Effect of Interspecific Neighbor During Selection: Alfalfa for Intercropping Systems

North American Alfalfa Improvement Conference

July 16, 2026

Intermediate wheatgrass (IWG)

- Forage grass now domesticated as the first perennial grain (Kernza®)
- Known for soil health benefits

Alfalfa as a potentially complementary neighbor

- IWG experiences stand decline, high N needs
- Alfalfa may reduce the amount of additional N needed by the IWG
- Intercropping has the potential to increase beneficial biodiversity, resource use efficiency

Experiment 1

Response to cropping system and nitrogen

Evaluate the relative performance of monoculture and intercropped IWG in terms of grain yield and forage yield and quality

Experiment 2

Evaluation of intercrop-selected populations

Evaluate productivity of alfalfa populations in intercrop with IWG





Dual-Purpose cutting schedule:

Spring before IWG stem elongation · Summer after IWG grain maturity · Fall

Understanding the effect of cropping system and N on IWG yields

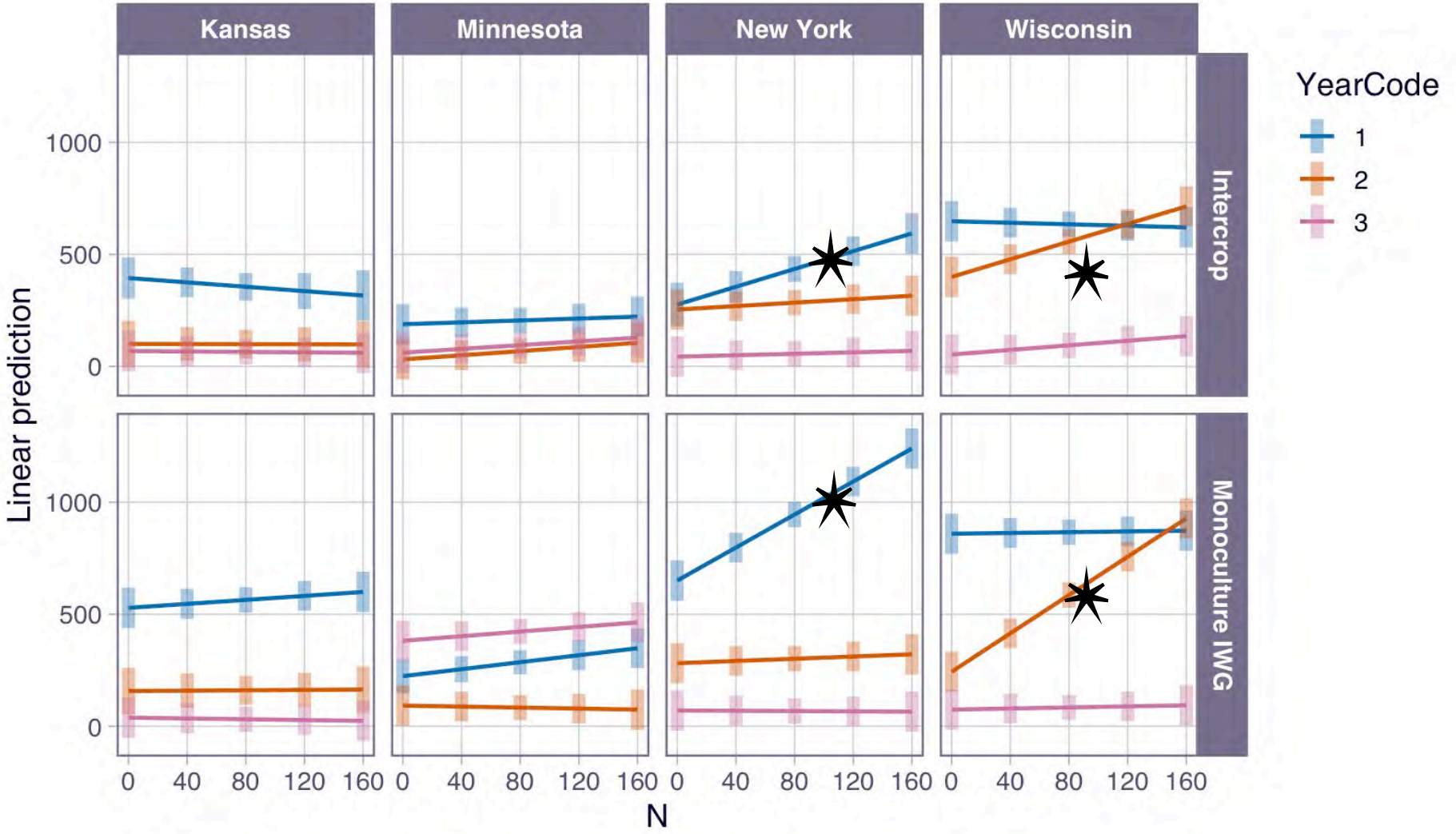
Megan Williams, MS '24

- MN Clearwater (IWG) and Shockwave BR (alfalfa)
- 15 treatments:
  - Crop system: IWG monoculture, alfalfa monoculture, intercrop (replacement)
  - Urea N rate: 0, 40, 80, 120, and 160 kg N ha-1
- 4 locations (KS, MN, NY, WI)

Grain Yield is often similar in both cropping systems

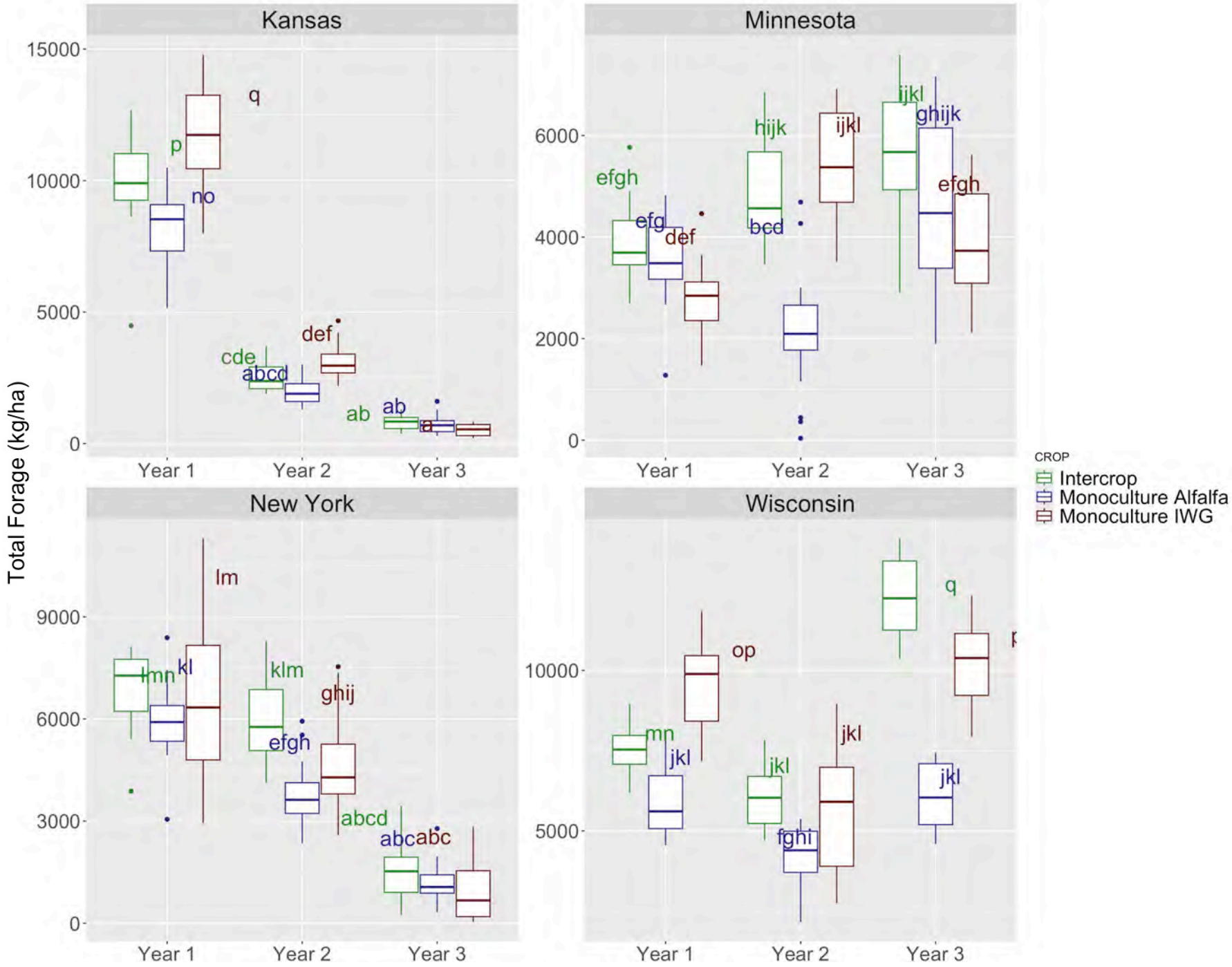
- Often, intercrop and monoculture at the same site-year-N rate will have no significant difference

