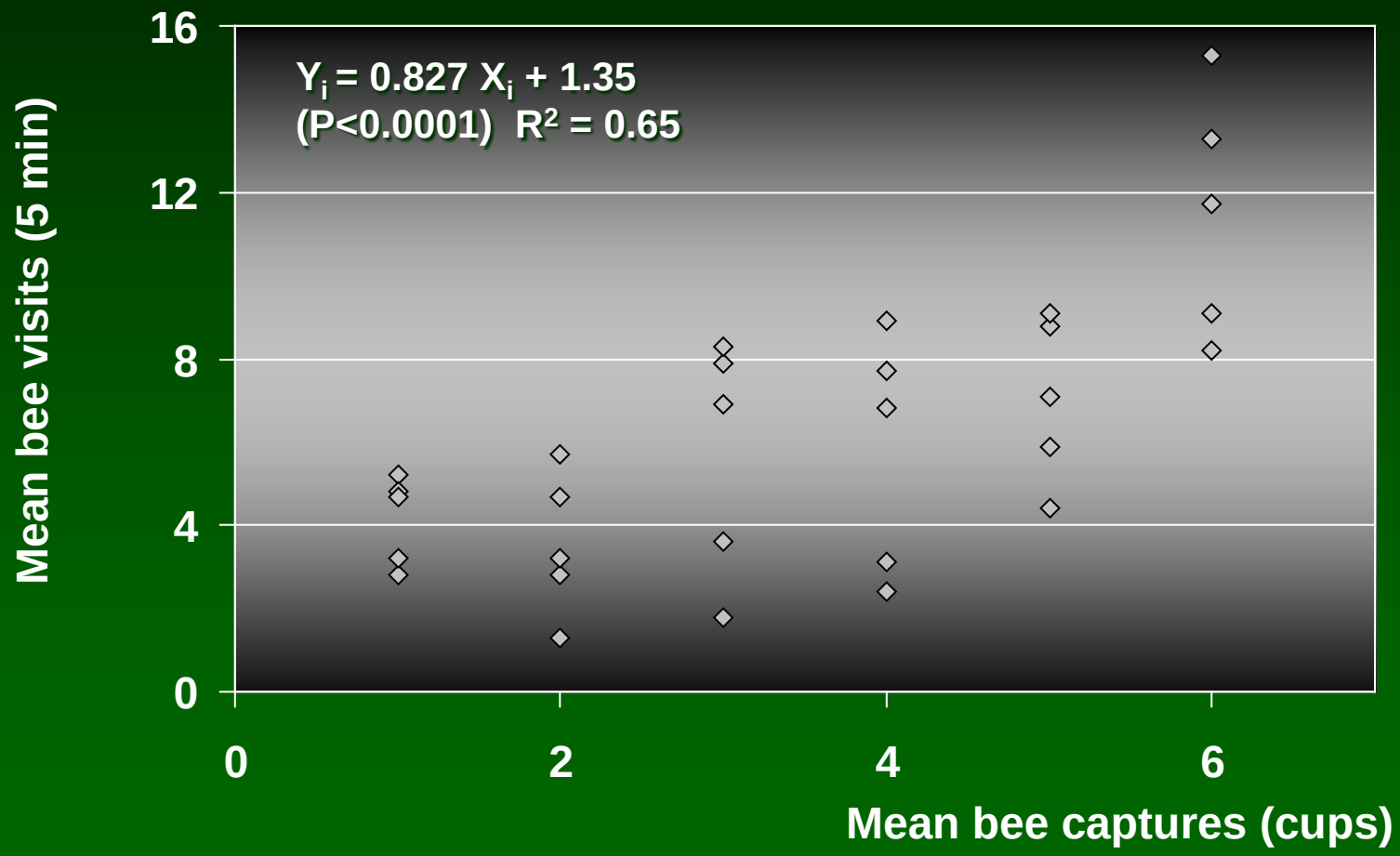


Wilton, WI #2
Cantaloupe
(2.4 acres)

