Use and Breeding of Forage Grasses in the North Central USA

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Forage Nutrition Environment
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Conservation/Hay/Silage

- **Timothy & Smooth brome** – long-time standards for hay; many old hayfields still around; used for CRP, but not much seed sales otherwise.
- **Orchardgrass** – often used in mixtures with alfalfa; sometimes mixed with other grasses.
- **Reed canarygrass** – mostly “invaded” wetlands.
- **Quackgrass** – it’s everywhere; very naturalized.
- **Tall fescue** – some old KY-31 types and some new types; not very common.
- **Ryegrasses** – both perennial and Italian types; mostly emergency forage.

Pasture for Dairy, Beef, or Sheep

- **Reed canarygrass** – a few pastures planted to low-alkaloid types.
- **Tall fescue** – soft-leaf types; endophyte is not needed for winter survival.
- **Perennial ryegrass** – niche usage in protected areas; mostly in mixtures.
- **Meadow fescue** – close relative of TF; introduced from Europe; demand >>> supply.
- **Unimproved "natural" pasture** – quackgrass, bluegrass, etc.; mostly unfertilized.

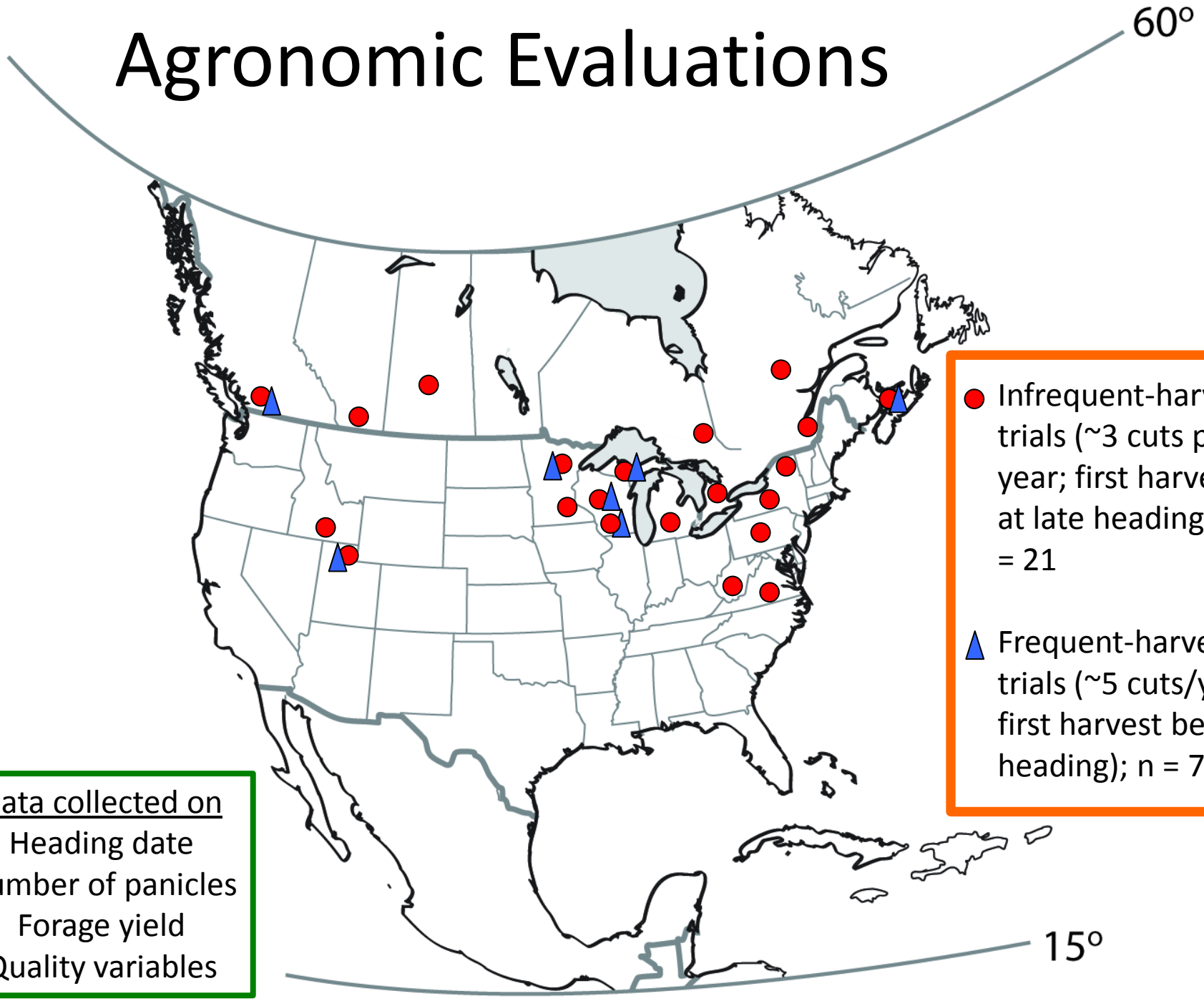
Forage Grass Breeding

- Development of ***meadow fescue*** as a "new" pasture crop. It's not really new, because it was very popular before the discovery of tall fescue. When KY-31 was released in 1953, meadow fescue completely disappeared within 7 years.
- Development of ***non-flowering orchardgrass*** for grazing. Most commercial orchardgrass is undesirable for grazing due to early and profuse flowering. Our goal is to produce a cultivar without flowering stems in the central USA.

Project Timelines