- Both monoculture and intercrop plots increased grain yield with increasing N rates in NY year 1 and WI year 2



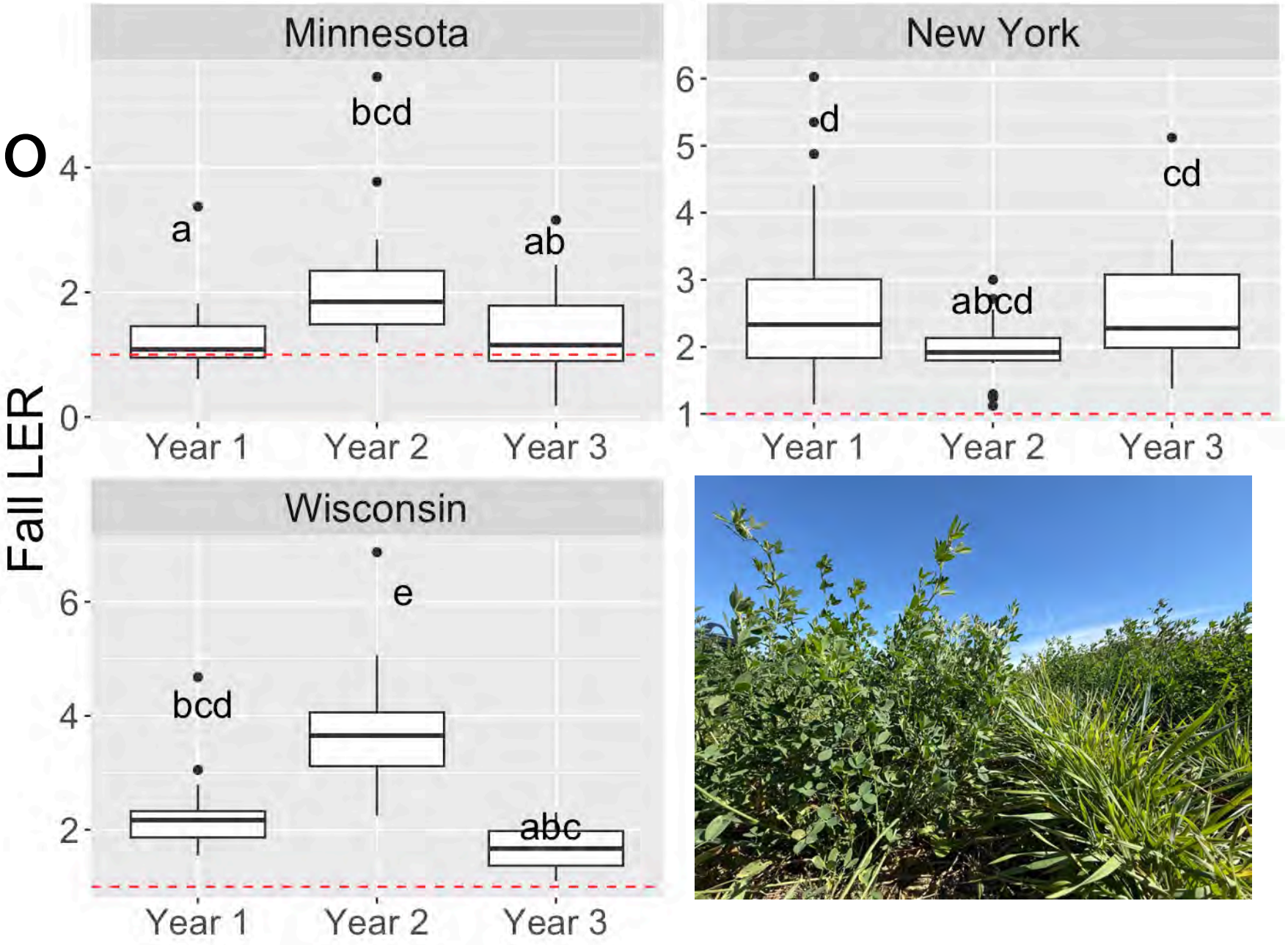
Summer Total Forage

- In MN and WI: intercrops became more productive than monocultures in later year



Fall Land Equivalent Ratio

