Sugar Beets and Safflower as Alternative Winter Forages

Sponsored by:

2020 S. SJV Alfalfa and Forages Virtual Field Day
September 23, 2020
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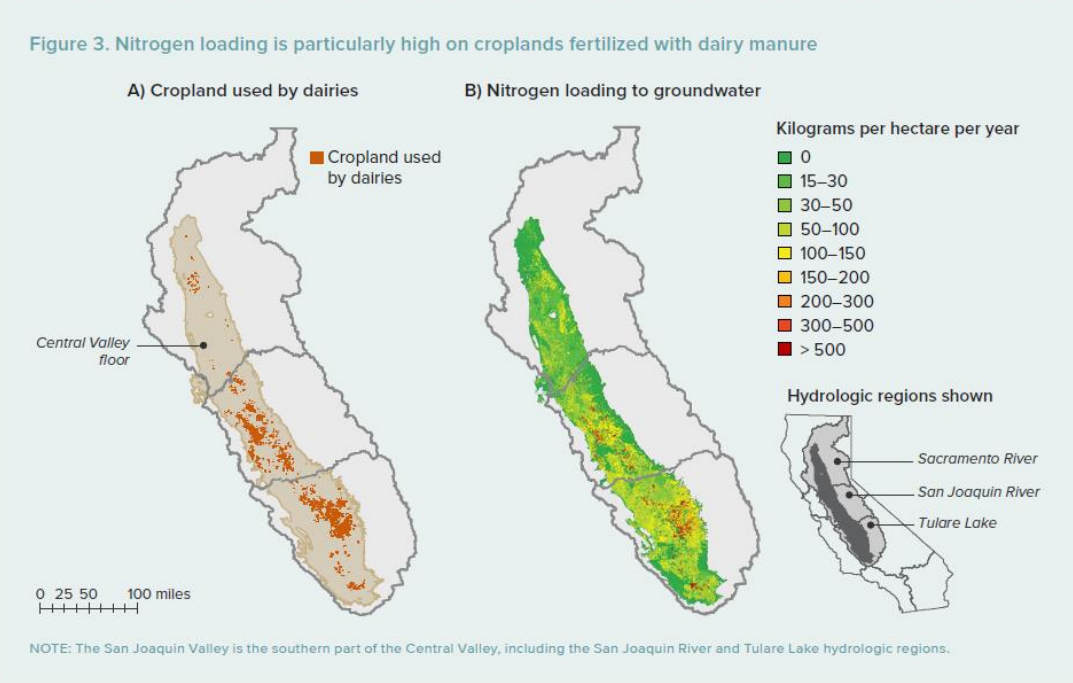
Thanks to the Fernandes Family and the Legacy Dairy, and the Wilbur Family and the Rio Blanco Dairy, Staas Brothers and Gombos Brothers

