

Suitability of semi-non-dormant Alfalfa for Winter Groundwater Recharge

Helen Dahlke, Nicholas Clark, Daniel Putnam

hdahlke@ucdavis.edu



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Alfalfa and Forage Field Day, September 19, 2019

Alfalfa for on-farm recharge

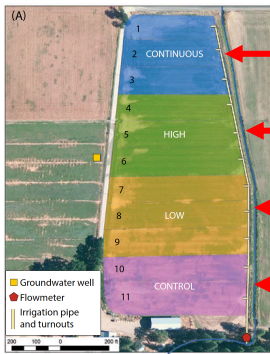
- Alfalfa supports \$6.4 billion dairy industry
- Large acreage (~980,000 acres) across the state
- Relatively low use of fertilizers, pesticides
→ low risk for leaching
- Flood irrigation most common irrigation method (~75%)
→ allows fast spreading of large water amounts



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Previous Research

Scott Valley, Siskiyou County

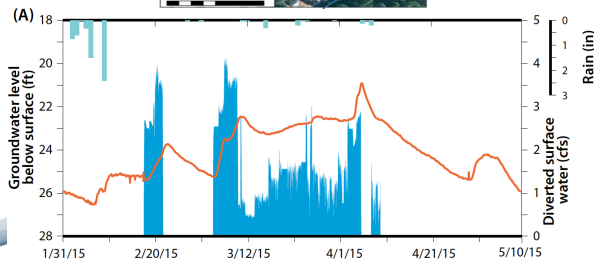


26.3 AF/acre

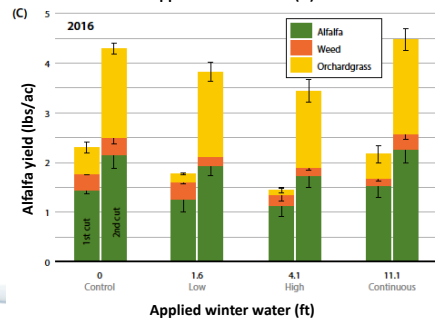
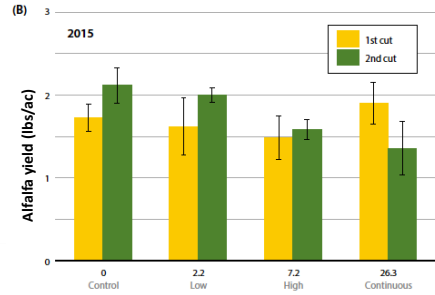
7.2 AF/acre

2.2 AF/acre

Rain only



Alfalfa BlazerXL (fall dormancy rating 3)



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Dahlke et al. 2018a, CalAg

Objective

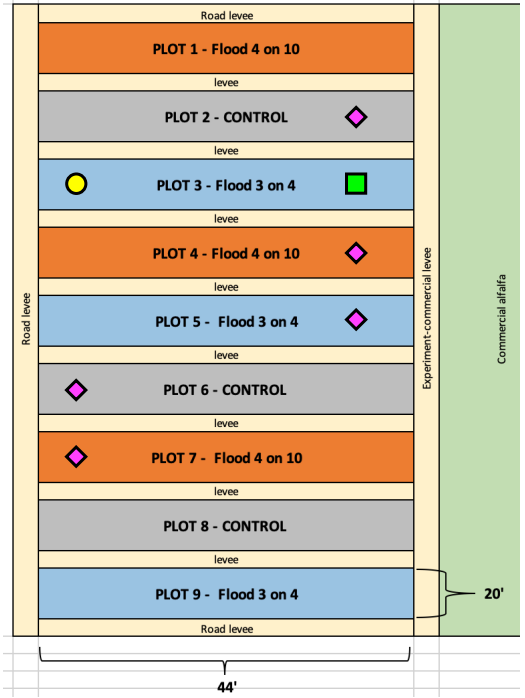
Evaluate the effect of winter flooding for groundwater recharge on semi-non-dormant alfalfa in a warm winter climate.



