

Breeding Alfalfa for California Rangelands



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And a special thank you
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me.


OUTLINE

- Current State of Rangeland Alfalfa
- Benefits of Non-Dormant Alfalfa on Rangeland
- “Spreading” Alfalfa
- Selection Goals
- Breeding Pipeline





TRADITIONAL RANGELAND ALFALFA VARIETIES

- Mainly developed in the N. Great-Plains region using dormant germplasm
- These varieties are often spreading or “creeping-rooted”, subsp. *falcata* background



**SEEDED
RANGE PLANTS
FOR CALIFORNIA**

Cooperative Extension
Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA
LEAFLET 21344e

(Revised from Leaflet 21344. No content was updated from the 1963 printing.)

DRYLAND ALFALFA

(*Medicago sativa* and *M. falcata*)

Importance

The presence of alfalfa in dryland pastures can improve forage yield and quality. Like all legumes it will fix atmospheric nitrogen that is unavailable to the grasses. The fixed nitrogen will encourage increased productivity and protein content of the associated grasses, and the increased quality and quantity of forage will increase livestock production per acre.

A study in northern Utah indicates that several dryland alfalfa varieties planted in the summer of 1956 were still surviving in the summer of 1957. Similar results have been observed in Modoc County in northeastern California.

Occurrence

Dryland alfalfas have been most valuable when planted with wheatgrasses in the semiarid region. Originally these alfalfas were interseeded with crested wheatgrass. Clover and *Ciceraria* intermediate wheatgrasses have replaced crested wheatgrasses in recent plantings. The wheatgrasses are not adapted to dryland seeding in the Mediterranean areas of California below 3,000 feet elevation.

Description

The alfalfa varieties Vernal, Lusk 85, Rambler, Norwegian, Drylander, Range-lander, and Victoria may be seeded with varying degrees of site preparation in dryland pastures. These varieties are winter hardy and capable of surviving arid conditions. In addition, some of these varieties, such as Rambler, have rhizomes that help the plants spread vegetatively.

Management

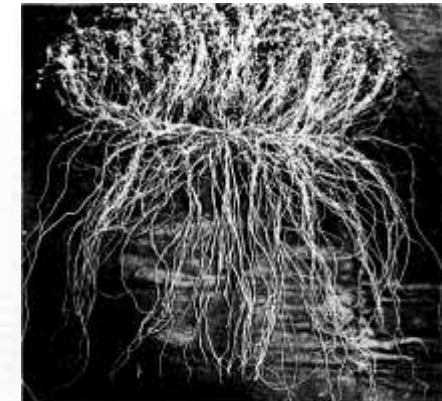
Good grazing management of dryland alfalfa requires periodic resting of the plants during the grazing season to allow regrowth and replenishment of carbohydrate reserves. The associated perennial grasses also need a rest period for regrowth and replenishment of reserves.

As long as alfalfa is adequately maintained in the dryland pasture it can "fix" atmospheric nitrogen, eliminating the need for nitrogen fertilization. However, alfalfa productivity and nitrogen fixation can be improved by addition of other nutrients such as phosphorus, sulfur, and potassium if they are deficient. When dryland alfalfa-wheatgrass stands lose alfalfa plants, alfalfa can be re-established by interseeding.