Growing sugarbeets and SB/almond hull silage

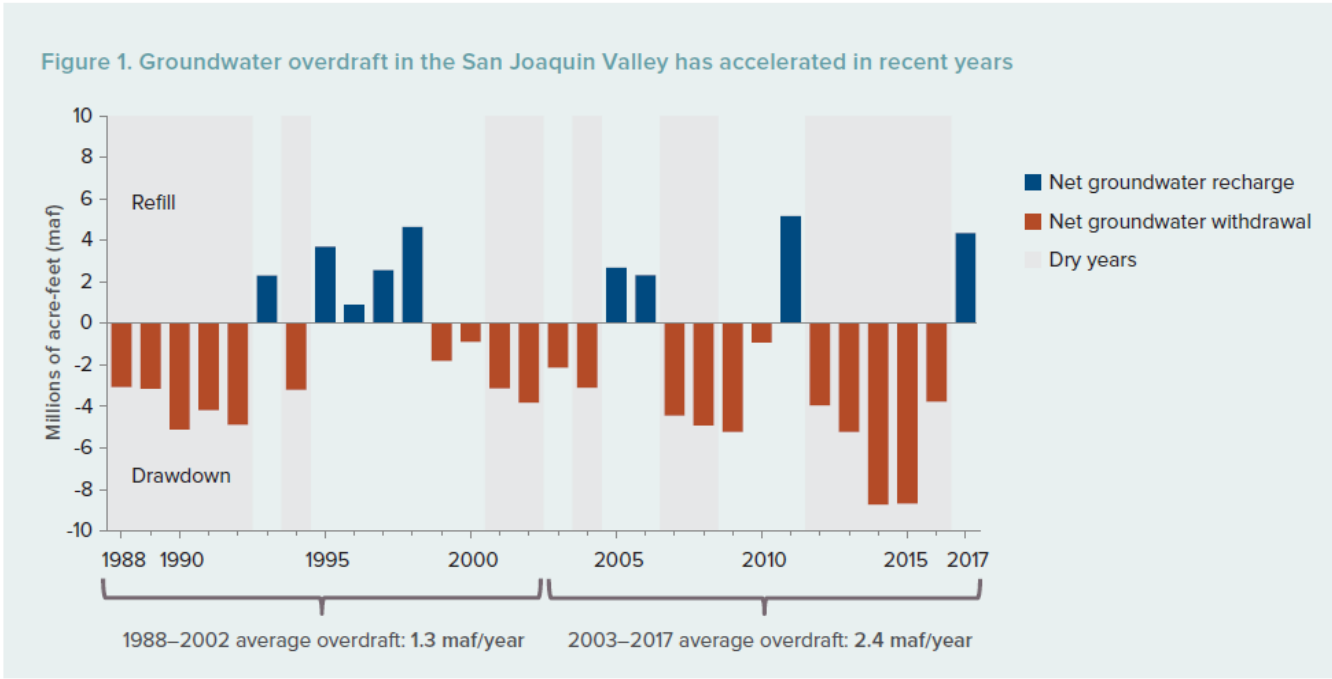
Growing safflower and safflower silage

Regulatory issues affecting farming and the state's dairy industry

The dairy industry in California may be the most efficient and lowest GHG emitting dairy systems anywhere, but are threatened by constraints on manure nutrient use and declining irrigation water supplies in the future. What might be done to help meet stricter regulatory requirements in the future?

