Beefing Up Irrigated Pastures with New Species and Varieties

Charlie Brummer
University of California, Davis

Outline

- Various options
- Alfalfa
  - Grazing tolerance
  - Low lignin
- Tall Fescue
- Getting variety data

Forage Species

Perennial Grasses

- Orchardgrass
- Tall Fescue
- Timothy
- Meadow Fescue
- Reed Canarygrass
- Perennial Ryegrass
- Festulolium
- Many others

Perennial Legumes

- Alfalfa
- Red Clover
- White Clover
- Birdsfoot Trefoil
- Kura Clover
- Sainfoin
- Cicer Milkvetch
- Many others

Orchardgrass

Later maturity – better quality and better for alfalfa mixtures

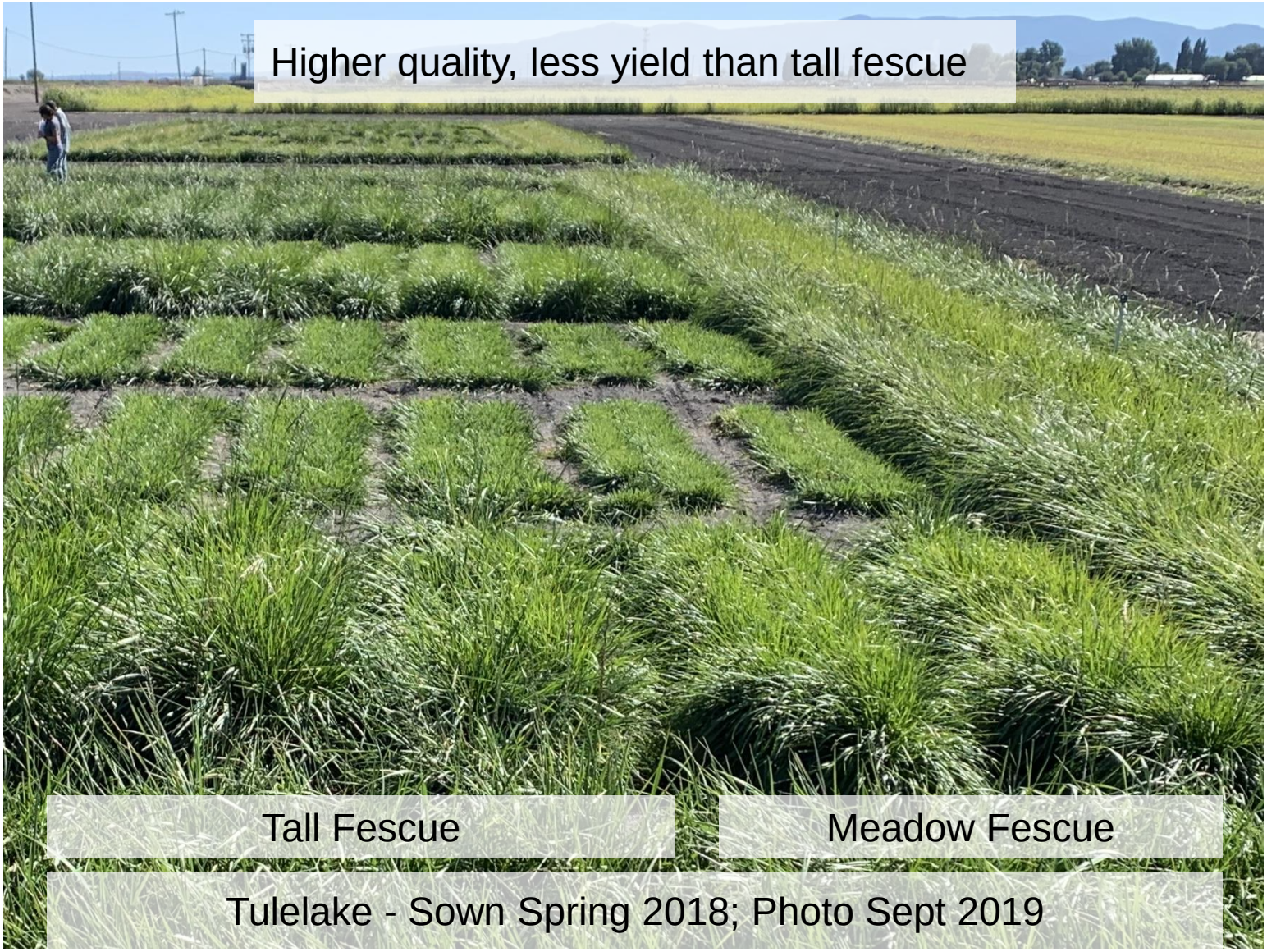
Table 1. Regional orchardgrass maturity comparison

Variety	Maturity rating				
	KY	PA	UT	VA	WI
	1-4*				
BAR DGL 1GRL	3.3	3.0	3.3	3.6	2.3
Barlegro	1.0	1.5	1.7	1.0	2.2
Benchmark Plus	3.1	2.7	2.7	3.2	2.4
Crown Royale	2.9	2.6	3.1	1.5	2.2
Dascada	1.6	2.3	2.3	1.1	2.6
Excellate SA	1.7	2.1	1.8	1.1	2.0
Harvestar	2.1	2.1	2.2	1.2	2.1
Pennlate	3.0	2.6	2.6	1.2	2.2
Persist	3.3	2.9	3.2	2.2	2.7
Potomac	2.4	3.2	2.7	1.2	2.6
Prairie	3.0	2.6	3.1	1.7	2.6
Profit	2.9	2.5	3.0	1.3	2.3
Quickdraw	3.1	3.1	2.7	2.6	2.4
LSD	0.4	0.4	0.5	0.9	0.3

Location means for maturity measured from 2011 to 2014 at Lexington, Ky.; Rock Spring, Pa.; Millville, Utah; Blackstone, Va.; and Arlington, Wis. (Robins, et al., 2017, *Crop, Forage & Turfgrass Management*).
*1 = very late; 4 = very early

https://www.hayandforage.com/article-1855-Orchardgrass-maturity-Why-it-matters.html

