Alfalfa to get back into planetary boundaries

2025 world alfalfa congress
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New alfalfa-based cropping systems

Liu N. & Cree K.

Parallel session 3

FROM 03 TO 06 nov. 2025

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Optimizing Alfalfa for Dual-Purpose Intercrop with Intermediate Wheatgrass

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[3]USDA Dairy Forage Research Center

FROM 03 › TO 06 nov. 2025

Outline

Background

Project Aims

Methods

Results from Year 1

Remaining Questions

Dual-Purpose Systems offer Intercropping Benefits with Flexible Market Options

Cereal – Legume Intercropping
↑ biodiversity
↑ resource use efficiency
↑ land equivalent ratio
↓ disease

Dual - Purpose
Grain (intermediate wheatgrass (IWG, Kernza®))
Forage (IWG + Alfalfa) and/or Grazing (IWG + Alfalfa)

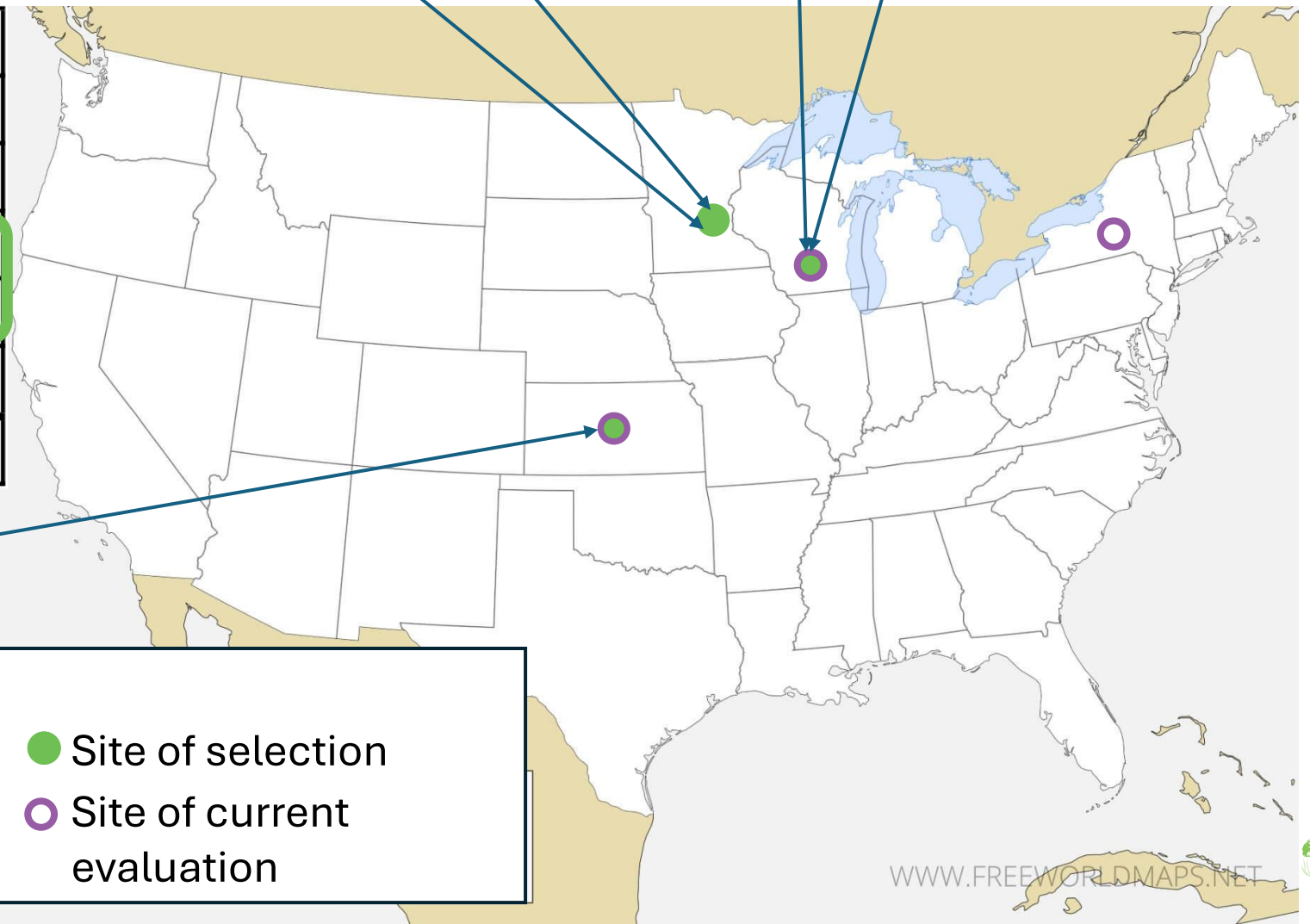
Certain alfalfa varieties may result in alfalfa-IWG intercrop being more successful than other varieties.

