

Oregon Agricultural College
Experiment Station

Oats and Vetch Versus Corn
or Sunflowers for Silage

By
ROY C. JONES



CORVALLIS, OREGON

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USE MORE OATS-AND-VETCH FOR SILAGE IN WESTERN OREGON

Oats-and-vetch, on the heavier, poorly drained soils, yields more tonnage than corn or sunflowers.

Oats-and-vetch silage produced slightly more milk than either corn or sunflowers in tests at the Oregon Experiment Station.

Oats-and-vetch fills the silo in early summer and keeps it from drying out and falling down.

Oats-and-vetch, placed in the silo in the spring and used out during the summer, allows double use of the silo, as it can be filled again in the fall with corn or sunflowers.

Oats-and-vetch is planted in the fall when other farm work is not so driving as in the spring.

Oats-and-vetch requires no cultivation after sowing.

Vetch is a legume and consequently a soil builder.

Oats and Vetch Versus Corn or Sunflowers for Silage

By
ROY C. JONES

Since the first silo was built and filled, many different crops, from maize to Russian thistles, have been ensiled with varying degrees of success. The common crops used in Western Oregon are corn, oats-and-vetch, and sunflowers. Many questions about the suitability of these crops for silage are constantly being received by this Experiment Station. The following are representative of the questions received. Which crop yields the most? Which produces the most milk? Does a silo full of oats-and-vetch weigh the same as a silo full of corn? Do the different kinds of silage have any effect on the flavor or quality of the butter-fat?

In order to have definite knowledge with which to answer these questions, this Station has conducted trials during the past three years involving thirty-six cows, or rather thirty-two different animals, as four of the animals were used two years in succession. The detailed plans and results are shown in the latter part of this bulletin.

RECOMMENDATIONS AND SUMMARY

Our recommendation for the practical application of these results is as follows: *Grow more oats-and-vetch for silage.*

Yields

On the dairy farms of Western Oregon, having heavy, rather poorly drained soil, oats- or barley-and-vetch should be grown much more extensively for silage purposes. It outyields corn about two to one. It nearly equals sunflowers in yield and far excels them in palatability. The average yields for the five years from 1918 to 1922 were: sunflowers 13.3 tons per acre, oats-and-vetch 9.6 tons, and corn 5.4 tons. The best yield of oats-and-vetch was 16.6 tons per acre, or more than any of the others. The Farm Crops department of the Station reports an average yield of oats-and-vetch from 1914 to 1921, on similar land, of 12.7 tons per acre.

Milk Produced

The oats-and-vetch silage produced a trifle more milk than the other kinds, the increase being about five percent. At the same time the cows gained .5 pound per day while getting the oats-and-vetch against .3 pound on corn and a bare maintenance of weight on the sunflowers.

Palatability

No difference could be noted between the oats-and-vetch and corn silage in the relish with which the cattle ate it. The sunflower silage, however, was so distasteful to most of the cows that they had to be partly starved before they would eat it and even then they did not relish it as much as the other silage. The Farm Crops department says that this can be overcome by the addition of 20 percent corn to the sunflowers when they are ensiled.

Grow Two Silage Crops

These facts do not necessarily mean that corn or sunflowers should not be grown as well as a crop of oats-and-vetch. There is quite an advantage in having a cultivated crop in the rotation. There is also an advantage in having a crop to put into the silo in the fall as well as in the spring. This gives one double use of the silo and enables one to get along with a smaller tonnage capacity.

Varieties to Grow

Common vetch and gray winter oats are the varieties which were used in the trials. These are the ones recommended by the Farm Crops department of the Station. The Farm Crops department also states that, for the Coast sections, purple vetch shows a little more promise than the common vetch, being easier to start and making an excellent growth. On the very heavy lands of the Willamette Valley, Hungarian vetch shows a great deal of promise. Winter barley can also be used with vetch for silage and produces good results.

Minnesota No. 13 was the variety of corn used, and Mammoth Russian was the variety of sunflowers.

Rate and Time of Seeding

Professor Hyslop states that the best results are obtained by using 60 to 80 pounds of vetch with 40 pounds of Gray winter oats per acre. The best time for sowing is usually from October 1 to 15. Well cultivated corn land can be made ready for vetch by simply disking and harrowing it.

