

Canada Thistle Research Update

ND Agriculture Commissioner's Weed Forum

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Overview



- Canada thistle biology
- Control options-IWM
- Research results
 - *H. litura* weevil release sites
 - Integrated management of Canada thistle combining biological control with other approaches
- Summary and Conclusion

Canada Thistle Biology



- Perennial, reproduces via seed and adventitious root buds
- Extensive and deep creeping root system
- Large range of habitats
- Grows well in moist areas and cooler climates
- Can spread 10-12 feet per year
- Vegetative buds can form 7-8 after germination

Canada Thistle Economic Damage

- Crop yield loss
 - Competition, alfalfa loss 50%
- Rangeland infestation
 - Deters livestock grazing
 - Outcompetes desirable plants
- Noxious weed
 - North Dakota-1 million acres
 - South Dakota
 - Minnesota
- Expensive to control



Control Methods

- Mechanical
 - Mowing and grazing
- Chemical
 - 2,4-D, clopyralid, dicamba, aminopyralid, glyphosate, picloram
- Biological
 - 78 identified, many eliminated
 - Closely related native thistles
- Integrated Weed Management



Biological Control

- *Hadroplontus*
(*Ceutorhynchus*) *litura*
- Native to Europe
- Adults feed on foliage
- Larvae feed within stems, mine pith but not vascular tissue



Feeding Damage



Plant Competition



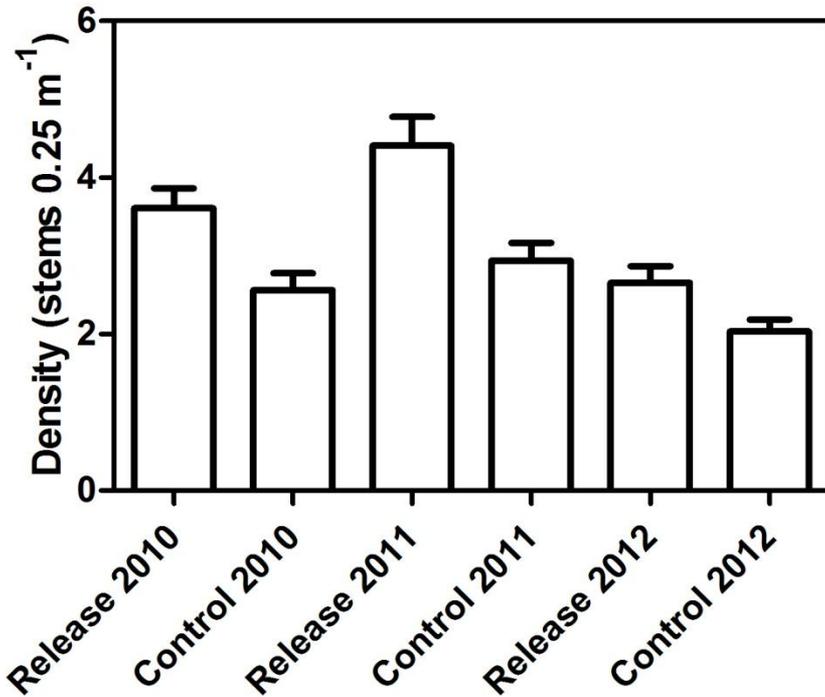
- Canada thistle spreads easily on disturbed soils
- Adding competitive desirable vegetation may deter proliferation
- Adjacent plants compete for resources such as water, nutrients, and light