Can we optimize alfalfa for intercrop with IWG through selection?

- Do populations selected for intercropping have different yield than unselected populations?
- Does the location selected in and species selected with affect yield?
- Is alfalfa intercrop performance stable across environments?

Alfalfa Entries originate from intercrop selection

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



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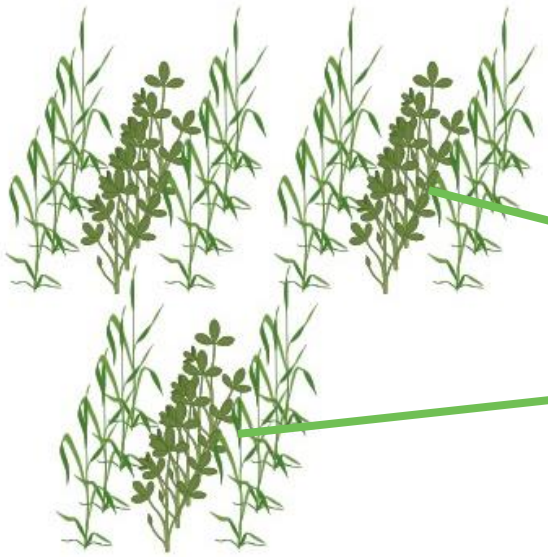
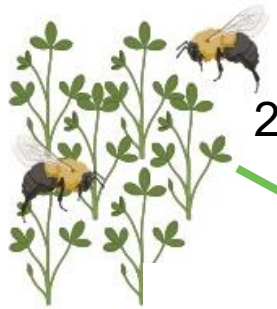
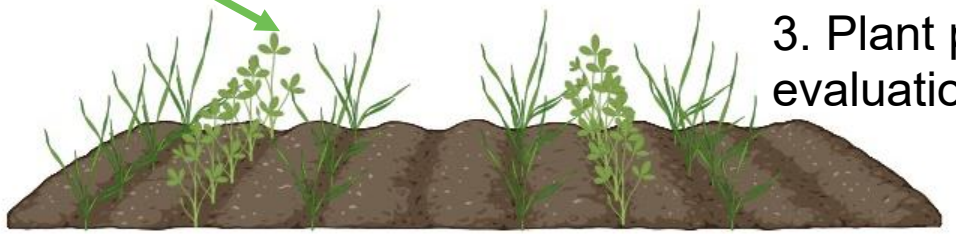
Originally selected from surviving alfalfa from intercrop system



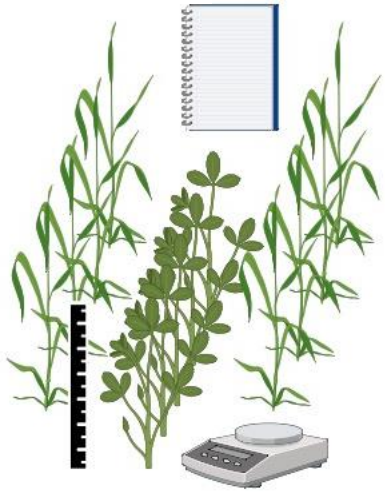
1. Initial evaluations for survival & visual performance