Harvesting

Oats-and-vetch should be harvested for silage when the oats are in the light dough stage and the seeds are formed in the lower pods on the vetch. This is about the time it is usually cut for hay; it contains about 75 percent water at that time. If it is a little too mature, enough water should be added at the silo so that it will pack down well.

SILAGE INVESTIGATIONS

YIELDS

The Dairy Husbandry department grows annually about 20 acres each of corn and oats-and-vetch and for the past four years has grown from two to three acres of sunflowers. The yields shown in Table I are these actual farm yields and not small plot yields.

TABLE I. YIELDS IN TONS PER ACRE

	Oats-and-vetch	Sunflowers	Corn
1918	2.80*	.....	4.6
1919	16.63	13.23	4.9
1920	16.00	15.00	5.5
1921	8.28*	15.00	5.0
1922	4.12†	10.00	7.2
Average	9.57	13.31	5.44

*A very severe infestation of aphid completely killed the vetch in 1918. In 1921 the early-sown vetch in two fields was badly damaged by a similar infestation, while one field, sown late after the removal of corn crop, was not damaged.

†Heavy frosts in February heaved the ground enough to kill most of the vetch.

The Farm Crops department reports an average yield of 12.7 tons of oats-and-vetch per acre for the years from 1914 to 1921. Corn yields check with ours quite closely. The Farm Crops department has not enough data on sunflowers to compare.

Over a period of five years, then, the sunflowers show the highest yield although in its good years the oats-and-vetch outyielded the sunflowers. The soil on which these crops were grown was rather poorly drained and very sticky, some of it classifying as white land and the rest very close to it.

WHICH PRODUCES THE MOST MILK?

The next question that naturally arises is, what are the comparative feeding values? In order to answer this question feeding trials have been conducted for the last three seasons, beginning 1919-20.

Trial 1, 1919-20

Plan. In the first year's trial the cows were not as carefully divided as in subsequent trials, so as to have the two groups uniform. The alternating method of feeding was used, however, so that the summary should not be seriously affected by this fact. The milk yield shown in Table II is that given in the first ten days in December. The trial started December 26.

TABLE II. DATA REGARDING COWS USED

Lot A				Lot B			
Herd No.	Breed	Fresh	10-day milk yield lbs.	Herd No.	Breed	Fresh	10-day milk yield lbs.
404	Ayrshire	Aug. 4, 1919	241.0	421	Ayrshire	Sept. 17, 1919	234.6
407	Ayrshire	Aug. 23, 1919	330.3	424	Ayrshire	April 29, 1919	127.3
405	Ayrshire	Jan. 31, 1919	79.0	216	Holstein	Jan. 30, 1919	136.4
408	Ayrshire	July 3, 1919	270.7	217	Holstein	Jan. 28, 1919	245.6
414	Ayrshire	June 19, 1919	211.1	602	Guernsey	Mar. 24, 1919	135.0
418	Ayrshire	July 21, 1919	139.6	19	Jersey	April 14, 1919	163.9
Total			1271.7	Total			1063.3

The 12 cows selected as above were fed a basal ration consisting of ten pounds of clover hay, one pound of grain to every three pounds of milk produced per day, and all the silage they would consume. The grain mixture consisted of 200 pounds mill-run, 100 pounds dried beet pulp, 25 pounds cocoanut meal, and 15 pounds linseed oil meal. A preliminary period of 10 days was allowed on each feed in order to fill the animals on the feed in question, then feeding was continued for 30 more days and weights recorded and used in results. Periods 1, 5, and 9 were preliminary or transition periods.

Results. The milk and fat produced and feed consumed are shown in Tables III and IV for the two lots and summarized in Tables V and VI.

