Noxious Weeds Update

By Quincy Law
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Outline

- Brief introduction
- Previous research
- Research direction

About Me

Born and Raised in Clear Lake, IA

Map credit: Google

Education

- B.S., Horticulture, Iowa State University
- M.S., Agronomy, Purdue University
- Ph.D., Horticulture + ESE, Purdue University

PREVIOUS RESEARCH

Nitrogen Application Timing Affects Mesotrione Activity

- Applied 43 lb N/A
  - 14, 7, 3, and 1 day before
  - Immediately before (day of)
  - 1, 3, 7, and 14 days after
- 5 fl. oz/A mesotrione
- 3-5 leaf large crabgrass

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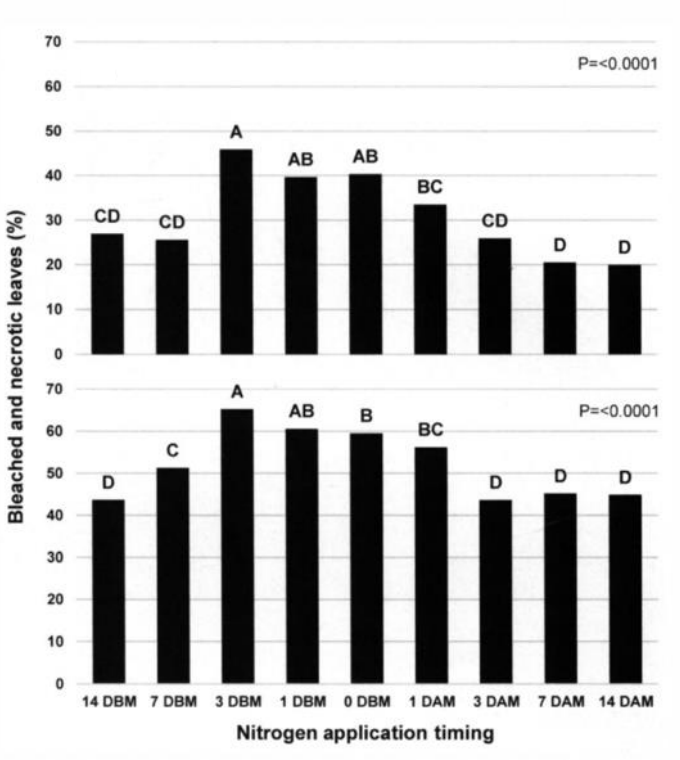
- **Nitrogen applications 3, 1, and 0 DBMA had the highest % bleached and necrotic leaves (>39% and >59%)**



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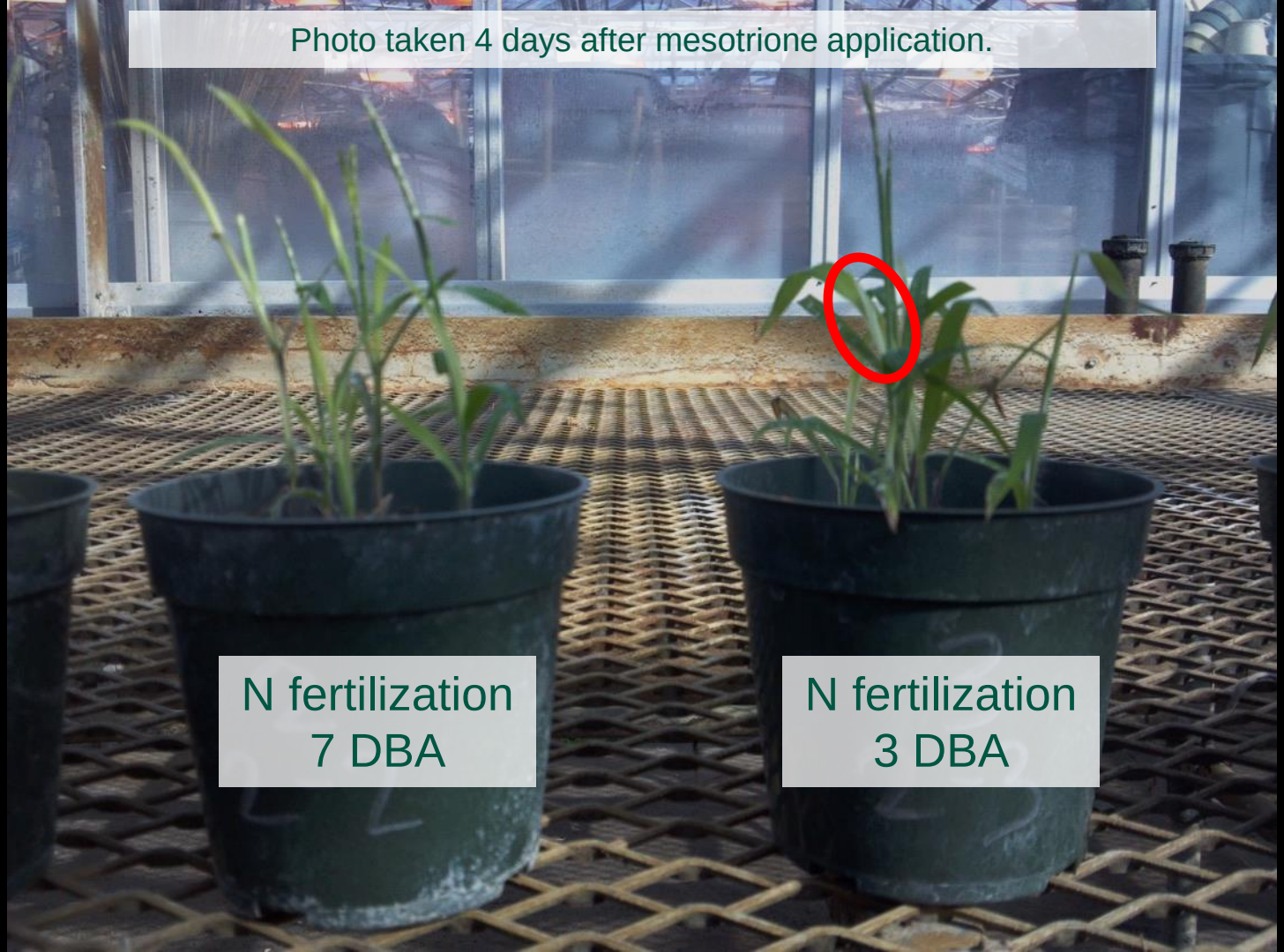


