

# Perennial Cool-Season Grasses and Grass Varieties for California

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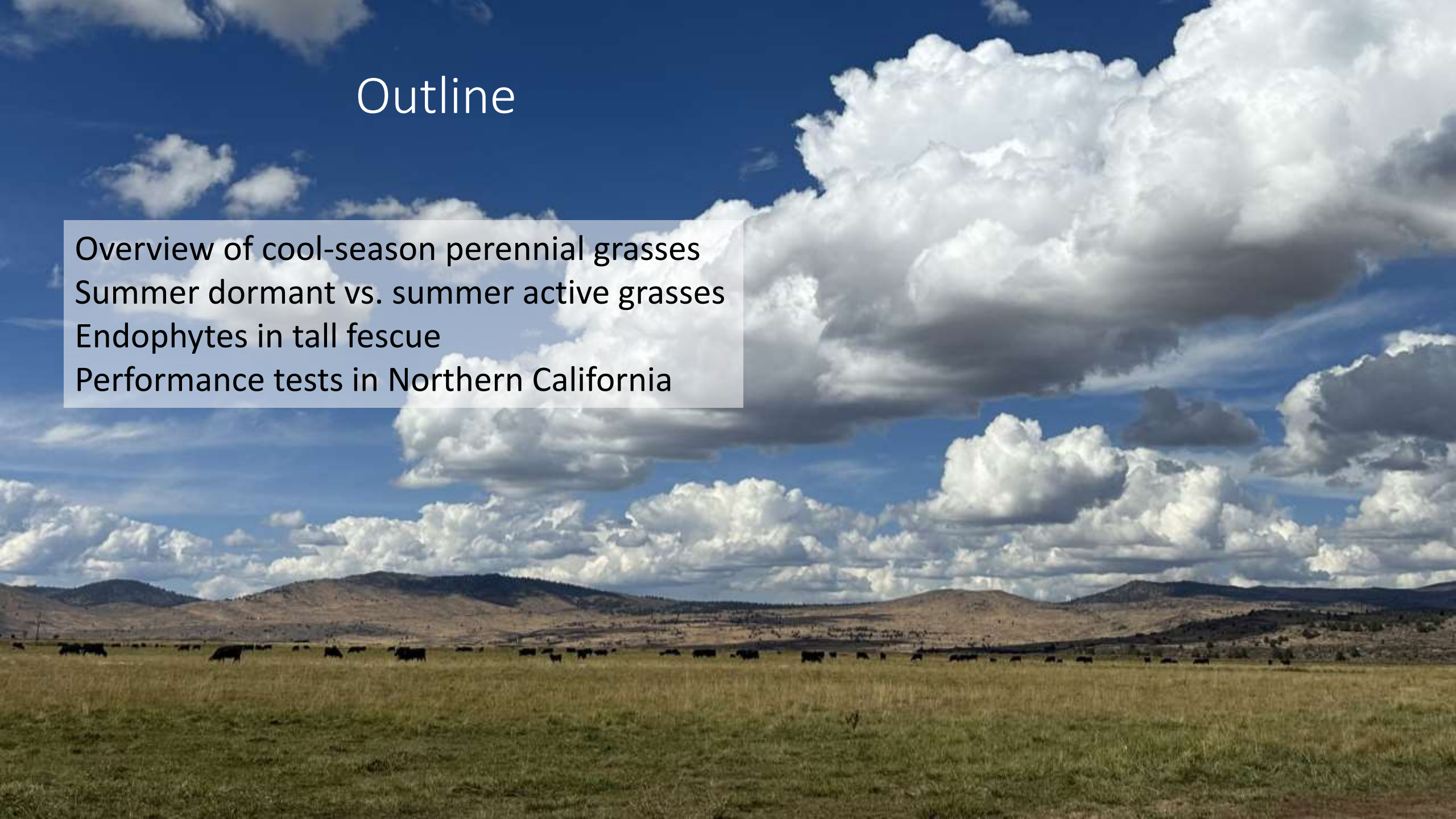
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# Outline

Overview of cool-season perennial grasses  
Summer dormant vs. summer active grasses  
Endophytes in tall fescue  
Performance tests in Northern California