TABLE III. PRODUCTION AND FEED CONSUMPTION FOR LOT A, 1919-20

10-day periods	Milk	Fat	Hay	Grain	Oats-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	1109.3	43.93	600	422.0	1750.5	.....	.....
3	1117.6	44.26	600	396.8	2052.5	.....	.....
4	1100.0	43.56	596	380.0	1991.5	.....	.....
Total	3326.9	131.75	1796	1198.8	5794.5	.....	.....
6	973.4	36.21	580	335	.....	1402	.....
7	955.4	35.54	580	335	.....	1296	.....
8	924.6	34.40	580	403	.....	1292	.....
Total	2853.4	106.15	1740	1073	.....	3990	.....
10	933.9	31.65	580	409	.....	.....	1333
11	893.4	30.29	586	405	.....	.....	1698
12	842.4	28.51	600	405	.....	.....	1881
Total	2669.7	90.45	1766	1219	.....	.....	4912

TABLE IV. PRODUCTION AND FEED CONSUMPTION FOR LOT B, 1919-20

10-day periods	Milk	Fat	Hay	Grain	Oats-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	896.9	33.63	600	350	1682.5	.....	.....
3	930.0	34.88	598	314	2157.5	.....	.....
4	928.6	34.82	582	290	2166.0	.....	.....
Total	2755.5	103.33	1780	954	6006.0	.....	.....
6	930.8	37.41	580	290	.....	.....	1900
7	948.9	38.15	580	290	.....	.....	1900
8	942.1	37.87	580	290	.....	.....	1838
Total	2821.8	113.43	1740	870	.....	.....	5638
10	844.7	35.48	562	277	.....	1795	.....
11	833.2	34.99	572	275	.....	1655	.....
12	774.1	32.51	600	275	.....	1645	.....
Total	2452.0	102.98	1734	827	.....	5095	.....

TABLE V. SUMMARY LOTS A AND B, 1919-20

	Milk	Fat	Hay	Grain	Silage
	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	2006.2	77.59	1200	772.0	3433.0
	2047.6	79.14	1198	710.8	4210.0
	2028.6	78.38	1178	670.0	4157.5
Total	6082.4	235.11	3576	2152.8	11790.5
Corn	1864.7	69.06	1160	699	3233
	1842.3	68.44	1166	695	3598
	1784.5	66.38	1180	695	3719
Total	5491.5	203.88	3506	2089	10550
Sunflower	1818.1	71.69	1142	612	3197
	1788.6	70.53	1152	610	2951
	1698.7	66.91	1180	673	2937
Total	5305.4	209.13	3474	1900	9085

TABLE VI. SUMMARY LOTS A AND B, 1919-20, FEED CONSUMED
PER UNIT OF PRODUCT

	—Per 100 pounds milk—		—Per pound fat—	
	Clover hay	Grain	Silage	Grain
	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	58.8	35.4	193.8	9.15
Corn	63.8	38.0	192.8	10.20
Sunflowers	65.5	35.8	171.2	9.10

These tables show that in actual yield of milk the oats-and-vetch silage ranks first, corn second, and sunflowers third.

Considerable difficulty was experienced in getting the cows to consume the sunflower silage readily. It did not seem to be as palatable as the other kinds. Some cows seemed to take a greater dislike to it than others. They did not consume enough of the sunflower silage to maintain their body weight, the 12 cows losing 186 pounds during the 30 days. On oats-and-vetch they gained 345 pounds and on corn 191 pounds.

Trial 2, 1920-21

Plan. A second test was started in February, 1921. More care was taken to equalize the two groups of cows as regards breed, freshening date, and milk yield, as will be seen from Table VII.

TABLE VII. DATA REGARDING COWS USED. 1920-21

Group A			
Cow	Breed	Fresh	Milk in Jan. 1921
			lbs.
22	Jersey	Nov. 21, 1920	785.6
212	Holstein	Oct. 29, 1920	1898.9
221	Holstein	Nov. 3, 1920	679.2
415	Ayrshire	Nov. 8, 1920	928.1
421	Ayrshire	Oct. 29, 1920	1129.2
425	Ayrshire	Jan. 5, 1921	880.0 (est.)
			6301.0
Group B			
			lbs.
612	Guernsey	Nov. 15, 1920	712.9
213	Holstein	Dec. 5, 1920	1417.4
222	Holstein	Nov. 30, 1920	1143.2
423	Ayrshire	Oct. 10, 1920	888.5
426	Ayrshire	Oct. 13, 1920	1228.0
431	Ayrshire	Nov. 16, 1920	927.7
			6317.7
436*	Ayrshire	Jan. 16, 1921	806.0 (est.)

*Substituted for 431 on account of sickness.