Photo taken 4 days after mesotrione application.
N fertilization
7 DBA
N fertilization
3 DBA

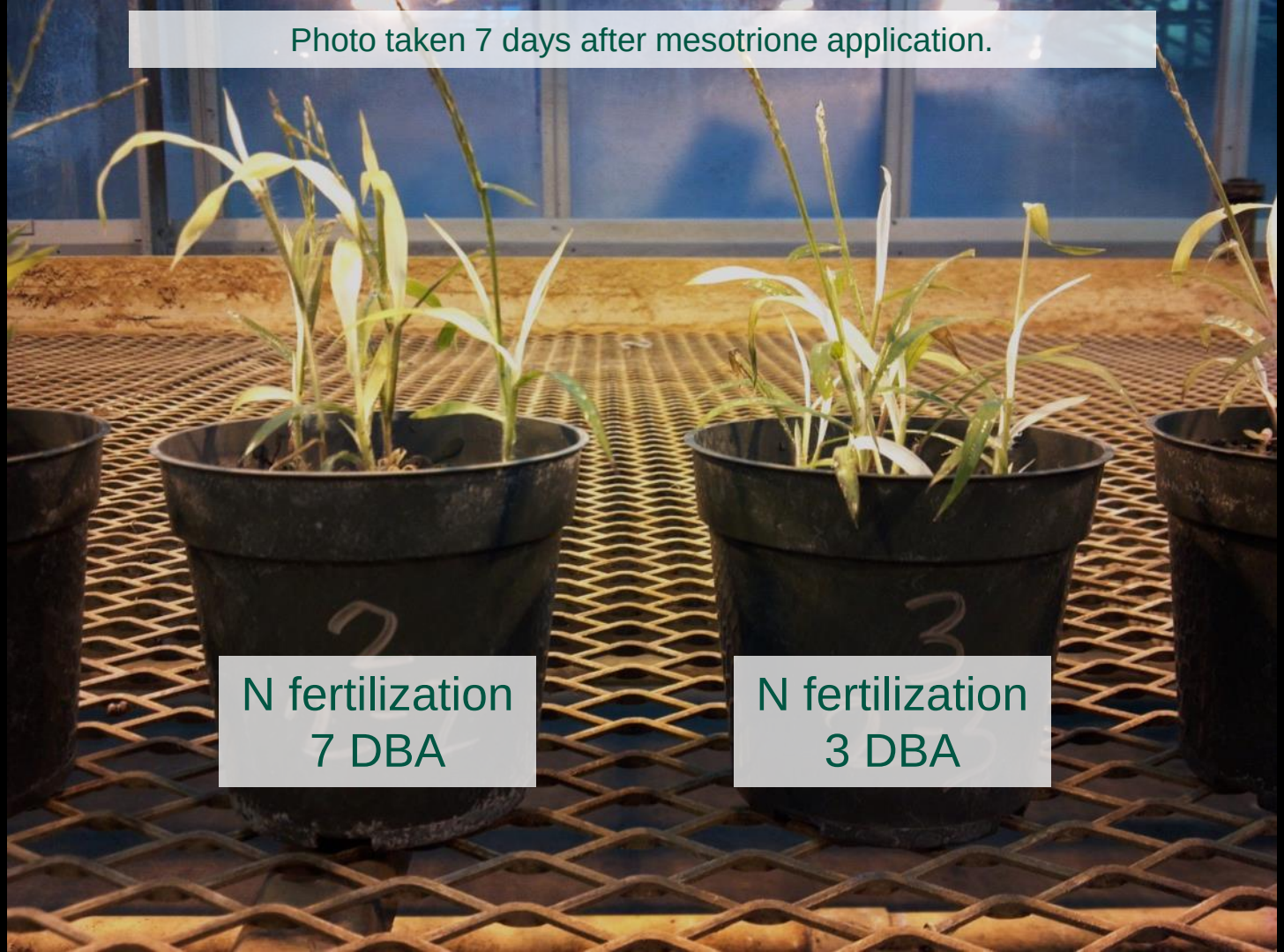


Photo taken 7 days after mesotrione application.
N fertilization
7 DBA
N fertilization
3 DBA