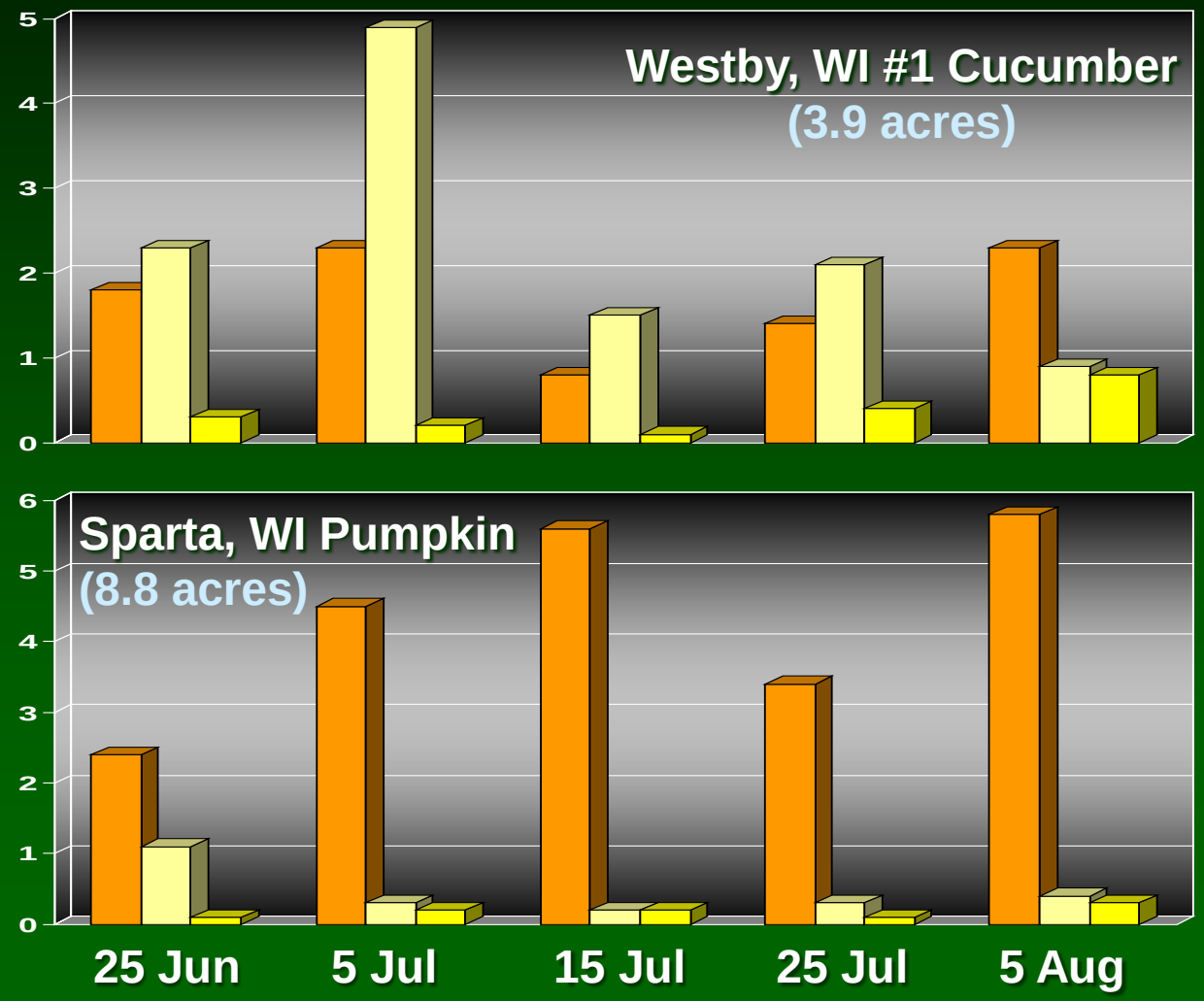


- ***A. mellifera***
- ***P. pruinosa***
- ***B. impatiens***
- ***L. leucozonium***
- ***A. sericeus***
- **Other**