BULLETIN 525
FEBRUARY 1965

TRAVOIS—An Alfalfa for Grazing



AGRONOMY DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY, BROOKINGS



2025

ALFALFA VARIETY RATINGS

Winter Survival, Fall Dormancy & Pest Resistance Ratings for Alfalfa Varieties

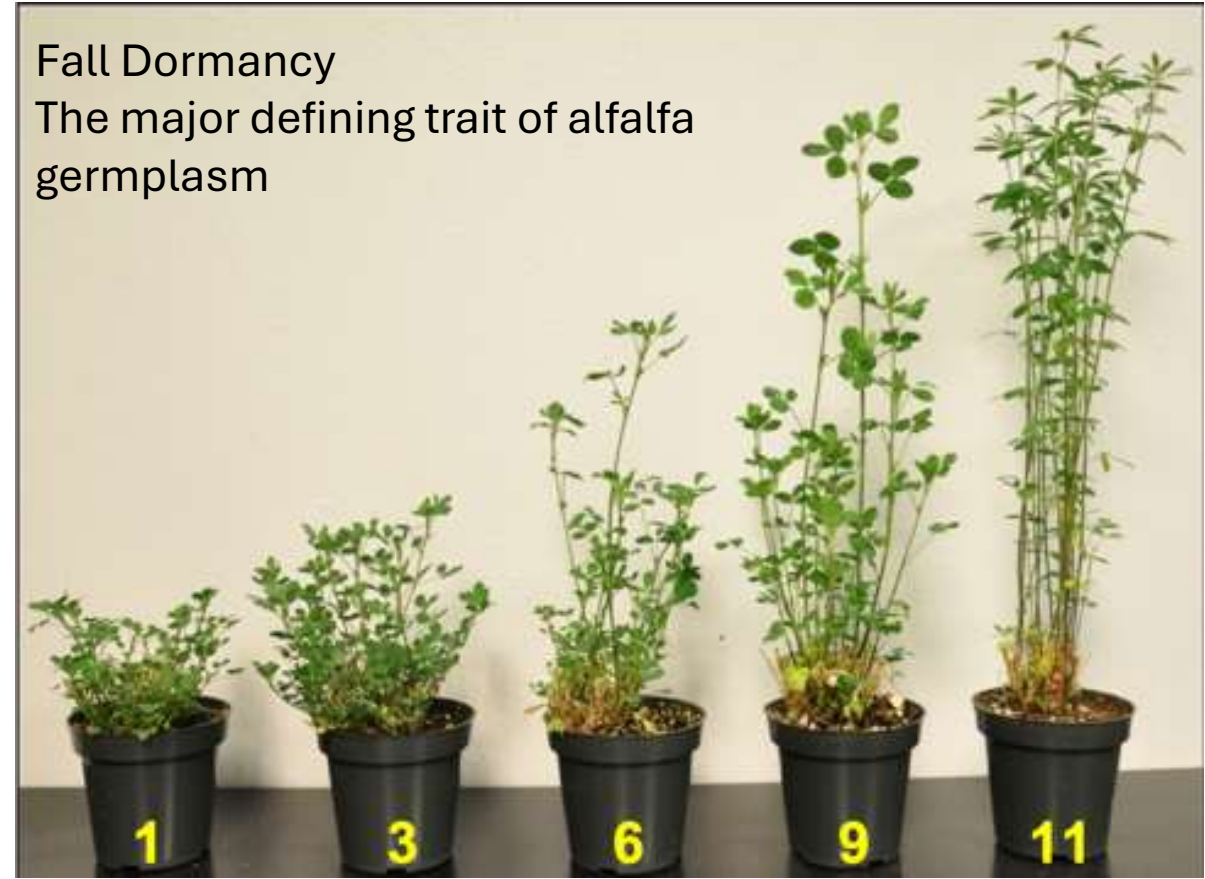
This National Alfalfa & Forage Alliance publication is intended for use by Extension and agri-business personnel to satisfy a need for information on characteristics of certified-eligible alfalfa varieties. NAFA updates this publication annually.



FALL DORMANCY (FD) RATING DESCRIPTIONS					
FD Rating		Description	FD Rating		Description
1	2	Very Dormant	6	7	Semi-Dormant
3	4		8	9	
5		Moderately Dormant	10	11	Very Non-Dormant

FD is the degree of fall alfalfa growth, as a response to temperature and day length. Lower dormancy ratings exhibit less fall growth, while higher dormancy ratings indicate greater fall growth. FD ratings are indices assigned by comparing the height of fall growth with standard check varieties, and tested across locations and years to accurately represent dormancy response across environments.