H. litura Release Study

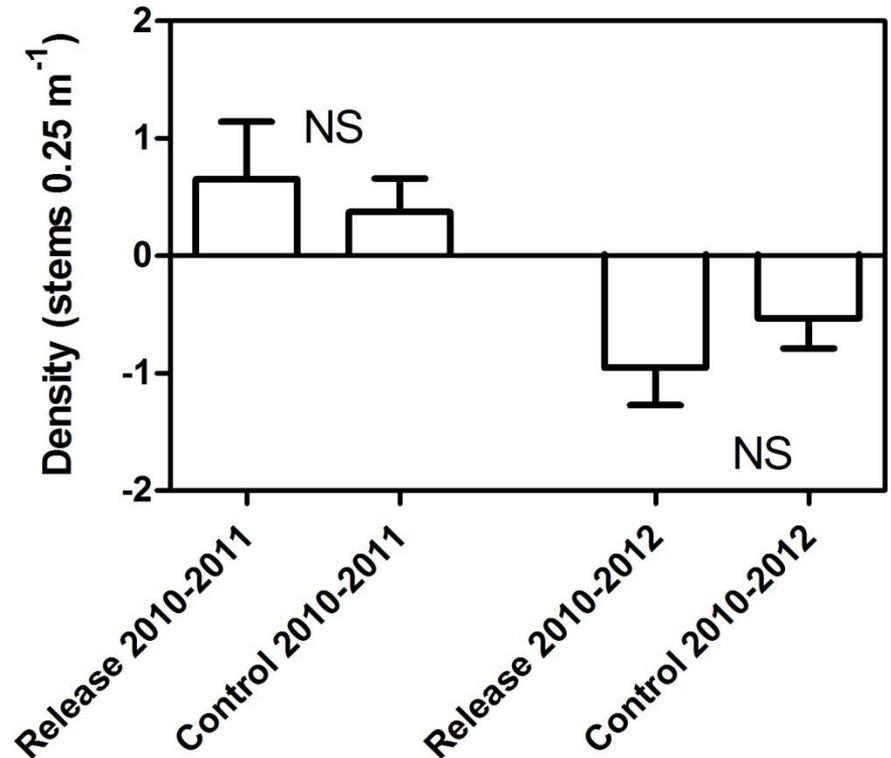
- Casual observations of thistle decline may be caused by many factors
- Need to observe thistle density change in plots with and without weevils
- Two sites: Magnolia and Alice ND WMAs
- Weevils released September 2010
- Thistle densities counted 2010, 2011, 2012
- Weevil larvae sampled in 2011 and 2012