2. Select, dig, & cross



3. Plant populations for intercrop evaluation trial (current work)



4. Data Collection

Alfalfa Entries included for unique characteristics

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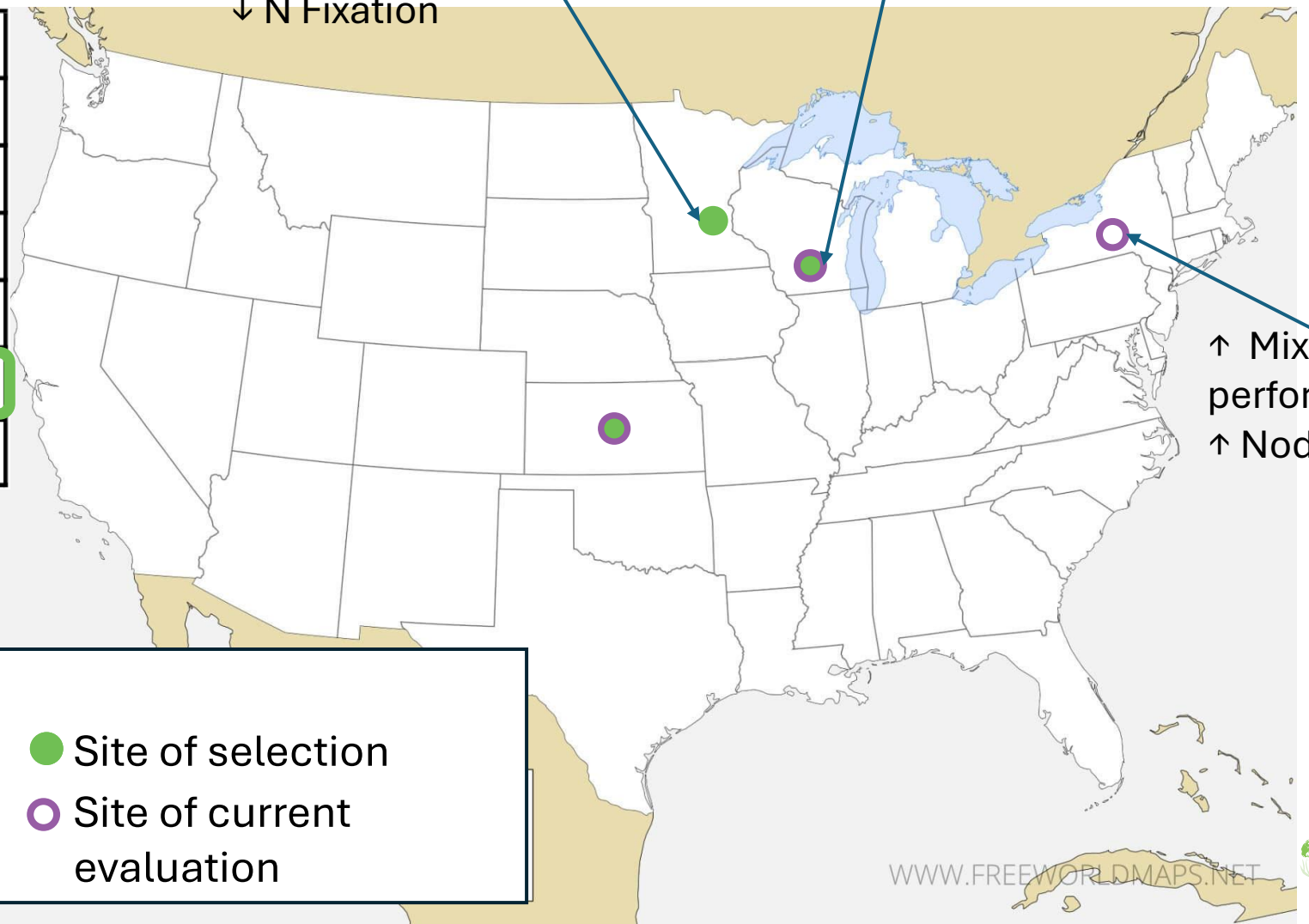
Selected (IWG)	6
Selected (Maize)	8
Other	8
Total	**29**



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Methods

trait ~ Entry * location + (1|location:replicate)

trait ~ selection_type * location + (1|Entry) + (1|location:replicate)