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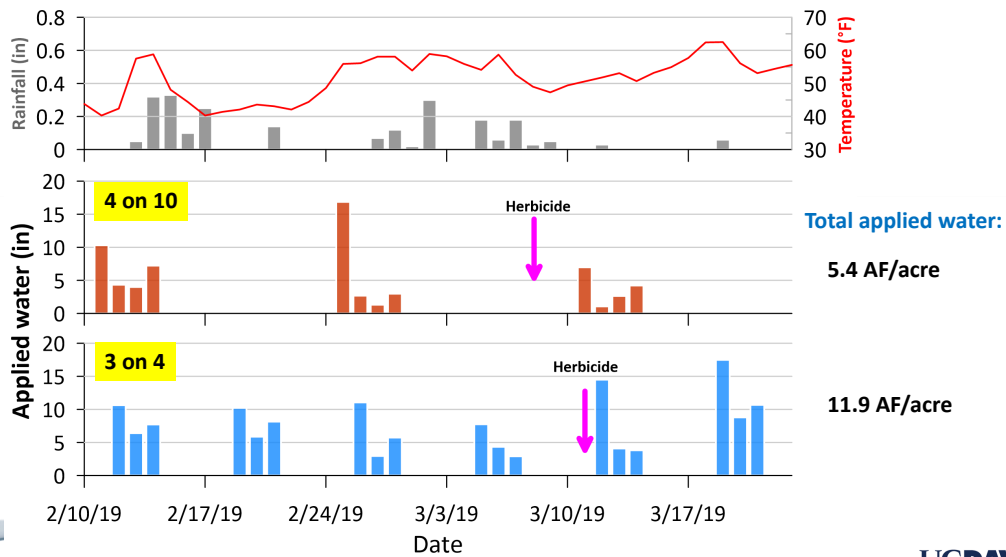
Experimental Setup

- 2-year alfalfa stand with fall dormancy rating of 8 (Ameristand 835NT RR)
- Hanford/Hesperia fine sandy loam (SAGBI good-excellent)
- Randomized complete plot design with three treatments and three replicates
- Treatments:
 - Control (ctrl)
 - 4 days of flooding, 10 days off (4 on 10),
 - 3 days of flooding, 4 days off (3 on 4)
- Measurements: hydrology, redox potential, oxygen content, yield, forage quality