Alice WMA Thistle Density

Thistle stem density, Alice WMA



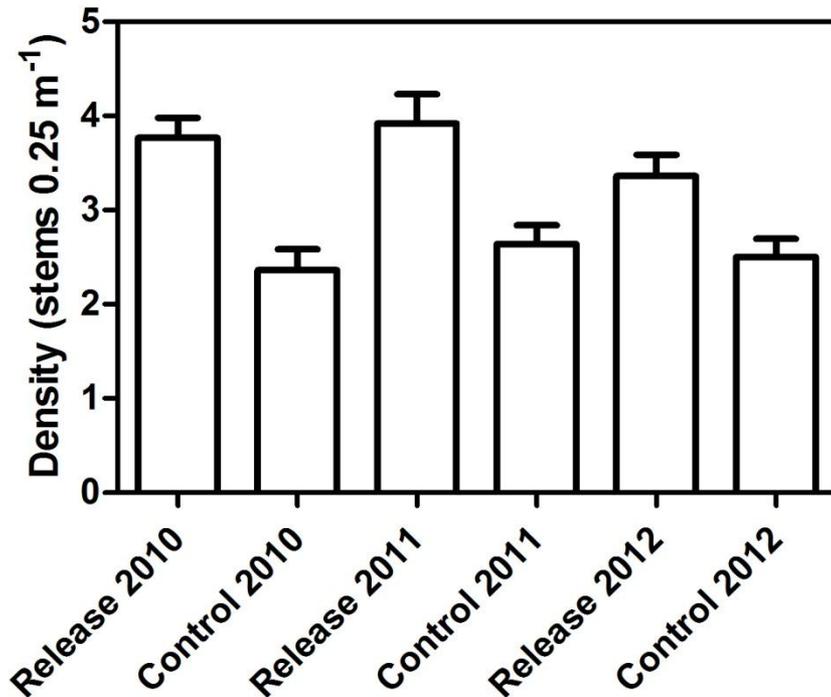
Thistle density change, Alice WMA



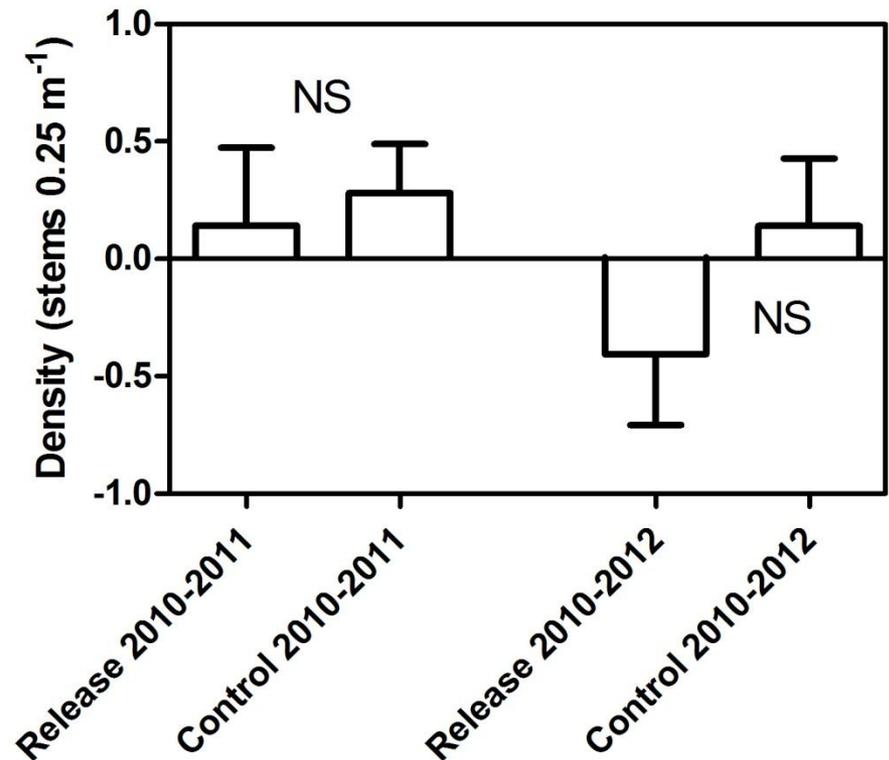
Treated plots – 3.5/20 stems with larvae in 2011, 1.75/20 stems with larvae in 2012
Control plots – No larvae were detected during 2011 and 2012

Magnolia WMA Thistle Density

Thistle stem density, Magnolia WMA



Thistle Density Change, Magnolia WMA



Treated plots – 7.25/20 stems with larvae in 2011, 0/20 stems with larvae in 2012
Control plots – 0.25/20 stems with larvae in 2011, 0/20 stems with larvae in 2012

Take-Home Messages

- Even though weevils were present in 2011, only increases in thistle densities were noted, both in release and control plots.
- Weevil populations crashed after the winter of 2011-2012.
- Minor reductions in thistle densities were observed in 2012, but declines did differ between treated and control plots.

Integrating Weevil Herbivory, a Native Cover Crop, and Soil Nutrients for Canada Thistle (*Cirsium arvense* L.) Control



Objective

Determine the effects of integrating *Hadroplonutus litura* and a native cover crop (*Helianthus annuus* L.) on Canada thistle growth and reproductive output



Methods

- Microcosm experiments
 - Established outdoors 2010/2011
 - 19-L plastic containers filled with sandy loam field soil
 - Canada thistle grown from single-ecotype root cuttings
- RCBD, four replicates, three factorial treatments
 - Weevil presence vs. absence
 - Cover crop presence vs. absence
 - High soil nutrients vs. low soil nutrients

Experimental Procedures

Cover Crop/Soil Nutrient Treatments

- Native common sunflower transplanted into microcosms with Canada thistle
- High soil nutrients (142 kg ha⁻¹ N, 55 kg ha⁻¹ P, 179 kg ha⁻¹ K)
- Low soil nutrients (60 kg ha⁻¹ N, 15 kg ha⁻¹ P, 132 kg ha⁻¹ K)