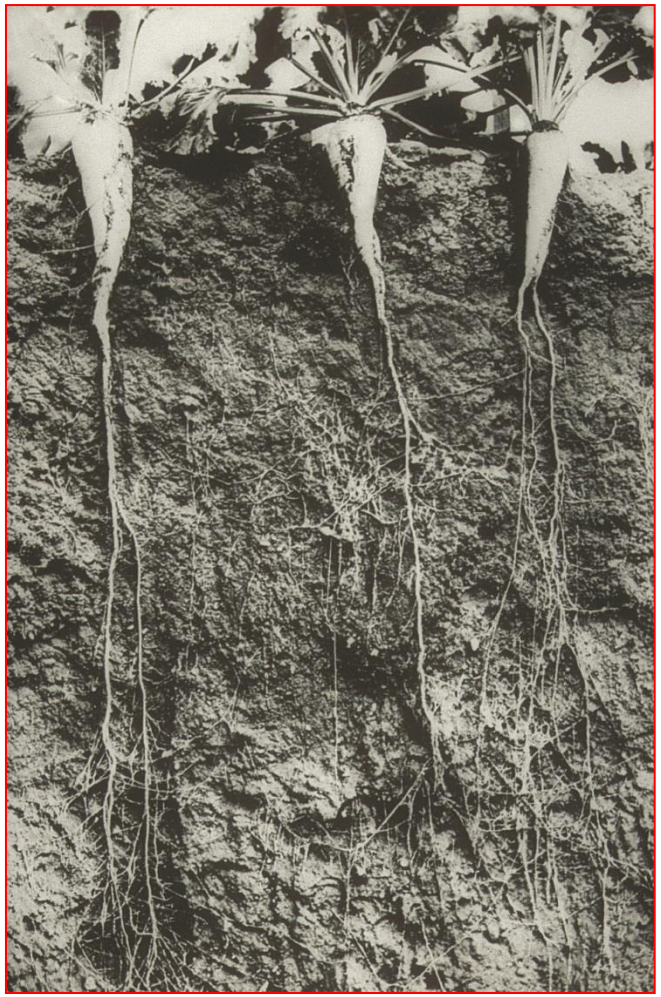


Nitrate pollution of groundwater



Ground water overdraft

SOURCE: Public Policy Institute of California_ https://www.ppic.org/publication/water-and-the-future-of-the-san-joaquin-valley/



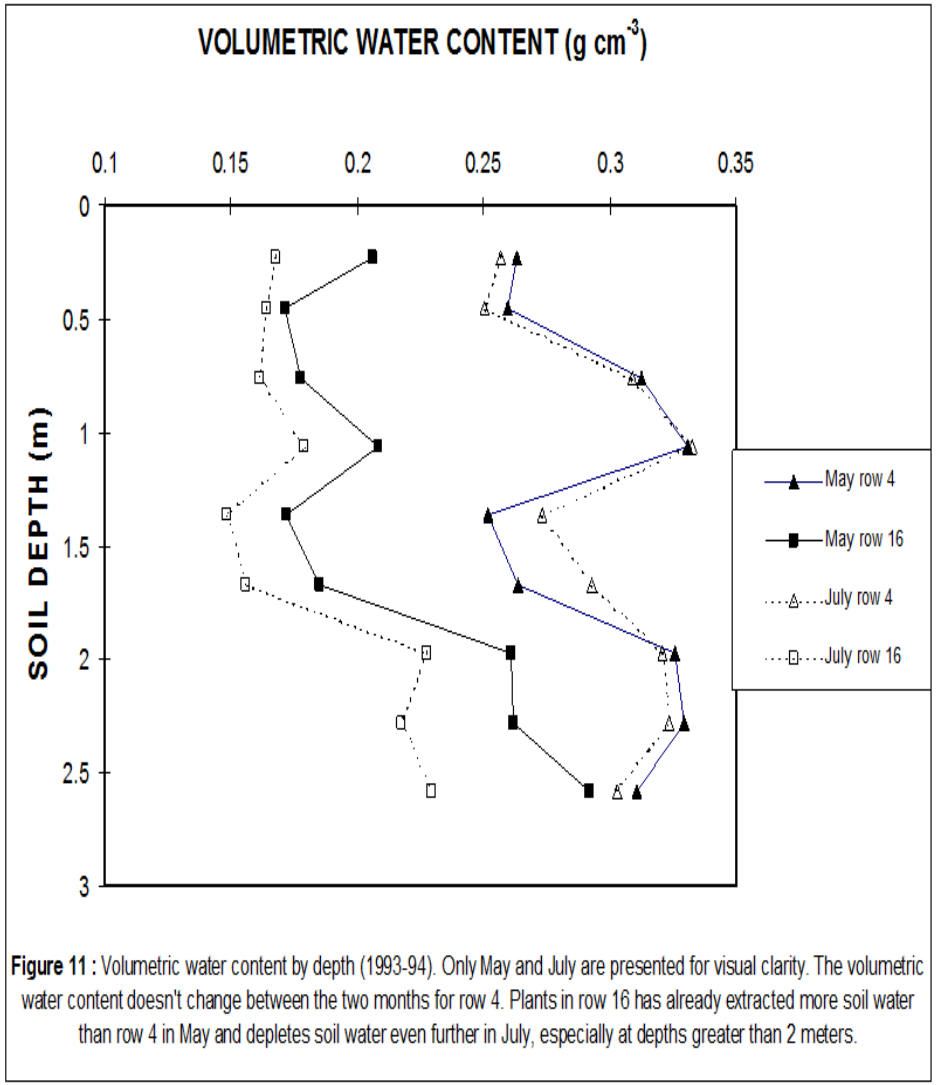


Figure 11 : Volumetric water content by depth (1993-94). Only May and July are presented for visual clarity. The volumetric water content doesn't change between the two months for row 4. Plants in row 16 has already extracted more soil water than row 4 in May and depletes soil water even further in July, especially at depths greater than 2 meters.