Grain was fed as in the previous trial, but alfalfa hay was fed in place of the clover, which was not available. The hay was fed at the rate of 1 pound for each 100 pounds of weight in the cow. Silage was fed at 3 pounds per 100 pounds of body weight.

The A group was started on oats-and-vetch silage, while the B group received sunflower silage.

Results. The same lack of palatability of the sunflower silage appeared as in the previous year; in fact, cow 431 went completely off feed during her preliminary period, and 436 was added to the group, making 7 cows in Group B. Subsequent experience with 431 has shown her to be

extremely fastidious in her appetite even when sunflowers are not concerned, so we have eliminated her from the tables in this trial.

Tables VIII, IX, X, and XI show the results of this trial using six animals in each group and eliminating cow 431.

TABLE VIII. LOT A. 1920-21

10-day periods	Milk	Fat	Hay	Grain	Oat-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	1834.7	24.31	650	565	1890	.....	.....
3	1756.5	71.14	650	565	1891	.....	.....
4	1733.3	70.20	650	565	1900	.....	.....
Total	5324.5	215.65	1950	1695	5681	.....	.....
6	1714.6	66.36	650	565	.....	.....	1900.0
7	1680.6	65.04	650	565	.....	.....	1891.5
8	1609.6	62.29	643	565	.....	.....	1838.0
Total	5004.8	193.69	1943	1695	.....	.....	5629.5
10	1535.5	61.42	650	565	.....	1842	.....
11	1527.7	61.11	650	565	.....	1900	.....
12	1628.7	65.15	650	565	.....	1900	.....
Total	4691.7	187.68	1950	1695	.....	5642	.....

TABLE IX. LOT B. 1920-21

10-day periods	Milk	Fat	Hay	Grain	Oat-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	1616.4	61.75	620	575	.....	1810	.....
3	1650.5	63.05	620	575	.....	1820	.....
4	1614.9	61.69	620	575	.....	1820	.....
Total	4881.8	186.49	1860	1725	.....	5450	.....
6	1481.0	60.87	620	575	1806.7	.....	.....
7	1301.4	53.49	618	575	1804.5	.....	.....
8	1371.4	56.36	615	575	1820.0	.....	.....
Total	4153.8	170.72	1853	1725	5431.2	.....	.....
10	1313.0	50.29	620	575	.....	.....	1820
11	1356.2	51.94	620	575	.....	.....	1820
12	1412.7	54.11	620	575	.....	.....	1820
Total	4081.9	156.34	1860	1725	.....	.....	5460

TABLE X. SUMMARY LOTS A AND B. 1920-21

	Milk	Fat	Hay	Grain	Silage
	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	3315.0	135.18	1270	1140	3696.7
	3057.9	124.63	1268	1140	3695.5
	3104.7	126.56	1265	1140	3720.0
Total	9477.6	386.37	3803	3420	11112.2
Corn	3027.6	116.65	1270	1140	3720.0
	3036.8	116.95	1270	1140	3711.5
	3022.3	116.40	1270	1140	3658.0
Total	9086.7	350.00	3810	3420	11089.5
Sunflower	3151.9	123.17	1270	1140	3652
	3178.2	124.16	1270	1140	3720
	3243.6	126.84	1270	1140	3720
Total	9573.7	374.17	3810	3420	11092

TABLE XI. FEED CONSUMED PER UNIT OF PRODUCT

	—Per 100 pounds milk—			—Per 1 pound fat—		
	Hay	Grain	Silage	Hay	Grain	Silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	40.1	36.1	117.2	9.8	8.8	28.8
Corn	41.9	37.6	122.0	10.9	9.8	31.7
Sunflowers	39.8	35.7	115.8	10.2	9.1	29.7

In amount of milk produced during this trial the sunflower silage ranks first, oats-and-vetch second, and corn last. With the exception of cow 431, these cows exhibited little difficulty with the sunflower silage although they did not take it as readily as they did the other kinds. The 12 cows gained 149 pounds in the 30 days on sunflowers, 129 pounds on oats-and-vetch, and 25 pounds on corn.

Trial 3, 1921-22

Plan. The general plan followed was the same as in Trial 2. Clover hay was again available and was used instead of alfalfa. Lot A was fed oats-and-vetch silage during period 1, followed by sunflower and then corn. Lot B was started with corn, followed by oats-and-vetch and sunflowers. We had the misfortune to lose cow 429 in lot B just as she started her final period due to the effects of a piece of baling wire she had swallowed. In order to equalize the groups we therefore eliminated from the tables her record and the record of cow 431, the animal she was paired with, making 10 cows in the trial.