Experimental Procedure

H. litura Treatment

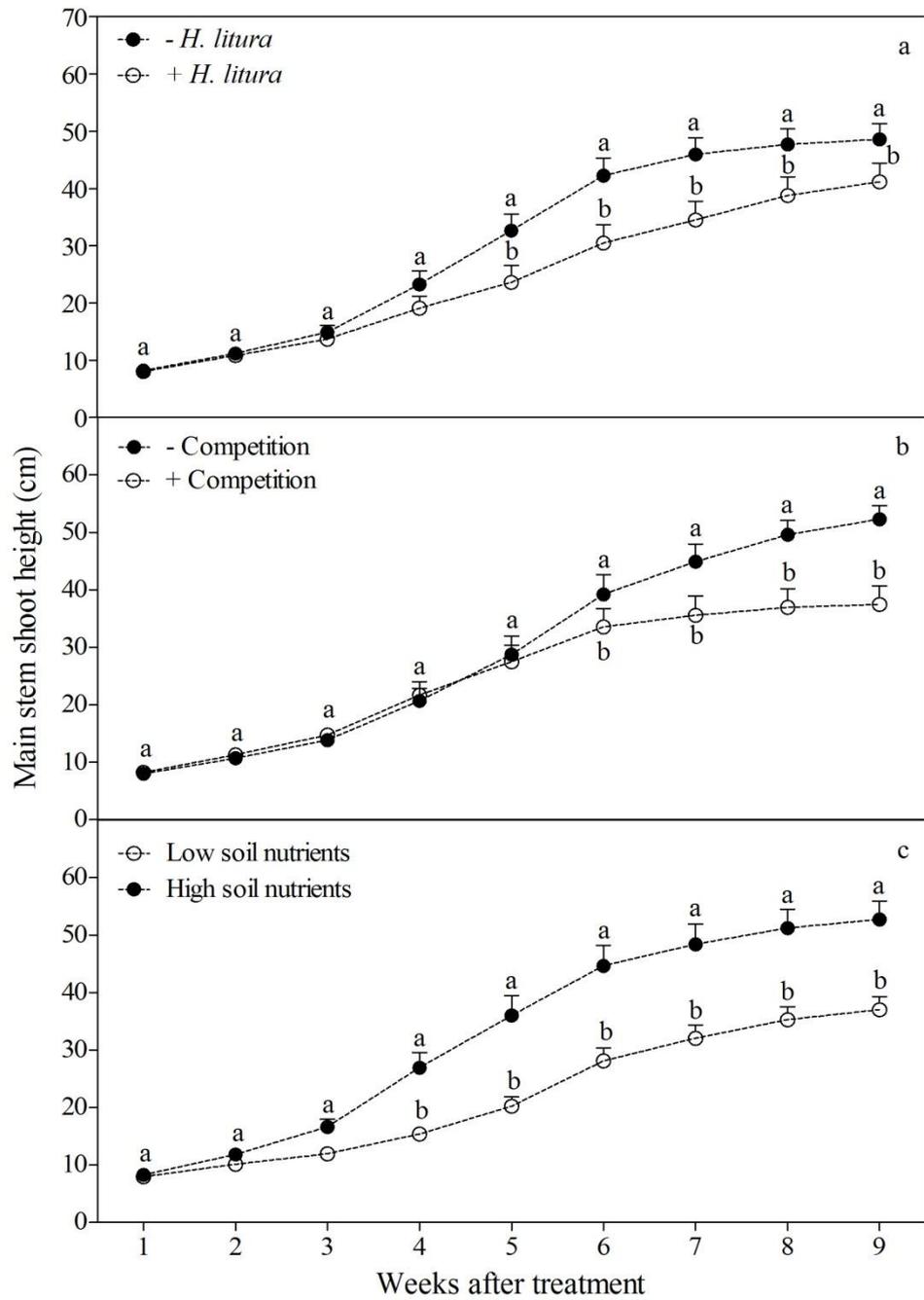
- Weevil presence vs. absence
- 10 adults
- Attack duration 7 d
- Caged during attack