- Above 1 (red line) indicates a relative total forage yield advantage for intercropped plots



- Comparable grain yield in monocultures and intercrops

- In some locations and years, biomass from intercrops is higher than either monoculture, indicating higher land use efficiency

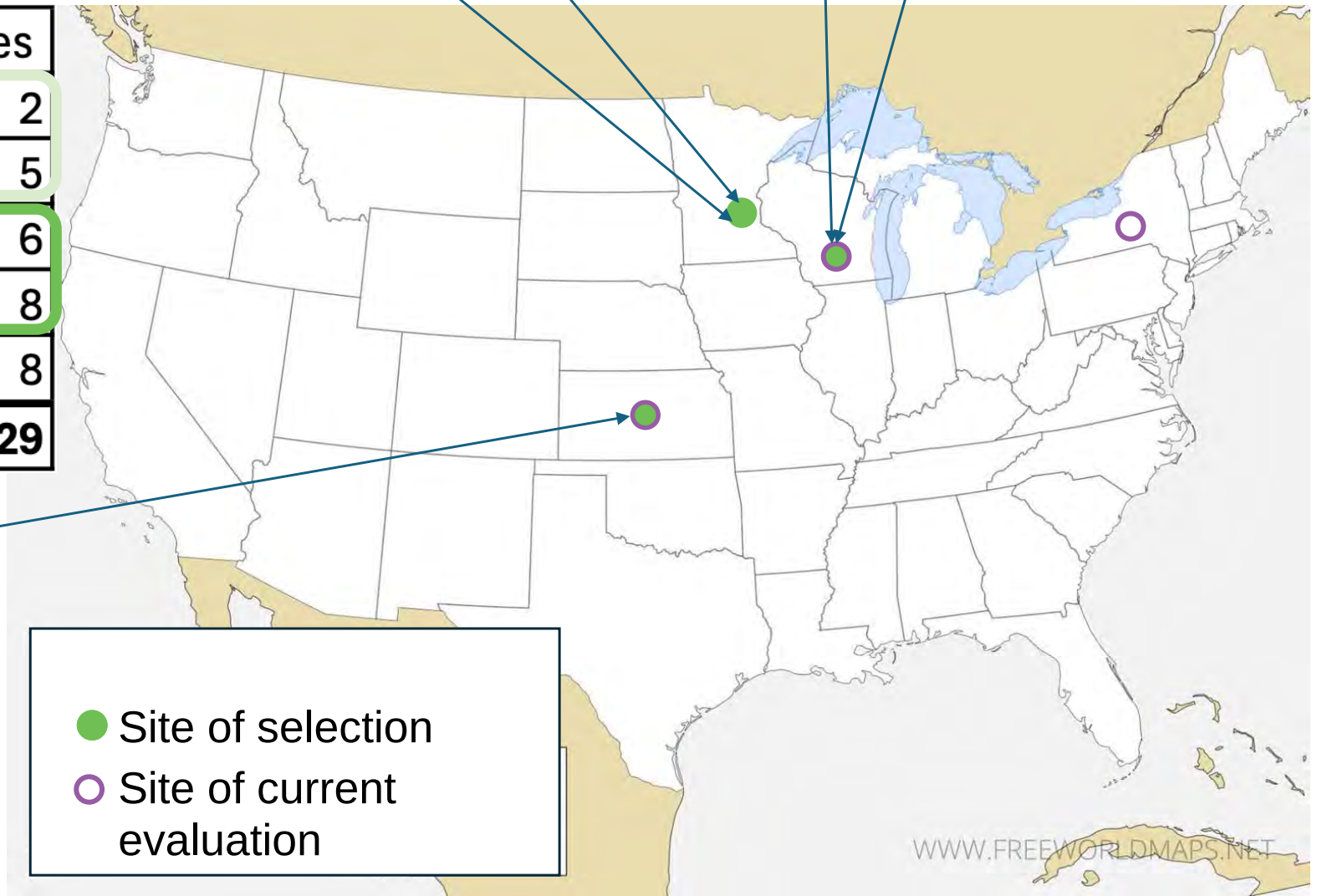
Evaluation of intercrop-selected populations