	Biomass	Height	Regrowth Vigor	Maturity
Entry			*	
Entry * location			*	

* = p-value <0.05

Summer Biomass: Differences explained by environment

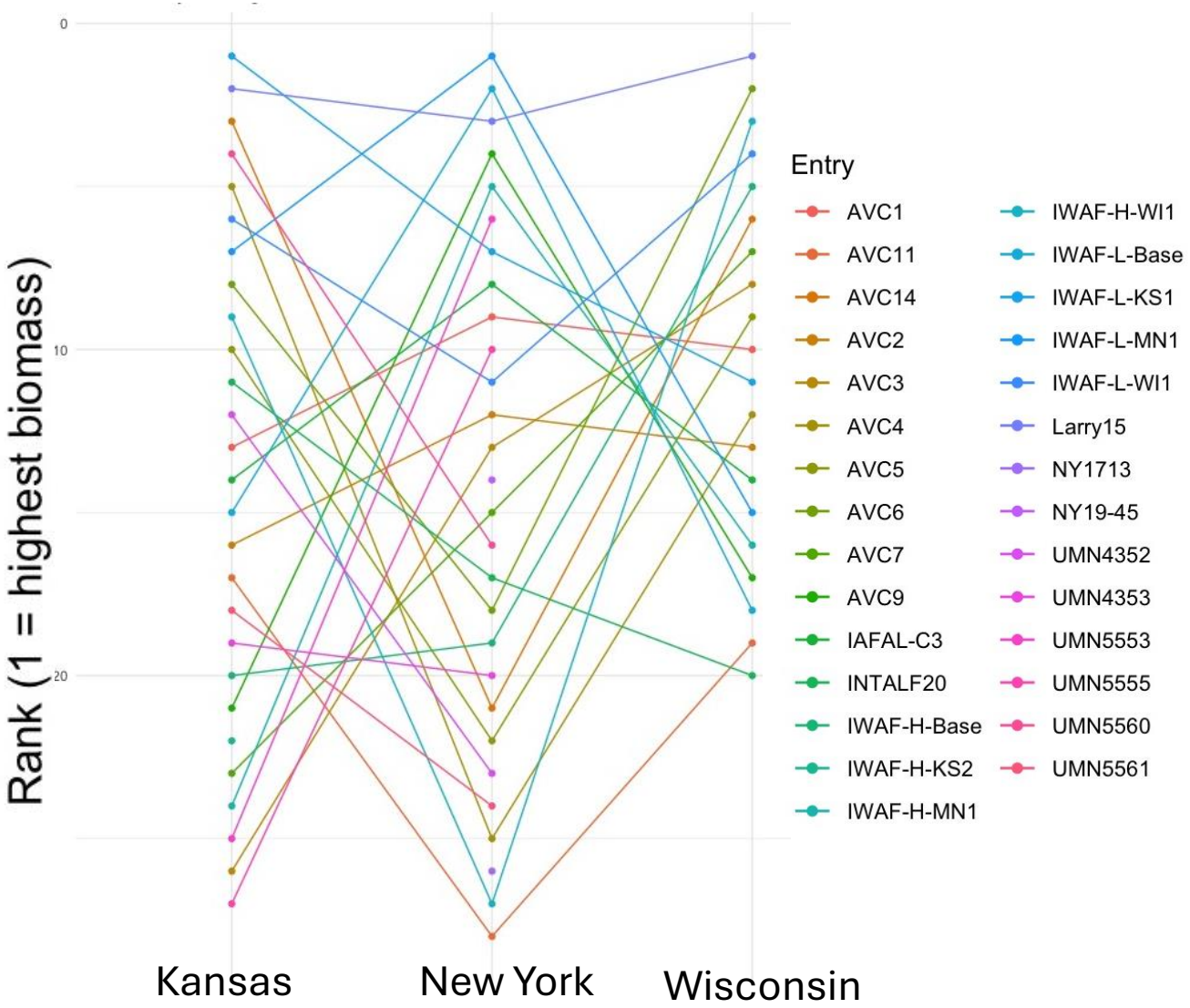
	NumDF	Pr(>F)
Entry	28	0.14531411
LOC	2	0.04400994 ★
Entry:LOC	43	0.06999833