- 1963 – First germplasm discovery (A.W. Hovin).
- 1993 to 2015 – Three generations of tandem selection
  - Seed production and disease resistance in the Willamette Valley of Oregon (Reed Barker, USDA & Devesh Singh, Barenbrug USA)
  - Forage production and sparse flowering in Wisconsin
- 2006 to 2011 – Proof of concept trials
- 2016 to 2017 – “Put up or shut up time”

Agronomic Evaluations



- Infrequent-harvest trials (~3 cuts per year; first harvest at late heading); n = 21
- Frequent-harvest trials (~5 cuts/year; first harvest before heading); n = 7

Data collected on
Heading date
Number of panicles
Forage yield
Quality variables

Infrequent-harvest Means

Cultivar	Heading Date	Panicle Density	Cut-1 Yield	Regr. Yield	Total Yield
	May	#/m^2	Mg/ha	Mg/ha	Mg/ha
Sparse #1	**30**	**53**	**3.36**	**4.86**	**8.17**
Sparse #2	**29**	**56**	**3.38**	**4.66**	**7.99**
Sparse #3	**30**	**74**	**3.67**	**4.88**	**8.48**
Benchmark	24	128	4.54	5.28	9.75
Albert	26	168	4.89	4.97	9.80
Icon	26	128	4.24	4.90	9.08
% Change	**8**	**-57**	**-24**	**-5**	**-14**
LSD(0.01)	1	13	0.26	0.36	0.41

Frequent-harvest Means

Cultivar	Cut-1 Yield	Regrowth yield	Total Yield
	Mg/ha	Mg/ha	Mg/ha
Sparse #1	**1.44**	**5.82**	**7.25**
Sparse #2	**1.35**	**5.74**	**7.09**
Sparse #3	**1.51**	**6.24**	**7.75**
Benchmark	2.17	6.92	9.09
Albert	2.11	6.39	8.51
Icon	2.00	6.27	8.27
% Change	**-32**	**-9**	**-15**
LSD(0.01)	0.25	0.48	0.54

Forage Quality Traits

	CP	NDF	NDFD	IVDMD
	g/kg	g/kg	g/kg	g/kg
First harvest				
Normal	118	607	597	760
Sparse	130	593	616	777
% Change	**10**	**-2**	**3**	**2**
LSD(0.01)	6	8	13	11
Regrowth				
Normal	147	581	644	795
Sparse	152	585	635	788
% Change	**4**	**1**	**-2**	**-1**
LSD(0.01)	**NS**	**NS**	**NS**	**NS**