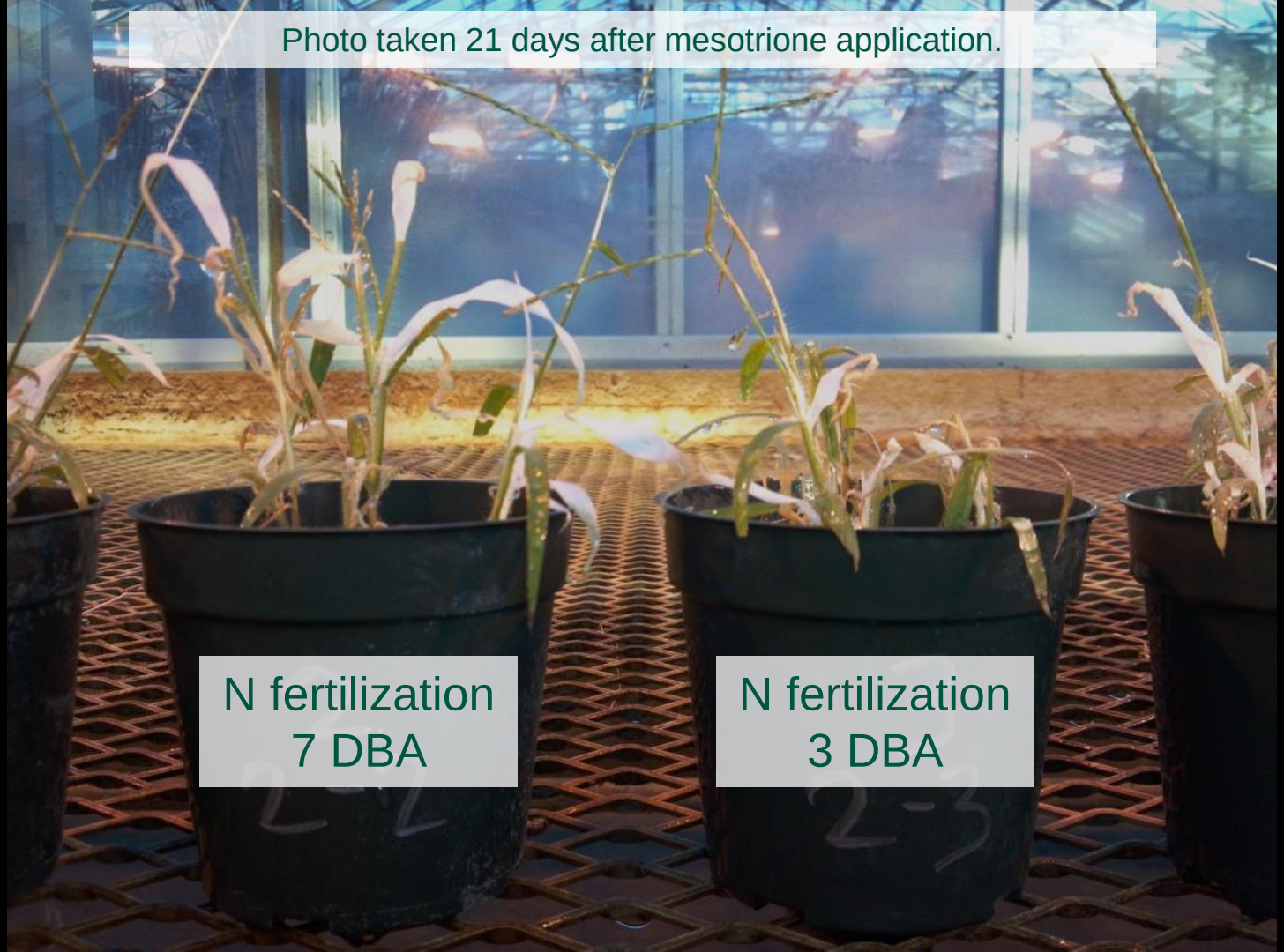
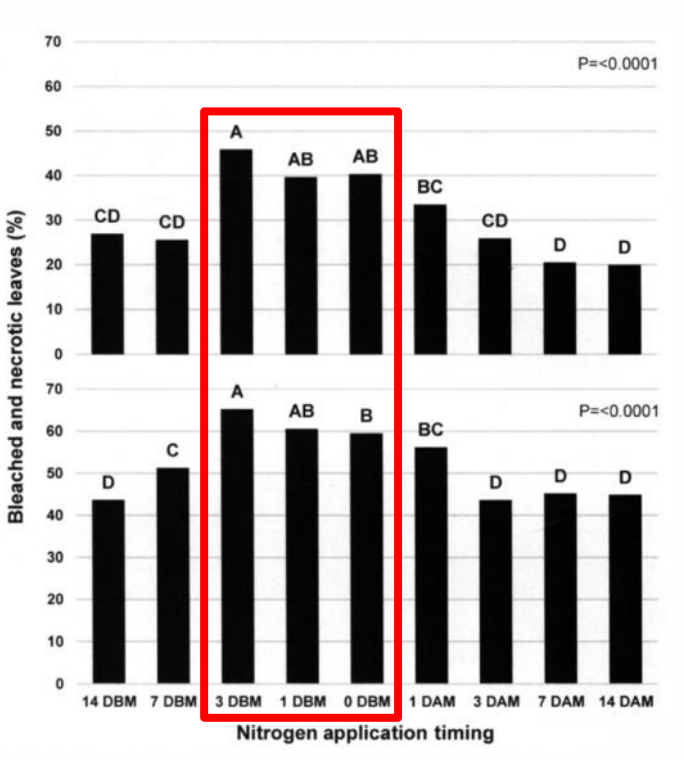


Photo taken 21 days after mesotrione application.
N fertilization
7 DBA
N fertilization
3 DBA

Nitrogen Application Timing Affects Mesotrione Activity

- What does this mean for practitioners?
- **Pair N and POST mesotrione applications together or in proximity to enhance crabgrass control**



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2,4-D Resistance in Buckhorn Plantain

2,4-D–Resistant Buckhorn Plantain (*Plantago lanceolata*) in Managed Turf

Aaron J. Patton[1], Daniel V. Weisenberger[2] and Geoff P. Schortgen[3]

[1]Professor, Department of Horticulture and Landscape Architecture, Purdue University, West Lafayette, IN, USA, [2]Retired Research Agronomist, Department of Horticulture and Landscape Architecture, Purdue University, West Lafayette, IN, USA and [3]Research Technician, Department of Horticulture and Landscape Architecture, Purdue University, West Lafayette, IN, USA