Can deep-rooted crops, grown in winter, be used strategically to improve water and nutrient management while also providing high quality feed?

This deep-rooted character makes beets more water use efficient and will help with nitrate management. The figure above was measured changes (depletion) of volumetric soil water content with depth on a Panoche clay loam at the UC WSREC in western Fresno County. Water (and nutrient) recovery were measured at 9 feet deep in the profile.

Sugarbeet canopy on Legacy Dairy, April, 2019. Beets were planted on October 24, 2018 and harvested on June 25, 2019.

Jeff Wilbur and Gene Aksland, May 14, 2020

Beet foliage. No evidence of disease or insect damage of any kind. Very vigorous foliage and root development. Roundup used to control weeds.

Legacy Dairy (2018-19)		
Root yields		
	average	SD
	t FW/ac	
Field	58.7	10.9
Beta	51.5	6.5
Holly	64.5	10.4

Root yields were higher than (conservatively) expected but consistent with current high yields in the IV of California. Tops were not used for feed but returned to the soil. If fed, care would be needed due to high nitrate levels.

Top and crown yields		
	t FW/ac	
Field	16.5	5.75
Beta	13.2	5
Holly	19.6	6.4

Co-ensiling sugarbeet roots and almond hulls
Legacy Dairy
June 26, 2019

The dry matter (DM) of the silage mass attained (~33%) was slightly below the target of 37% due to a lower than expected DM content of the sugarbeet roots. Beets fermented easily and were stable in Ag bags. Proximate analyses of feed values were within expected ranges, although nitrate-N levels were moderately high. The NE_l value, ~0.66 Mcal/lb DM, was similar to that of corn silage. When incorporated in rations for lactating dairy cattle, the cows were observed to readily consume the silage and even to seek out beet pieces.

Composition of the Sugar Beet/Almond Hull Co-Ensiled Silage ~60 d Post Ensiling

Location	Sample Site on the Ag Bag					
	Lower (A) (1 ft above grade)		Middle (B) ($^1/_2$ way up the bag)		Top (C) (Top of bag)	
Core Depth	Outer	Inner	Outer	Inner	Outer	Inner
Temperature (^{o}F)	95.0	92.5	95.0	94.6	97.2	97.5
Density (lbs/ft^3)	47.1	78.5	27.5	53.2	31.0	49.6
Density (lbs DM/ft^3)	11.4	24.5	8.8	17.5	9.2	17.5
Dry matter (%)	24.1	31.2	32.0	32.9	29.6	35.3
Yeast (cfu ,000)	1133	-	282	-	<100	-
Yeast (cfu: ,000)	<100	-	<100	-	<100	-
pH	3.92	3.88	3.95	3.96	3.97	4.01
Acids (% DM)						
Lactic	-	7.1	-	7.1	-	6.0
Acetic	-	2.1	-	1.9	-	1.5
Butyric	-	<0.01	-	<0.01	-	<0.01
Propionic	-	0.03	-	<0.01	-	0.03
Succinic	-	0.07	-	0.07	-	0.07
Formic	-	0.20	-	0.22	-	0.22
Ethanol (% DM)	-	3.4	-	3.0	-	3.1
Ash (% DM)	-	13.3	-	12.3	-	14.0
Crude protein (% DM)	-	7.6	-	7.5	-	7.2
Ammonia N (ppm DM)	-	1300	-	1200	-	900
Nitrate N (ppm DM)	-	955	-	752	-	898
aNDF (% DM)	-	25.4	-	26.7	-	26.9
WSC (% DM)	-	14.5	-	12.5	-	15.8
NFC (% DM)	-	53	-	53	-	51
NE_l (Mcal/lb DM)	-	0.67	-	0.66	-	0.65