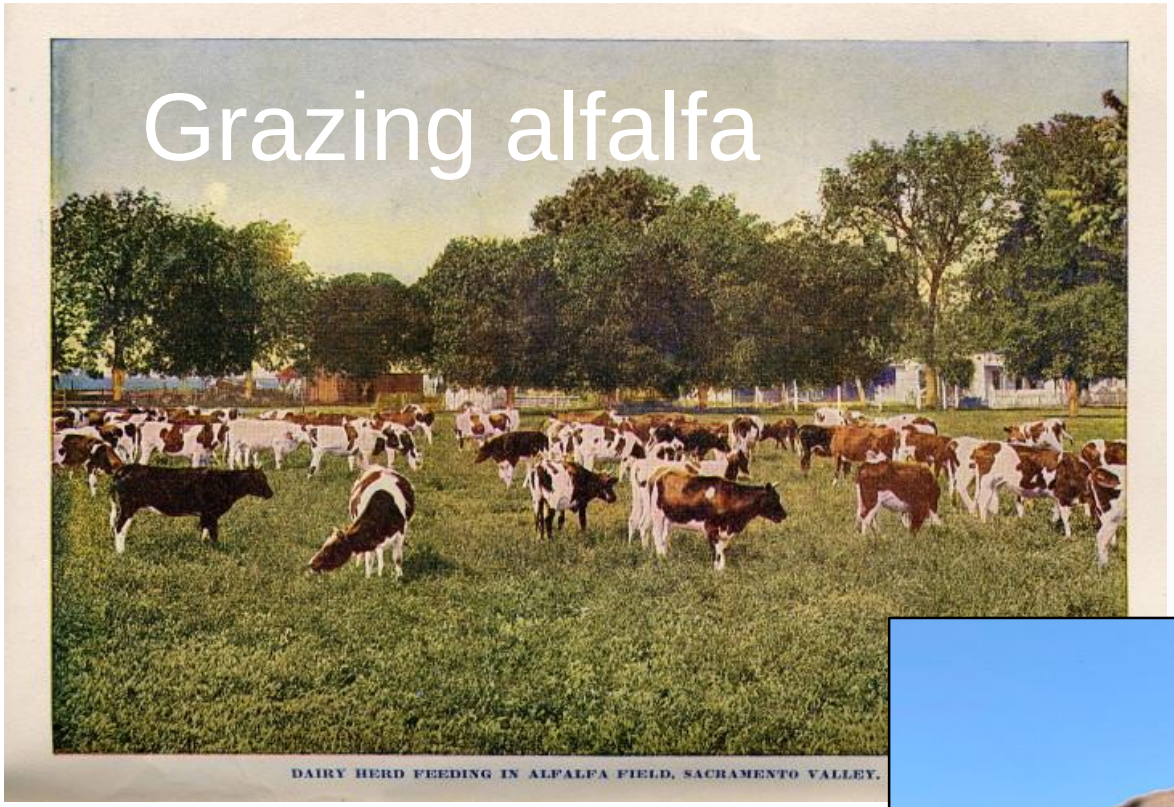
Meadow Fescue



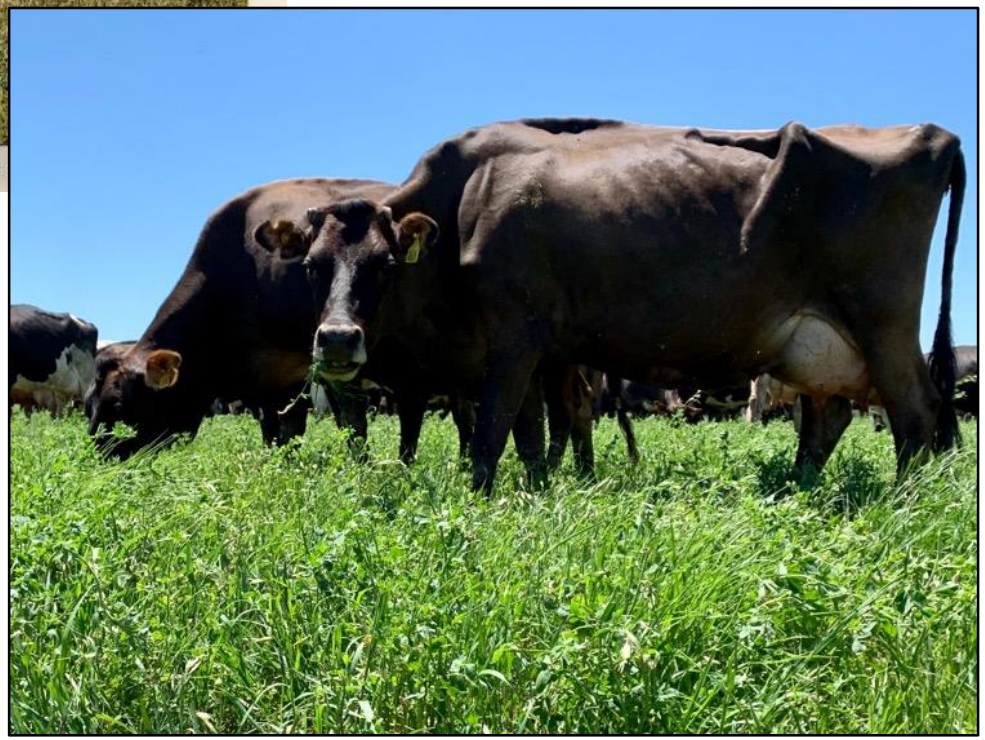
Kura Clover

Dense roots/rhizomes
Very cold tolerant
Grazing tolerant once established

Grazing alfalfa



From the book “Sacramento Valley and Foothill Counties California,” 1915 https://sites.rootsweb.com/~yvonne/sacvalleybook.html



Dairy Herd Feeding in Alfalfa-Grass Field, Córdoba, Argentina, November 2018

Yellow-flowered “falcata” alfalfa

Older grazing tolerant varieties

Tend to be low growing, have extensive roots, sprawling plants

Very winter hardy and tolerant to heavy grazing

But low yielding

Grazing Tolerant Alfalfa Varieties
With High Yield

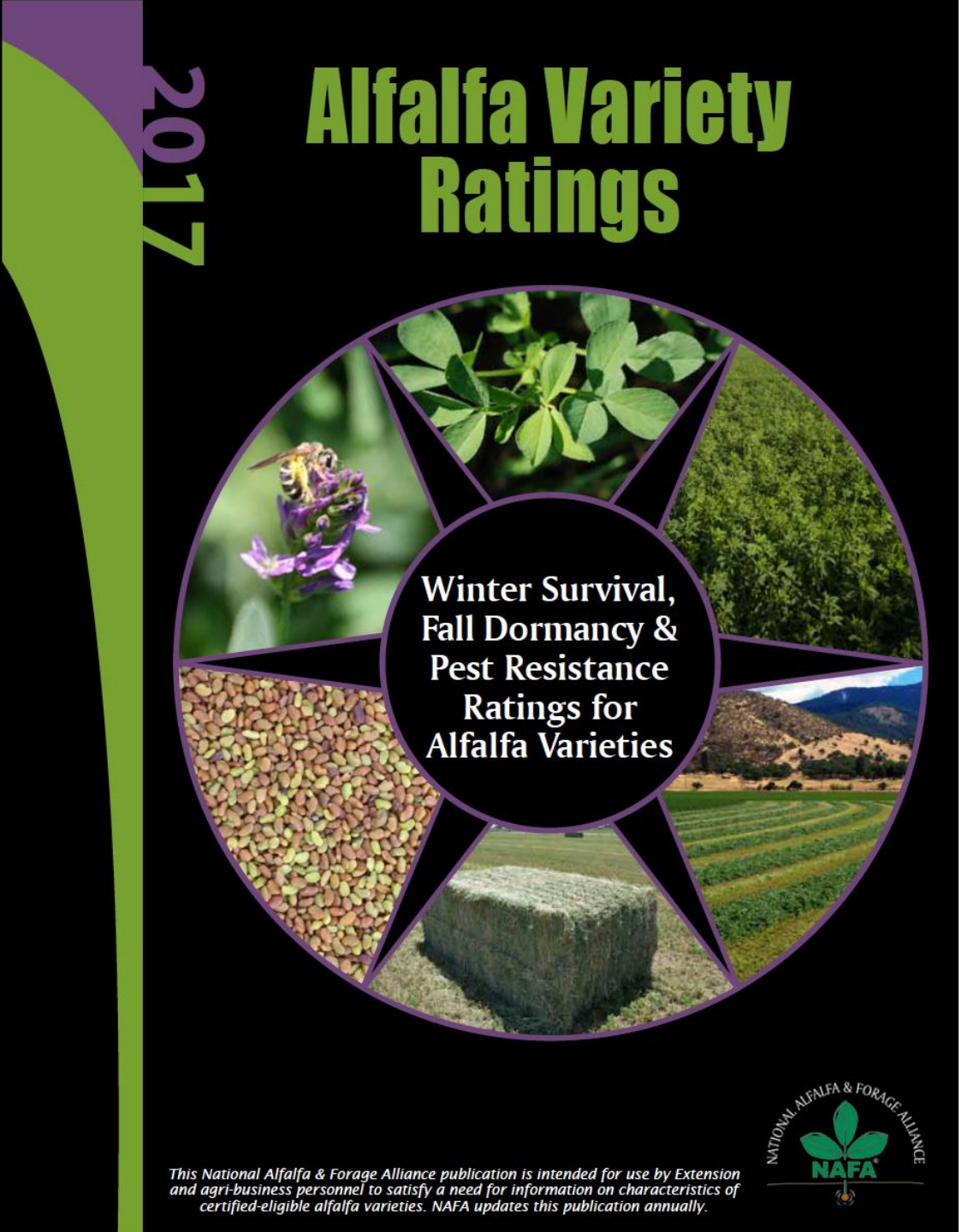
Graze high yield varieties
Select surviving plants after grazing
Resulting cultivars are grazing tolerant

