

Optimizing forage and grain value of Kernza in polycultures

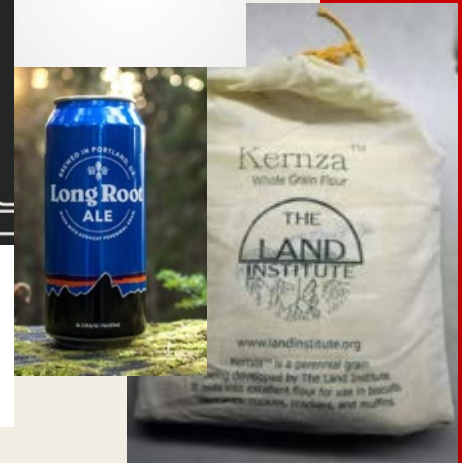
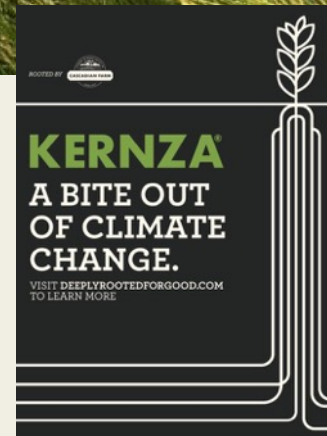
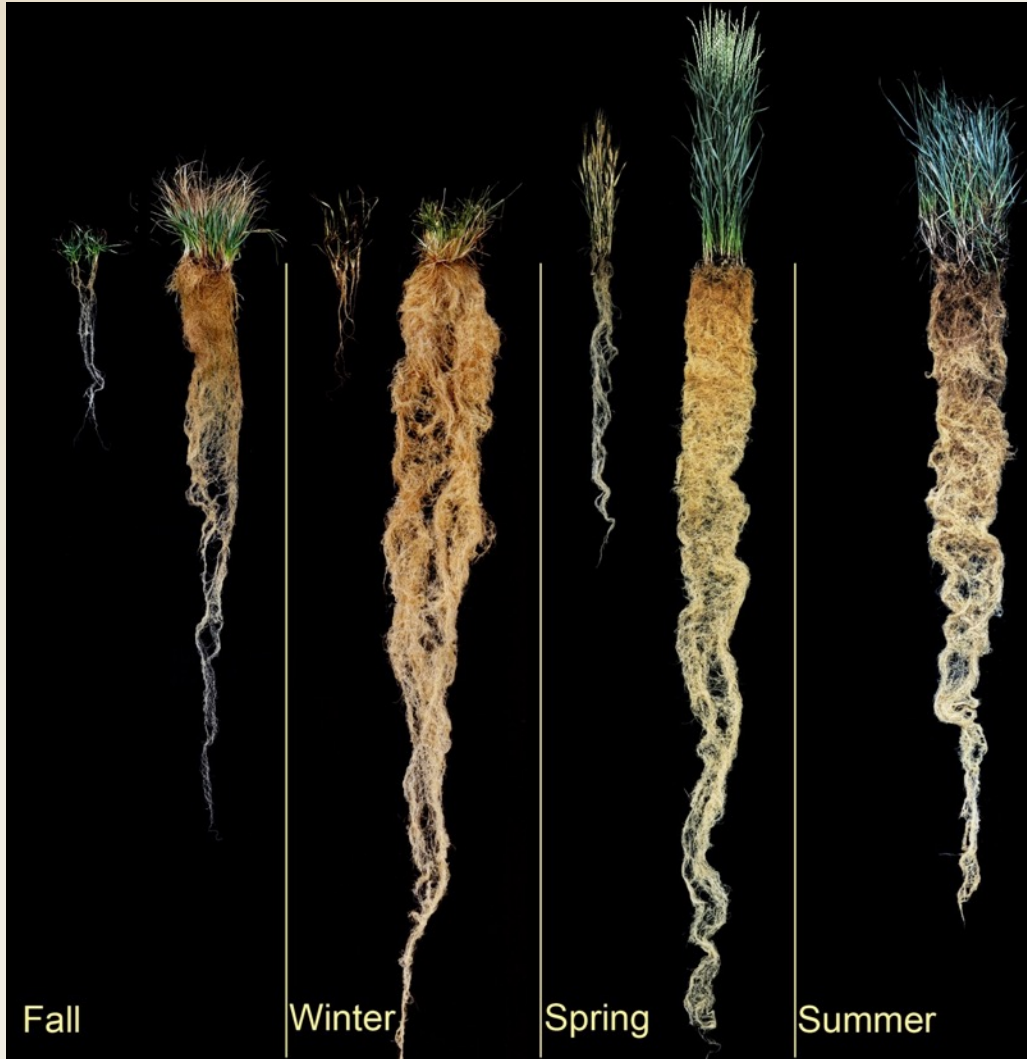
Valentín D. Picasso

picassorriso@wisc.edu

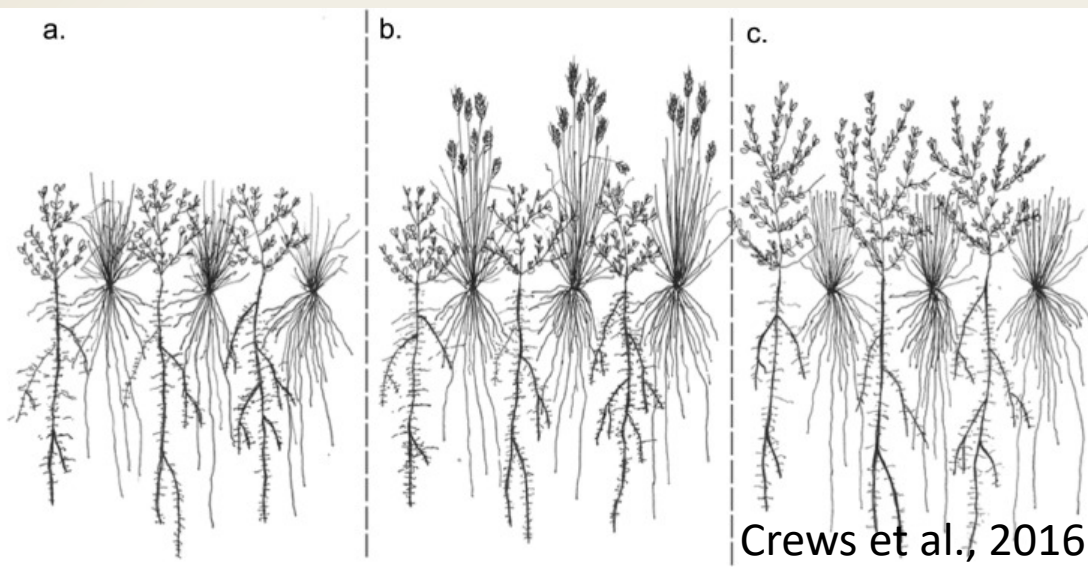
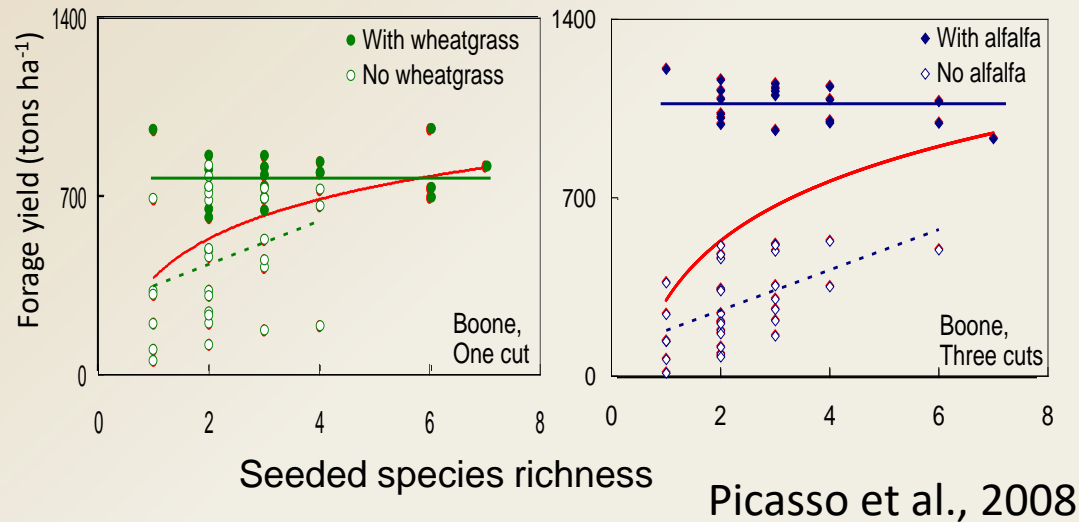
Assistant Professor
Agronomy Department
University of Wisconsin – Madison
USA