TABLE XII. DATA REGARDING COWS USED

Cow	Breed	Lot A		Cow	Breed	Lot B	
		Fresh	Dec. milk			Fresh	Dec. milk
			lbs.				lbs.
22	Jersey	Dec. 7, 1921	878*	23	Jersey	Dec. 29, 1921	*806
227	Holstein	June 8, 1921	552	224	Holstein	July 6, 1921	563
405	Ayrshire	Aug. 17, 1921	789	408	Ayrshire	Sept. 29, 1921	826
431	Ayrshire	Dec. 5, 1921	900*	429	Ayrshire	Dec. 16, 1921	*900
432	Ayrshire	Sept. 24, 1921	738	420	Ayrshire	Sept. 21, 1921	826
441	Ayrshire	Nov. 9, 1921	580	442	Ayrshire	Dec. 8, 1921	750
Total			4437				4435

*Estimated to full month.

Results. Tables XIII to XVI show the results of this trial after eliminating cows 429 and 431.

TABLE XIII. LOT A. 1921-22

10-day period	Milk	Fat	Hay	Grain	Oats-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	1039.8	46.79	480	350	1420	.....	.....
3	981.3	44.16	480	350	1420	.....	.....
4	933.5	420.10	480	350	1420	.....	.....
Total	2954.6	132.96	1440	1050	4260	.....	.....
6	800.3	37.61	480	350	.....	1345	.....
7	812.8	38.20	480	350	.....	1298	.....
8	878.2	41.28	480	350	.....	1298	.....
Total	2491.3	117.09	1440	1050	.....	3941	.....
10	723.2	34.14	480	350	.....	.....	1420
11	769.0	36.30	480	350	.....	.....	1420
12	857.1	40.45	480	350	.....	.....	1420
Total	2349.3	110.89	1440	1050	.....	.....	4260

TABLE XIV. LOT B

10-day period	Milk	Fat	Hay	Grain	Oats-and-vetch silage	Sunflower silage	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
2	1058.0	46.34	490	370	.....	.....	1860
3	1013.9	44.41	490	370	.....	.....	1860
4	983.4	43.07	490	370	.....	.....	1860
Total	3055.3	133.82	1470	1110	.....	.....	4080
6	863.0	34.16	490	370	1360	.....	.....
7	848.6	33.60	490	370	1360	.....	.....
8	830.9	32.90	490	370	1360	.....	.....
Total	2542.5	100.66	1470	1110	4080	.....	.....
10	764.2	31.94	490	370	.....	1256	.....
11	762.9	31.89	490	370	.....	1291	.....
12	793.5	33.17	490	370	.....	1356	.....
Total	2320.6	97.00	1470	1110	.....	3903	.....

TABLE XV. SUMMARY LOTS A AND B, 1921-22

	Milk	Fat	Hay	Grain	Silage
	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	1902.8	80.95	970	720	2780
	1829.9	77.76	970	720	2780
	1764.4	74.91	970	720	2780
Total	5497.1	233.62	2910	2160	8340
Corn	1781.2	80.48	970	720	2780
	1782.9	80.71	970	720	2780
	1840.5	83.52	970	720	2780
Total	5404.6	244.71	2910	2160	8340
Sunflowers	1564.5	69.55	970	720	2601
	1575.7	70.09	970	720	2589
	1671.7	74.45	970	720	2654
Total	4811.7	214.09	2910	2160	7844

TABLE XVI. FEED CONSUMED PER UNIT OF PRODUCT

	Per 100 pounds milk			Per 1 pound fat		
	Hay	Grain	Silage	Hay	Grain	Silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	52.9	39.4	151.7	12.5	9.3	35.7
Corn	53.8	40.0	154.3	11.9	8.8	34.1
Sunflowers	60.4	44.8	165.1	13.5	10.1	36.6

Here the oats-and-vetch leads in amount of milk produced, with corn and sunflowers following in order. Again the sunflowers showed lack of palatability, but with a little coaxing the cows consumed quite liberal quantities. Cow 431 was much worse affected than the rest, but as she was paired with the heifer that died her figures were eliminated from the average. They are given later under the heading, Palatability.