# Major perennial cool-season forage grasses

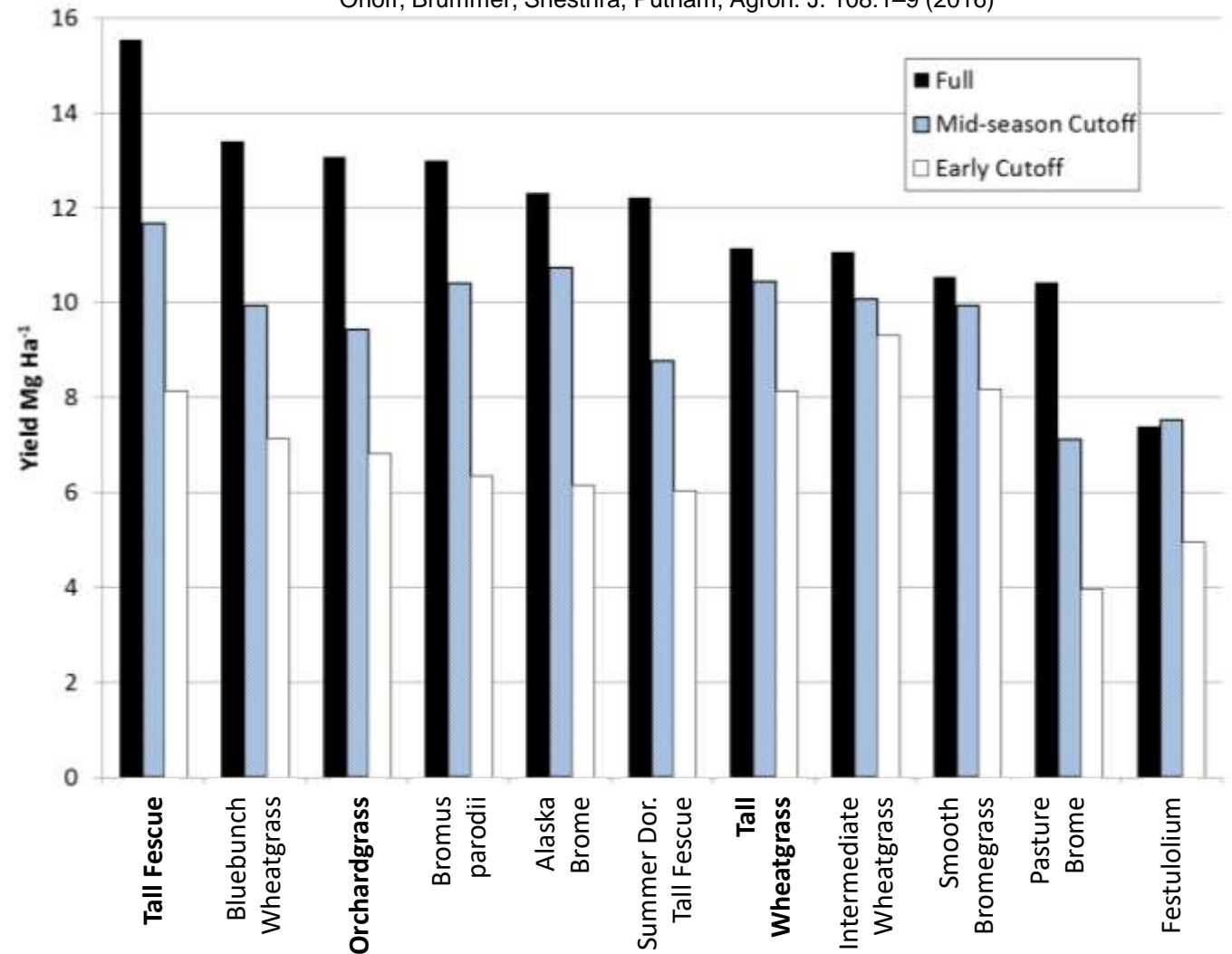
Ranked from best to worst forage quality

(Poor quality forages can be managed to be good or even excellent quality and vice versa).

1. Perennial Ryegrass
2. Festulolium
3. Timothy
4. Orchardgrass
5. Tall Fescue
6. Hardinggrass (Phalaris)
7. Intermediate Wheatgrass
8. Smooth Bromegrass
9. Reed Canarygrass
10. Tall Wheatgrass
11. Native rangeland and other minor species

Yield in Tulelake, CA - 3 irrigation treatments

Orloff, Brummer, Shesthra, Putnam, Agron. J. 108:1-9 (2016)



# Summer Dormant vs. Summer Active Cool-Season Grasses

(*Mediterranean*)                      (*Continental*)

Some species like orchardgrass and tall fescue contain both ecotypes.

Summer dormant cool-season grasses produce more biomass than summer active grasses in winter under conditions conducive to growth, but are dormant in summer under hot temperatures and no precipitation.

1-30-2024, Plant Sciences Farm, Davis



Summer dormant/  
winter active  
'Berber'  
orchardgrass

Summer active  
orchardgrass cultivars



# Summer Dormant vs. Summer Active Cool-Season Grasses

(*Mediterranean*)                      (*Continental*)

Summer active grasses aren't dormant over winter, but they do not grow very much.  
Summer active ecotypes have superior winter survival in colder regions than summer dormant ecotypes

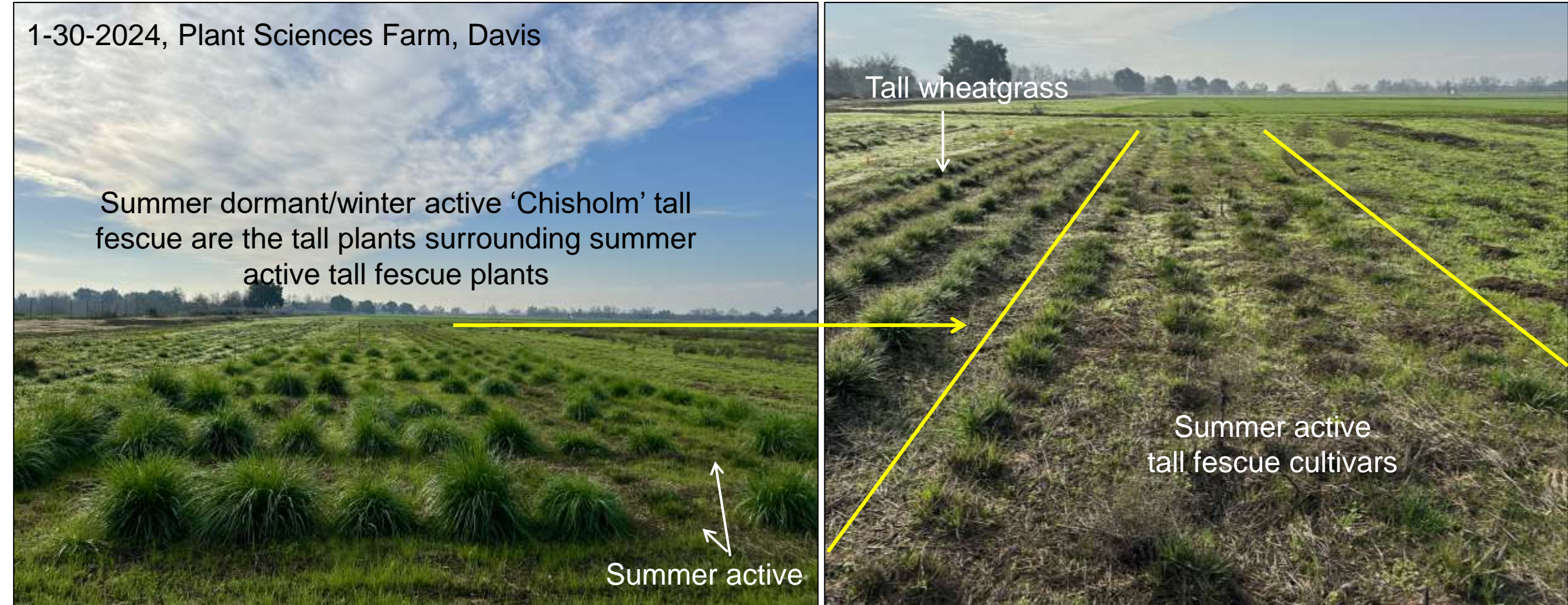
1-30-2024, Plant Sciences Farm, Davis

Summer dormant/winter active 'Chisholm' tall fescue are the tall plants surrounding summer active tall fescue plants