Kernza intermediate wheatgrass



Perennial polycultures



**Kernza
experimental
niche crop**



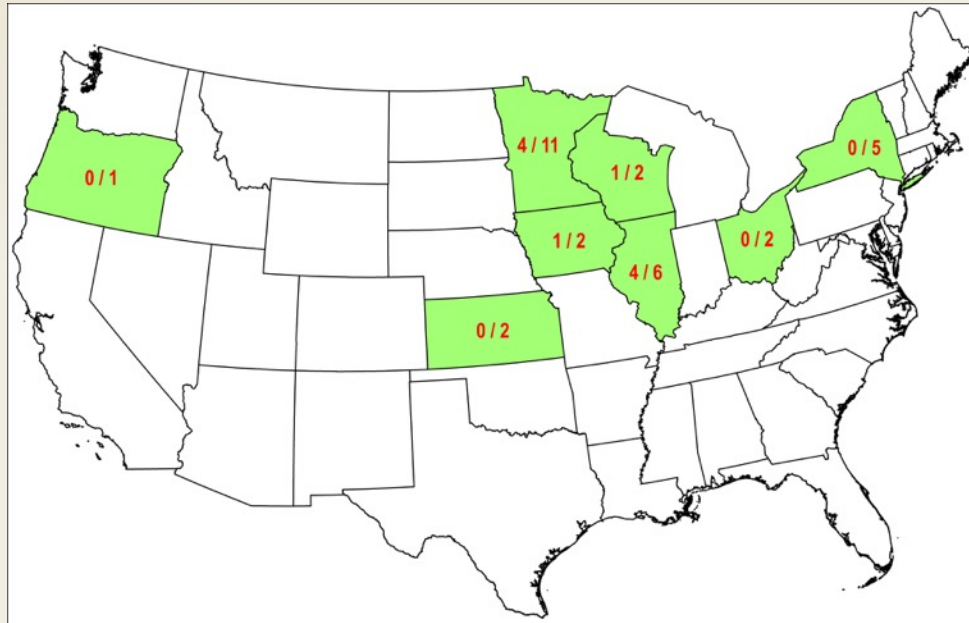
**Kernza – polyculture
in the mainstream
landscape**



- What do Kernza farmers say?
- Dual use: grain and forage
 - What is the forage nutritive value?
 - Grazing impacts on grain yield?
 - Can cattle be fed Kernza crop residue?
- Intercropping with legumes
 - Which legume species?
 - Which varieties?
 - Which management?

Farmer Perspectives on Growing Kernza

Lanker et al., in review



- 10 semi-structured, on-farm interviews with Kernza growers
- Summer 2017, U.S Midwest (MN, WI, IA, IL, OH)
- Ages: 30 to 80 years old
- Crops: Diversified row crops, some w/ livestock, some grass seed
- 4 Organic, 3 Conventional (except Kernza), 3 Mixed
- Farm acreage: 160 to 10,000; Kernza acreage: 1 to 38
- Kernza start date: Fall 2011 to fall 2016





Motivations - “I guess I was just interested in something new, looking to try something different.”

- **Sense of innovation**
- Personal connection to Kernza social network
- Environmental consciousness
- Interest in niche markets
- Some level of criticism of the dominant system

Management - “we don’t know much about the management.”

- Lack of agronomic management information
- Planting: diverse methods, late dates
- Harvest grain: 3 Combine, 4 swathing
- Limited inputs (some fertilizer)
- Weeds: perennials; Cutting/mowing



Farmers' questions and challenges

- Establishment (seeding, density, spacing)
 - *"nobody knows much about how to establish this."*
- What's a 'good stand'
 - *"Should I terminate this? Is this an adequate stand?"*
- Obtaining seed on time
 - *"the seed not coming 'til late. Just everything happened too late...."*
- Forage value
 - *"If I had cattle and I could feed it ..."*
- Weed management
 - *"pretty much squeezes everything else out."*
 - *"quickly become a weedy mess."*
- How to keep Kernza productive over years
 - *"it became sodbound"*
- Economics, processing & markets
 - *"what would the market price for it be right now?"*



Forage value of Kernza intermediate wheatgrass in monoculture vs mixture with red clover