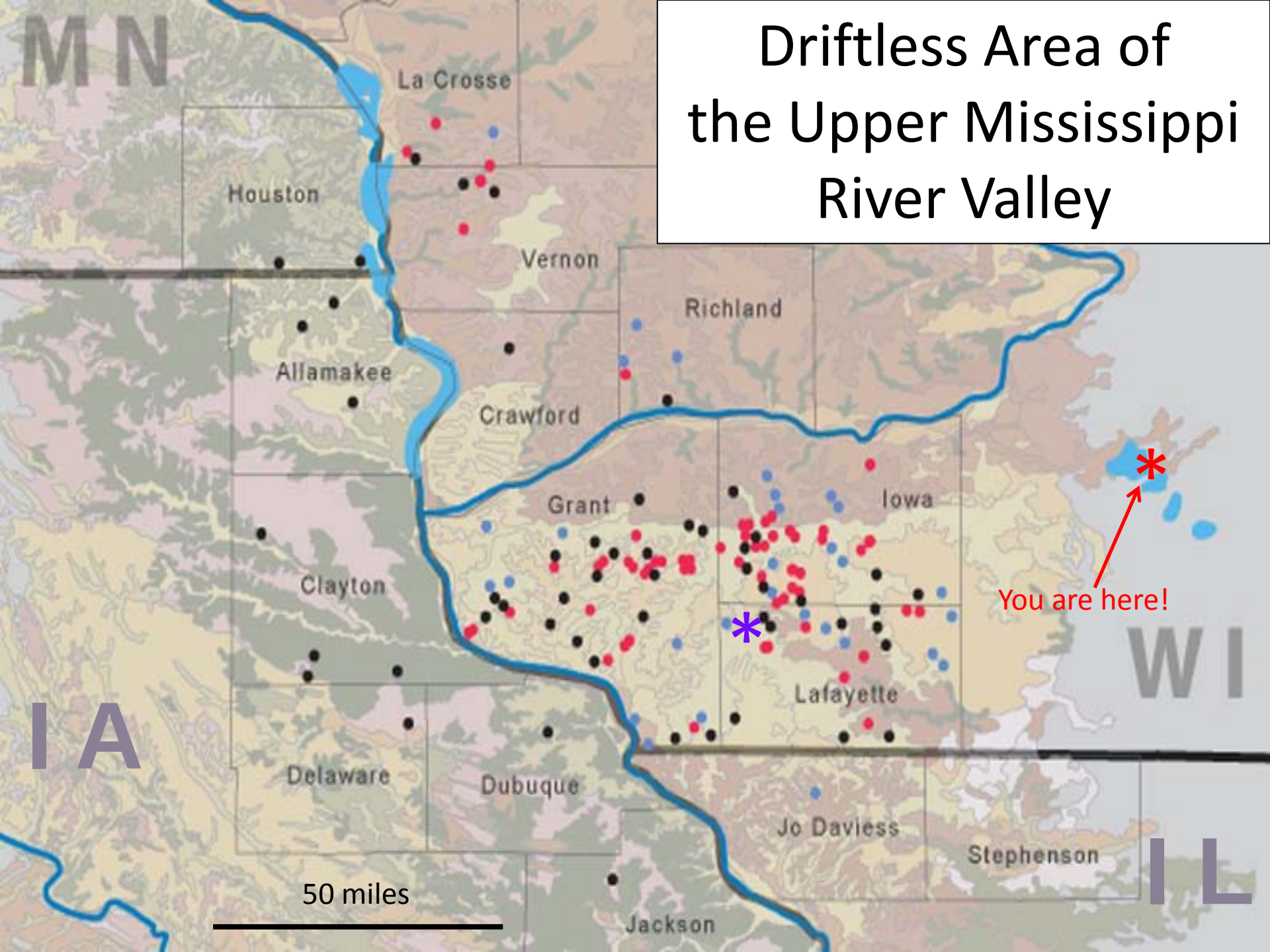

June 2nd 2016, Arlington, WI

Charles Opitz Farm: Remnant Oak Savanna in 1990

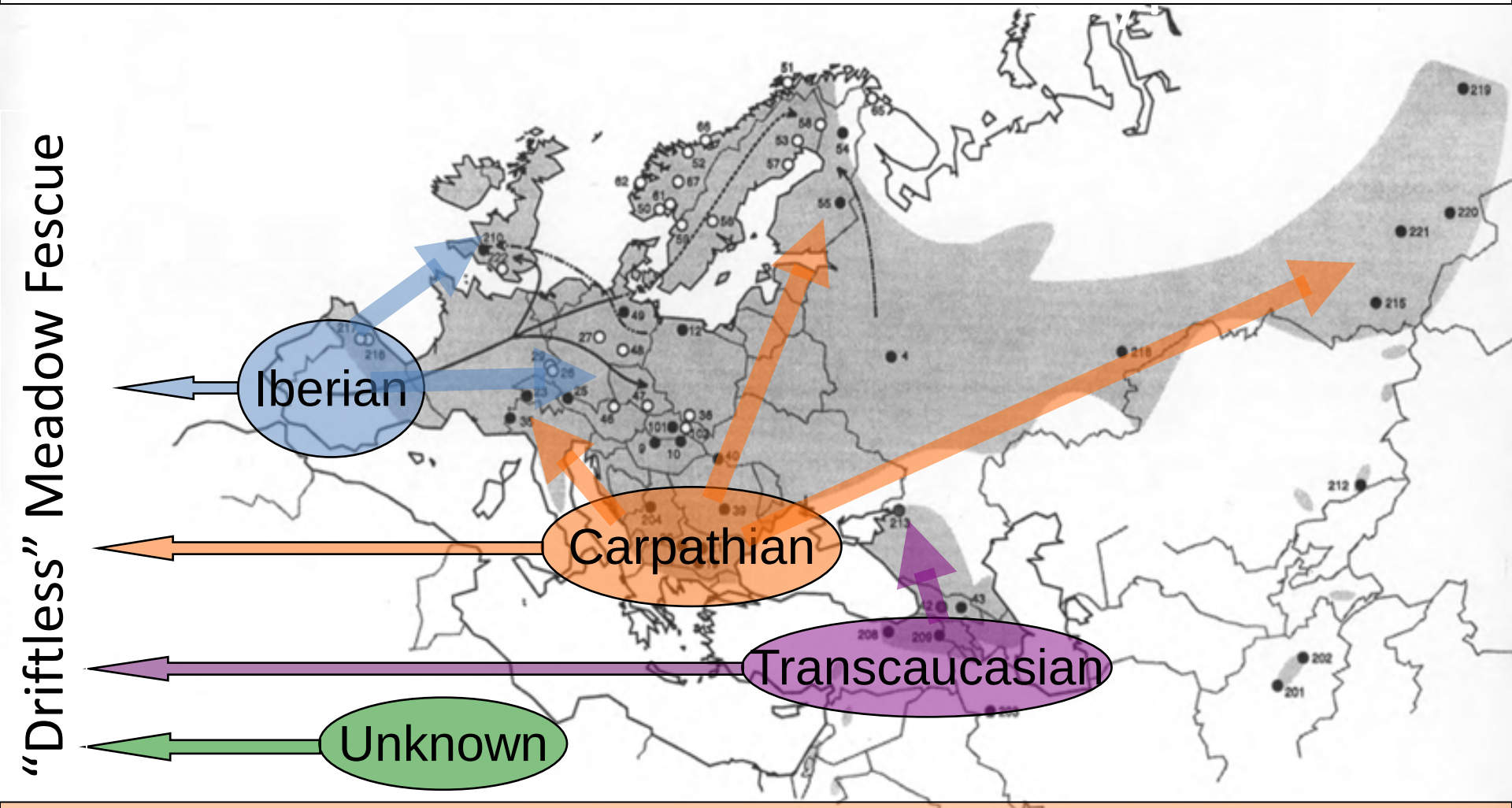
First documentation of meadow fescue since the 1950s

DNA marker tests to identify the unknown species

Collection and agronomic evaluations to follow


Driftless Area of the Upper Mississippi River Valley
MN
La Crosse
Houston
Vernon
Richland
Allamakee
Crawford
Grant
Iowa
Clayton
You are here!
WI
IA
Lafayette
Delaware
Dubuque
Jo Daviess
Stephenson
IL
50 miles
Jackson