Fall Dormancy
The major defining trait of alfalfa germplasm



NON-DORMANT ALFALFA

- In this trial, only FD 8+ show regrowth
- Greater fall and winter production
- Less winter hardy

January 12, 2016, El Centro, CA

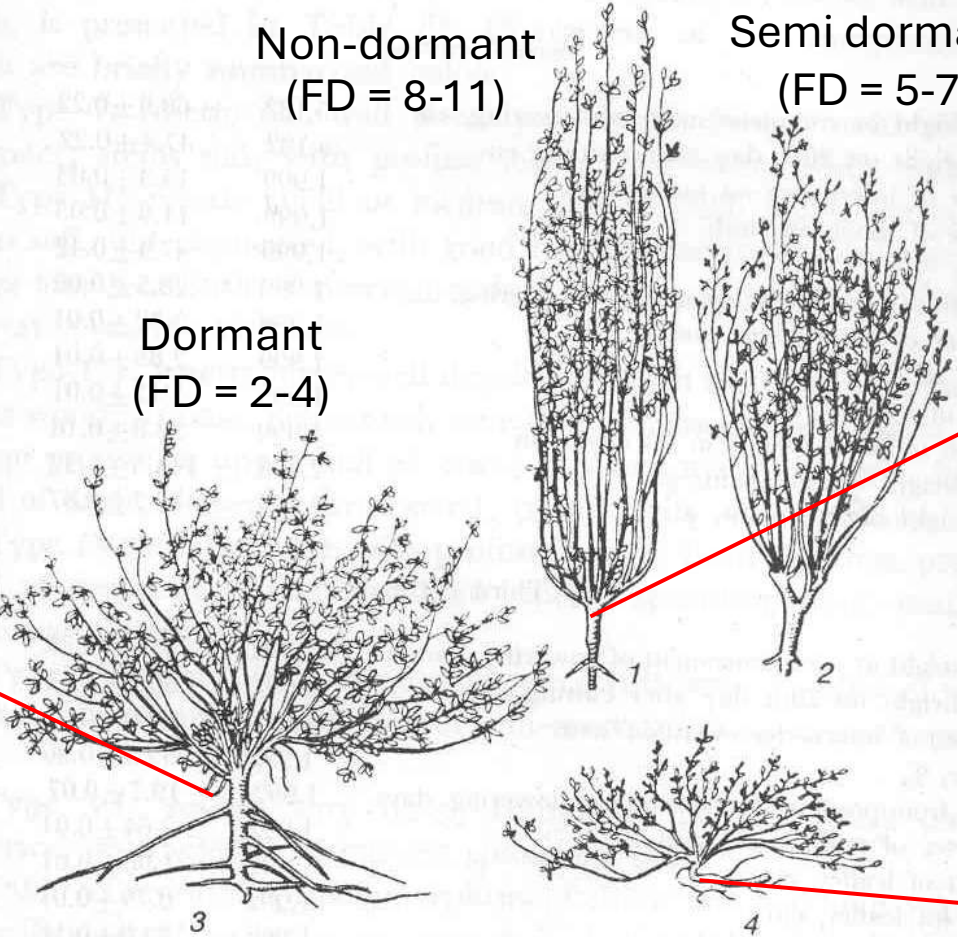


PLANT TYPES ASSOCIATED WITH DORMANCY



“rangeland” alfalfa germplasm

strong branch roots
(tap root severed when digging)



Non-dormant
(FD = 8-11)

Semi dormant
(FD = 5-7)

Dormant
(FD = 2-4)

Very dormant (FD = 1)

low growing, deep set crowns, abundant crown buds, buds arising from branched roots – spreading, “creeping” roots
(tap root has been severed by the digger)