- Lancaster, WI, USA
- Arlington, WI, USA
- First production year

Dual-use management

Spring forage harvest



Grain/straw harvest



Fall forage harvest



Vegetation

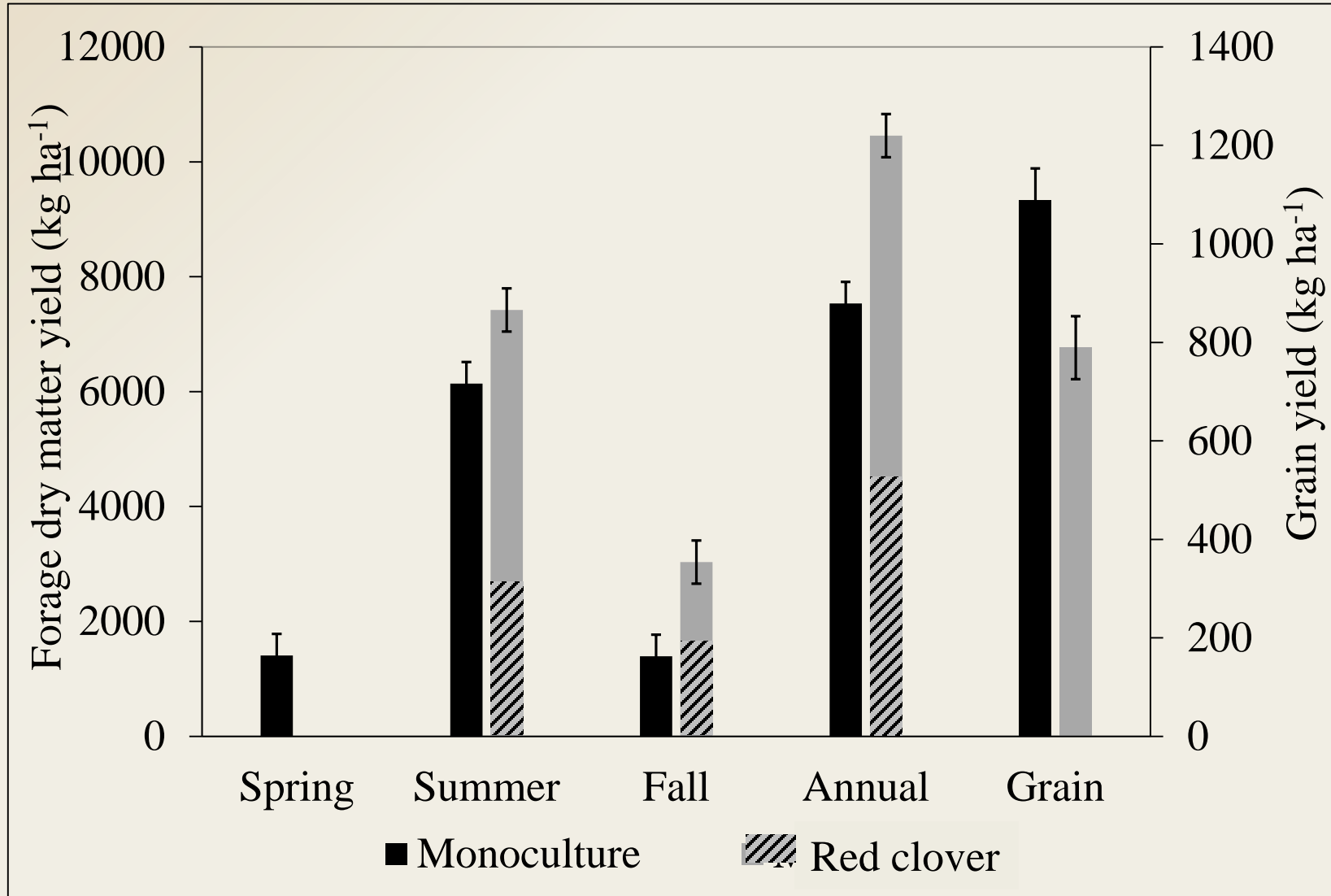
1. Kernza monoculture
2. Kernza – red clover



Sampling: Quadrat harvest at the soil level



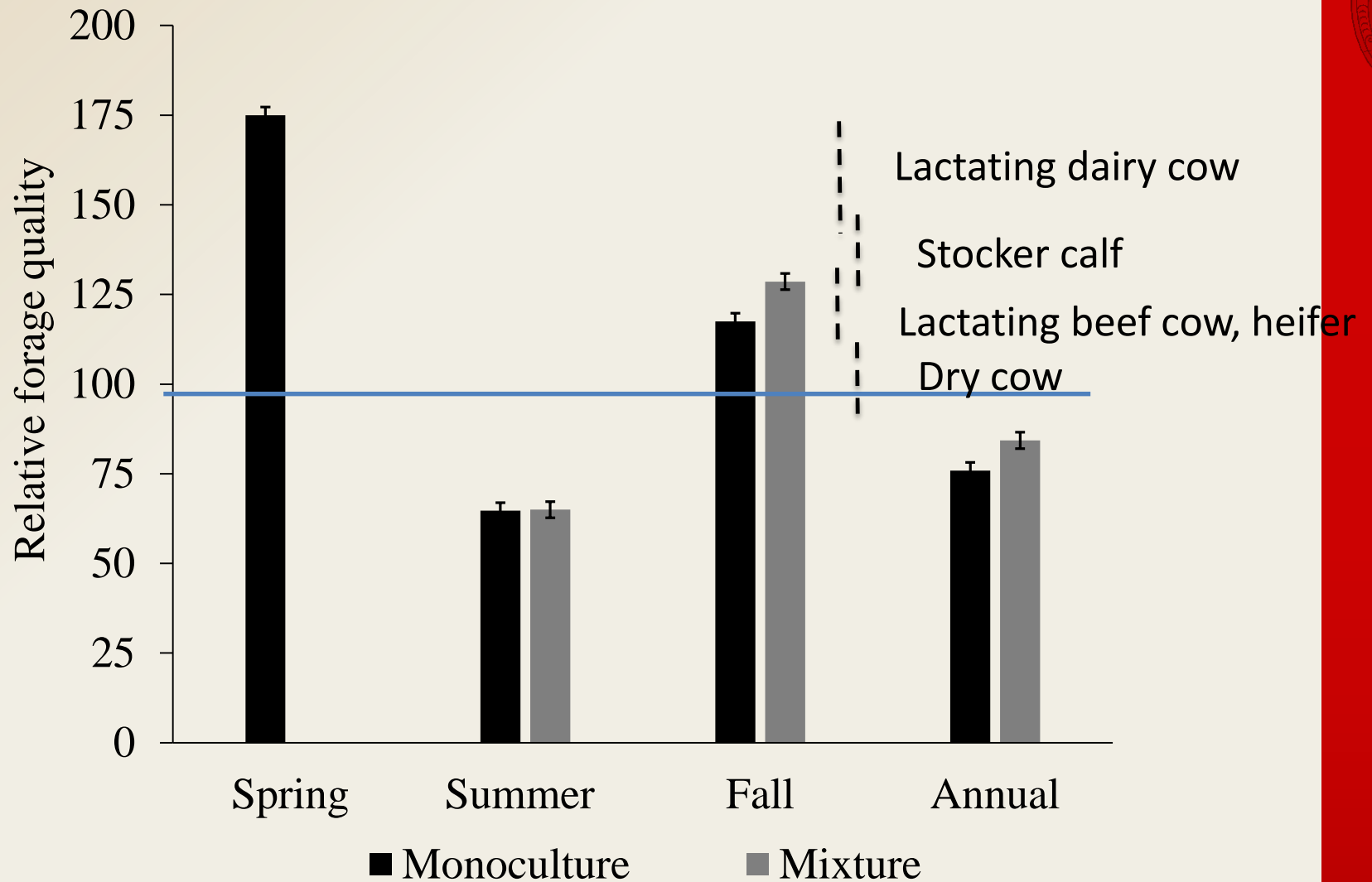
Forage and grain yields – 1st year, Wi



Forage nutritive value – 1st year, Wi



Material		Season		
		Spring	Summer	Fall
NDF (%)	IWG monoculture	46 ef	70 ab	59 cd
	IWG/clover mixture	-	64 bc	44 f
ADF (%)	IWG monoculture	25 d	43 ab	34 c
	IWG/clover mixture	-	41 b	28 d
CP (%)	IWG monoculture	23 a	5 f	12 d
	IWG/clover mixture	-	9 e	18 bc
ttNDFD	IWG monoculture	0.53 a	0.41 b	0.40 b
	IWG/clover mixture	-	0.35 b	0.33 b