Summer active

Tall wheatgrass

Summer active tall fescue cultivars



# Tall Fescue Ecotypes – El Centro

Planted Fall 2017

(Below) With full irrigation, no stand loss of either summer dormant or summer active varieties



2 August 2018

**Full irrigation**



6 February 2019

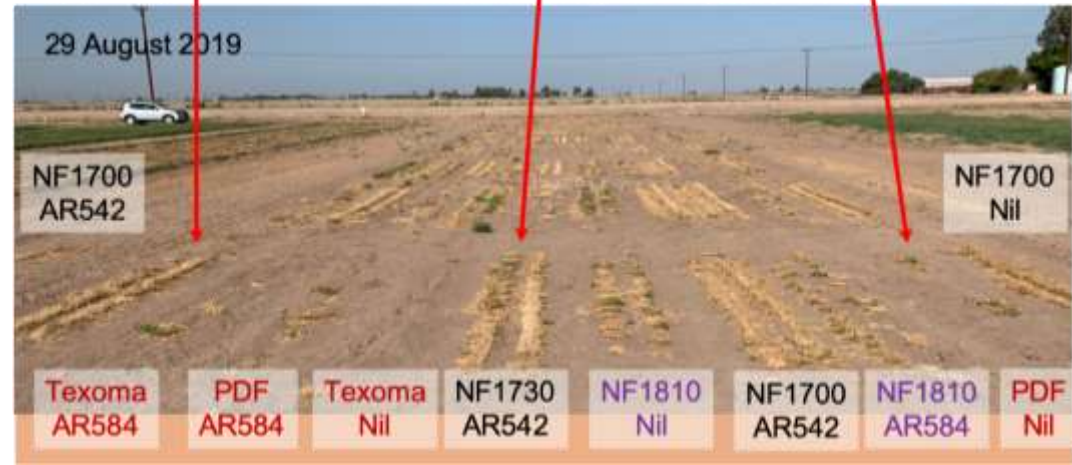


2 August 2018

**No irrigation**



6 February 2019



29 August 2019

NF1700  
AR542

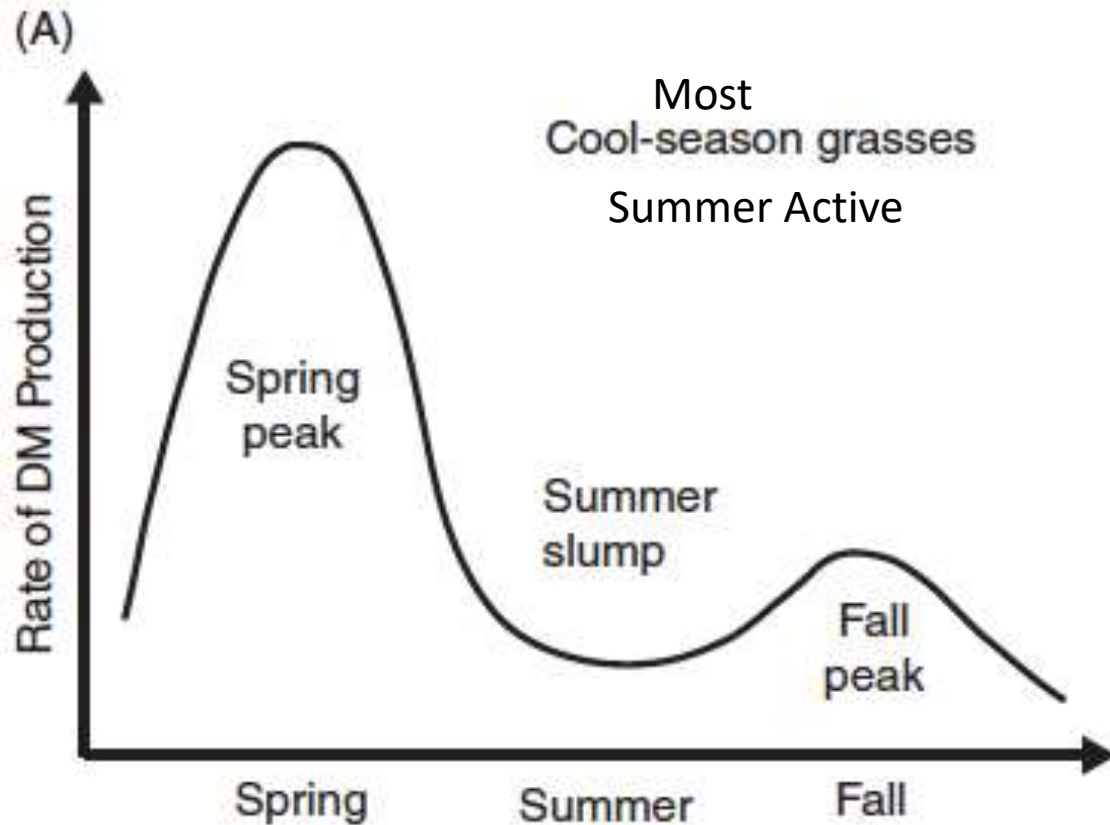
NF1700  
Nil



14 January 2020

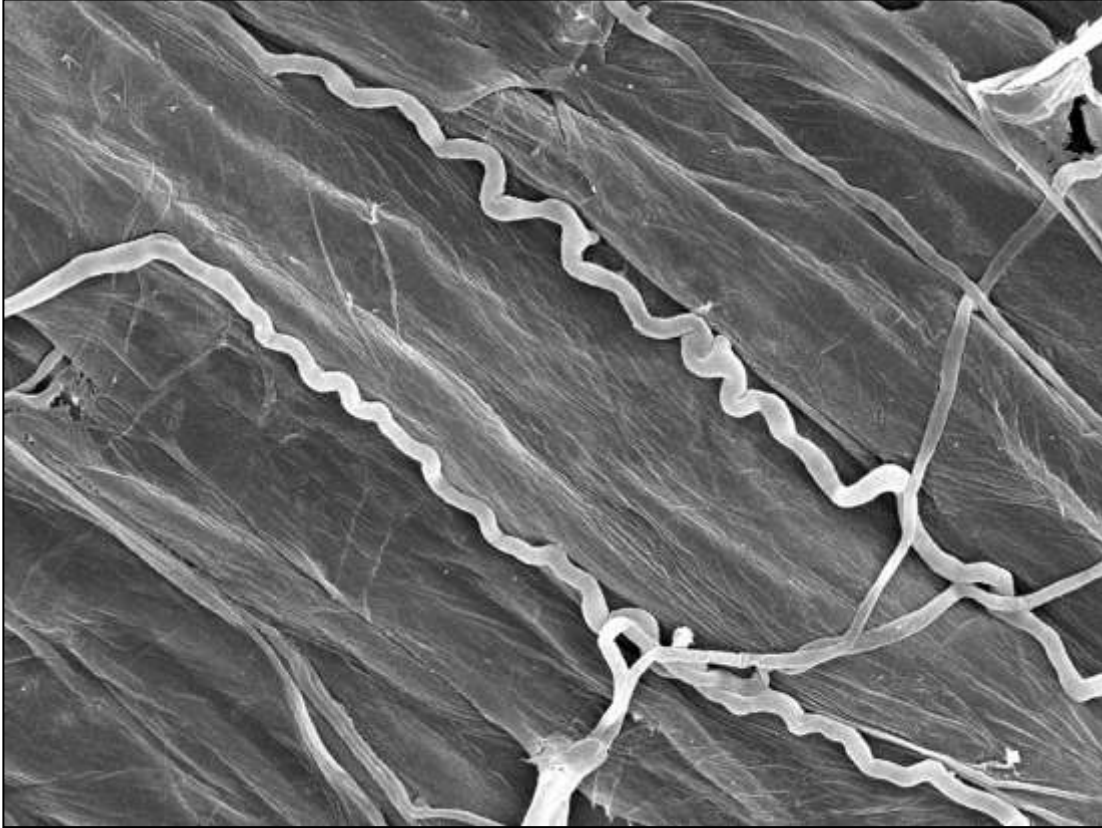
(Right) With no summer irrigation, no/little stand loss of summer dormant varieties, but **summer active varieties** (in **yellow outlines**) are dead after one or two years.

# Distribution of cool-season forage production



In areas with mild winters:  
Switch to summer dormant grasses  
Don't irrigate in summer to conserve water  
Production from fall through spring