Vashti, TX

Tifton, GA

2014-2016 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 8/21/13

		2014 Yield	2015 Yield	2016 Yield	Average	
	FD		Dry t/a			
Released Varieties						
Integra 8420 (EM)	4	10.06 (4)	8.55 (6)	7.36 (2)	8.65 (1)	A
AmeriStand 455TQ R	4	9.99 (8)	8.69 (2)	7.03 (10)	8.57 (3)	A B C
Archer III	5	10.04 (5)	8.48 (7)	7.17 (6)	8.56 (4)	A B C
Integra 8400	4	9.93 (10)	8.55 (5)	7.02 (11)	8.50 (7)	A B C D
WL 363HQ	5	10.03 (6)	8.47 (8)	6.95 (18)	8.48 (8)	A B C D
Masterpiece II	4	10.33 (1)	8.45 (10)	6.61 (40)	8.46 (9)	A B C D
Integra 8420 (OGP)	4	9.93 (9)	8.14 (24)	7.29 (3)	8.45 (10)	A B C D
Integra 8401RR	4	9.62 (24)	8.22 (18)	7.46 (1)	8.43 (11)	A B C D
RR NemaStar	4	10.01 (7)	8.21 (20)	7.06 (8)	8.43 (12)	A B C D
DG 4210	4	9.67 (22)	8.65 (3)	6.95 (16)	8.42 (13)	A B C D
Mutiny	4	9.55 (30)	8.60 (4)	6.95 (17)	8.37 (14)	B C D
6401N	4	9.79 (15)	8.21 (19)	6.94 (20)	8.31 (16)	B C D
6547R	4	9.68 (21)	8.36 (11)	6.84 (30)	8.29 (17)	C D
Trophy	4	9.68 (20)	8.04 (32)	7.09 (7)	8.27 (18)	D
Integra 8420 (QR)	4	9.56 (29)	7.86 (39)	6.91 (22)	8.11 (34)	
AmeriStand 445NT	4	9.55 (31)	8.08 (28)	6.68 (36)	8.10 (35)	
Integra 8420	4	9.43 (35)	7.89 (38)	6.94 (21)	8.09 (36)	
6497R	4	9.50 (32)	8.03 (34)	6.65 (38)	8.06 (37)	
DKA43-22RR	4	9.18 (41)	8.03 (33)	6.87 (24)	8.03 (38)	
Vernal	2	9.27 (39)	7.85 (40)	6.89 (23)	8.00 (39)	
AmeriStand 427	4	9.25 (40)	7.82 (41)	6.79 (32)	7.95 (40)	
MEAN		9.66	8.20	6.91	8.26	
CV		4.44	4.47	5.00	2.82	
LSD (0.1)		0.51	0.44	0.41	0.28	