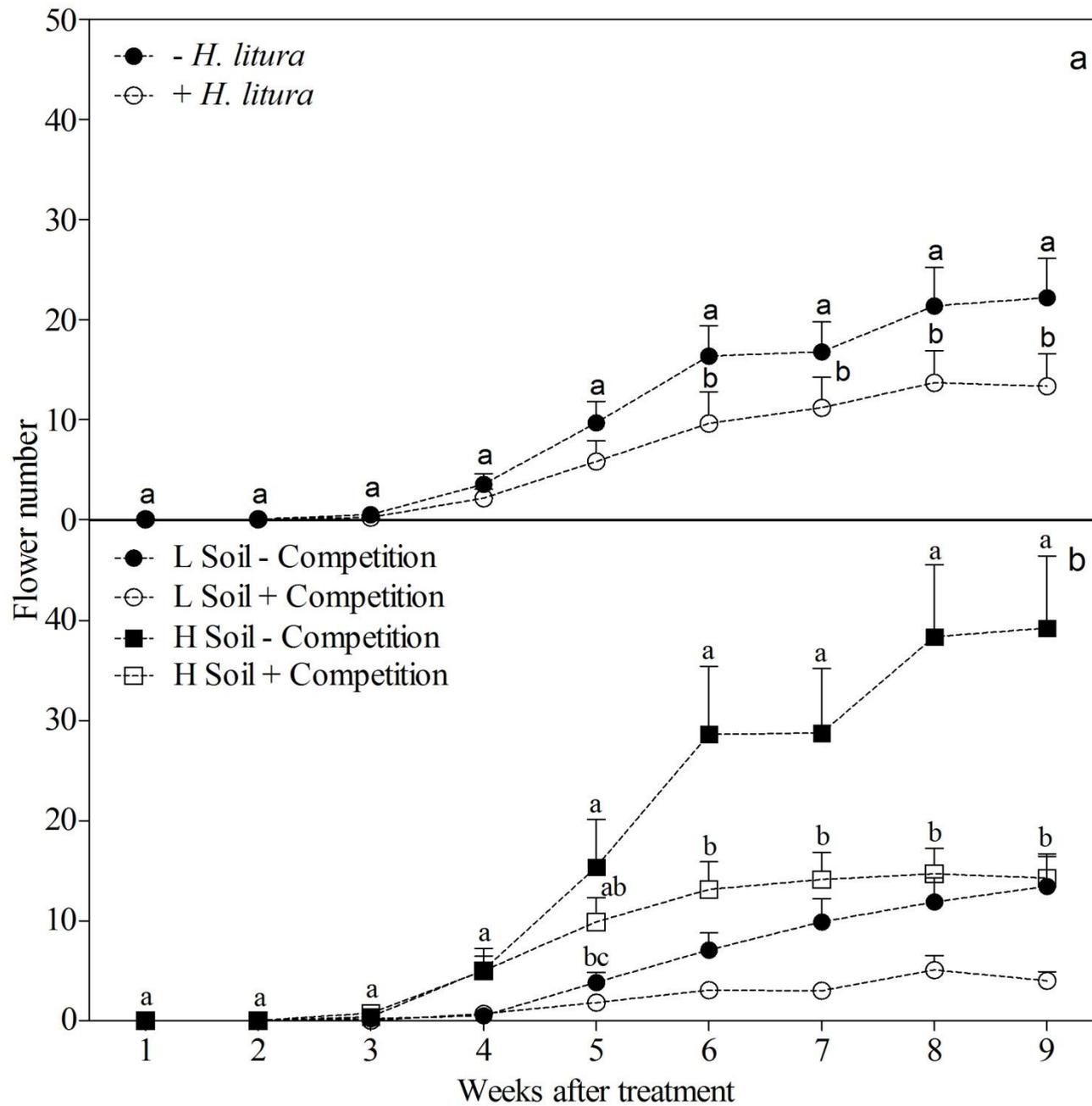


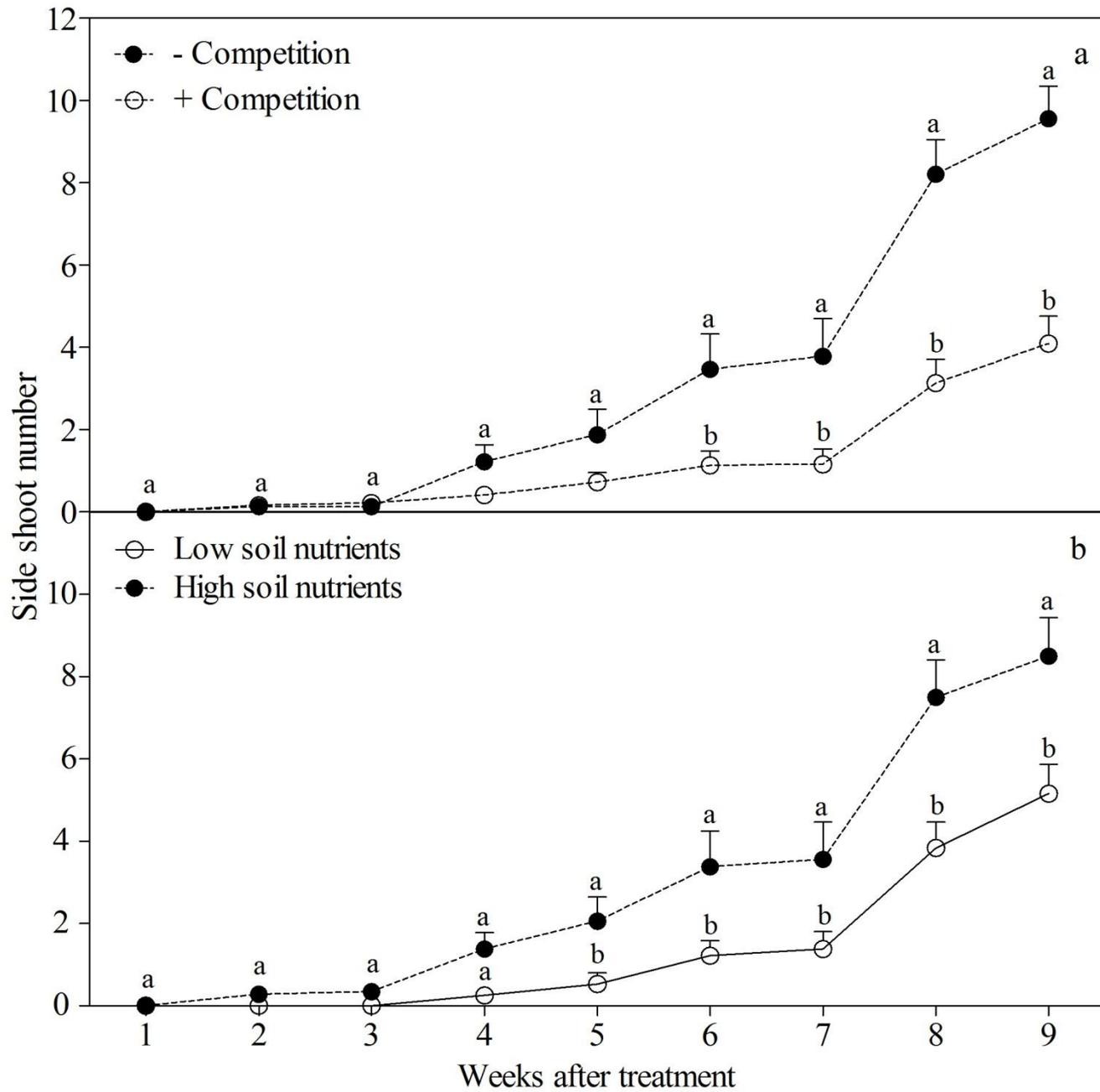
Data Collection

- Non-destructive weekly measurements
 - Plant height
 - Basal stem diameter
 - Leaf number
 - Flower number
- Destructive harvest
 - Colored dyes injected into the root systems to aid in root separation
 - Final shoot and root biomass