Intercrop-selected and non-intercrop selected populations evaluated in single 15’ rows with IWG on each side

8 of these entries also represented as monocultures in NY only

Alfalfa populations from intercrop selection

	# Entries
Base Population (IWG)	2
Base Population (Maize)	5
Selected (IWG)	6
Selected (Maize)	8
Other	8
Total	**29**



Alfalfa populations included for unique characteristics

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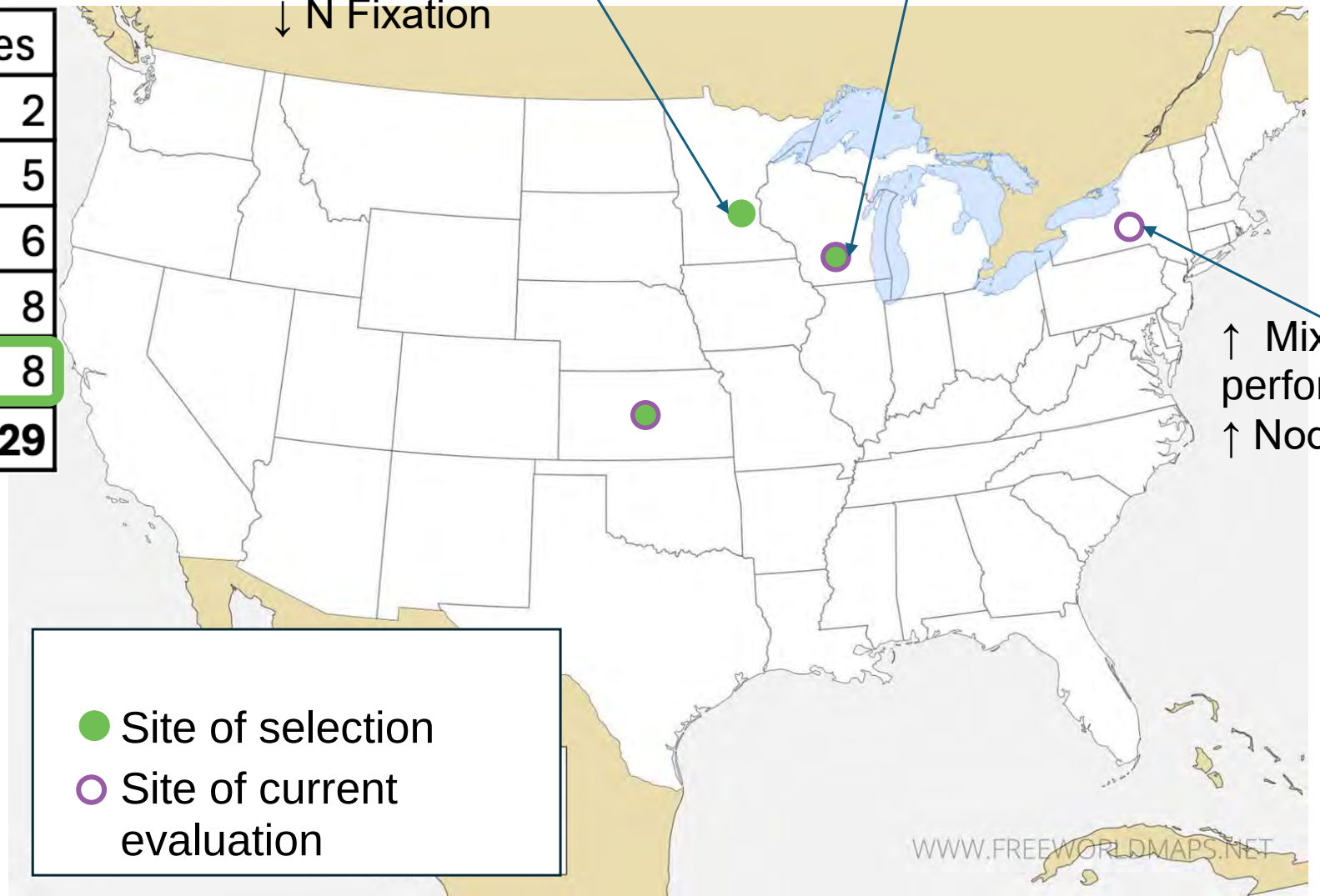
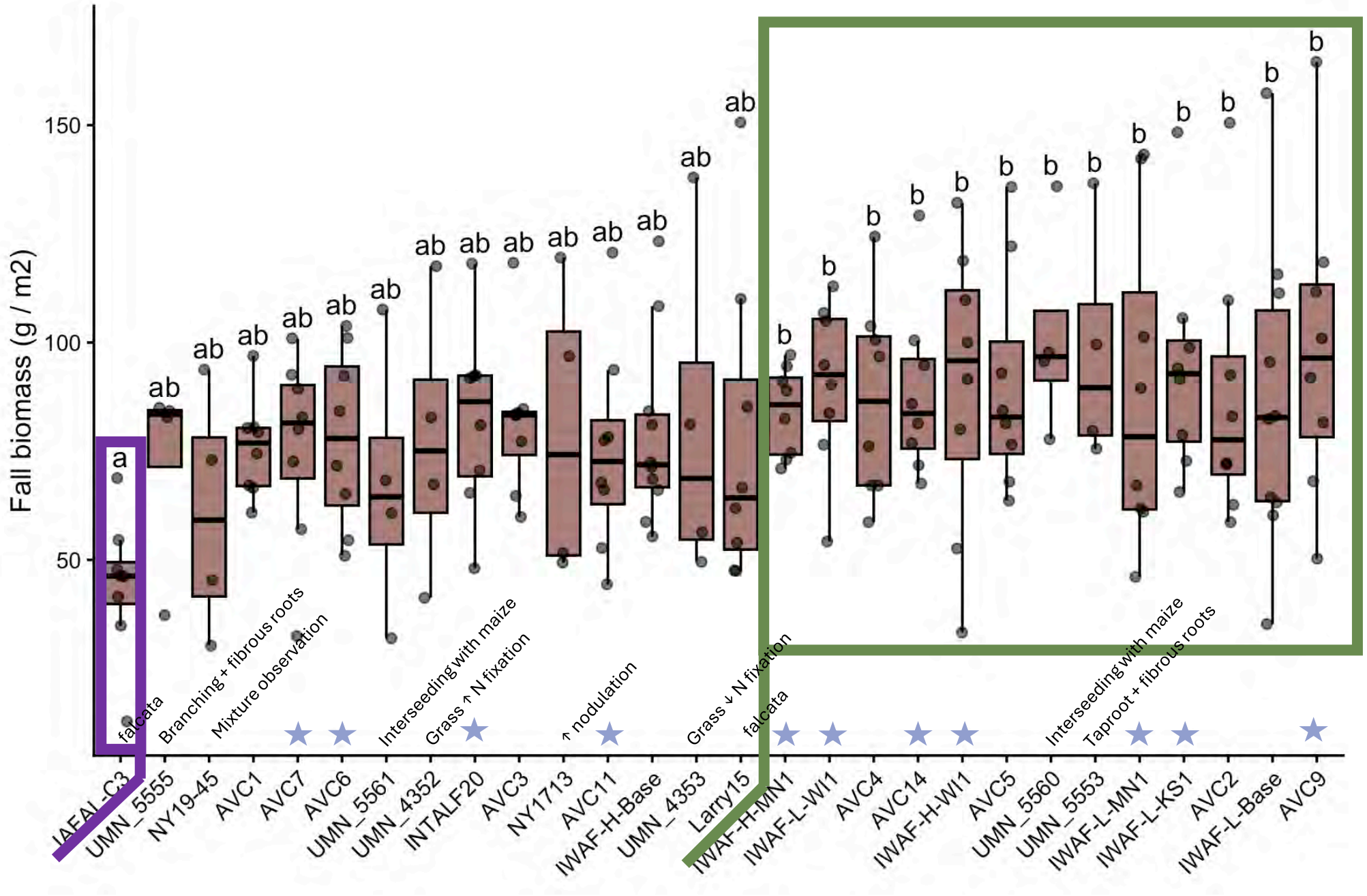