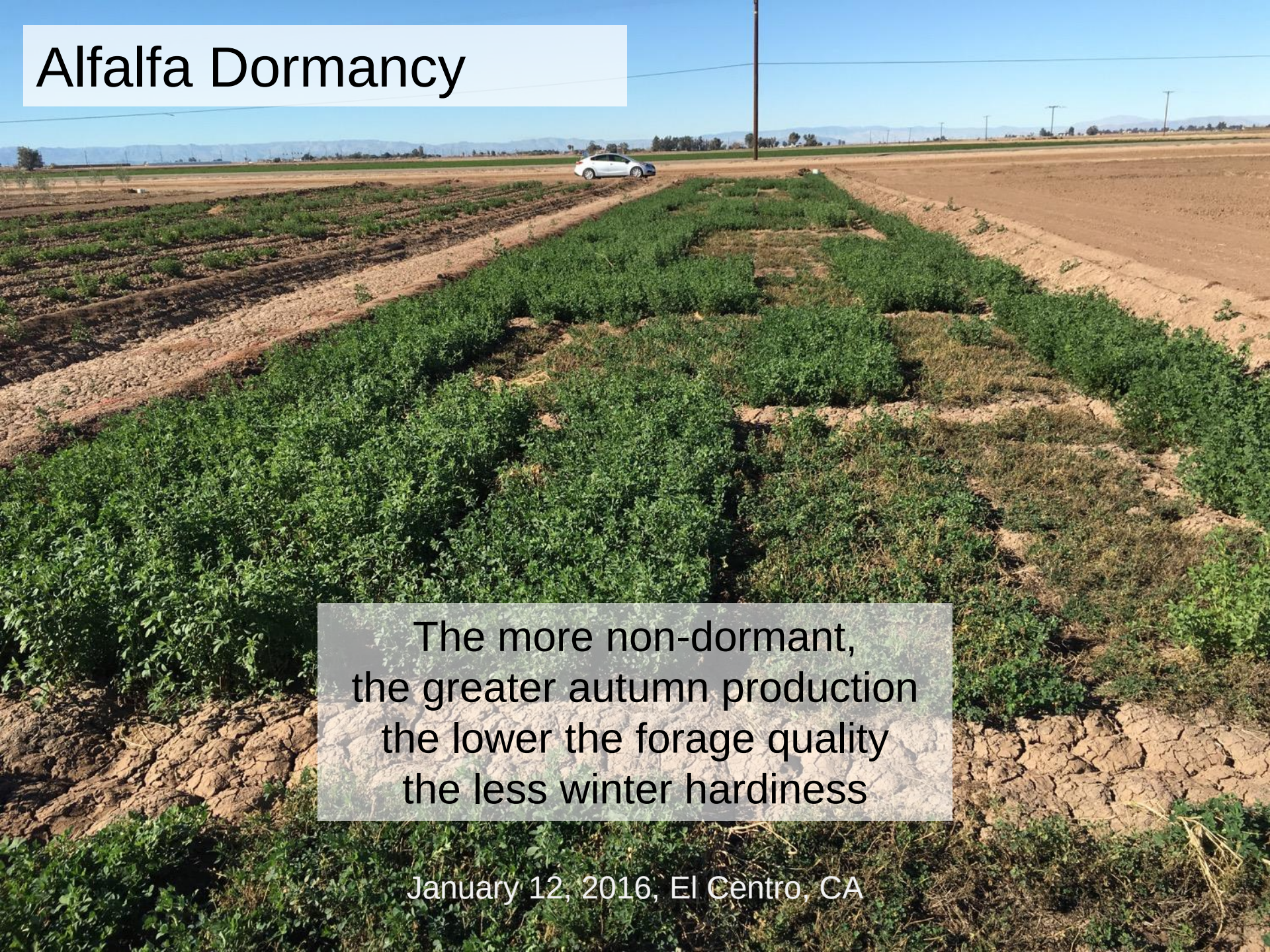
National Alfalfa and Forage Alliance

www.alfalfa.org

Selected FD4 and FD9 cultivar ratings

	Variety	Contact for Marketing Information	Winter Survival	Bacterial Wilt	Verticillium Wilt	Fusarium Wilt	Anthracnose Race 1	Phytophthora Root Rot	Aphanomyces Race 1 Root Rot	Aphanomyces Race 2 Root Rot	Spotted Alfalfa Aphid	Pea Aphid	Blue Alfalfa Aphid	Potato Leafhopper	Stem Nematode	Southern Root Knot Nematode	Northern Root Knot Nematode	Multifoliolate Expression (H-High/M-Mod/L-Low)	Continuous Grazing Tolerance (Y-Yes)	Standability Expression (R-Resistance)	Salt Tolerance (G-Germination/F-Forage)	R-RRA; H-75-95% Hybrid
FD 4 - DORMANT	Integra 8444R	Wilbur-Ellis		R	HR	HR	HR	HR	R		HR				HR		R	M			G/F	R
	Lancer	Growmark/SS/TFC	2	HR	HR	HR	HR	HR	HR			HR		HR	R			L				
	Magnitude	Growmark/Allied	2	HR	HR	HR	HR	HR	HR		R	R			HR			H			G	
	Magnum 7	Dairyland	2	HR	HR	HR	HR	HR	HR	R		R			HR	R	HR					
	Magnum 7-Wet	Dairyland	2	HR	HR	HR	HR	HR	HR	R		R			HR	HR	HR					
	Magnum Salt	Dairyland	2	HR	HR	HR	R	HR	R			R			HR	R	HR				G/F	
	Magnum V	Dairyland	2	HR	R	HR	R	HR	MR		R	R	MR		R		MR					
	Mariner IV	Growmark/Allied	2	HR	HR	HR	HR	HR	HR	R		R			HR	HR	HR					
	Marvel	Growmark/Allied	2	HR	HR	HR	HR	HR	HR		R	HR			R		MR	H				
	Medalist	Union	3	HR	HR	HR	HR	HR	R		HR	R			HR		HR	M				
FD 9 - NON-DORMANT	PGI 908-S	Alforex Seeds		R	R	HR	HR	HR			HR	HR	HR		R	HR	HR				G/F	
	RR Desert Rose	Croplan		R	R	HR	HR	HR			HR	HR	HR		R							R
	RR902	Channel		MR	R	R	LR	HR			HR	HR			R						G	R
	RRALF 9R100	Eureka		R	R	HR	R	HR			HR	HR	HR		HR						G	R
	SALTANA	Imperial Valley		HR		HR		R			HR	R	HR			HR						
	Sun Quest	Croplan		MR		R	R	HR			HR	HR	HR		HR						G/F	
	SW 9215	S&W		R		HR		R			HR	R	HR			HR					F	
	SW 9628	S&W		LR		R	LR	R			HR	R	R			HR						

Alfalfa Dormancy



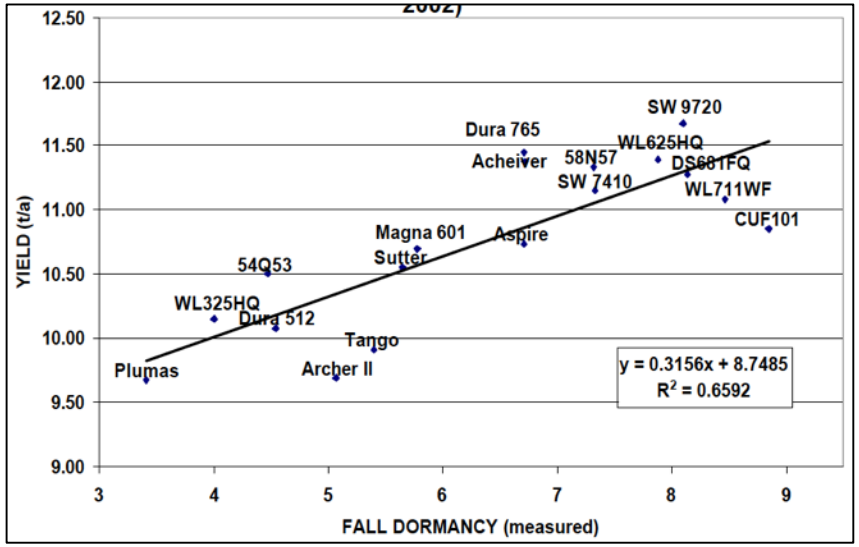
The more non-dormant,
the greater autumn production
the lower the forage quality
the less winter hardiness

January 12, 2016, El Centro, CA

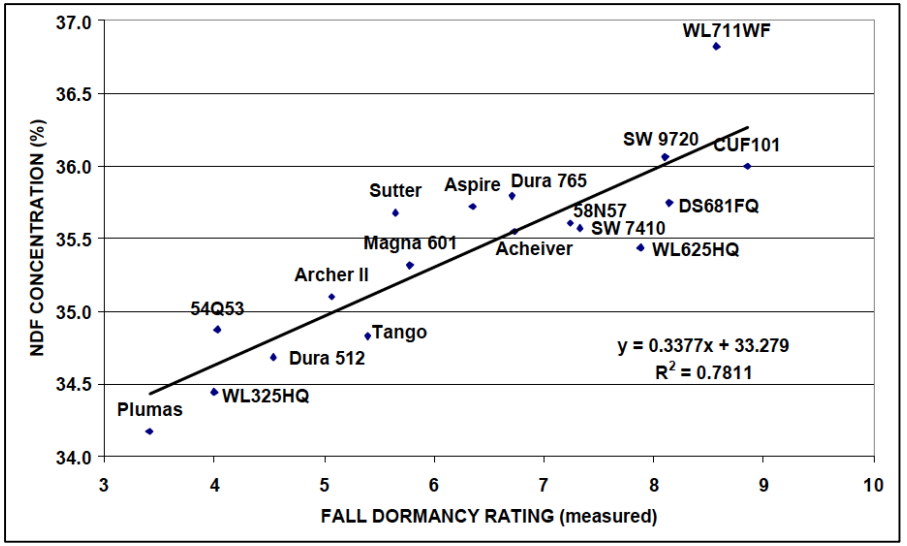
Less dormancy associated with
higher yield
faster regrowth rate
higher fiber (lower quality)
earlier flowering time