Results – Relationship of Cup Captures and Bee Visitation Counts – All species



Results – Seasonal Occurrence of Native and Domestic Pollinators



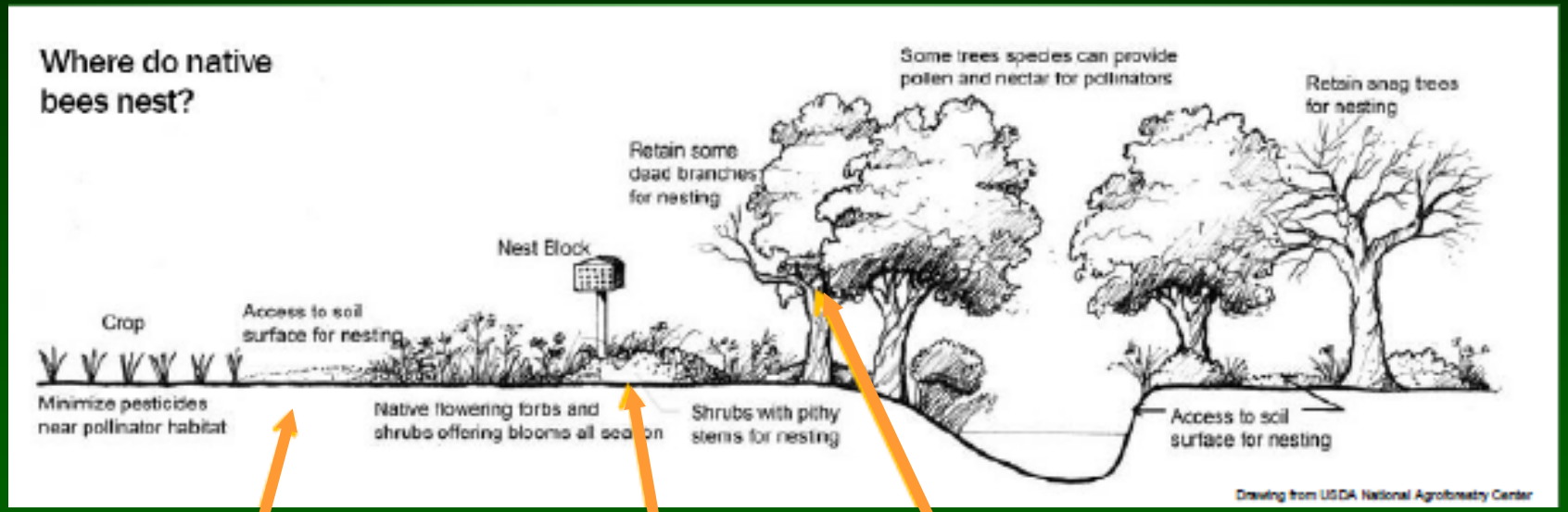
squash bee

- *A. mellifera*
- *P. pruinosa*
- *B. impatiens*

honey bee

Results – Bee Nesting Habitat Southwestern Wisconsin

- Nesting habitat for stem-, cavity- and ground-nesting bees:



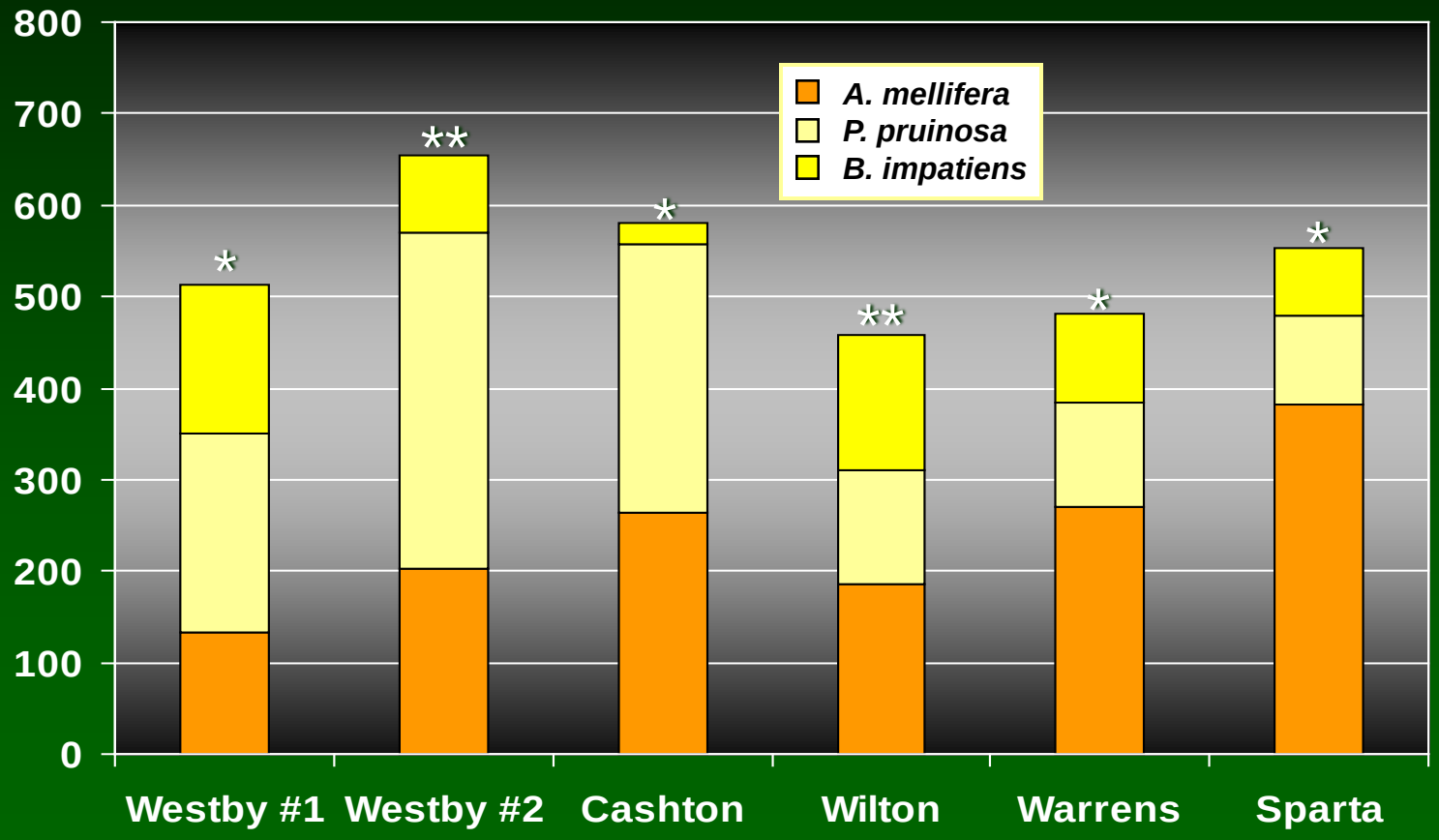
Squash bee nesting habitat (bare soil)

Bumble bee nesting habitat (undisturbed meadows)

Honey bee nesting habitat (tree cavities)

Results – Abundance and Pollination Efficiency

- Observed numbers of bees per site, 2009



* Convention management
** Organic management

Native and Domestic Pollinators Summary

- In 2009, squash bees, honey bees, and bumble bees were the most abundant bee pollinators in our study areas.

- Relative proportions of bees varied among sites, but *A. mellifera* abundance related to field size.

- Bee captures in cup traps well correlated with visitation surveys in fields – exception was *B. impatiens*.

- Bee abundance trended towards management tactics – organic vs. conventional practices / tillage practices.

- *Apis mellifera* abundant in the local environment

Future Research

- Refine rates, delivery systems, and integrated control programs for cucurbit pest management.
- Investigate new chlorantraniliprole and cyantraniliprole technologies, especially as seed and soil treatments
- Repeat experiments in 2010 to confirm proportions of native bee species present in cucurbit production
- Develop and refine plant lists for pollinators and test project specifications with cooperating growers / producers, NRCS, and the Xerces Society.

Acknowledgements

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