# Tall Fescue Endophyte



Endophytic fungus grows intercellularly and does not penetrate plant cells

**Transmitted through seed, so infected plants produce infected seed**

Non-endophyte containing plants cannot get infected with endophyte

Mutualism: Plants give endophyte nutrients and a habitat to live and grow

Endophytes give plant heat & drought tolerance, insect resistance, generally greater vigor and seed production

The “wild-type” endophyte can cause animal performance problems

- Low weight gain
- Abortion
- Hooves/tails falling off

Problem is not widely known in California



# Irrigated pasture west of Davis

with Morgan Doran

Species: Majority tall fescue with some white clover, dallisgrass, annual ryegrass, and some curly dock (weed)

Cattle symptoms:

Low pregnancy rates

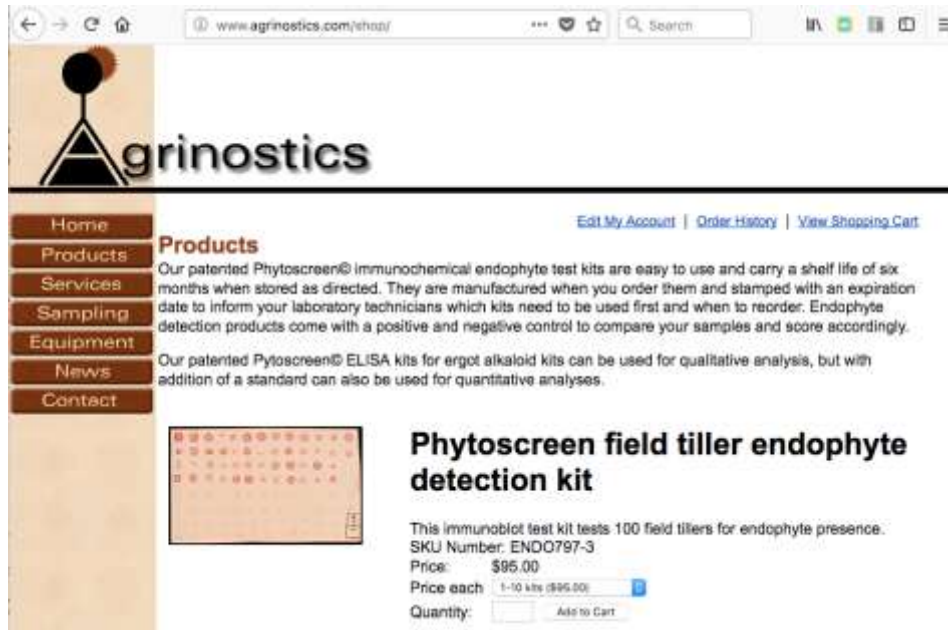
Ends of tails and hooves starting to fall off