Abstract

A population of buckhorn plantain with suspected resistance to 2,4-D was identified in central Indiana following 30 yr of 2,4-D–containing herbicide applications. Our objectives were to (1) confirm and quantify the level of herbicide resistance in the buckhorn plantain population using dose–response experiments and (2) find alternative herbicides that could be used to control this population. Greenhouse experiments were conducted to quantify the dose–response of resistant (R) and susceptible (S) biotypes of buckhorn plantain to both 2,4-D and triclopyr, two synthetic auxin herbicides from different chemical families. The R biotype was ≥6.2 times less sensitive to 2,4-D than the S biotype. The efficacy of triclopyr was similar on both the R and S biotypes of buckhorn plantain, suggesting the absence of cross-resistance to this herbicide. This is the first report of 2,4-D resistance in buckhorn plantain and the first report of 2,4-D resistance in turf. The resistance mechanism was limited to within a chemical family (phenoxycarboxylic acid) and did not occur across all WSSA Group 4 synthetic auxin herbicides, as the pyridinecarboxylic acid herbicides clopyralid and triclopyr and the arylpicolinate herbicide halauxifen-methyl provided control in our experiments.

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All plants received 10× labeled 2,4-D rate (16.8 kg ae/ha).

Photos taken 4 weeks after treatment.

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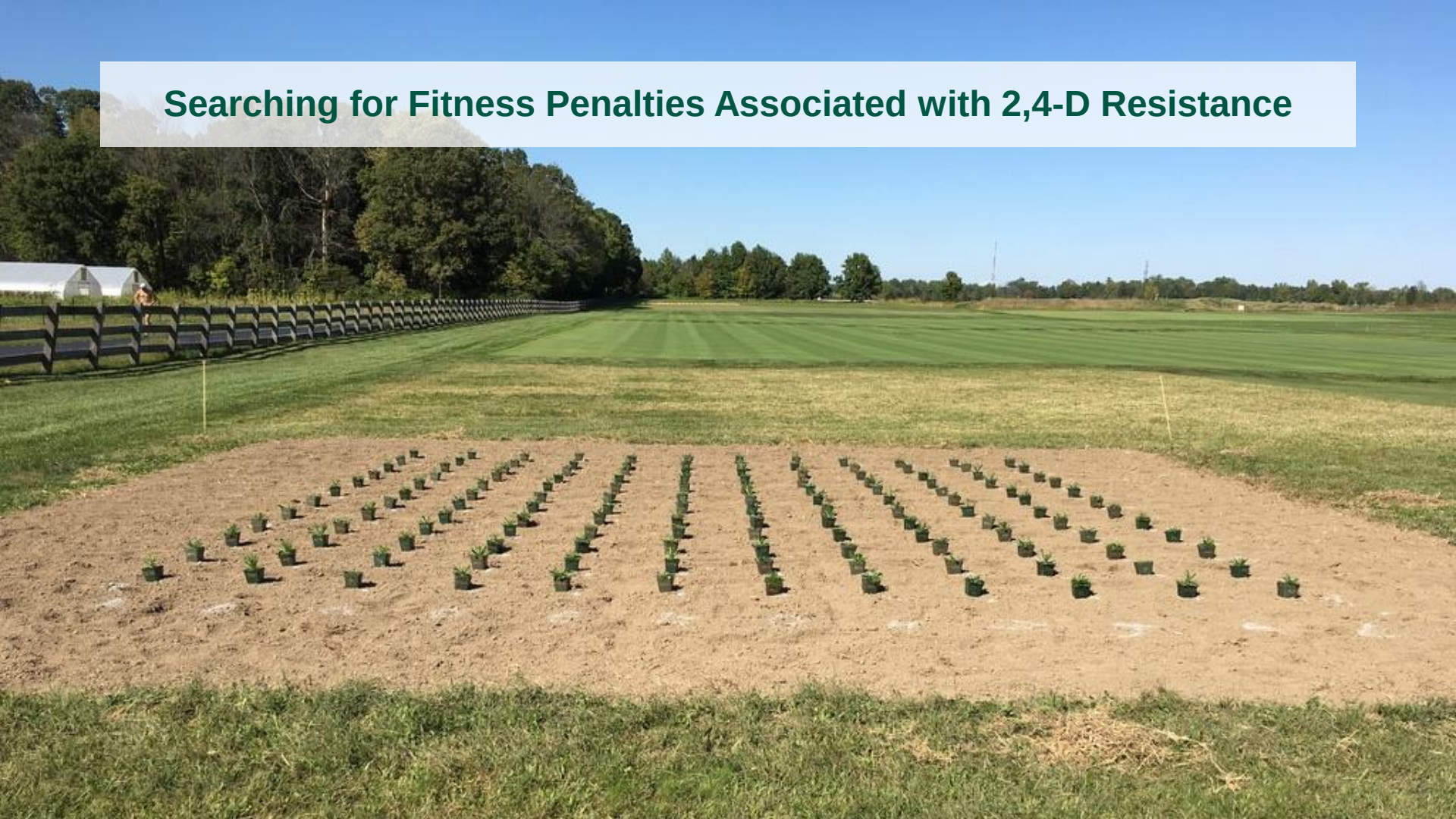
Photos taken 4 weeks after treatment.