Grazing impacts on Kernza grain yield



NCR-SARE grant – UW, UMN, TLI

- Lancaster, WI
- Morris, MN



Treatments

Vegetation (2 treatments):

- a) Kernza monoculture
- b) Kernza + legume intercrop

Grazing (4 treatments):

- a) Spring grazing
- b) Fall grazing
- c) Spring and fall grazing
- d) No grazing

Grain harvest from every plot



Planting

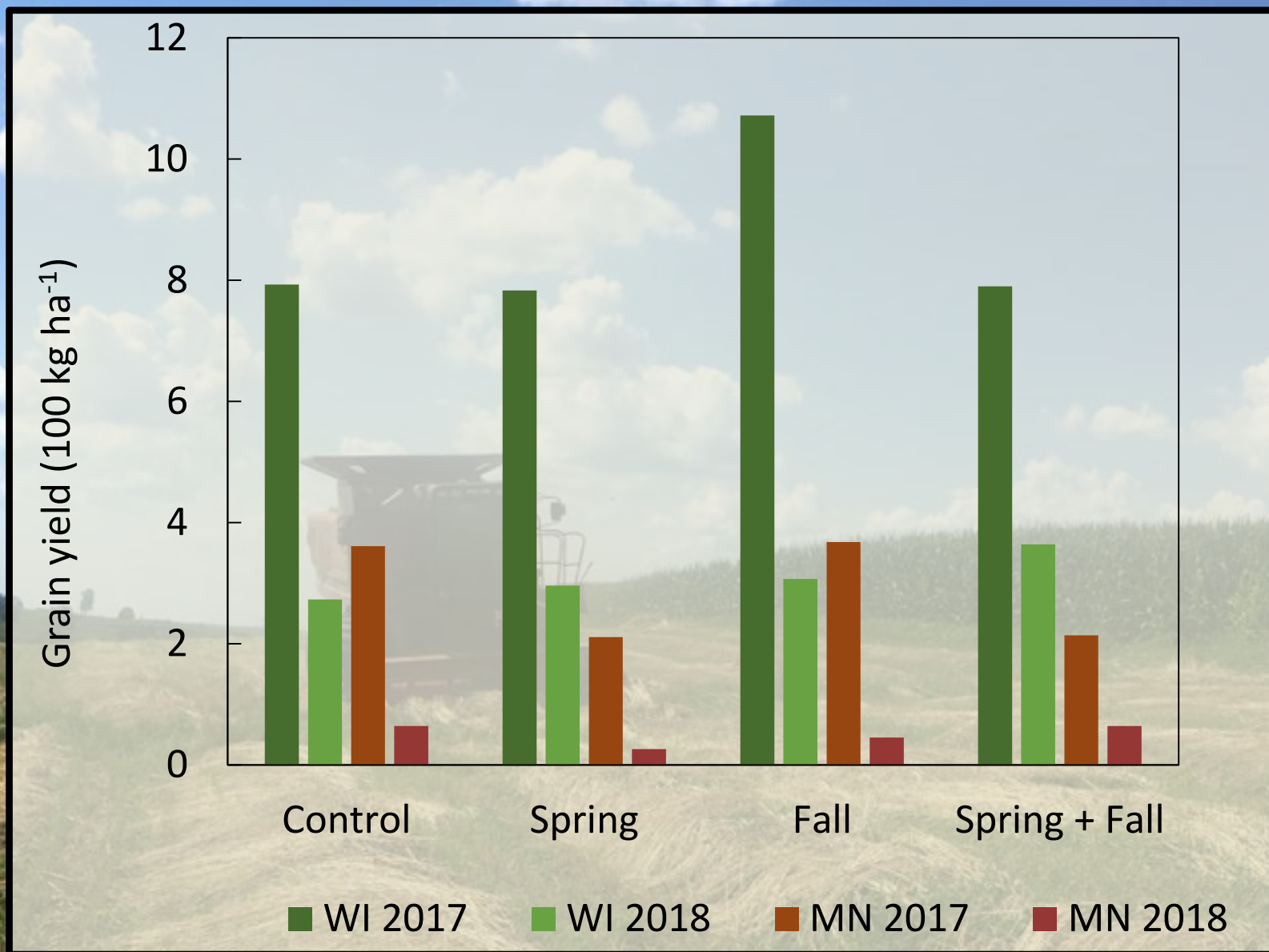
Grazing

Grain
harvest

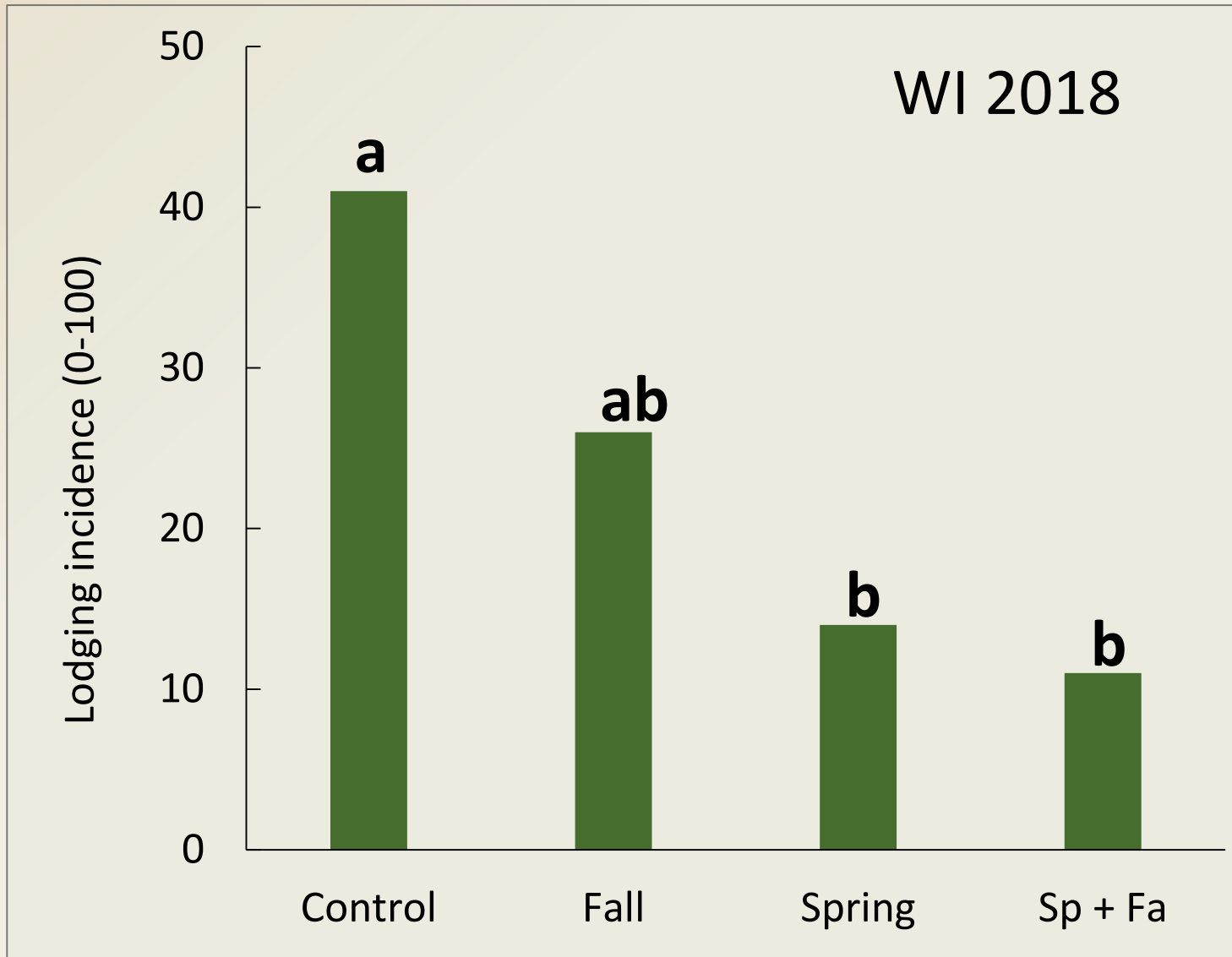
Grazing

Sept Oct Nov [...] April May June July Aug Sept Oct

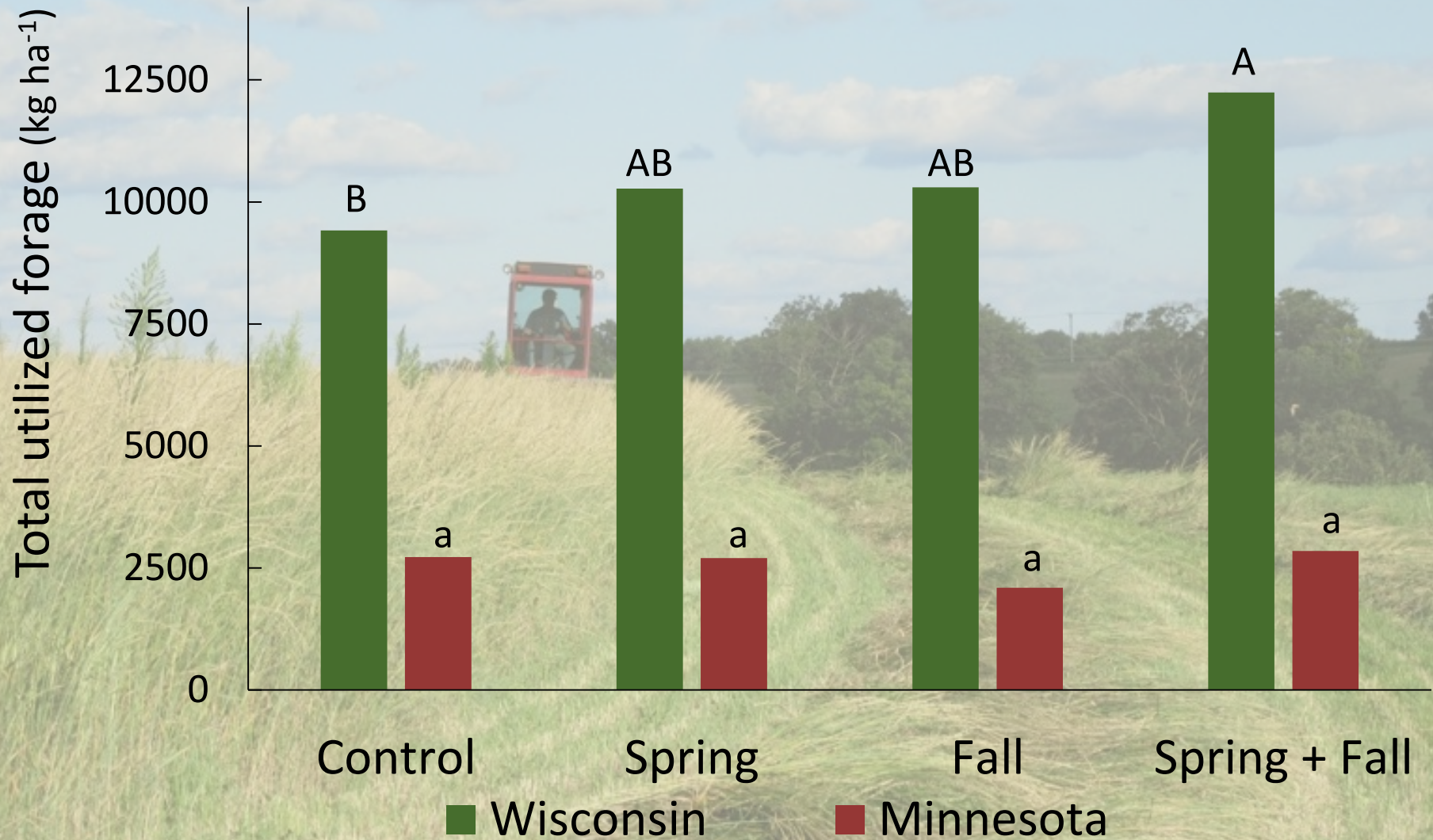
Grain yield vs grazing timing



Lodging vs grazing timing



Forage yield vs grazing timing



Beef cattle performance in a feeding trial with Kernza crop residue



		100% grass- alfalfa haylage	50% Kernza crop residue + 50% haylage	p-value	SEM
Cow final body weight	kg	769	739	0.05	7.6
Average daily gains	kg day ⁻¹	0.92	0.45	0.02	0.1
Dry Matter intake	g kg BW ⁻¹	28.7	21.4	<0.01	0.4
Increase in Body Condition Score	-	0.3	0.1	0.05	
Calf birth weight	kg	40.8	39.5	0.55	1.44
Calf weaning weight	kg	203	211.2	0.42	5.5

Intercropping legumes with Kernza



Experimental design

Locations: Arlington and Sturgeon Bay, WI

Seeds from Cycle 4 IWG – TLI, 11 kg ha⁻¹

5 replications


Main plot factor: Row Spacing

- 38 cm
- 57 cm


Sub-plot factor: IWG cropping system

- IWG monoculture – weedy
- IWG monoculture – weed free
- IWG monoculture + 45 kg N ha⁻¹
- IWG monoculture + 90 kg N ha⁻¹
- IWG + Alfalfa
- IWG + Red Clover
- IWG + Kura Clover
- IWG + Berseem Clover
- IWG + Soybean




A close-up photograph of a field. In the foreground, there are tall, slender green grasses. Interspersed among the grasses are numerous small, bright pink flowers, which are the blossoms of red clover. The background shows a continuation of the field under a clear sky.