## What was causing the problems?

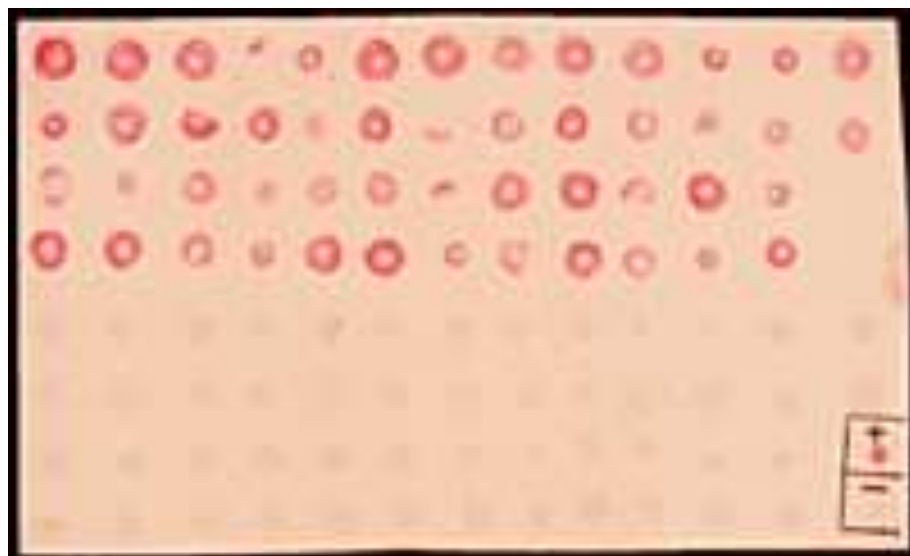
1. Toxic tall fescue? *Need to test but symptoms look like it.*
2. Ergot produced by dallisgrass seedheads? *No ergot present.*
3. Curly dock toxicity? *Probably not because symptoms of that problem are mainly gastric distress or dermatitis.*
4. Something else? *Nothing obvious from a walk of the pastures.*

# Detecting Endophyte: ELISA ... or PCR

(POLYMERASE CHAIN REACTION)

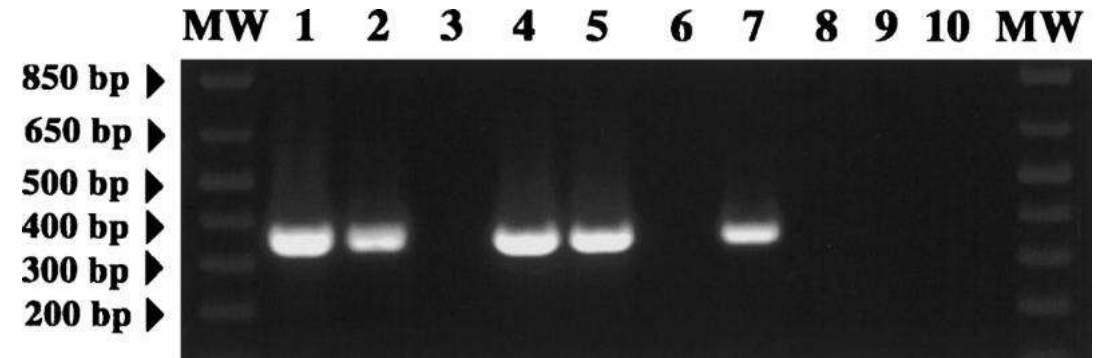


The screenshot shows the website for agrinostics.com. The main navigation menu includes Home, Products, Services, Sampling, Equipment, News, and Contact. The 'Products' section is active, displaying the 'Phytoscreen field tiller endophyte detection kit'. The product description states: 'Our patented Phytoscreen® immunochemical endophyte test kits are easy to use and carry a shelf life of six months when stored as directed. They are manufactured when you order them and stamped with an expiration date to inform your laboratory technicians which kits need to be used first and when to reorder. Endophyte detection products come with a positive and negative control to compare your samples and score accordingly. Our patented Phytoscreen® ELISA kits for ergot alkaloid kits can be used for qualitative analysis, but with addition of a standard can also be used for quantitative analyses.' The product image shows a grid of test wells. Below the image, the product name is 'Phytoscreen field tiller endophyte detection kit'. The description reads: 'This immunoblot test kit tests 100 field tillers for endophyte presence. SKU Number: ENDO797-3. Price: \$95.00. Price each: 1-10 kits (\$95.00). Quantity: [input field] Add to Cart'.



Tillers with endophyte are in top half

Tillers in the bottom half are endophyte free.



MW, Invitrogen 1 kb plus DNA ladder; (1) *N. coenophialum*, tall fescue; (2) E+ seed, tall fescue; (3) E- seed, tall fescue; (4) *N. lolii*, perennial ryegrass; (5) E+ seed, perennial ryegrass; (6) E- seed, perennial ryegrass; (7) E+ seed, Italian ryegrass; (8) E- seed, Italian ryegrass; (9) 0.5 ng of *Claviceps pupurea* DNA; (10) water control.

Markers are specific to endophytes

Different markers can be used to distinguish strains of endophytes



# Toxic Endophyte in CA Pastures

Three Ranches – Yolo, Solano, and Sacramento Counties



	<b>Total Tillers</b>	<b>E+</b>	<b>% Infected</b>
Ranch 1	39	16	41%
Ranch 2	40	0	0%
Ranch 3	30	8	27%

Ranch 1: Infection and animal symptoms  
Ranch 2: No infection; no animal symptoms  
Ranch 3: Infection but no animal symptoms

- Toxic endophyte containing fescue is in California
- Extent is unknown
- Can cause animal performance problems