Davis, CA yield trials

Less dormancy – Higher yield



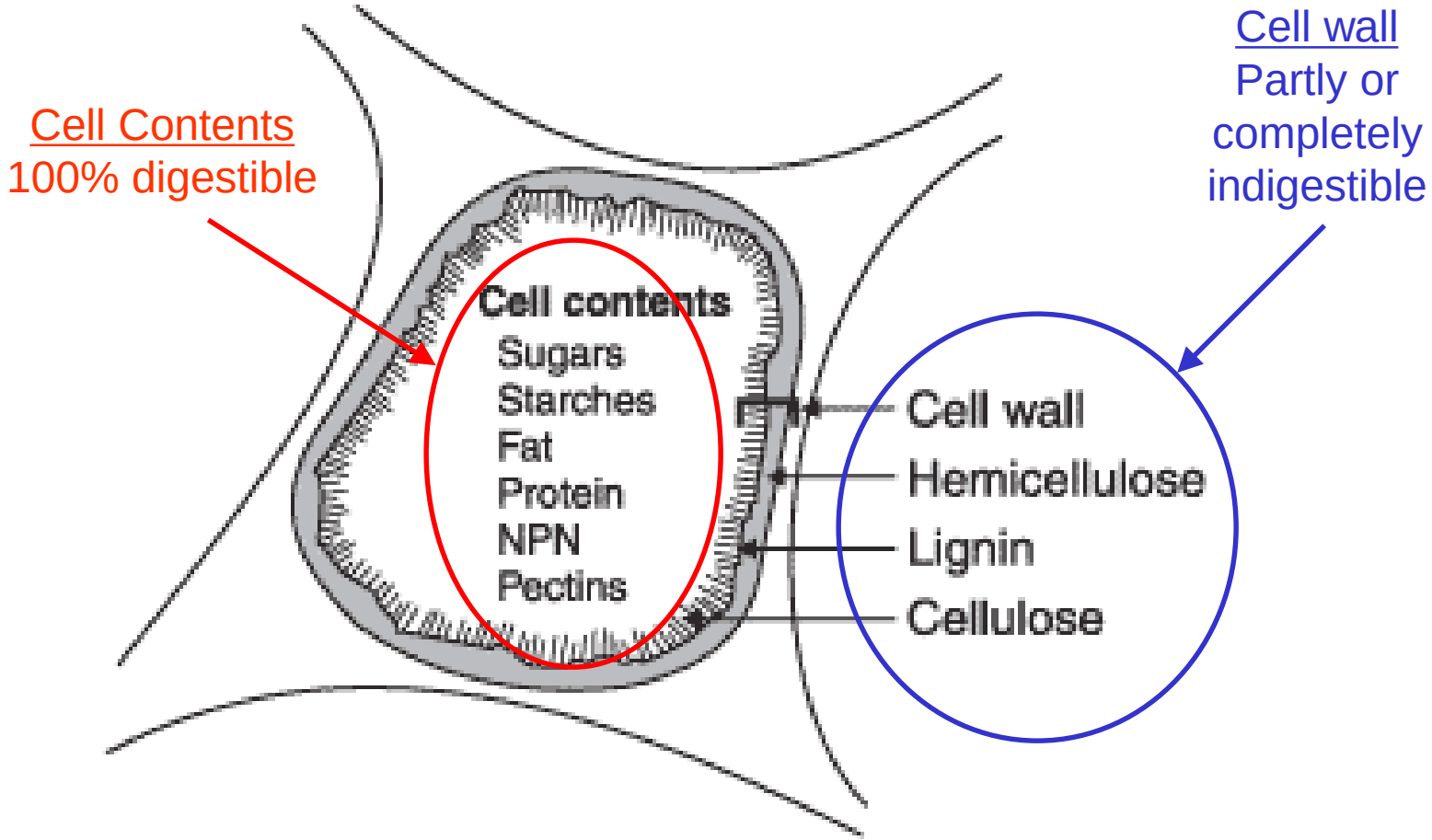
Less dormancy – Lower quality



Putnam & Orloff, 2003, 33rd CA Alfalfa Symposium

Low Lignin Alfalfa

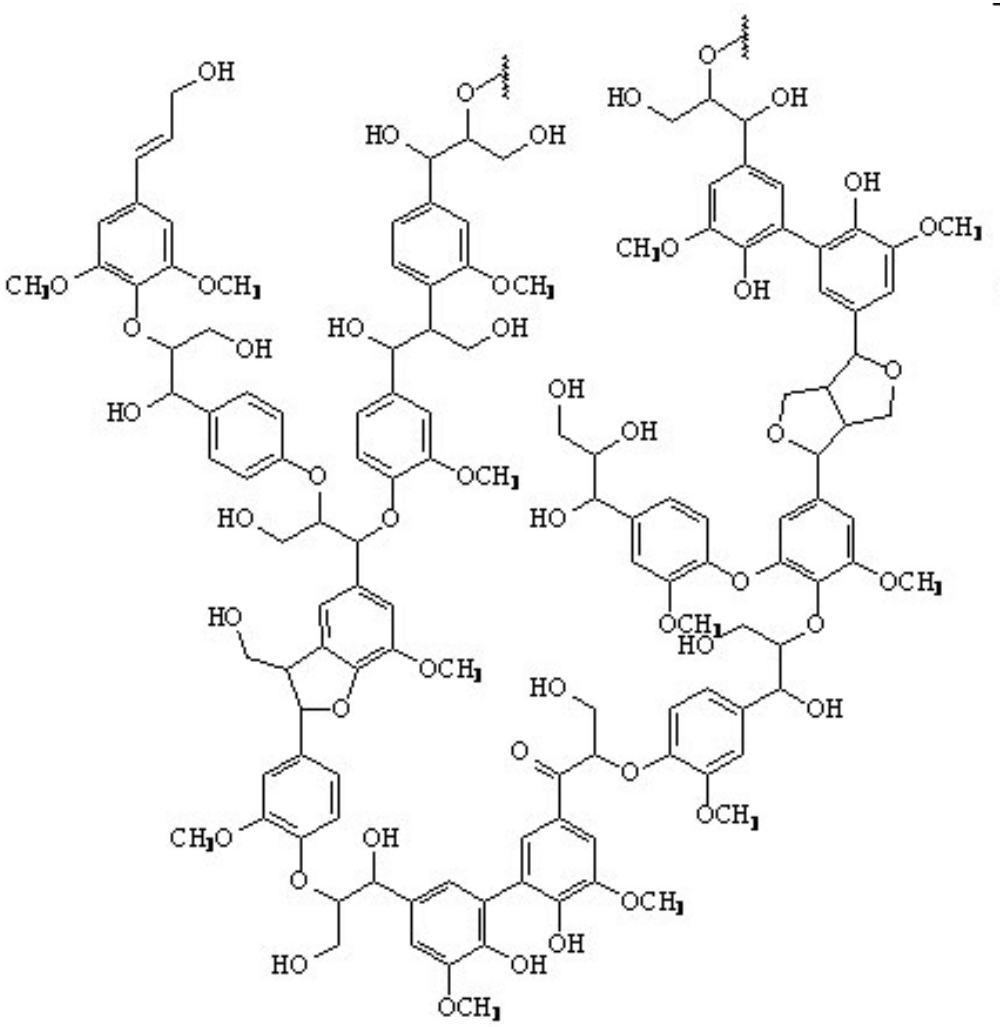
Forage Plant Cell Composition



Lignin is the problem nutritionally
(but it enables plants to stand up….so…)

Lignin

- Undigestible by rumen microbes
- Limits digestion of cellulose and hemicellulose
- Reducing lignin could improve digestibility of cell wall (i.e., fiber digestibility or NDF digestibility)
- Low lignin alfalfa has altered lignin amount and composition