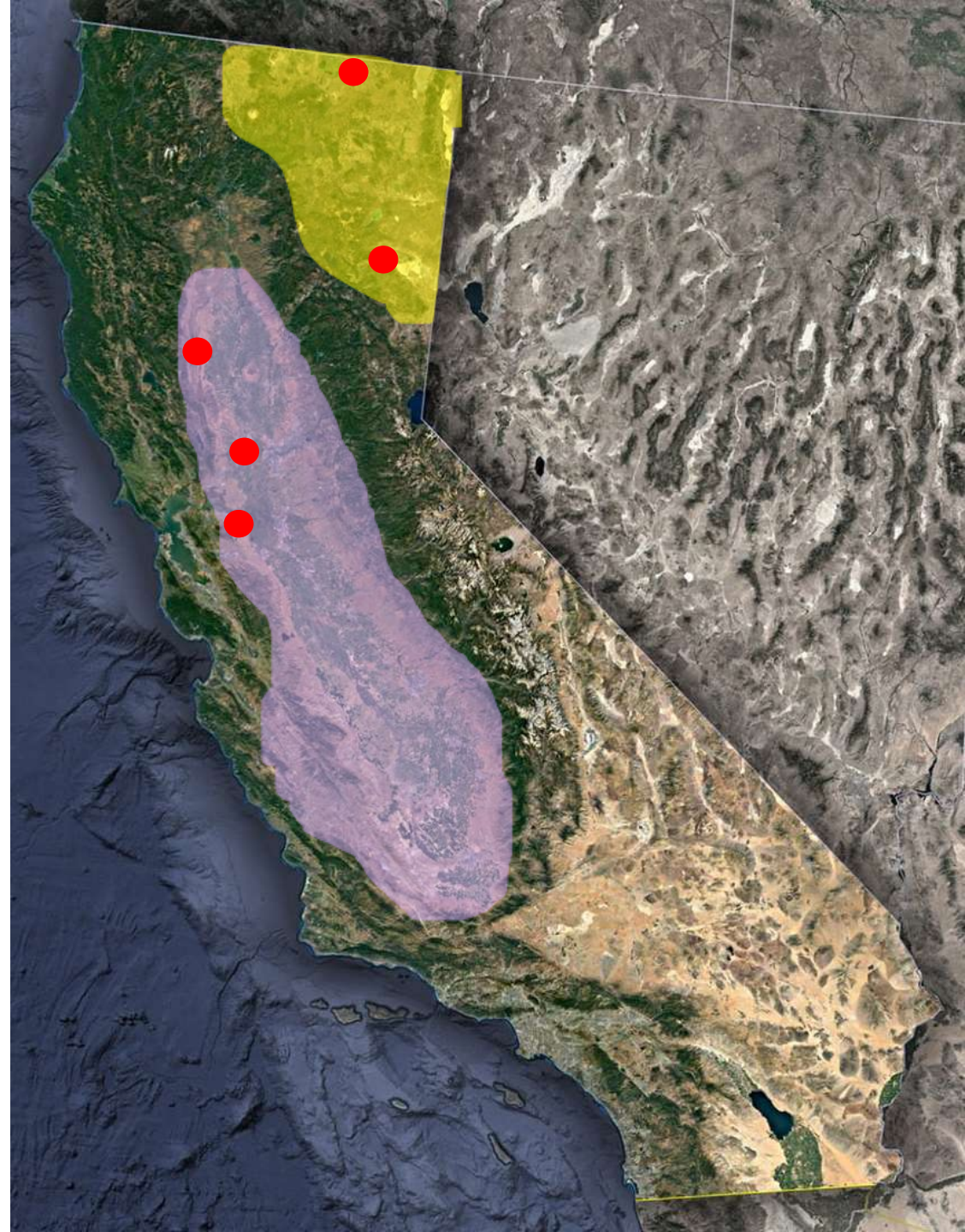
“hay-type” alfalfa germplasm



“rangeland” alfalfa germplasm

CALIFORNIA RANGELANDS

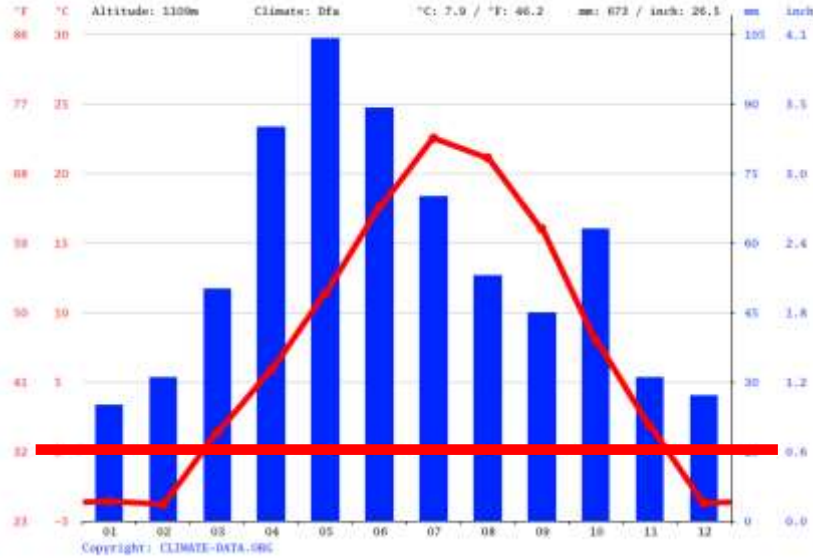
- Alfalfa commonly used on rangelands in North & Northeast CA
- Alfalfa on rangelands could be expanded to the hills of the Central/South Valley
- Nursery/selection locations shown in red →
 - Tulelake
 - Herlong
 - Paskenta
 - Davis
 - Rio Vista