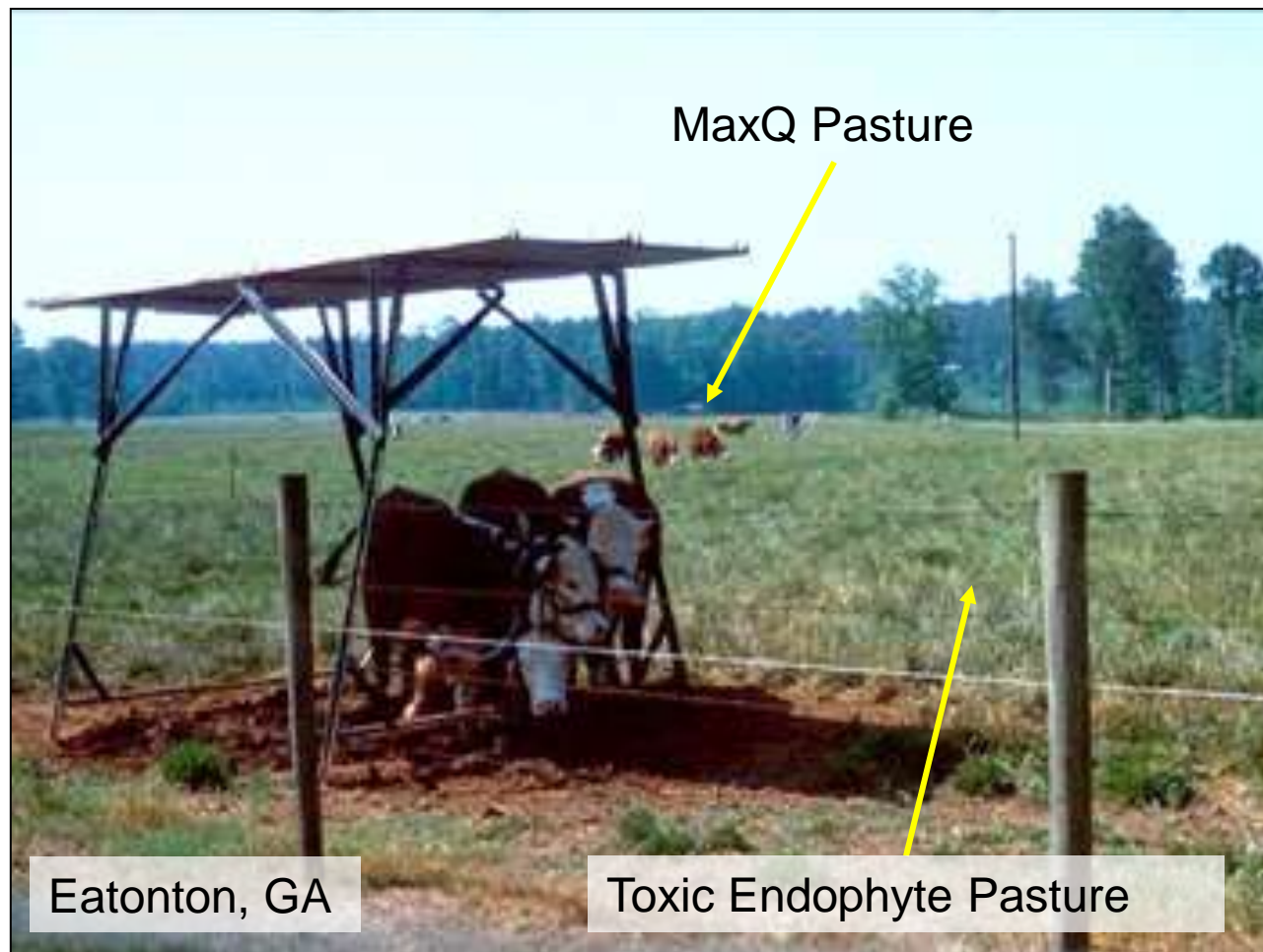
# Non-toxic endophytes in tall fescue

Identified by New Zealand scientists from naturally occurring tall fescue, esp. in southern Europe and North Africa and introduced into a cultivar – Jesup MaxQ – at Univ. of Georgia

Plants have no toxicity but still persist as well as wild type...unless animals overgraze!



Garry Latch (AgResearch, NZ) and Carl Hoveland and Joe Bouton (UGA)



Eatonton, GA

Toxic Endophyte Pasture

Tall fescue varieties of both ecotypes

With and without endophyte in adjacent plots

No stand loss under drought or no drought

No obvious effect of endophyte in this trial



Tulelake, CA, June 2020.