Searching for Fitness Penalties Associated with 2,4-D Resistance



Searching for Fitness Penalties Associated with 2,4-D Resistance

- Differences between ecotypes
  - Winter survival
  - Flowering date
  - Prostrate vs. upright growth
  - Leaf length and width
  - Inflorescence production

- These differences were not directly linked to 2,4-D resistance
  - No fitness penalties?
  - Differences in mechanism of 2,4-D resistance?
  - Complicating factors

Investigating Metabolism-Based 2,4-D Resistance

- Malathion (cytochrome P450 inhibitor) applied 18 h prior to 2,4-D

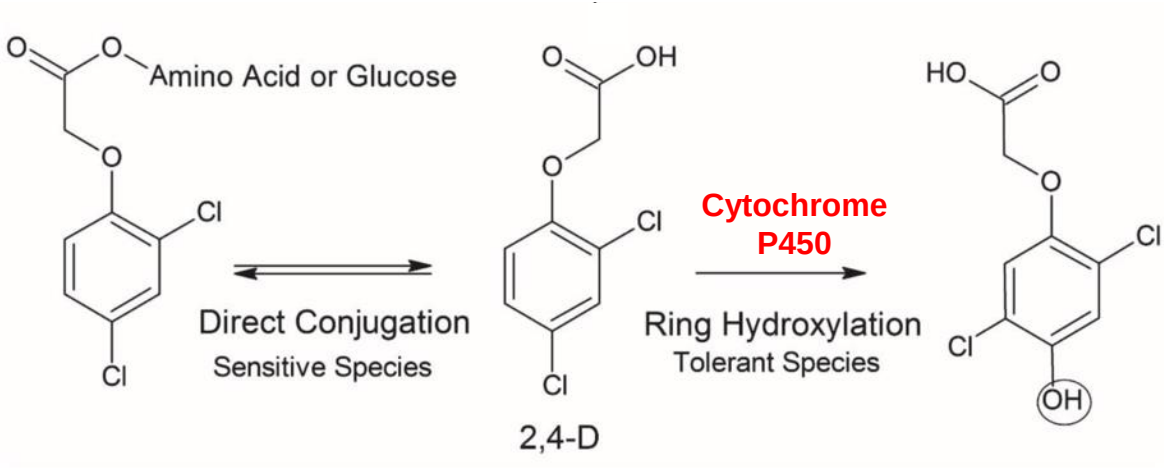


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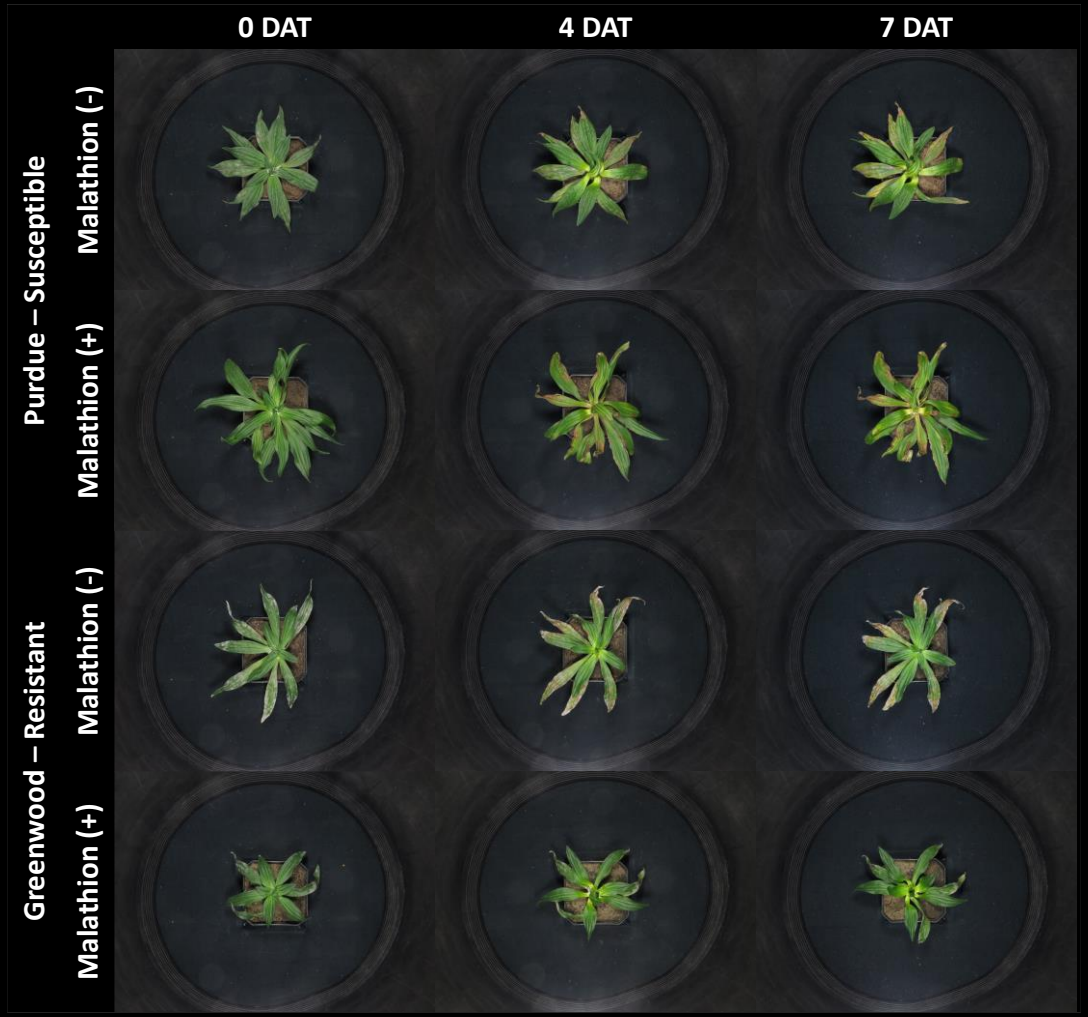
Image courtesy of Peterson et al. (2016)

Investigating Metabolism-Based 2,4-D Resistance

- Malathion (cytochrome P450 inhibitor) applied 18 h prior to 2,4-D

- Differences in early symptomology ($P < 0.05$)
- No differences in control, fresh weight, or dry weight 6 or 10 WAT ($P > 0.05$)
  - Malathion does not completely reverse phenotype from R to S
  - Supported by Palma-Bautista et al. (2020)