- Summer Biomass: differences by location
- Fall Biomass: differences by population
- Spring Biomass (WI): no differences in biomass

- NY & KS : no differences in weed biomass

- NY: no differences in weed biomass
  - Intercrop > monoculture biomass


Fall biomass (g / m2)
150
100
50
a
ab
b
IAFAL-C3
falcata
UMN_5555
Branching + fibrous roots
NY19-45
Mixture observation
AVC1
AVC7
AVC6
UMN_5561
Interseeding with maize
UMN_4352
Grass ↑ N fixation
INTALF20
AVC3
NY1713
↑ nodulation
AVC11
IWAF-H-Base
UMN_4353
Grass ↓ N fixation
Larry15
falcata
IWAF-H-MN1
IWAF-L-WI1
AVC4
AVC14
IWAF-H-WI1
AVC5
UMN_5560
Interseeding with maize
UMN_5553
Taproot + fibrous roots
IWAF-L-MN1
IWAF-L-KS1
AVC2
IWAF-L-Base
AVC9

Take aways

Some genetic variation for biomass in fall of year 1

No clear intercrop-selection effect (some have higher biomass than one falcata)

So far, no evidence of selected populations having different biomass than their associated base population

This summer fall + next summer fall left to observe; potential differences may emerge at later stand ages

Other future work:

Additional characteristics/ traits

Allele frequency shifts from base to selected and seedling to 3rd year stands

Acknowledgments

Virginia Moore Lab

- Jesse Chavez
- Jamie Crawford
- Ryan Crawford
- Julie Hansen
- Solveig Hanson
- Megan Williams (‘24)
- Erika Everest (‘25), Emily Fratz, Raksha Thapa (‘26), undergraduate research assistants

- Jake Jungers (U Minnesota)
- Valentin Picasso (Swedish University of Agricultural Sciences)
- Heathcliffe Riday (USDA Dairy Forage Research Center)
- Brandon Schlautman (The Land Institute)
- Debby Samac & Zhanyou Xu (USDA-ARS)

Funding: USDA Alfalfa Seed & Alfalfa Forage Systems (ASAFS) Program