# On-farm Tall Fescue Variety Trial, Herlong, CA

Tom Getts

Luke Garrod, Cooperating Farmer

## Endophyte Free

Barelite

Bariane

Teton II

Cajun II

## Non-toxic Endophyte

Baroptima Plus E34

Tower Protek

Martin 2 Protek

Texoma MaxQ II

## Summer dormant

Chisholm

Flecha

## Meadow Fescue

Pradel

Summer dormant do not persist well over winter

Meadow fescue is poor

Endophyte +/- has no obvious effect in this hay trial

Barelite  
Tall Fescue

Pradel  
Meadow Fescue

Martin II Protek  
Tall Fescue

Tower Protek  
Tall Fescue

# Cool-season Grass Variety Trials

Planted Fall 2020

IREC – Tulelake

UC Davis

Hanson Ranch, Susanville

~~Maltby Ranch, Williams~~

30 Tall Fescue (8 with non-toxic endophytes)

27 Orchardgrass

13 Timothy

8 Meadow Fescue

2 Reed Canarygrass,

2 Meadow Brome

2 Tall Wheatgrass

1 Other Wheatgrass







Fescues and others



Orchardgrass

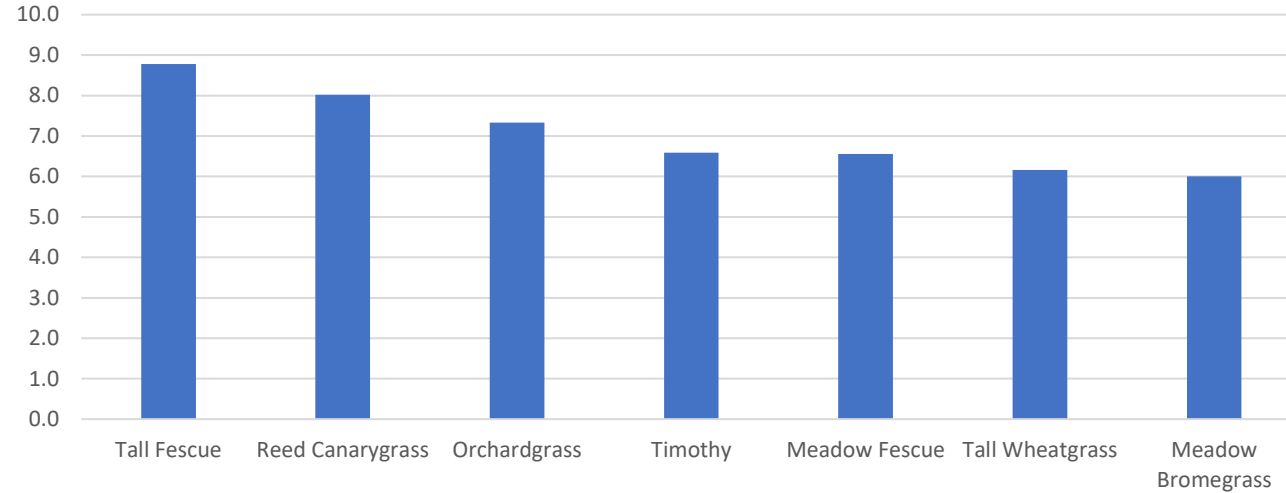


Timothy

# IREC Variety Trials, Tulelake

Rob Wilson, Darrin Culp, Kevin Nicholson, Grace Woodmansee

Average Yield 2021-2024

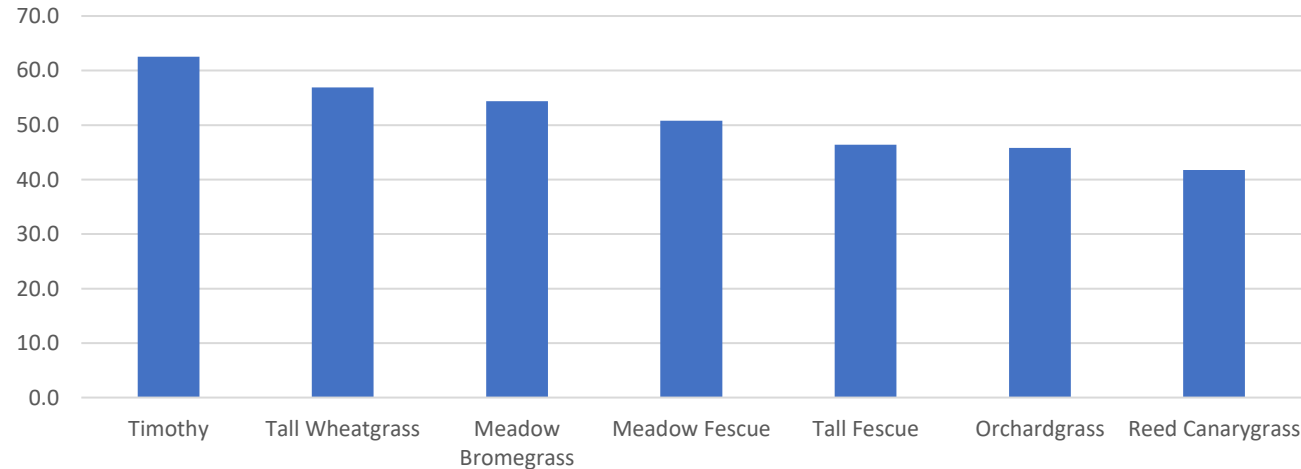


Few differences among varieties

Orchardgrass varieties with lower yield than the top varieties:

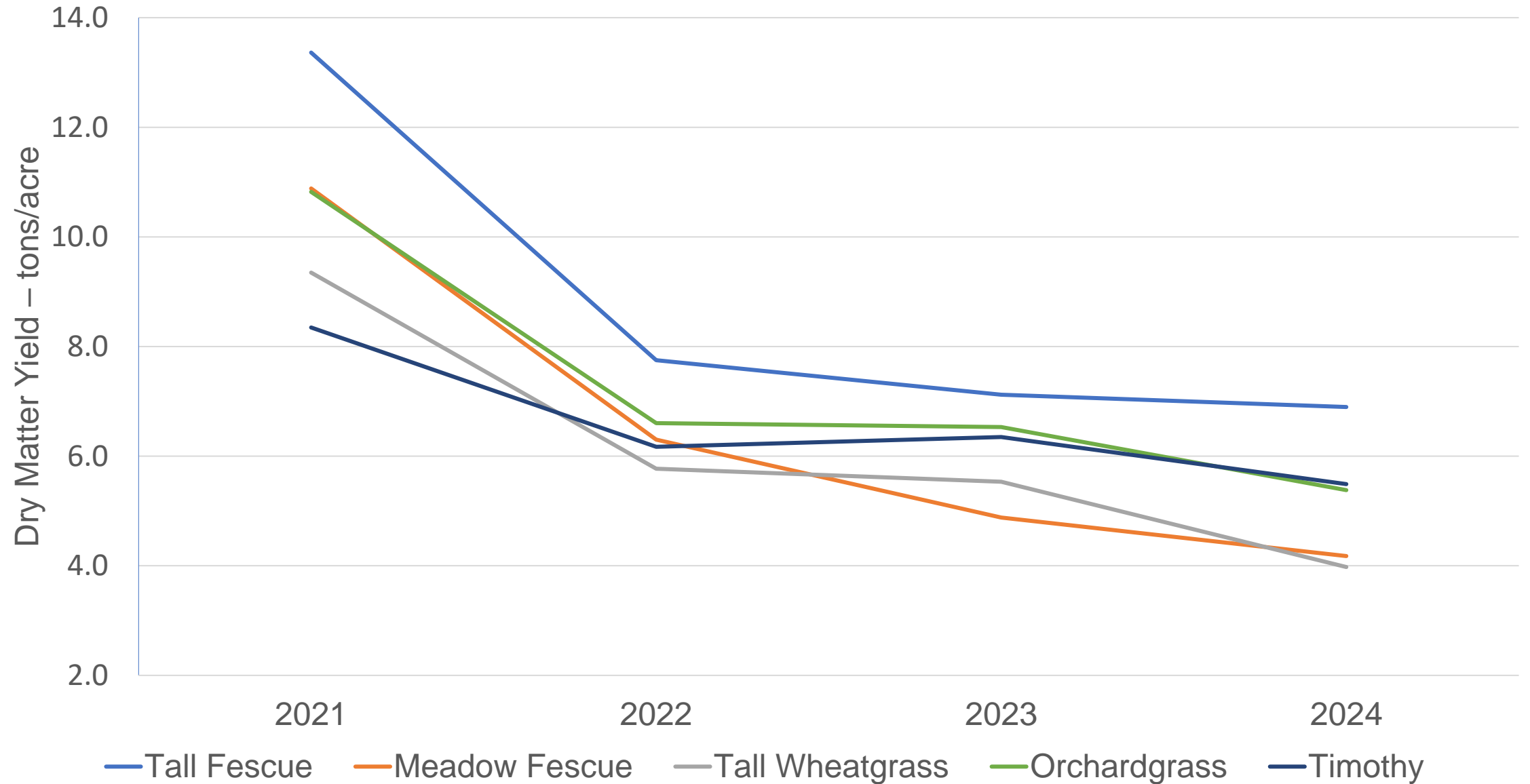
- Hallmark
- Extend
- Baraula
- Husar\*
- Amba