5× labeled 2,4-D rate
(8.4 kg ae ha^{-1})

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(8.4 kg ae ha^{-1})

- Resistant ecotype
- 5× labeled 2,4-D rate (8.4 kg ae ha^{-1})
- 5 DAT

Turfgrass Management Practices Influence Buckhorn Plantain Persistence and Viable Seed Production

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Low Mowing and N Fertilization Reduce Buckhorn Plantain Coverage

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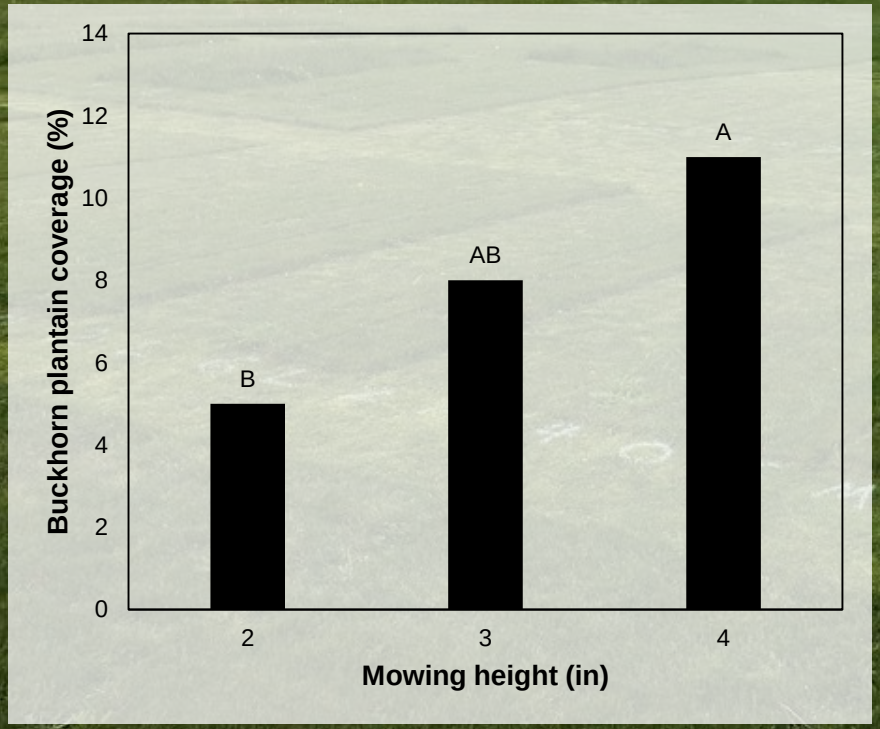
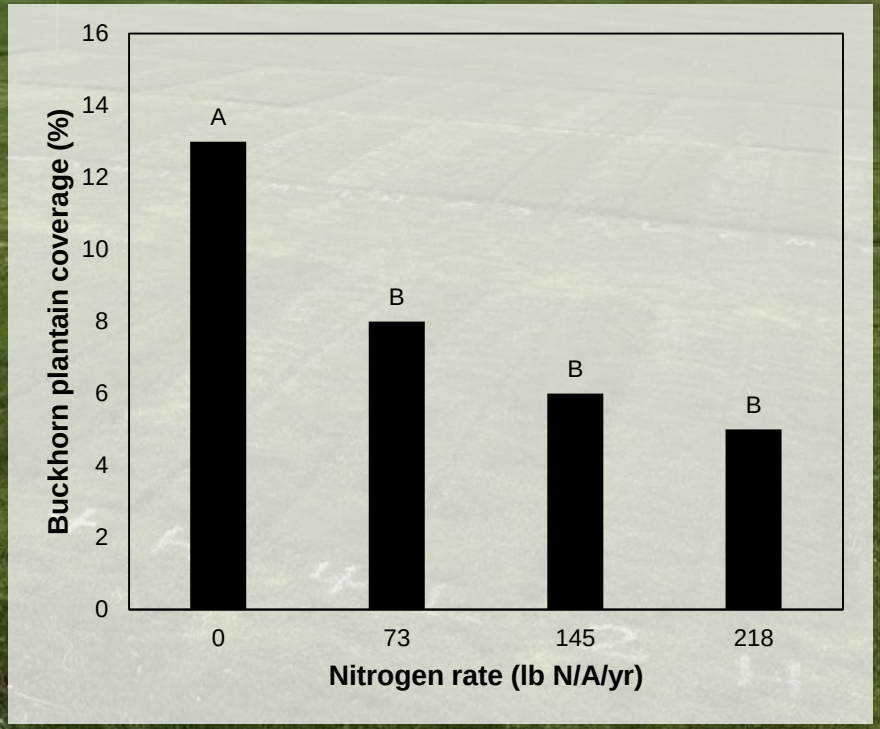
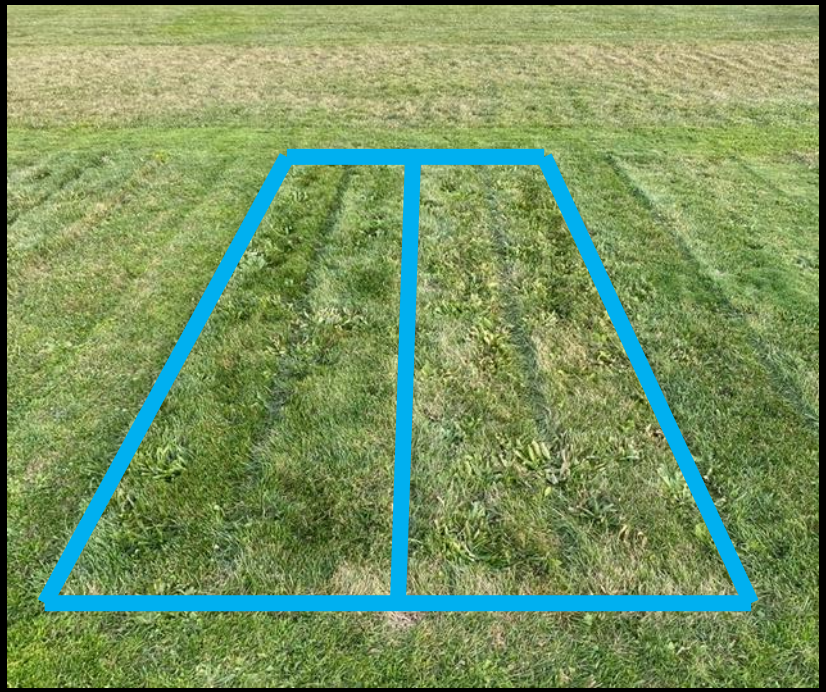