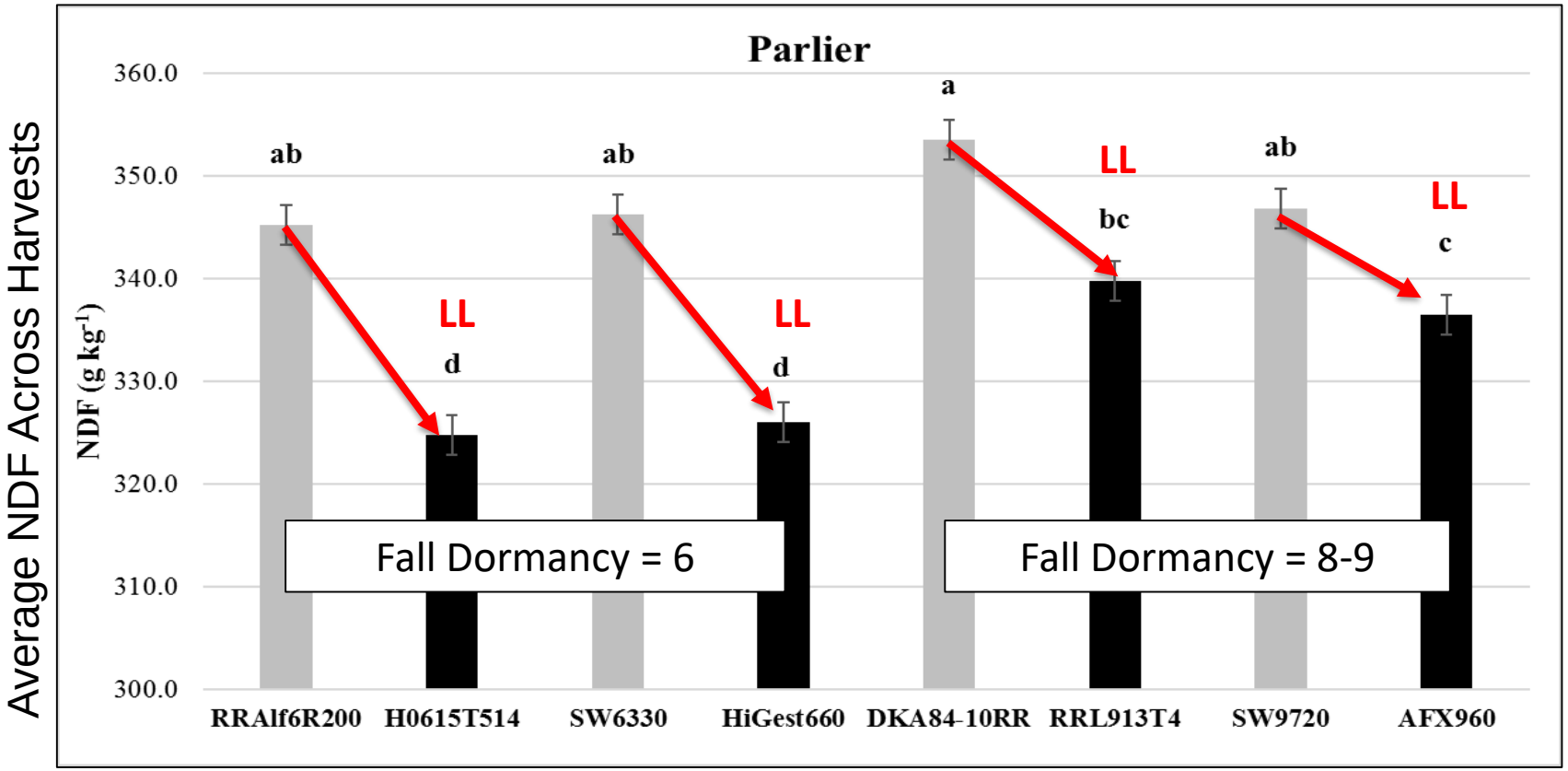
UC Davis Low Lignin Alfalfa Trial

Brenda Perez, Chris De Ben, and Dan Putnam, UC Davis

Variety	Fall Dormancy	Type	Round Up Ready
Semi Dormant			
RRAlf6R200	6	Conv	Yes
RRL63T5/H0615T514	6	HarvXtra	Yes
SW6330	6	Conv	No
Higest660	6	HiGest	No
Non Dormant			
WL555.RR/DKA84-10RR	8	Conv	Yes
RRL913T4	8	HarvXtra	Yes
SW9720	9	Conv	No
AFX960	9	HiGest	No

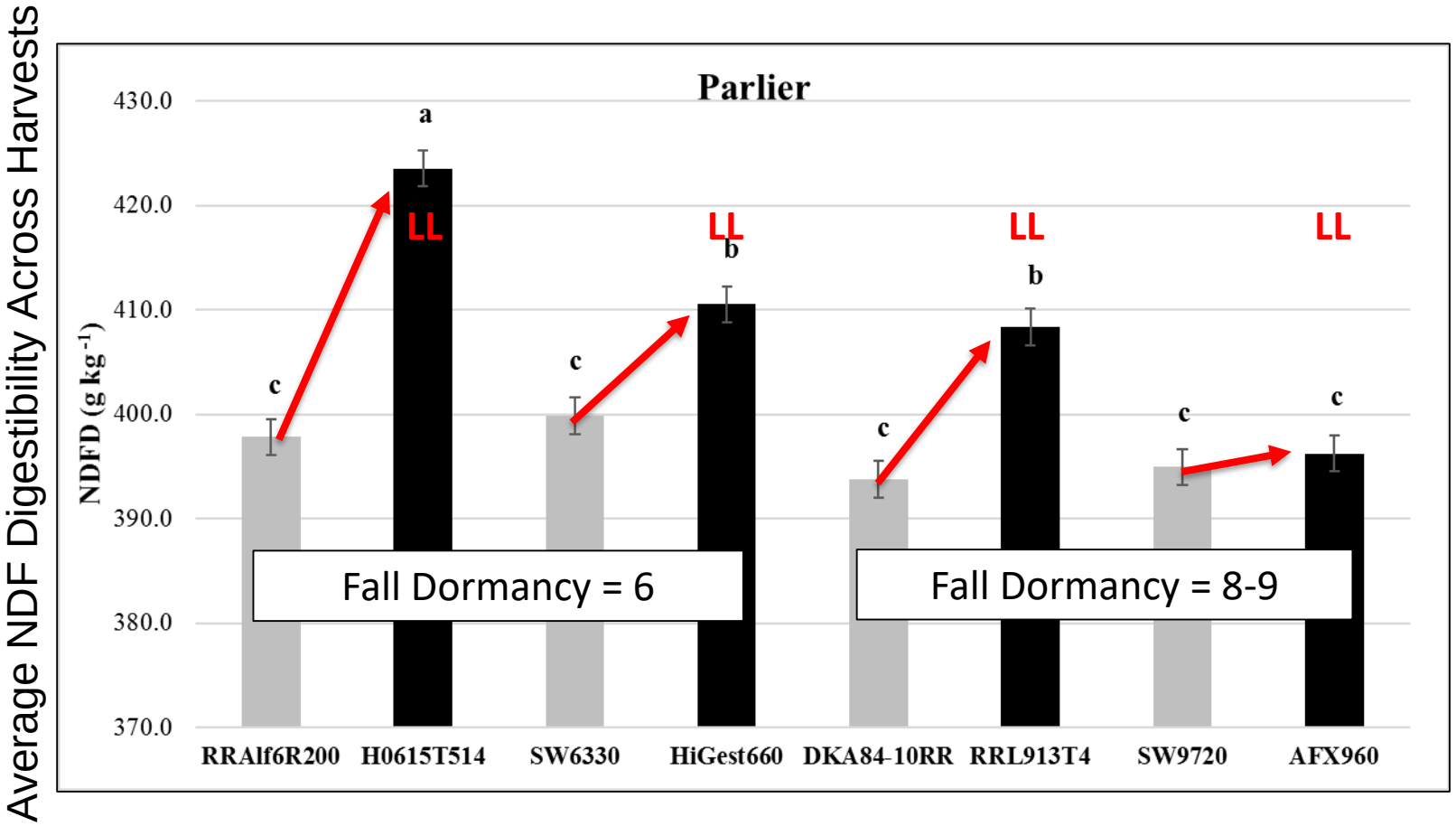
Varieties in RED are Low Lignin Varieties

Low Lignin Alfalfa Varieties Have *Lower Fiber Concentration*



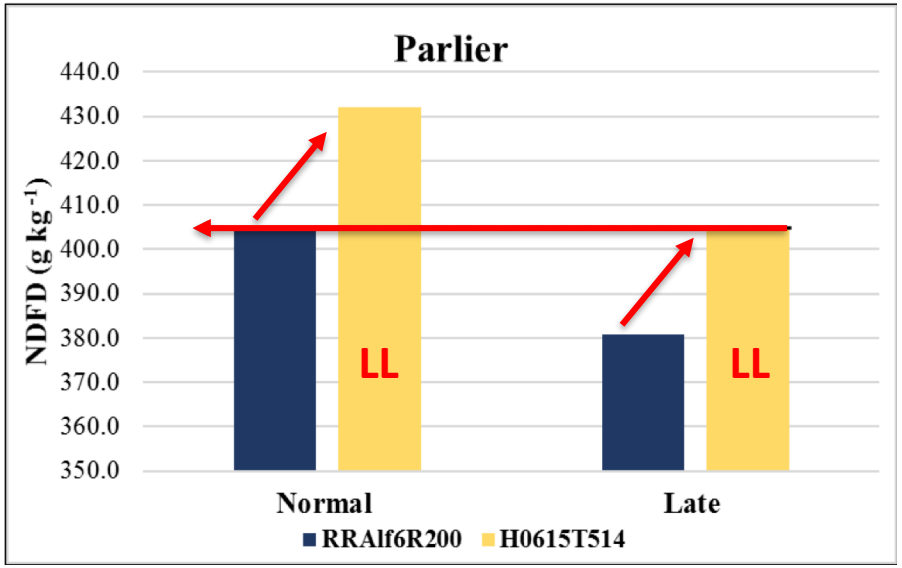
Brenda Perez, Chris De Ben, and Dan Putnam, UC Davis