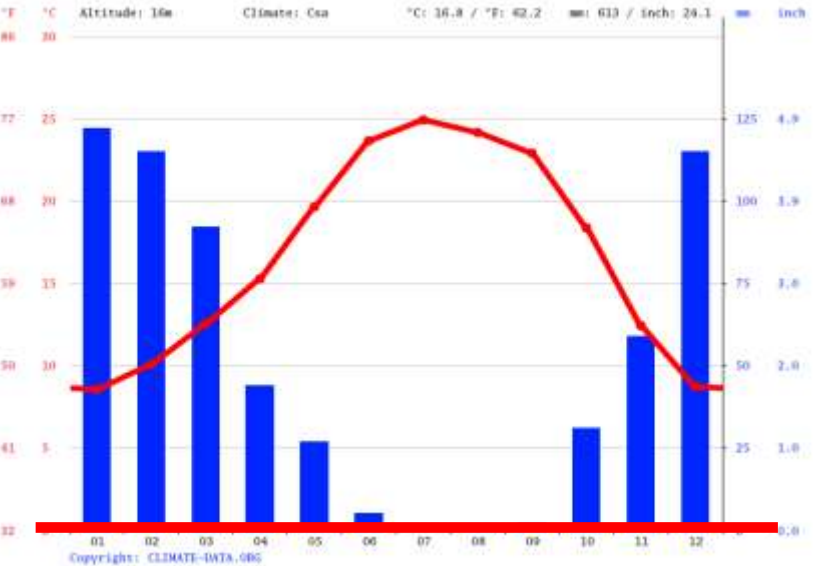
CALIFORNIA RANGELANDS

- Aligning the growth pattern of alfalfa with California's precipitation pattern

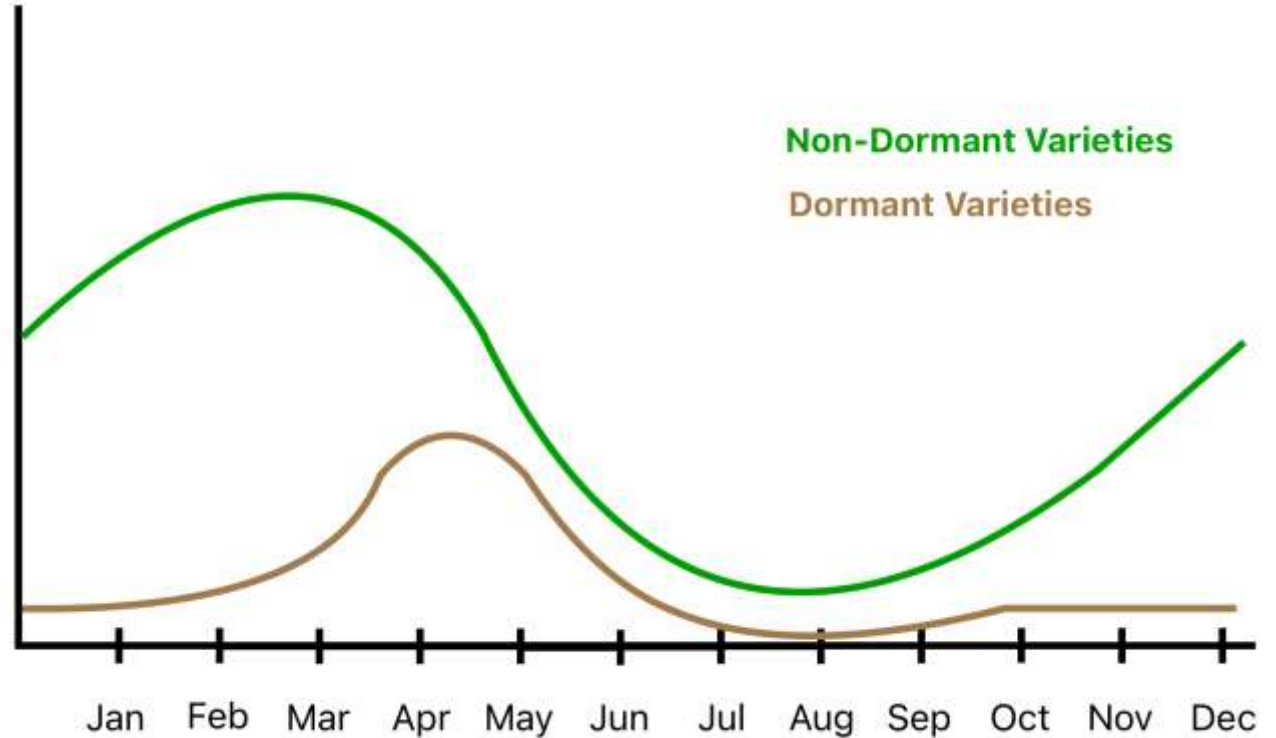
Rapid City,
South Dakota



Sacramento,
California



Plant Growth / Biomass Accumulation



“RE”-SEARCH



COWS IN UNIRRIGATED ALFALFA, OCTOBER 1st NEAR WILLIAMS, CALIFORNIA

- Increased winter productivity (Non-dormants)
- Grazing tolerance
- Heat, drought tolerance; problems that seem to be getting worse