Low Mowing Reduces Buckhorn Plantain Coverage… At a Cost

N Fertilization Reduces Buckhorn Plantain, Dandelion, and Crabgrass Coverage



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Frequent Mowing Reduces Viable Buckhorn Plantain Seed Production

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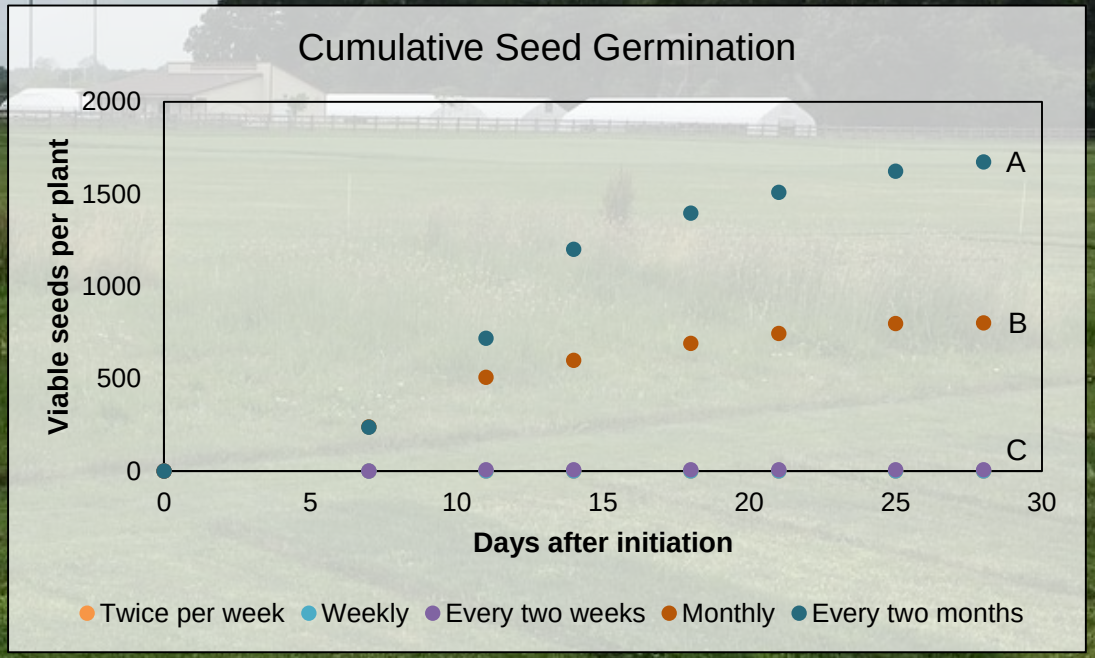
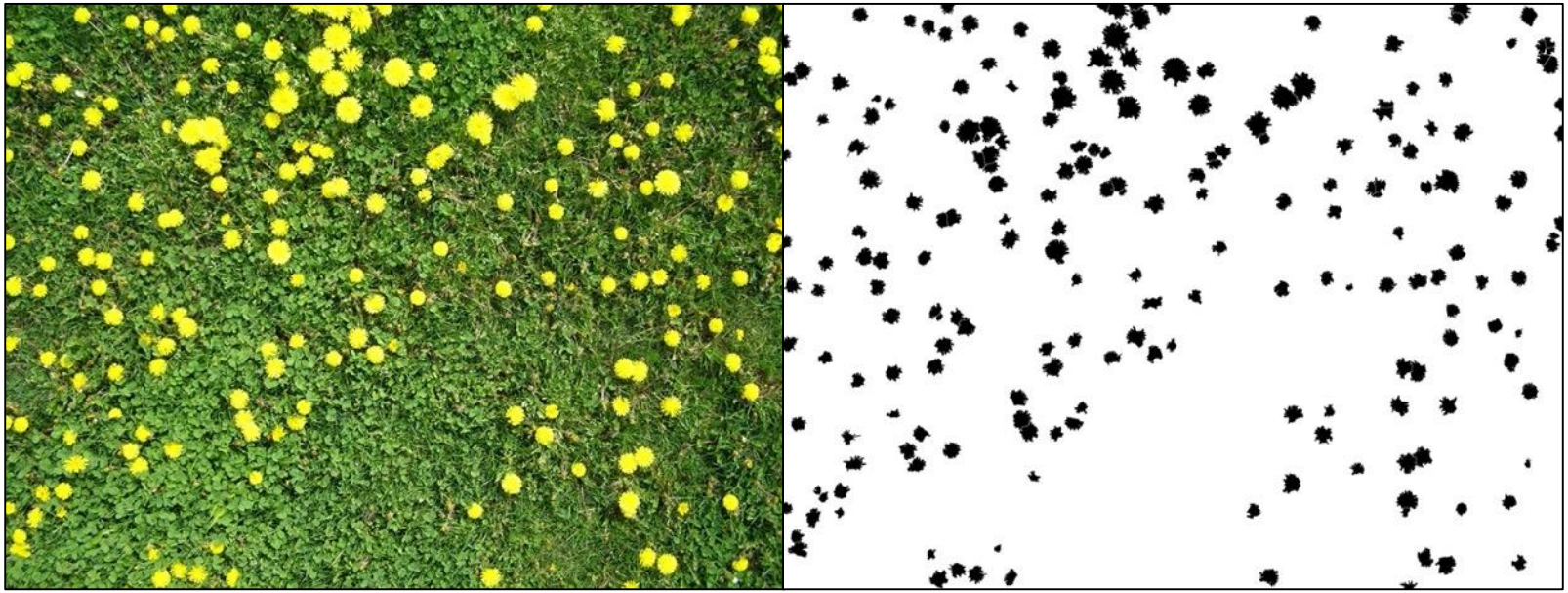