% of Yield in First Harvest



\*also poor stands in Susanville grazing trial

# Yield Across Years, IREC





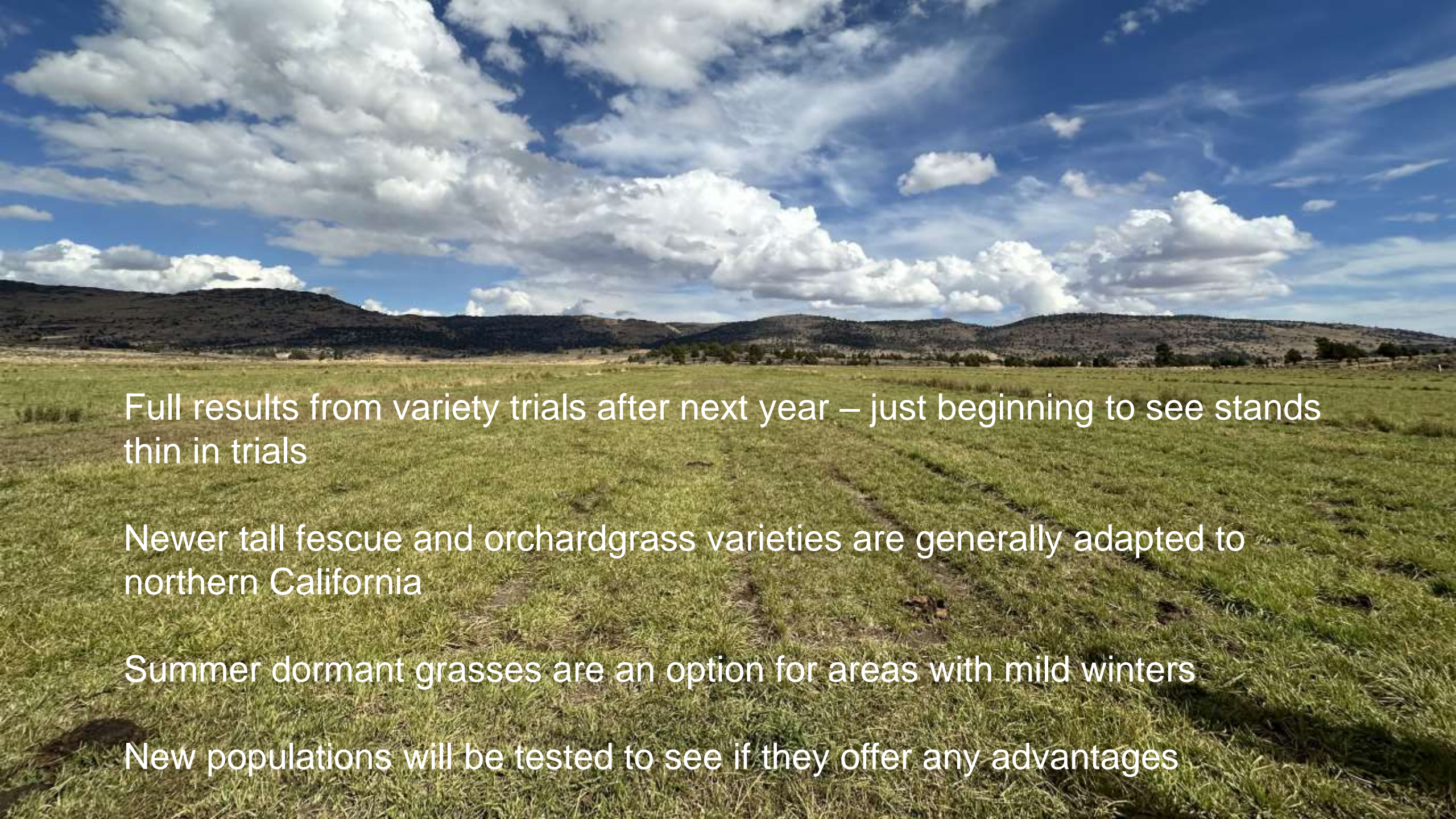
## Tall Fescue Rust

Cultivars 'Fawn' and  
'Rustler' have worst  
rust infection  
Davis trial

# Grass Breeding Nurseries

Selected based on freedom from disease, vigor, medium-late heading in Davis under limited irrigation  
Cloned selections and planted in Tulelake in 2024  
Produce seed on best plants this coming summer





Full results from variety trials after next year – just beginning to see stands thin in trials

Newer tall fescue and orchardgrass varieties are generally adapted to northern California

Summer dormant grasses are an option for areas with mild winters

New populations will be tested to see if they offer any advantages