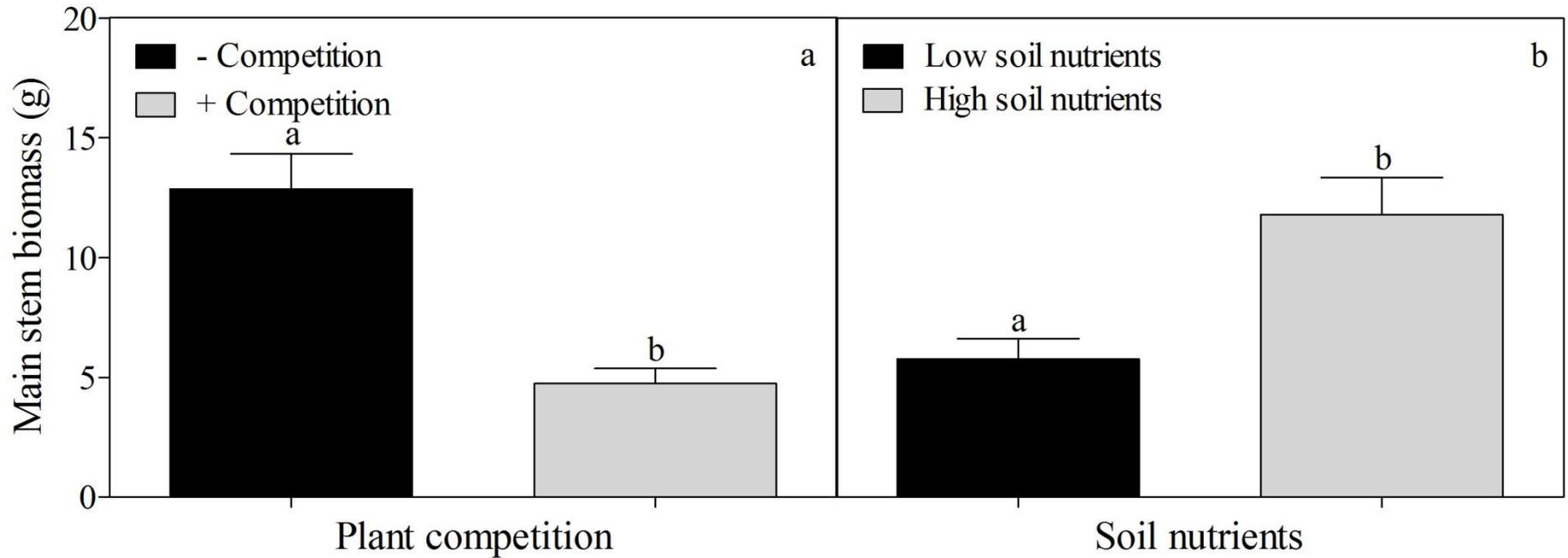


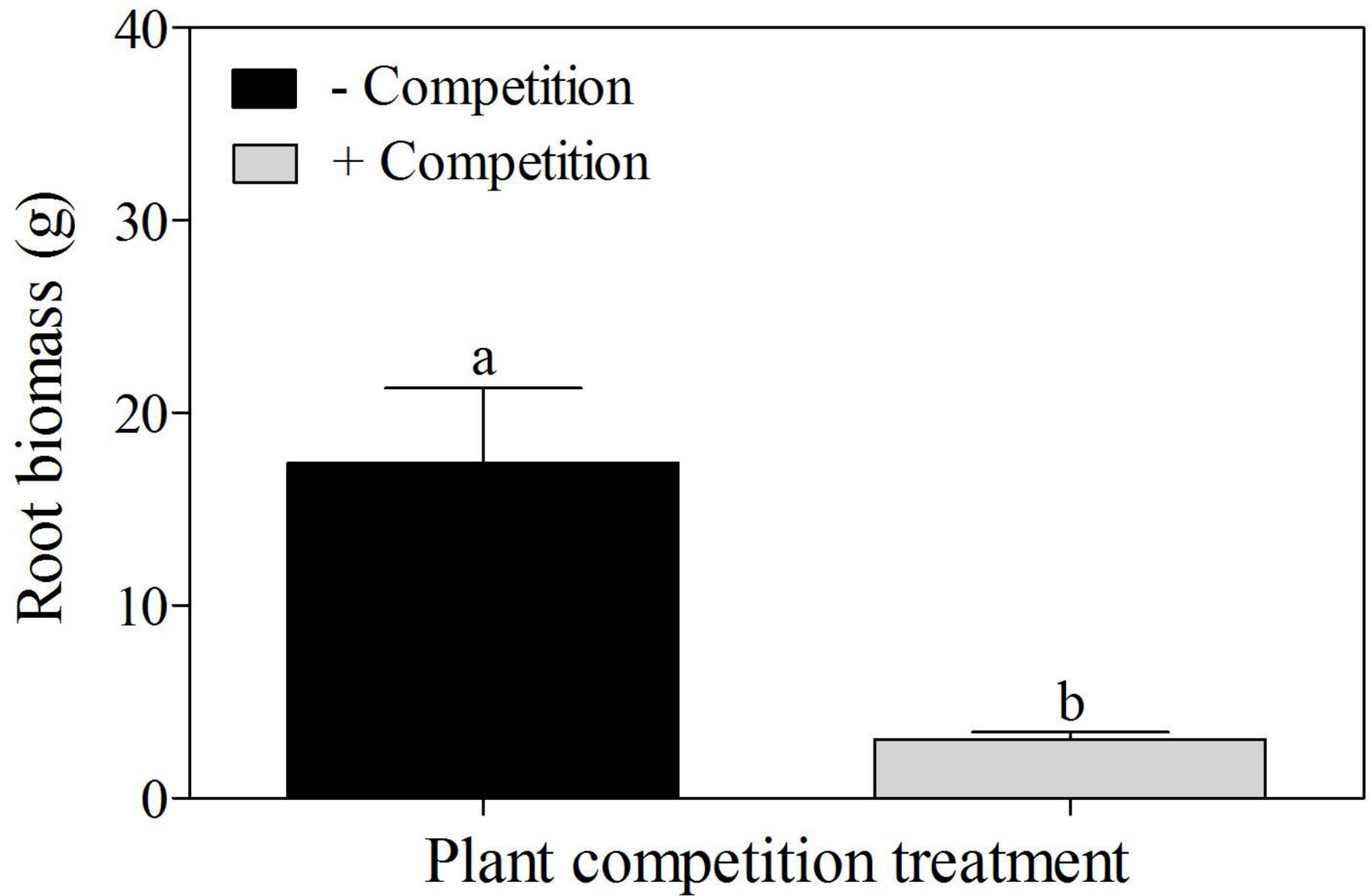






Destructive Harvest Results





Summary

- Weevil attack reduced main stem shoot height and flower number throughout season.
- Side shoot number was reduced only by low nutrients and plant competition.
- Final shoot biomass was reduced by low soil nutrients and plant competition.
- At the end of the season, final root biomass was only reduced by plant competition.

Implications

- Weevil attack alone is unlikely to control Canada thistle because root biomass is unaffected-this is crucial for spread!
- Plant competition appears to have the ability to reduce side shoot production and root biomass, thereby enhancing control.
- Under just the right circumstances, weevils may have some impact, but our research does not demonstrate efficacy.

Why Has Biocontrol of Canada Thistle Not Been Greatly Successful?

- In native range, CT has few natural enemies and these enemies cause minor damage.
- A combination of root and shoot feeding insects would be ideal, but there are no known CT root feeders.
- A complex of various pests, including pathogens, may negatively affect CT under certain environmental conditions (dry, low nutrients), but widespread reliable control is unlikely.

Acknowledgements

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Questions?