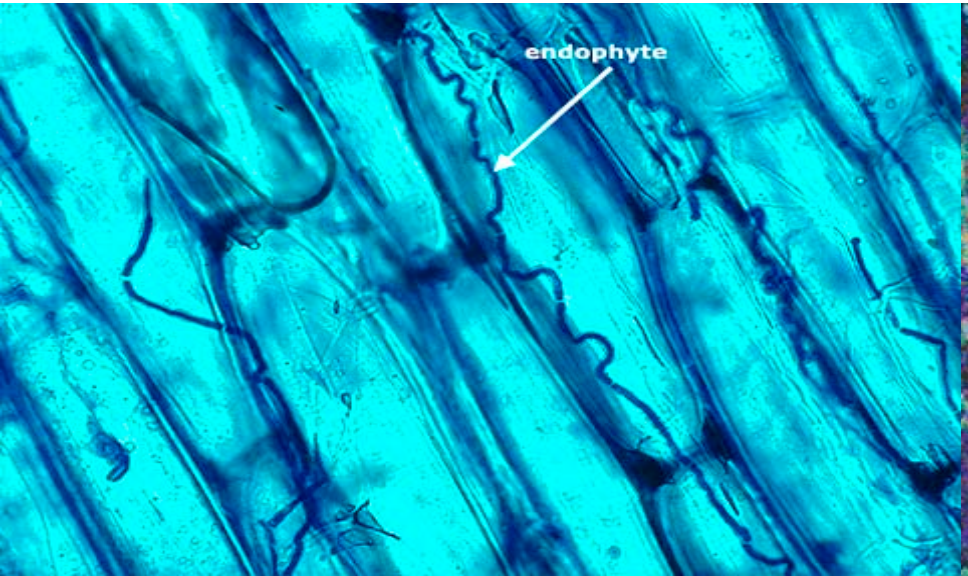
European Meadow Fescue:
Post-Glacial Range Expansion: ~11,000 yrs ago

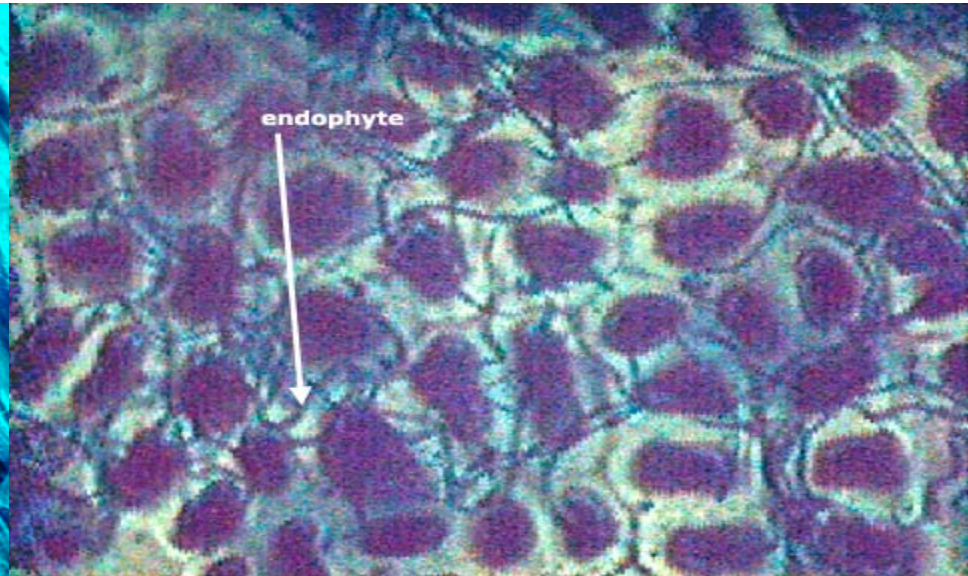


At least four introduction events are responsible for immigration of meadow fescue into the Upper Mississippi Driftless Region.

