

Growing and Feeding Sugarbeets to Dairy Cows in the San Joaquin Valley:

Part 1-Production

Stephen Kaffka*, Gene Aksland, Peter Robinson and Nick Clark

Stagnant or declining milk prices and ever more restrictive environmental regulation, including the recent sustainable groundwater management act (SGMA), have increased the need for dairy producers to find new ways to reduce costs and maximize the value of feed produced with less available water. **Sugarbeets can be grown as a winter crop**, with much greater water use efficiency than comparable summer forage crops. Winter beets can produce **large root yields with high energy values and favorable fiber characteristics**. As a **deep-rooted crop** (6 feet +), beets may also help with nitrate management. Winter production minimizes or eliminates most pest management issues, lowering the cost of production. The **objective** of this research was to quantify yields and costs for the production of sugarbeets grown as a winter forage crop under dairy conditions in the SJV.

Methods: Two trials were conducted in 2018-19 on the Legacy Dairy near Pixely, and 2019-20 on the Rio Blanco Dairy near Tulare. Round-up tolerant sugarbeet hybrids were planted using strip-till methods following corn silage in late October or early Nov and harvested in late June. Water use was approximately 2.5 ac ft. Yields were 52 and 40 FW tons of roots per acre respectively. They were ensiled with almond hulls (40% by weight). Beet tops (leaves and crowns) and root quality were analyzed at harvest and beet-almond hull silage was analyzed when feeding commenced. Production results are reported in this poster. Silage was fed to all lactation groups and readily consumed. Silage quality results are reported in a companion poster (Robinson et al, 2020).

Results : **Sugarbeet emergence** under strip-till averaged 65% of seed planted and resulted in 40K plants per acre in year 1, but more variable in year 2. Hand harvest **plot yields for roots and tops** are reported in the poster and averaged 59 t/ac of roots (range: 52 to 65) in year one. In year two, fields were planted later and harvested earlier by one month and averaged 42 t/ac. There were no major insect pest or disease issues observed in either year. **Water use** was estimated at 2 to 2.5 acre feet for both crops from all sources. Sugarbeet **roots and tops were analyzed for nutrient content and forage quality at harvest**. Silage samples were collected after ensiling and at feeding (Robinson et al, 2020). The **costs of production** using expenses from both farms using strip-till methods and industry data for harvest costs were estimated to be \$1100 per acre, or \$28 per ton, not including the costs of ensiling. Combined silage costs (beets + almond hulls) were \$63.30/t using almond hulls priced at \$140/t.

Conclusions: Beets differ from other silage crops. The logistics of harvesting and ensiling beets will require additional equipment not commonly found on dairy farms, which is a barrier to adoption. Based on initial results, however, sugar beets are a promising winter forage alternative for dairy producers facing water and other regulatory challenges.

A third trial is currently planned for the Blake Wilbur Dairy near Tulare, CA.

At the Legacy Dairy, beets were strip-tilled into a pre-irrigated corn silage field on October 30. Emergence was 63% of seed planted and spacing was 2.5 beets per foot on average, nearly ideal. Beets were Round-up Ready and Roundup was sole weed control used.



Sugarbeet stands on the Legacy Dairy in late December (12-23-18). Beets were planted 60 days earlier.



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

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

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



Legacy Dairy 2018-2019 Feeding Beets Trial (root quality as harvested)								
Roots	DM	aNDF	aNDF-	Ash	N (Total)	P (Total)	K (Total)	NO3-N
	%	%	%	%	%	%	%	ppm
ave	94.7	10.99	12.08	5.96	1.02	0.17	1.40	1950.0
SD	0.8	0.58	0.65	0.44	0.07	0.02	0.13	474.4
median	94.7	10.9	12.0	6.0	1.0	0.2	1.4	2010.0
min	92.4	9.9	10.9	5.4	0.9	0.1	1.3	1380.0
max	95.6	12.5	13.8	7.1	1.2	0.2	1.6	2920.0

Root FW quality (as harvested), prior to ensiling. Dry weight was approximately 22%. (Range 20 to 25%).

Legacy Dairy, 2018-2019 Feeding beets trial (sampled 6-20-19)											
Leaves and tops	DM	ADF-	N (Total)	Protein	TDN-	Crude	Ash	aNDF-	P (Total)	K (Total)	NO3-N
	%	%	%	%	% DM	%	%	%	%	%	ppm
Ave	92.28	20.38	3.20	19.99	60.36	2.57	22.04	31.67	0.32	6.14	6914.21
SD	0.32	2.95	0.33	2.05	1.99	0.33	2.89	3.57	0.03	0.88	1656.7
Median	92.30	19.90	3.18	19.90	60.70	2.59	22.70	31.10	0.31	5.30	6990.0
Max	92.80	27.70	3.82	23.90	62.70	3.10	26.20	40.30	0.37	6.36	10940.0
Min	91.80	16.90	2.28	14.20	55.40	1.75	16.00	27.80	0.28	3.48	3900.0

Beet leaves and tops of roots (called crowns) were dried and analyzed. Ash contents reflect soil contamination in part. If tops are to be fed, then care would be needed because of very high nitrate contents (expected).



Rio Blanco Dairy June 2020 Leaf Analyses									
	DM	ADF	TDN	CP	NO3-N	N	P	K	
	%	%	at 90% DM	%	ppm DM	%	%	%	%
Ave	92.8	17.6	62.2	21.8	8481.3	3.5	0.4	5.6	
SD	0.84	1.36	0.91	2.16	2666.17	0.34	0.05	0.68	
CV	0.91	7.72	1.47	9.87	31.44	9.85	13.30	11.98	

Rio Blanco Dairy Root Analyses (hand harvested samples) June 10, 2020									
	DM	ADF	TDN	CP	NO3-N	N	P	K	
	% FW	% DM	% DM	% DM	ppm DM	% DM	% DM	% DM	% DM
Ave	21.35	6.55	69.7	8.15	2070.3	1.30	0.19	1.52	
SD	1.52	0.45	0.30	1.06	531.60	0.17	0.01	0.11	
CV	7.13	6.83	0.43	12.95	12.95	12.82	5.59	7.55	

Estimated N uptake at 40 t/ac beets (22% DM) and 30 tons tops per acre (15% DM) = 260 lbs acre in roots and 370 lbs/ac in tops = 630 lbs per acre. Only roots were removed.

N uptake		
	leaves	roots
Yield (t/ac)	35	40
lb/t	2000	2000
lb/ac	70000	80000
% DM	0.15	0.22
DM (t/ac)	10500	17600
%N	0.035	0.015
lb/ac	367.5	264

Silage costs		
Roots	Cost	Costs
t/ac	per ton	with almond hulls and bagging
35	35.2	71.2
40	32.5	68.5
45	30.4	66.4
50	28.7	64.7
55	27.3	63.3
60	26.2	62.2

Notes: Harvest and hauling costs: \$7.50/t from Imperial Valley production costs
330 lbs almond hulls per ton of FW beets
almond hulls = \$140/t
Costs based on strip till methods

Out thanks to our dairy cooperators and industry sponsors for supporting this trial.