TRIAL OBSERVATIONS –

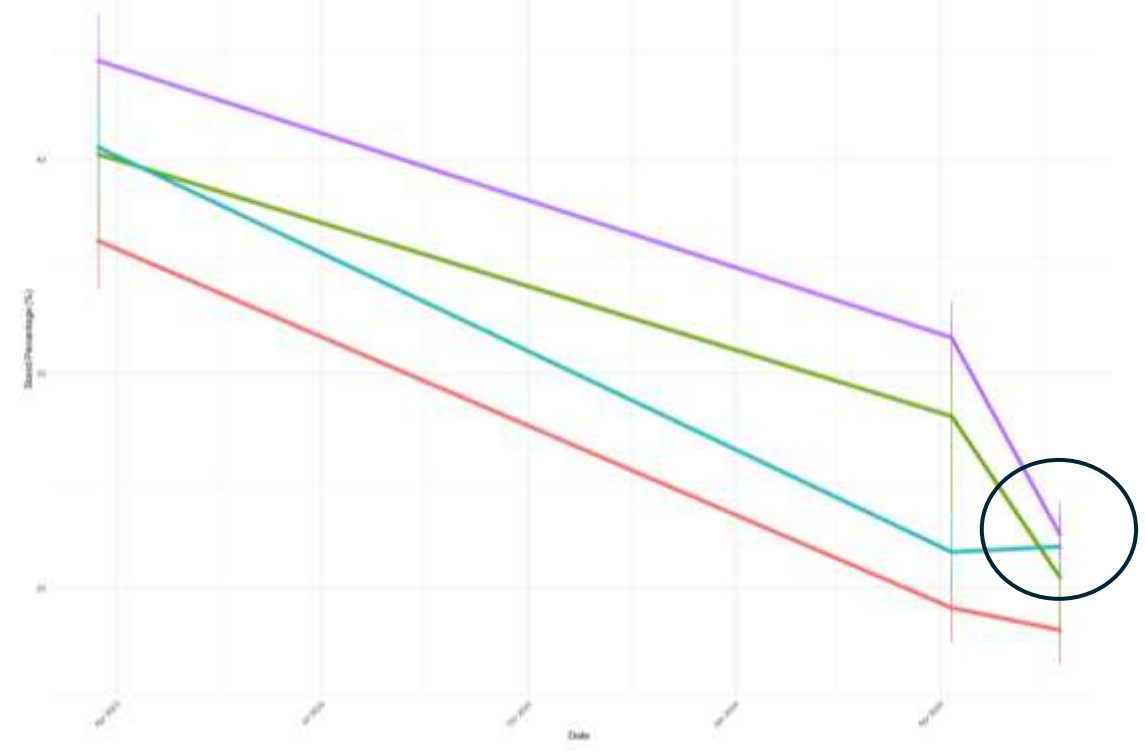
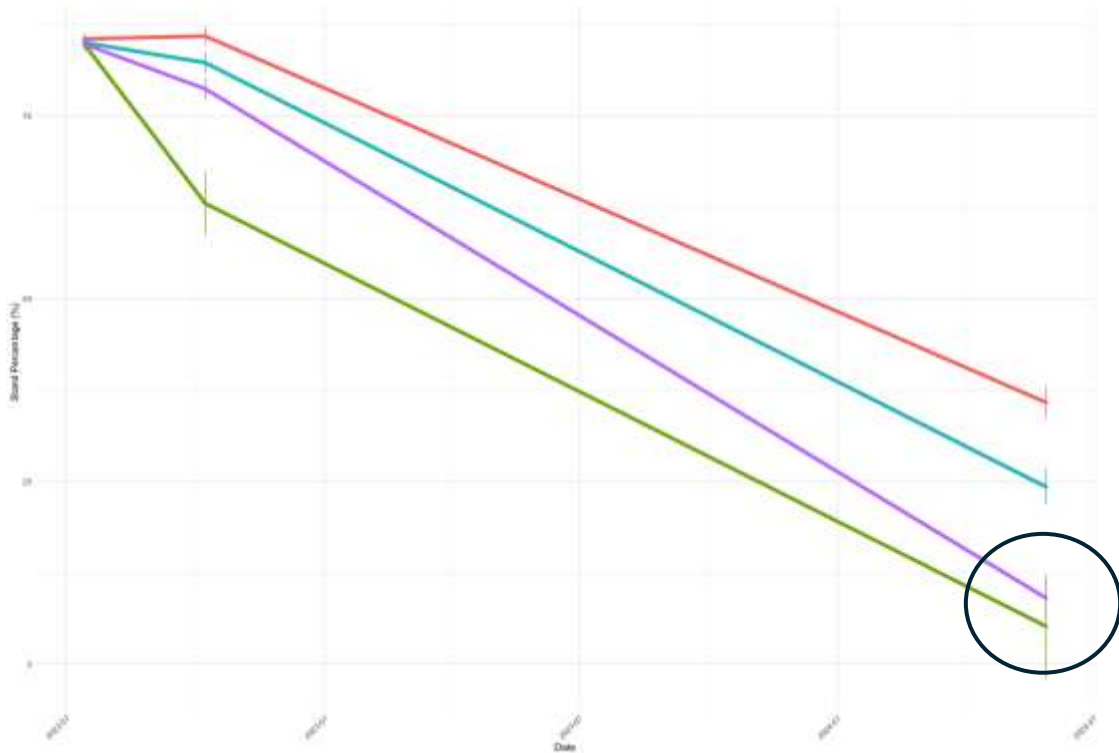
DORMANTS VS NON-DORMANTS STAND % OVER TIME

Davis, CA

Rio Vista, CA

Irrigated pasture, intentional mismanagement for overgrazing (accelerated aging)

Dry-farmed rangeland, infrequent rotational grazing



Dormancy 1-3 4-6 7-9 10-11

Dormant varieties persist better

Non-dormant varieties outcompete native grasses

“SPREADING” ALFALFA

- Present in some dormant germplasm
- Incorporation of trait into non-dormant varieties
- Trial in Tulelake, CA – Goal: to better understand the genetics of this complex trait



“SPREADING” IS A COMPLEX TRAIT

- Trait is absent in non-dormant genetic backgrounds



Pop # (# plants)	Population Type	# Spr.	# Not Spr.	% Spreading
Pop 1 (n = 143)	(Spreader × ND) F2	10	133	6.99%
Pop 2 (n = 82)	(ND × Spreader) F2	3	79	3.61%
Pop 3 (n = 38)	(Spreader × ND) BC to Spreader	11	27	28.9%

SELECTION GOALS FOR RANGELANDS WITH MILD WINTERS

- High yielding non-dormants (winter active)
- Tolerance to grazing
- Ability to survive summers with no water (irrigation or rainfall)
- Compatibility with grasses