Red clover
Trifolium pratense

A close-up photograph of a field. The foreground is dominated by a dense growth of tall, green grasses. Below the grasses, there are green, trifoliate leaves of Kura clover. Some small yellow flowers are visible among the leaves.

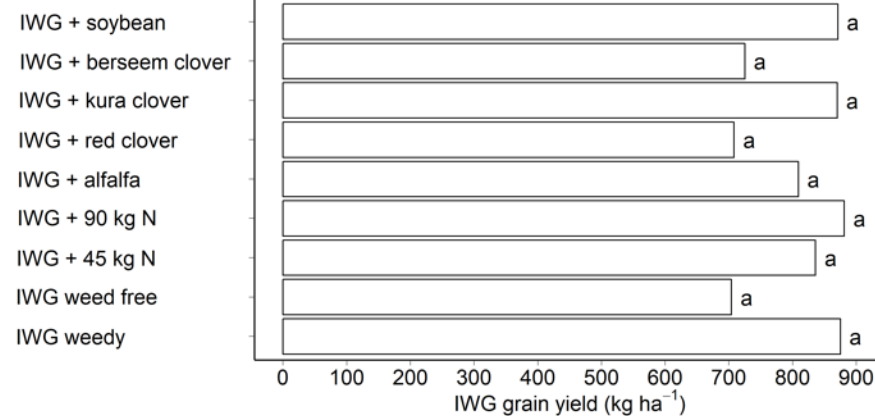
Kura clover
Trifolium ambiguum

A wide-angle photograph of a large field of alfalfa. The field is filled with dense, green alfalfa plants. In the background, a farm with several white buildings and trees is visible under a cloudy sky.