Costs Per Acre To Produce Sugar Beet Forage

Legacy Ranch Dairy, Pixley

Operation	Operation time Hr/Ac	Labor Cost Costs	Fuel Lub & Repairs	Material Costs	Custom Rent	Total Cost
Strip Till post corn silage						30
Strip Till Prep for planting						15
Plant Sugar beets seed cost	0.33	3.18	7.66	100	0	111.17
Glyphosate weed control 3X						66
Irrigate 6 X	11.25	64.12	0	55.5	0	100
Irrigation water				150		150
Pickup Truck use	0.1	2.85	2.86	0	0	5.71
Total Cultural Costs	11.68	70.15	10.52	305.5	0	477.88
Topping and Digging	0	0	0	0	49	49
subtotal						**526.88**
Interest on Operating Capital @5.75%						15
Total Operating Costs / Acre		**176.94**	**126.13**	**461.92**	**120.7**	**541.88**
Liability Insurance						0.3
Office expence						30
Field Sanitation						0.52
Property taxes						4.08
Property insurance						2.91
Investment repairs						1.3
Rent share @ 16% of Gross						138.65
Total Cash overhead costs						**177.76**
Total non-cash overhead						**39**
Total Costs/Acre						**758.64**

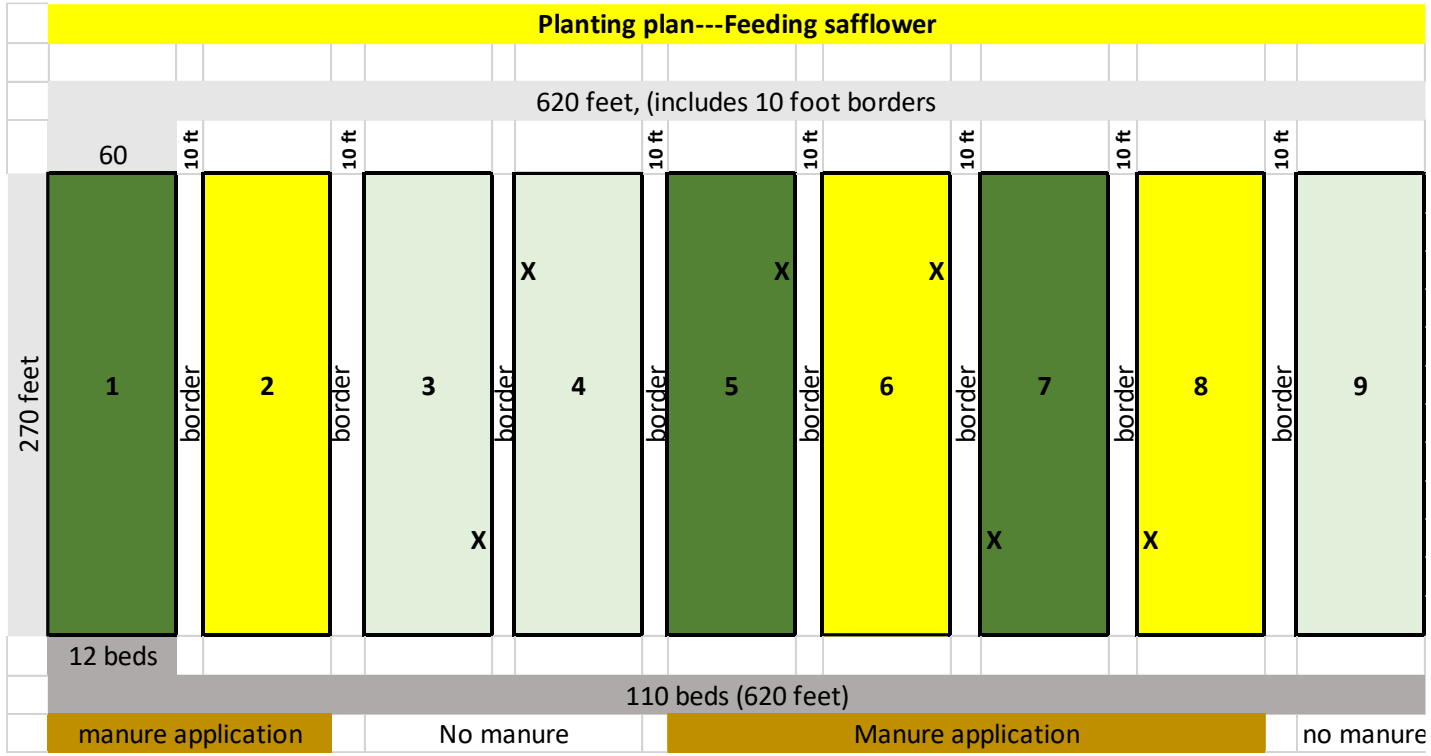
tons/ac	Cost/t beets	Bagging costs Plus almond hulls
25	30.35	66.33
30	25.29	61.27
35	21.68	57.66
40	18.97	54.95
45	16.86	52.84
50	15.17	51.15
55	13.79	49.77
60	12.64	48.62