Counting Dandelion Blooms Using Digital Image Analysis



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RESEARCH DIRECTION

North Dakota Noxious Weeds

- Absinth wormwood
- Canada thistle
- Dalmatian toadflax
- Diffuse knapweed
- Houndstongue
- Leafy spurge
- Musk thistle
- Palmer amaranth
- Purple loosestrife
- Russian knapweed
- Saltcedar
- Spotted knapweed
- Yellow toadflax

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Noxious Weed Biology and Ecology

- Of the 13 ND noxious weeds, few tolerate repeated mowing
  - Rangeland and pasture
  - Roadsides and ditches
  - Oil fields
- Determine the influence of management practices
- Genetic diversity of noxious weeds in North Dakota

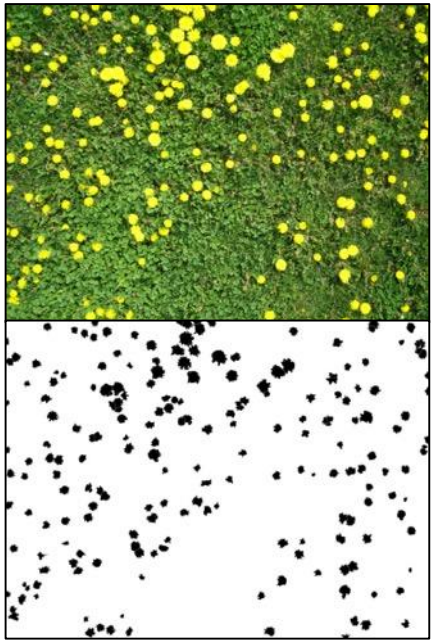
- Identify noxious weed “weaknesses” and exploit them

System-Wide Approach

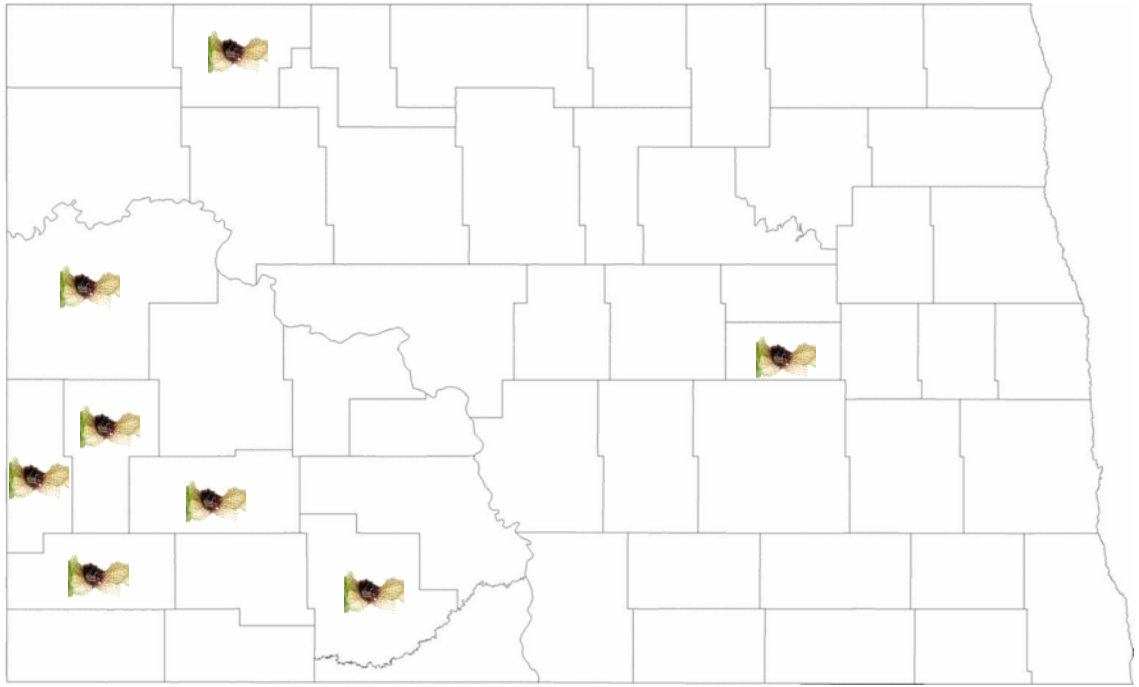
- Controlling weeds in an entire crop rotation system
  - Different herbicide chemistries available
  - Crop canopy (soybean vs. sugar beet)
  - Diverse management practices
- Enables collaboration

Explore Weed Control Technologies

- Weed-sensing technologies
- New herbicides
  - Test efficacy and crop safety



Counties Listing Black Henbane as Noxious



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Questions?

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