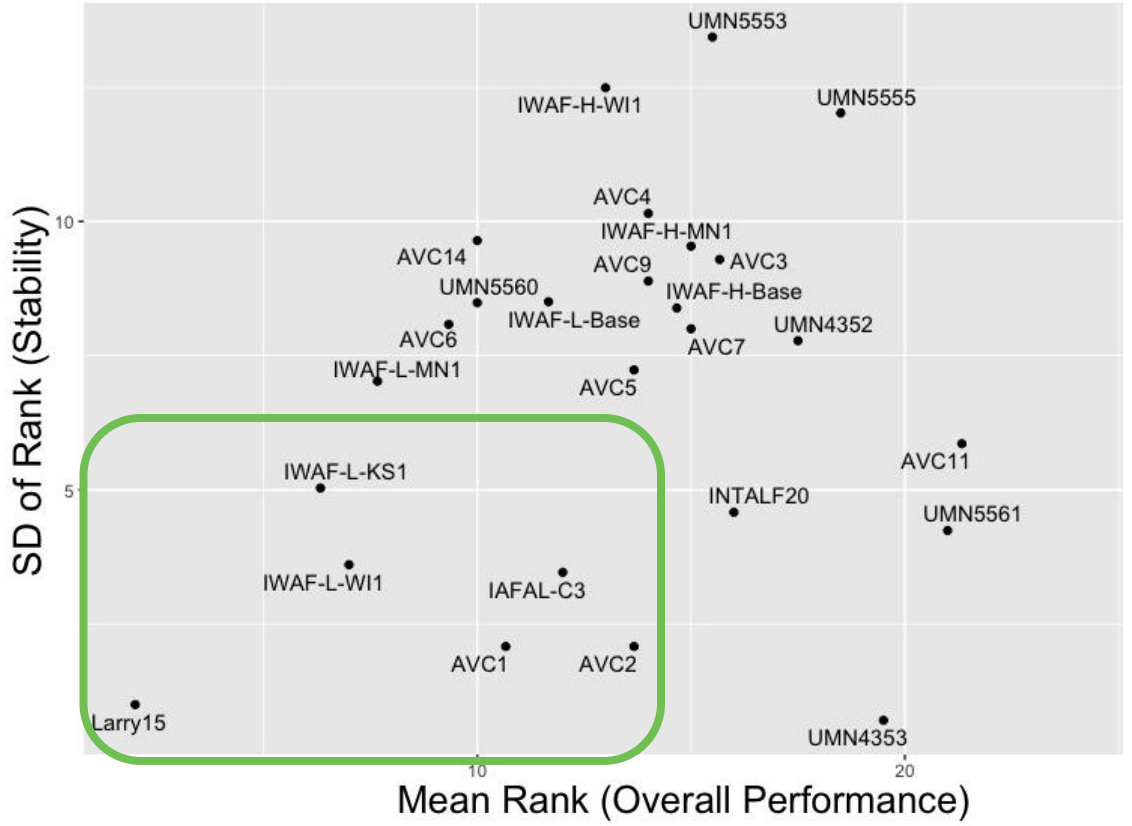
Biomass~ Entry*location + (1|location:replicate))

	NumDF	Pr(>F)
selection_cat	7	0.39834966
LOC	2	0.04165215 ★
selection_cat:LOC	13	0.14555910

Biomass~ Selection type*location + (1|Entry) + (1|location: replicate))