SELECTING GERMPLASM FOR GRAZING TOLERANCE

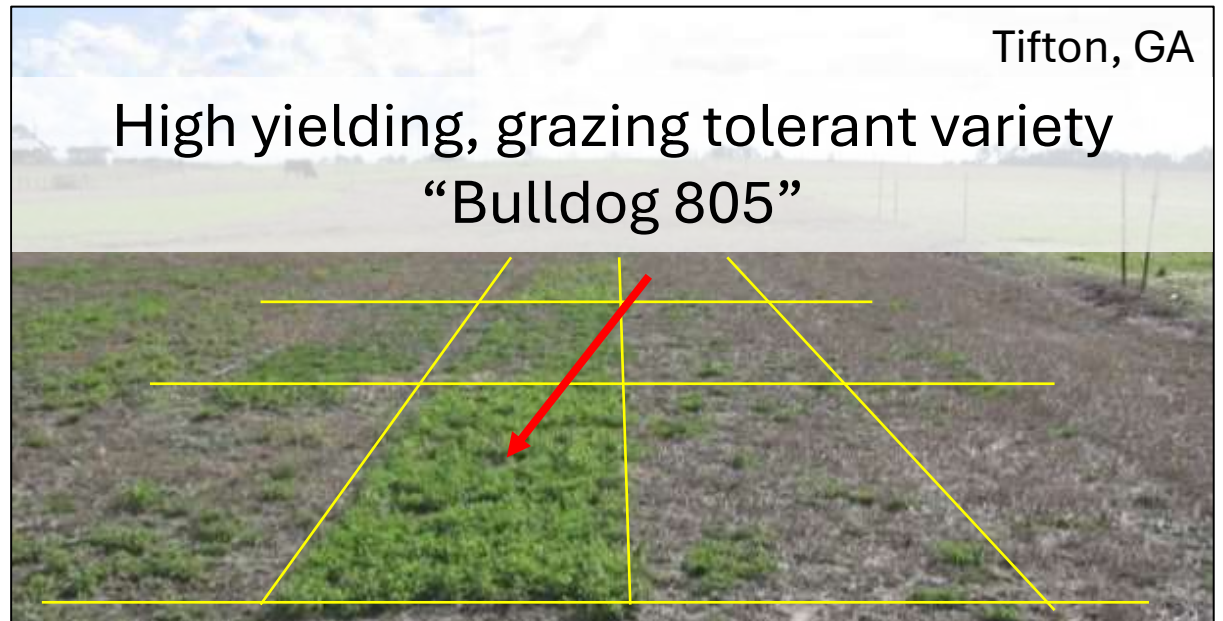
Start with high yielding, non-dormant germplasm that is not grazing tolerant



Graze heavily and select most non-dormant survivors



Result is grazing tolerant, high yielding, and non-dormant



SELECTING PLANTS FOR SURVIVAL UNDER RANGELAND OR LOW IRRIGATION CONDITIONS WITH OR WITHOUT GRAZING

These plants are currently being crossed in the greenhouse

Selecting survivors from non-dormant alfalfa plots to improve grazing tolerance; trial at sheep barn on UCD Campus – grazed heavily by sheep, limited irrigation

Rangeland alfalfa trial planted Nov '21 (Paskenta, CA). No irrigation. Selecting few surviving plants, Jun '24



SELECTING FOR SURVIVAL UNDER DROUGHT

These plants received no irrigation for 20 years without grazing (left 2 photos), & 3 years with rotational grazing (right 2 photos)



Herlong, CA (13" rain, 21" snow annually. ; September 2024

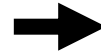
Rio Vista, CA (20" annual rainfall); May 2024

ALFALFA BREEDING PIPELINE

SELECTION ENVIRONMENT



SELECT VIGOROUS SURVIVORS



HYBRIDIZE SELECTIONS



INCREASE SEED IN CAGES WITH BEES



MULTILOCATION TRIALS FOR DATA COLLECTION IN HAY & RANGE TRIALS



BEGIN SEED PRODUCTION DURING TRIALING

CONCLUSIONS

- Increasing productivity of rangeland alfalfa, especially for warmer areas of California
- Increased grazing tolerance of non-dormant germplasm
- Genetic analysis of “spreading” trait
- Improved populations are being tested

THANK YOU!



Russel L. Rustici Rangeland
and Cattle Research Endowment