Alfalfa (Lucerne)
Medicago sativa

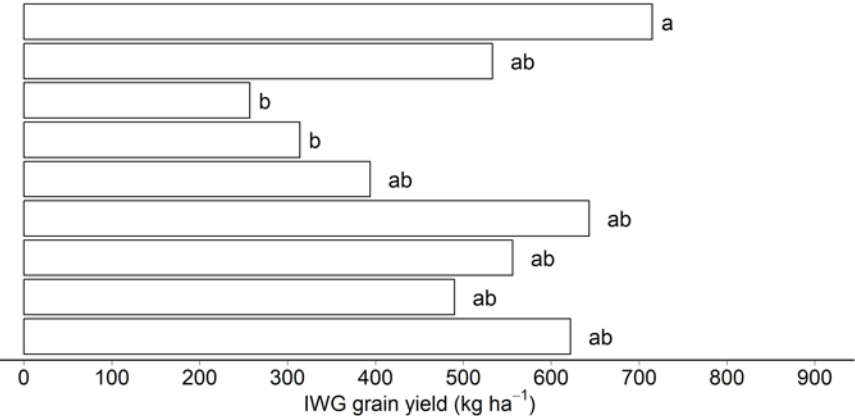
AARS 2017

IWG grain yield

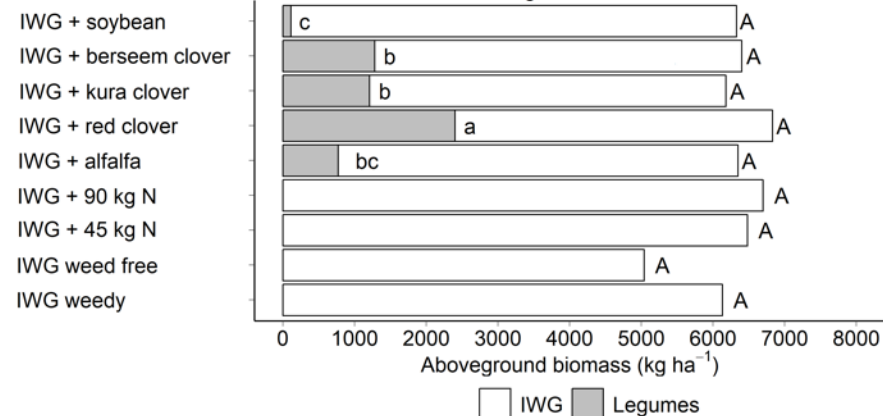


AARS 2018

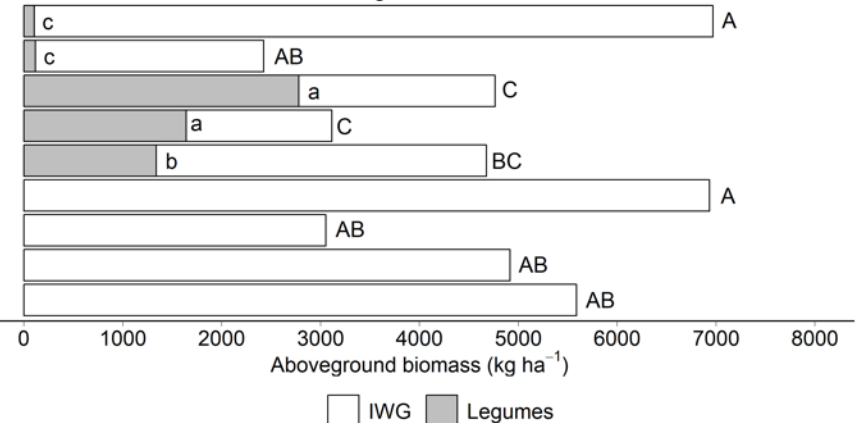
IWG grain yield



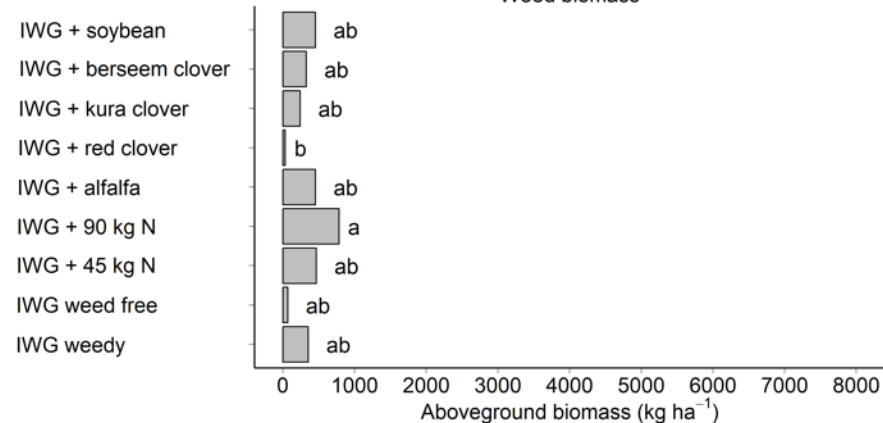
Aboveground biomass



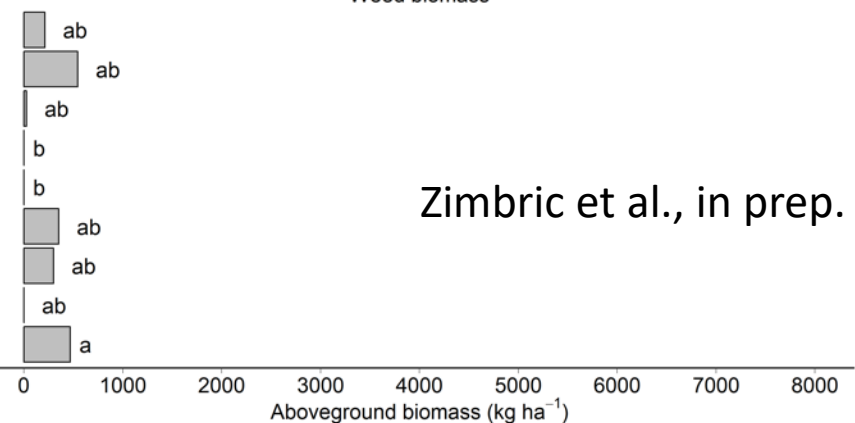
Aboveground biomass



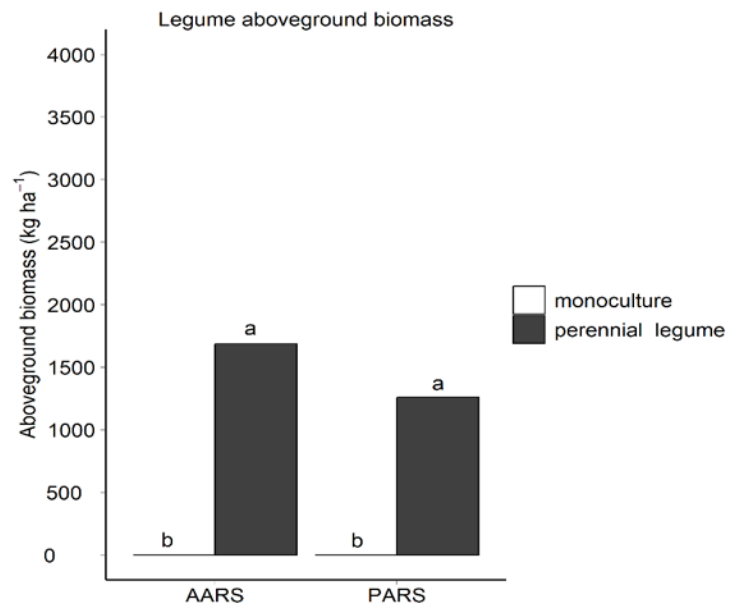
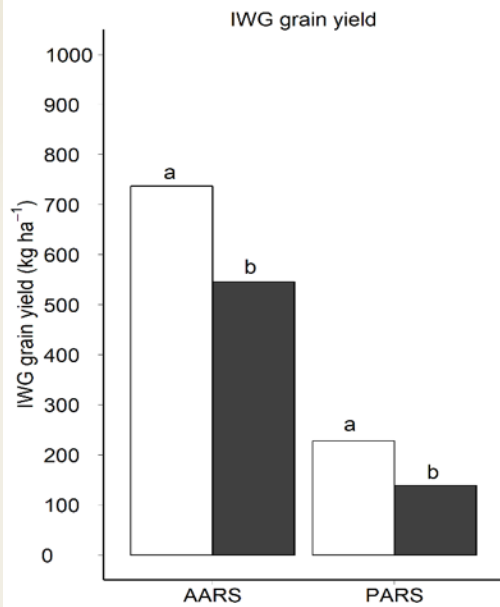
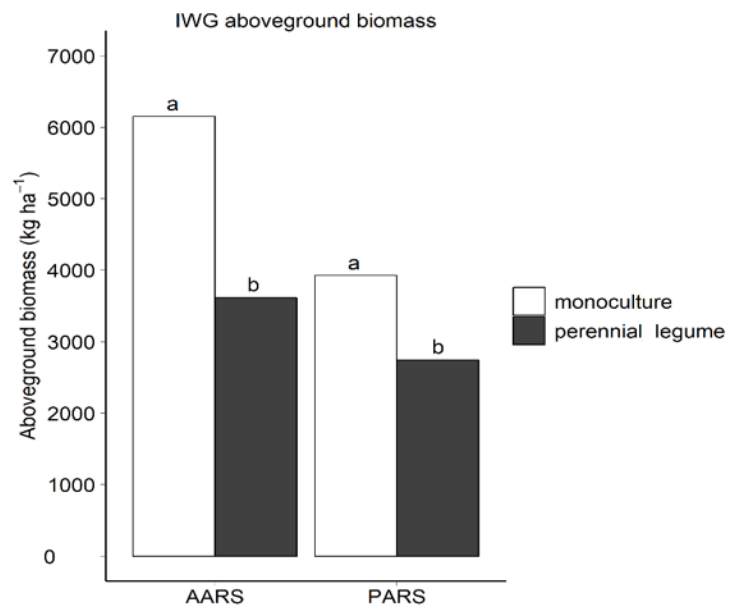
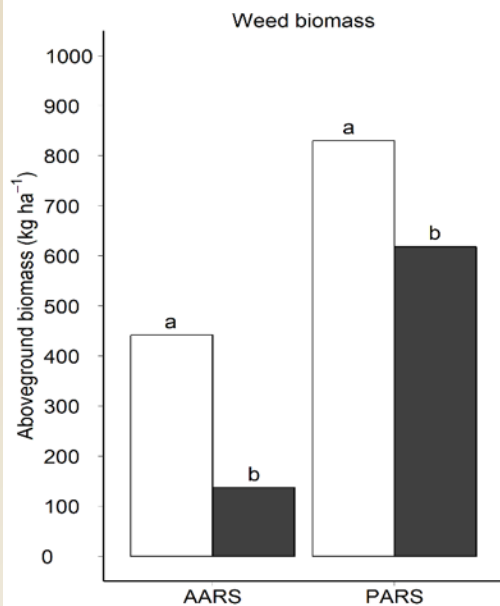
Weed biomass



Weed biomass



Zimbric et al., in prep.



Alfalfa varieties for Kernza intercropping

Brandon Schlautman et al.