Production costs = $760/ac; almond hulls were added at cost of $35.25/t of beets

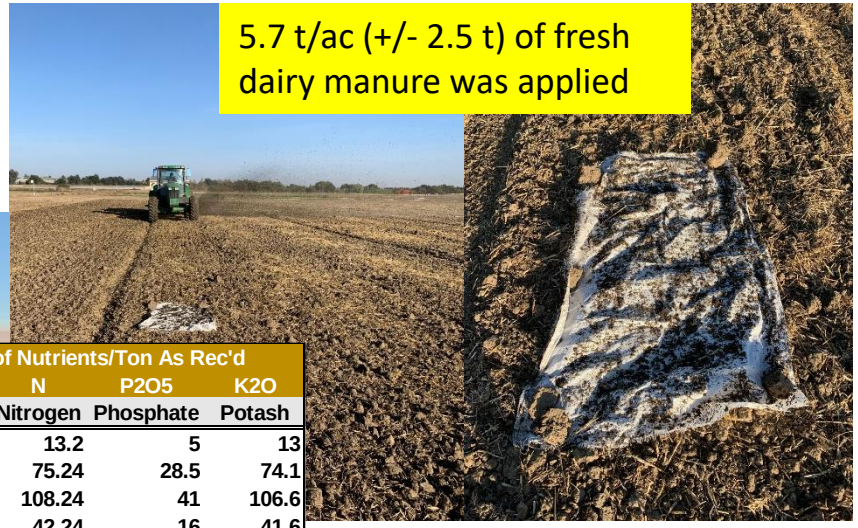
UC Davis: November 2019 to April 2020

Feb. 29, 2020

April 27-29, 2019



	lb N/ac
No N	
target N	100
high N	200



Pounds of Nutrients/Ton As Rec'd	N	P2O5	K2O
	Nitrogen	Phosphate	Potash
per ton	13.2	5	13
as applied	75.24	28.5	74.1
Range (+)	108.24	41	106.6
Range (-)	42.24	16	41.6

Project management: Safflower (Seedtec-S535) was planted with a grain drill on the UC Davis campus farm on October 31, 2019 and irrigated on November 11 to help with germination in the absence of rainfall. There were no further irrigations and all crop growth was based on rainfall and stored soil moisture from previous years. Rainfall = 12.7 inches (67% of normal), with most falling in December. Treflan was used as a pre-plant herbicide. There were no other pest management practices applied. Samples were collected starting in early February and then approximately monthly until a full harvest for silage was made on April 29. Small plots were left and subsamples collected on May 23, when the experiment was terminated. Soil moisture and crop water use was monitored using neutron access tubes and a neutron source from February until the end of the trial.

February 28, 2020, High N plot; Left: subsample;
Right: neutron access tube (soil water depletion sample site)


Subplots left for additional soil water and yield and quality monitoring