Meadow Fescue Endophyte

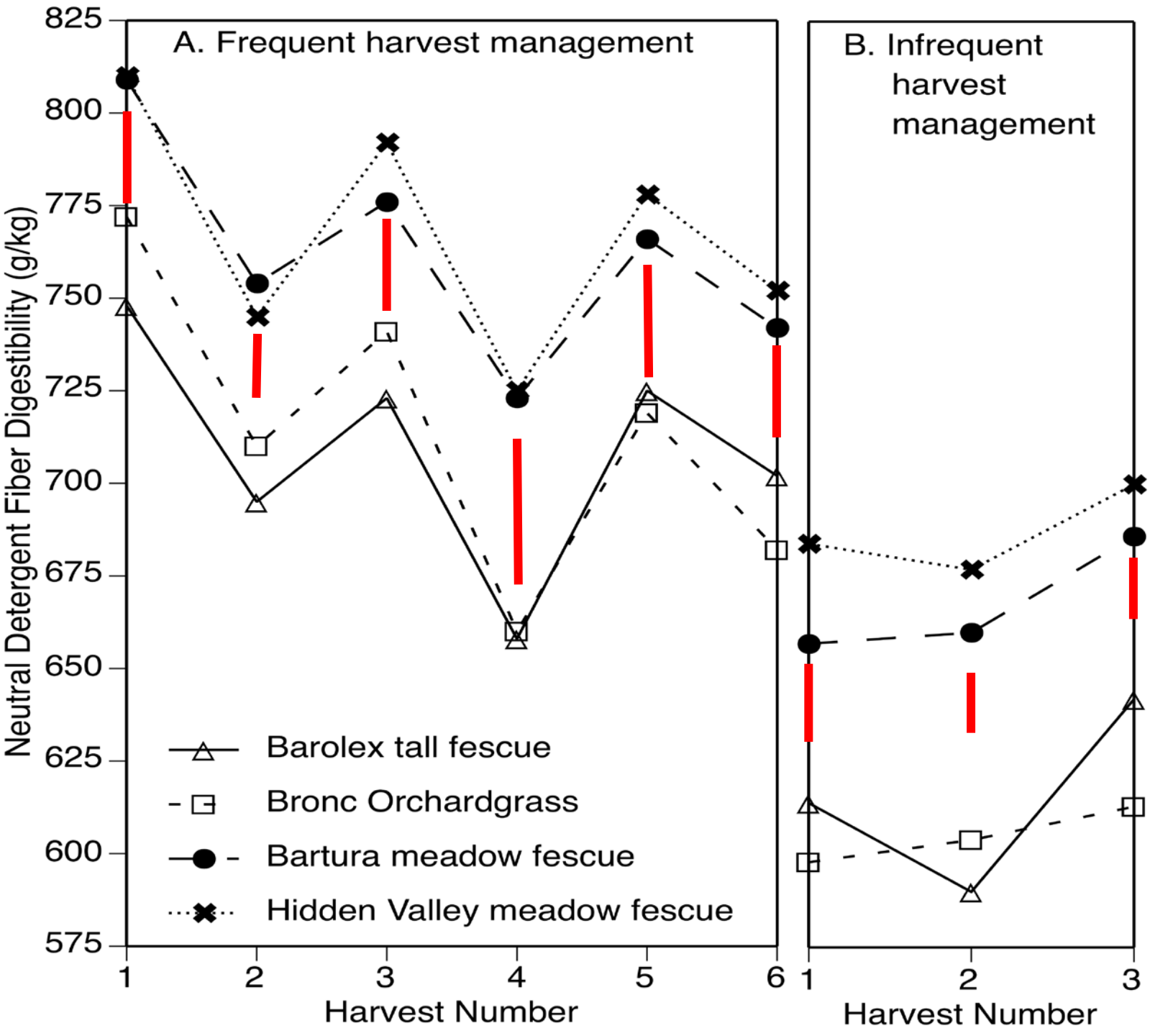
- Fungal endophyte that lives in stems, leaf sheaths, and seeds.
- Mutualistic relationship
  - Host plant provides water, nutrients, & structure
  - What does the endophyte do for the host?
- Sample of 31 farms: 82% infection rate!





Agronomic Performance of 'Hidden Valley' Meadow Fescue

Cultivar and Species	Wisconsin Forage Yield	New York Forage Yield	Wisc. in vitro NDFd	NY in vitro NDFd
	Mg/ha	Mg/ha	%	%
Orchardgrass	6.51	-	67.8	-
Tall Fescue	7.04	10.67	67.7	71.6
European MF	6.26	9.81	73.0	73.0
Hidden Valley MF	**6.43**	**10.14**	**74.0**	**73.5**
LSD(0.05)	0.12	0.35	0.8	1.0
HVMF (% Change)	**-8%**	**-5%**	**+9%**	**+3%**


A. Frequent harvest management
B. Infrequent harvest management
Neutral Detergent Fiber Digestibility (g/kg)
825
800
775
750
725
700
675
650
625
600
575
1
2
3
4
5
6
Harvest Number
Barolex tall fescue
Bronc Orchardgrass
Bartura meadow fescue
Hidden Valley meadow fescue


400

Meadow Fescue Cultivars

- Hidden Valley (2014) public release – seed multiplication from the Opitz farm.
- Azov (2015) public release – strain cross of selections made from plant introductions collected on the Azov peninsula on the Black Sea.
- “Unnamed” cultivar (2017) Barenbrug USA – selection based on seed production and rust resistance in Oregon, combined with high yield and rust resistance in Wisconsin.

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QUESTIONS?