Biomass rank was not stable across locations

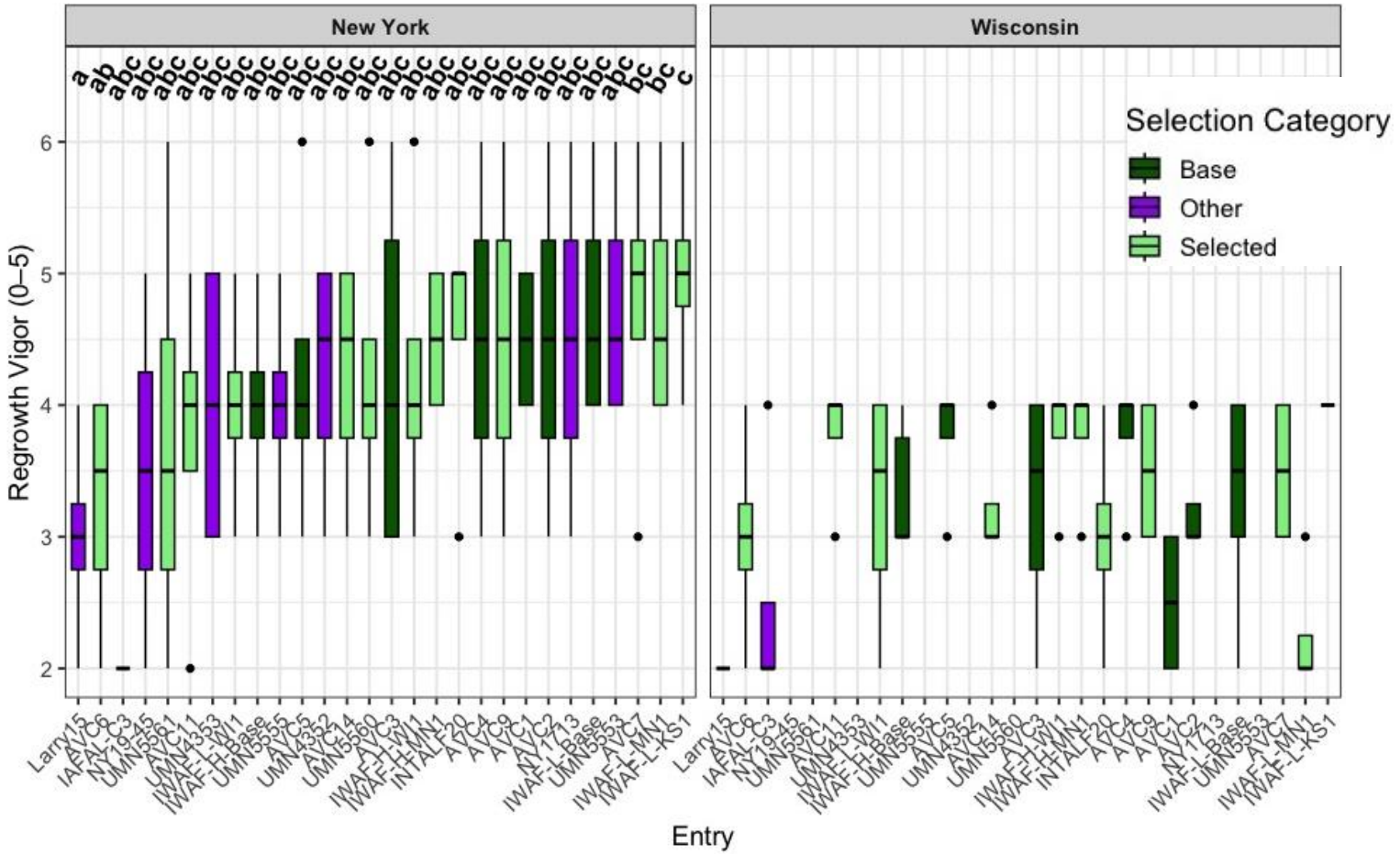




Regrowth: Differences by Entry across Locations

Regrowth_Vigor~ Entry*location + (1|location:replicate))

	LR Chisq	Df	Pr(>Chisq)
Entry	97.90429	27	5.67e-10
LOC	4.28421	1	3.85e-02
Entry:LOC	47.17254	27	9.48e-03



Can we optimize alfalfa for intercrop with IWG through selection?

- Most variation was due to environmental effects- not alfalfa variety differences
- Population origin showed no trait variation
  - No difference between the selected alfalfa and its associated base
- Alfalfa biomass yield was largly unstable across environments

Continuing Research

- 2 more years of biomass data
- Selections based on 3 years of evaluation in intercrop
- Are any measured traits associated with intercrop ability?
- Do populations selected in different locations show genetic divergence from the base population ?

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Questions?

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