Low Lignin Alfalfa Varieties Have *Better Fiber Digestibility*



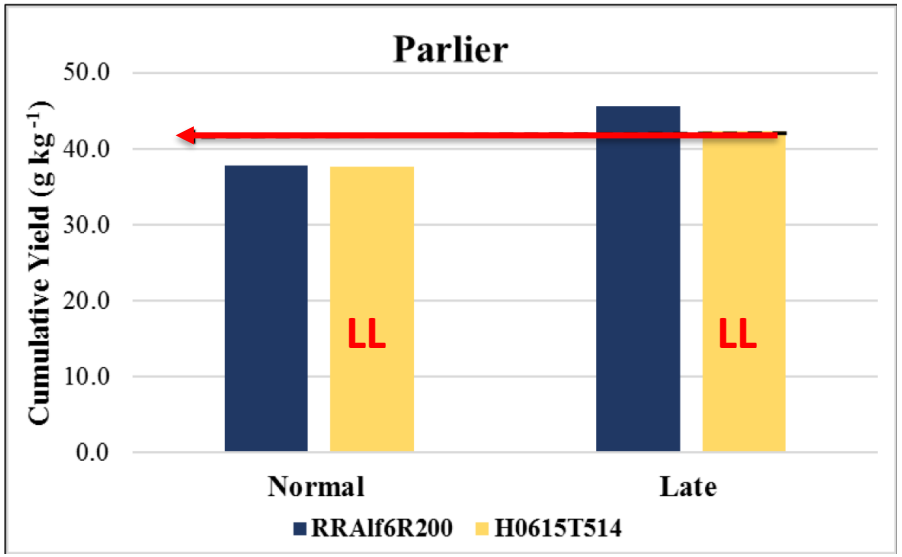
Brenda Perez, Chris De Ben, and Dan Putnam, UC Davis

Low Lignin Alfalfa – Management Options



Low lignin has better fiber digestibility in both harvest dates

LL late harvest has same quality as conventional variety at normal harvest



Late harvest – higher yield than normal harvest interval

LL late harvest yield is greater than conventional at normal

Brenda Perez, Chris De Ben, and Dan Putnam, UC Davis

Tall Fescue Ecotypes

Continental or <u>summer active</u> tall fescue

- Main production is spring through fall; some winter activity
- Most commonly grown tall fescue varieties

Mediterranean or <u>summer dormant</u> tall fescue

- Winter active but partially to completely dormant in summer
- Productive from autumn through spring if conditions allow
- Flecha, Chisholm (new variety)

Wild-type Endophyte Infected Fescue

Kentucky-31 type tall fescue

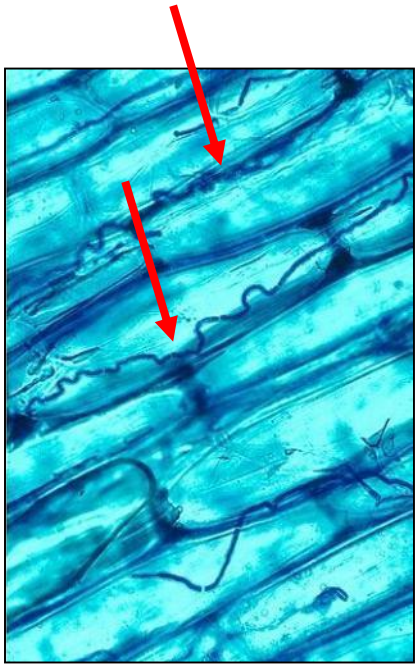
Endophyte produces toxic alkaloid that causes animal disorders

(low weight gain, fescue foot, repro problems)

Alkaloid concentrations worse in spring and fall

highest toxin in stems and seedheads

increased toxin with high N application rates



Tall Fescue On-line Monograph

Effect of Endophyte on Plant Growth

E- E+

Same cultivar with and without endophyte
El Centro, CA, Dec 12, 2017
Recovery after summer drought and heat stress

Endophyte free fescue

No toxin problem = no animal problems

Plants not as drought tolerant

Animals will graze more readily than infected plants

May have persistence problems

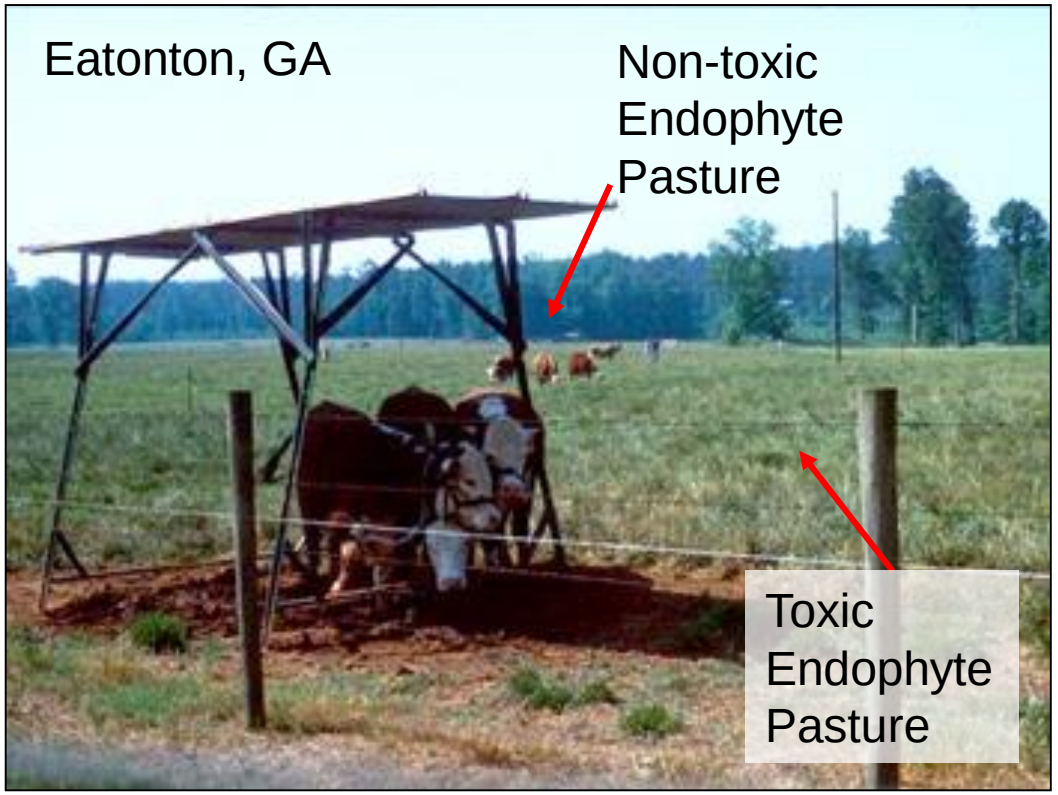
Non-toxic endophytes

Endophyte doesn't produce toxin

Excellent animal performance

Plants persist as well as wild type…

…unless animals overgraze!



Non-toxic Endophytes On The Market

- Texoma **MaxQ II**; Lacefield **MaxQ II**
- Estancia **ArcShield**
- Baroptima **PLUS E34**
- Tower **Protek**, Martin 2 **Protek**
- (Jesup **MaxQ** – being phased out)

Endophyte has a limited life

Endophyte viability in seed declines in 1-2 years.

Endophyte will die before seed dies.

Plant by the date on the bag to ensure high infection in the field

What Variety Should I Choose?