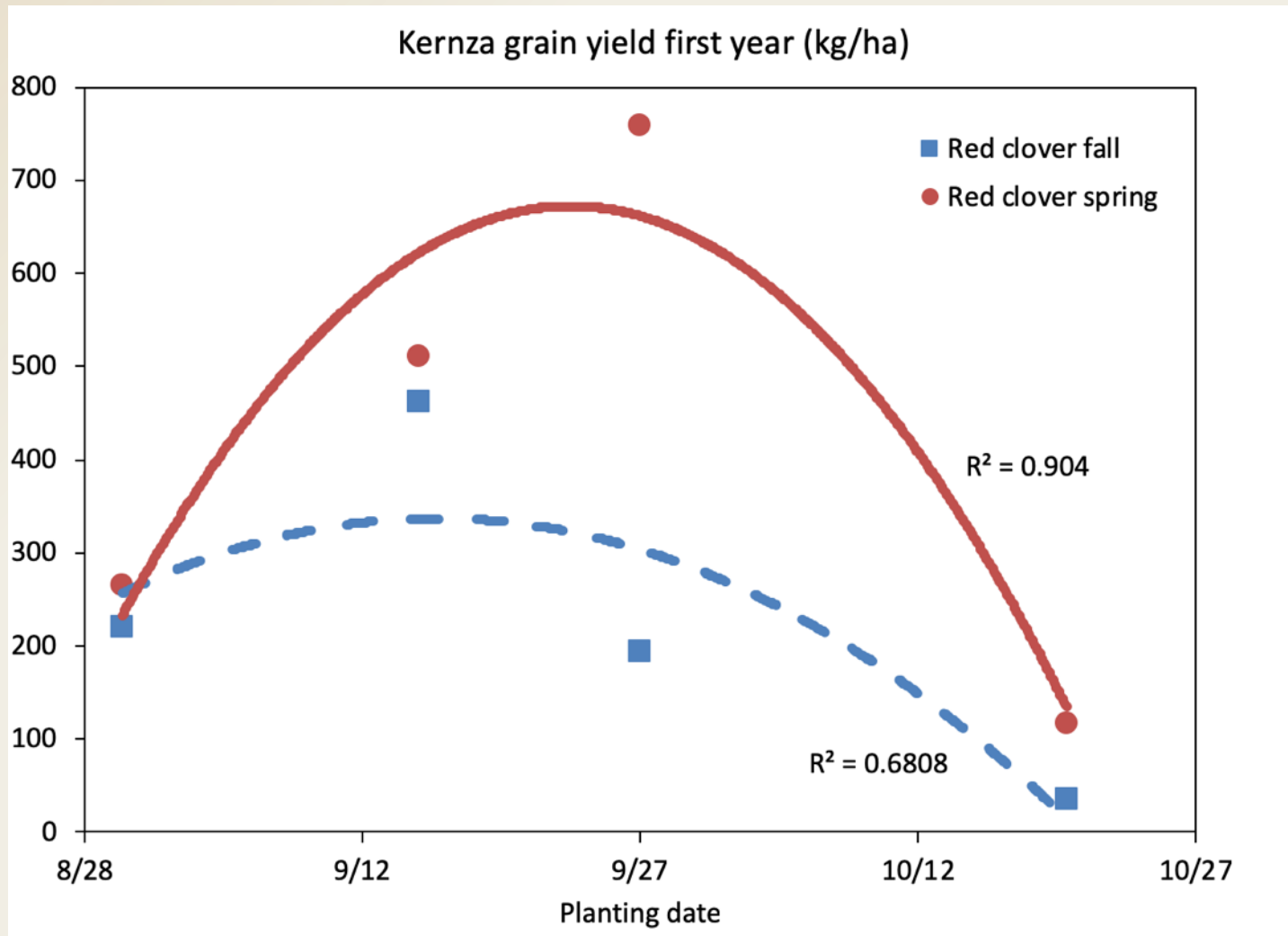


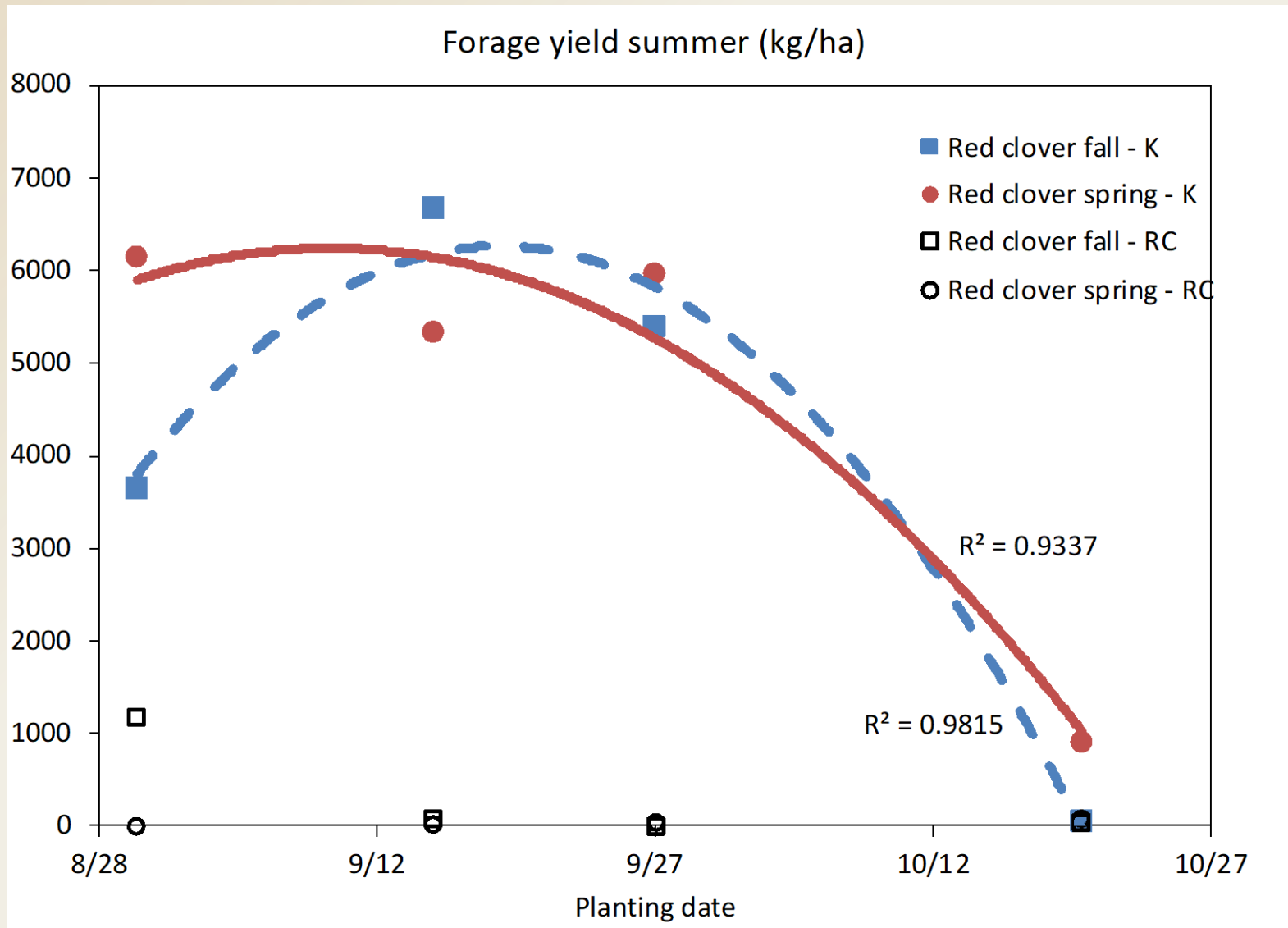
UW, Arlington, WI



Alforex, West Salem, WI

Planting date of Kernza and legume





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Thank you!

Chequamegon-Nicolet
National Forest

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Eau Claire

Wausau

WISCONSIN

Green Bay

Stevens Point

Appleton

Oshkosh

Wisconsin
Dells

USDA

Milwaukee

Janesville

Kenosha

Dubuque