◆ VWC, Redox, O₂
 ● VWC
 ■ Redox, O₂

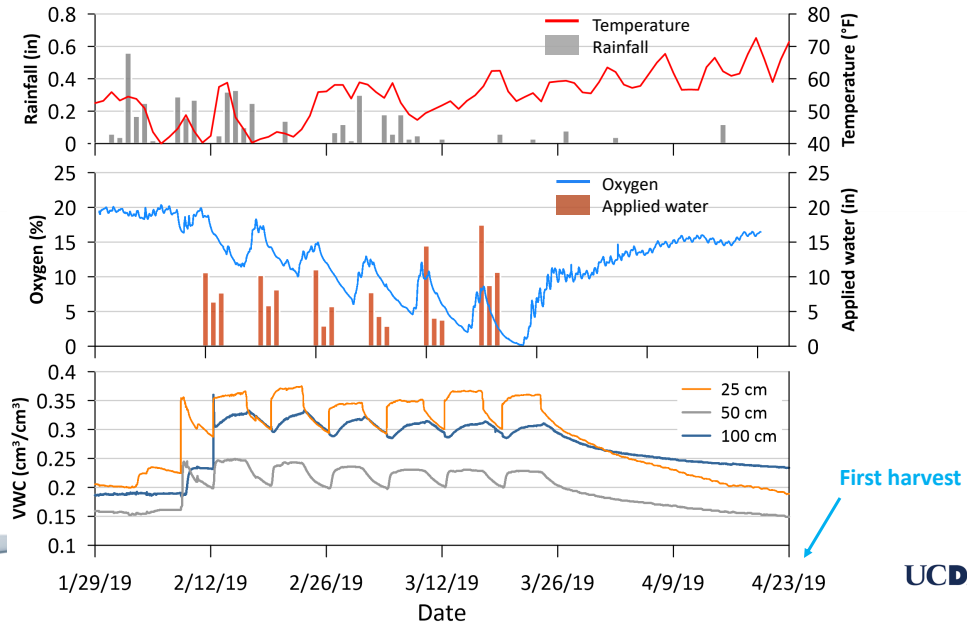
Water application & water budget



*Roundup and Poast (2.25 pt/ac) with a COC or MSO in mix

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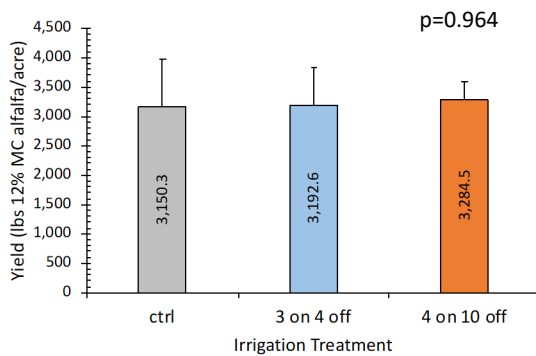
Soil oxygen & moisture content (3 on 4)



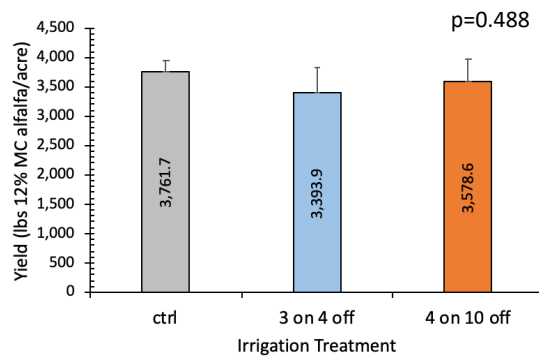
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Alfalfa yield

1st cutting (4/23/2019)



2nd cutting (6/3/2019)



12% MC = 12% moisture content

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Feed Analysis



Tukey test on treatments:

	Treatment	Amylase-treated neutral detergent fiber (aNDF)		Acid Detergent Fiber (ADF)		Ash		Crude Protein (CP)					
Control	1	39.75	Good	b	31.54	Good	a	12.07	a	21.56	Premium	a	
4 on 10 off	2	42.23	Fair	a	33.31	Fair	a	11.79	High	a	20.17	Premium	b
3 on 4 off	3	40.72	Fair	ab	32.02	Fair	a	11.96		a	20.76	Premium	ab
p-value		0.047		0.078		0.69		0.036					

aNDF = total insoluble fiber in feeds
 ADF = least digestible fiber, subset of aNDF
 Ash = total mineral content
 CP = nitrogen content of alfalfa amino acids

	ADF	NDF	RFV	TDN-100%	TDN-90%	CP-100%
Supreme	<27	<34	>185	>62	>55.9	>22
Premium	27-29	34-36	170-185	60.5-62	54.5-55.9	20-22
Good	29-32	36-40	150-170	58-60	52.5-54.5	18-20
Fair	32-35	40-44	130-150	56-58	50.5-52.5	16-18
Utility	>35	>44	<130	<56	<50.5	<16

ADF = Acid Detergent Fiber; NDF = Neutral Detergent Fiber; RFV = Relative Feed Value; TDN = Total Digestible nutrients. RFV calculated using the Wis/Minn formula. TDN calculated using the western formula. Values based on 100% dry matter, TDN both 90% and 100%.

Hay report: https://www.ams.usda.gov/mnreports/ml_gr311.txt

Feed Analysis



Tukey test on harvest date:

	Date	Acid Detergent Fiber (ADF)		Amylase-treated neutral detergent fiber (aNDF)		Ash		Crude Protein (CP)	
4/23/2019	1	30.39	b	39.32	b	11.87	a	21.46	a
6/3/2019	2	34.19	a	42.48	a	12.01	a	20.19	b
p-value		0.00003		0.001		0.579		0.006	

Increase in fiber content over growing season is expected

Decrease in protein content over growing season is expected

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Conclusions

- High-frequency and low-frequency flooding of semi-non-dormant alfalfa during late winter, early spring showed no significant effect on alfalfa yield
- Recharge of 5.4 and 11.9 acre-feet/acre could be accomplished in well draining soil (SAGBI rating good-excellent)
- High-frequency recharge created short-lived anoxic conditions in the root zone during 5th and 6th recharge event
- Winter flooding might have an effect on feed quality (digestible fiber) – more research needed.
- There was a need for herbicide application in the middle of experiment to reduce weed pressure

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