Running a strip trial on your farm

Prep the field - control weeds, fertilize

Flag the plots

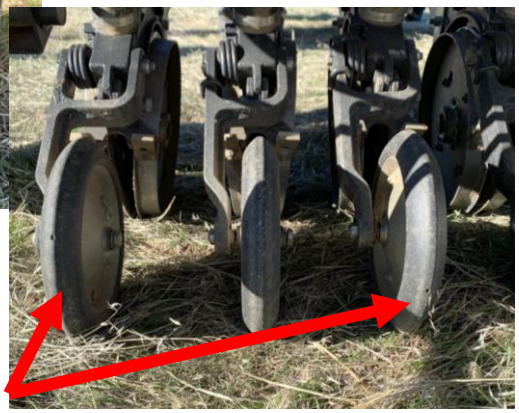
Calibrate the drill

Get seed

Running a strip trial on your farm

Depth bands

Double disc opener



Press wheels

Vacuum out seed after planting each variety

2018 On-farm tall fescue variety trial Planted 12-10-2018

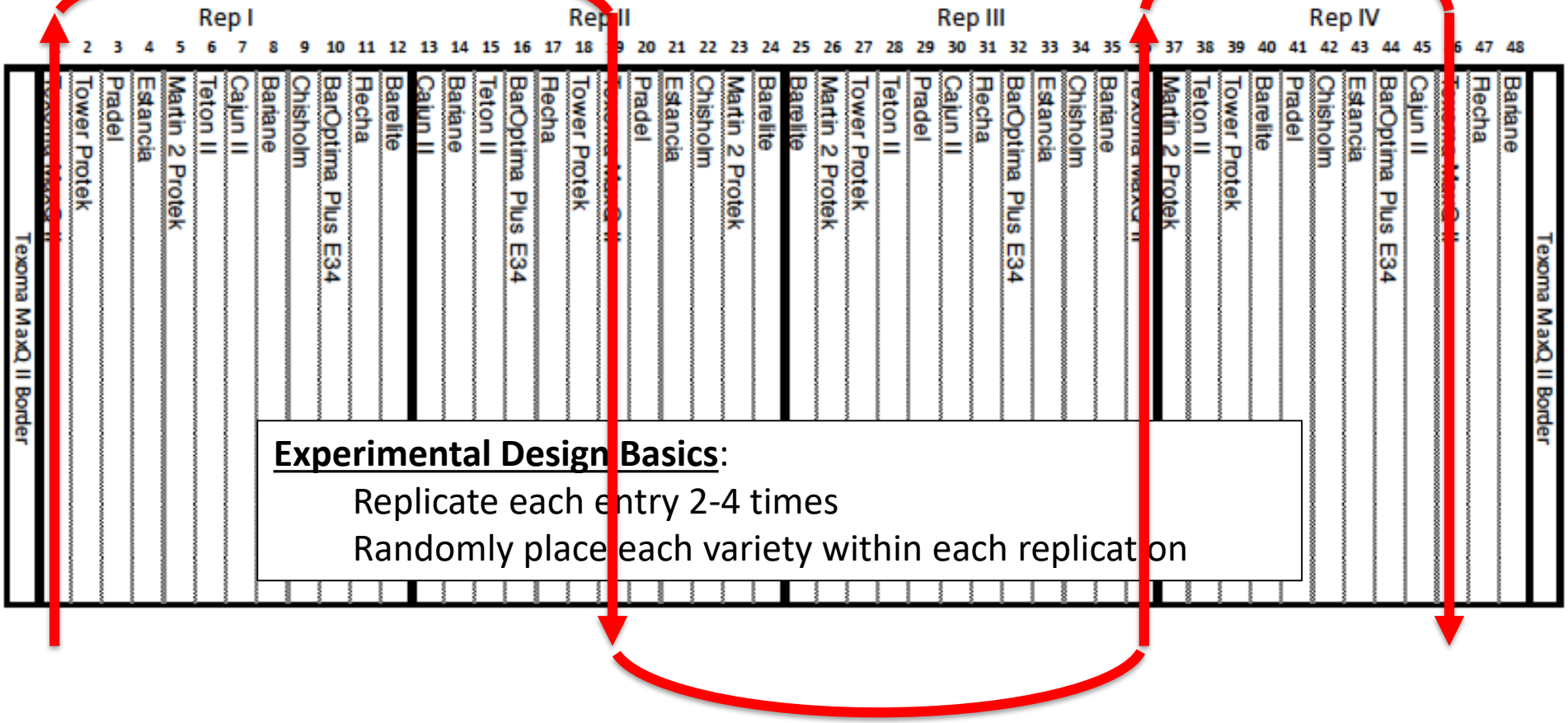
Tony Turri Farm, Paskenta, CA (39°53'41.1"N 122°30'50.8"W [39.894757, -122.514117])

Plots 8' wide x 140' long; 4' gap between reps; Seeding rate ~4.5 lb/a

Planted with Truax drill; soil conditions moist

Good weed/grass emergence from rains prior to planting; Sprayed Roundup @ 2 pints/acre immediately before planting

E
N + S
W



Experimental Design Basics:

Replicate each entry 2-4 times

Randomly place each variety within each replication

I gratefully thank the following funding agencies:

UC DAVIS
UNIVERSITY OF CALIFORNIA

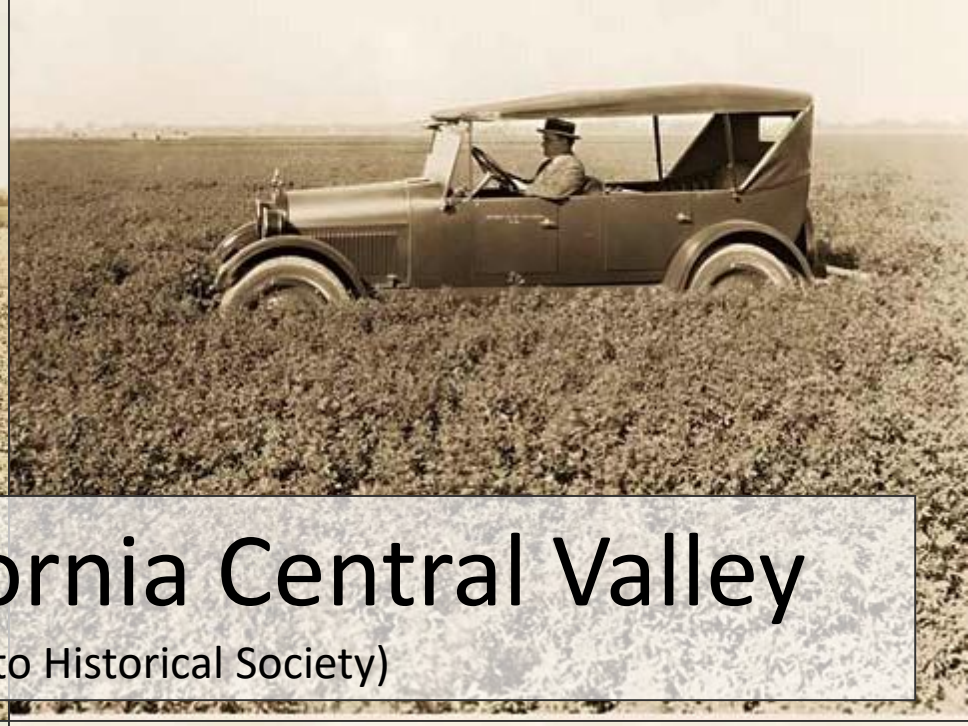
USDA United States Department of Agriculture National Institute of Food and Agriculture

Alfalfa and Forage Research Program (AFRP)
Agriculture and Food Research Inititiative (AFRI)

NAFA Alfalfa
U.S. Alfalfa Farmer Research Initiative

CALIFORNIA CROP IMPROVEMENT ASSOCIATION
OFFICIAL SEED CERTIFICATION AGENCY ®

Jan Monchablon, "Early Afternoon" (1886), Haggin Museum, Stockton, CA.



Alfalfa in the California Central Valley

(Photos: Sacramento Historical Society)