Summary of Three Trials

Table XVII shows a summary of the milk produced, feed consumed, and gains or losses sustained during the three trials.

TABLE XVII. SILAGE EXPERIMENT SUMMARY: TOTAL MILK AND FEED
THREE SEASONS

	Milk	Fat	Fat	Hay	Grain	Silage	Initial weight	Final weight	No. of	
	lbs.	%	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Gain	cows
Oats-and-vetch										
1920	6082.4	3.86	235.11	3576	2152.8	11790.5	11799	12144	345	12
1921	9477.6	4.07	386.37	3803	3420.0	11112.2	11440	11569	129	12
1922	5497.1	4.25	233.62	2910	2160.0	8340.0	9515	9553	380	10
Total	21057.1	4.06	855.10	10289	7732.8	31242.7	32754	33266	512	34
Corn										
1920	5491.5	3.71	203.88	3506	2089	10550	12180	12371	191	12
1921	9086.7	3.85	350.00	3810	3420	11089.5	11454	11479	25	12
1922	5404.6	4.53	244.71	2910	2160	8340	9536	9619	83	10
Total	19982.8	4.00	798.59	10326	7669	29979.5	33170	33469	299	34
Sunflower										
1920	5305.4	3.94	209.13	3474	1900	9085	12208	12022	186*	12
1921	9573.7	3.91	374.17	3810	3420	11092	11385	11534	149	12
1922	4811.7	4.44	214.09	2910	2160	7844	9415	9500	85	10
Total	19690.8	4.05	789.39	10194	7480	28021	33008	33056	48	34

*Loss.

In this summary we still see the oats-and-vetch producing the largest amount of milk, with corn and sunflowers following in order. Giving the milk production on corn a rating of 100, the oats-and-vetch yielded 105.3, while the sunflowers yielded 98. In fat production, with corn as 100 again, the oats-and-vetch yielded 107, while the sunflowers went 100.

Table XVIII shows the same data worked down to a per-cow per-day basis. It will be noted that gains were made on both the oats-and-vetch and corn groups, while the sunflower group barely maintained themselves.

TABLE XVIII. AVERAGE PER COW PER DAY

	Milk	Fat	Fat	Hay	Grain	Silage	Gain
	lbs.	%	lbs.	lbs.	lbs.	lbs.	lbs.
Oats-and-vetch	20.64	4.06	.838	10.08	7.58	30.63	.5
Corn	19.59	4.00	.783	10.12	7.52	29.39	.29
Sunflower	19.30	4.05	.783	9.99	7.33	27.47	.05

Table XIX shows the digestible nutrients consumed in each feed each year and the pounds of total digestible nutrients and protein required for each hundred of milk and pound of fat.

TABLE XIX. DIGESTIBLE NUTRIENTS CONSUMED. POUNDS

			Protein	CH and fat	Protein per 100 pounds milk	Digestible nutrients per 100 pounds milk	Digestible nutrients per 1 pound fat	
			lbs.	lbs.	lbs.	lbs.	lbs.	
Oats-and-vetch	1920	Hay, clover	195.61	1649.61	.....	.....	.....
		Grain	195.90	1267.92	.....	.....	.....
		Silage	194.54	1575.21	.....	.....	.....
		Total	586.05	4492.74	9.63	83.49	21.60	
	1921	Hay, alfalfa	403.12	1559.23	.....	.....	.....
		Grain	311.22	2012.67	.....	.....	.....
		Silage	178.91	1713.50	.....	.....	.....
		Total	893.25	5285.40	9.42	65.20	16.00	
	1922	Hay, clover	221.16	1260.03	.....	.....	.....
		Grain	196.56	1271.16	.....	.....	.....
		Silage	130.94	1457.83	.....	.....	.....
		Total	548.66	3989.02	9.98	82.55	19.42	
		Grand total and average	2027.96	13767.16	9.63	75.01	18.47	
	Corn	1920	Hay, clover	191.78	1617.32
			Grain	190.10	1227.38
Silage			142.43	1809.38	.....	.....	.....
		Total	524.31	4654.03	9.62	94.37	25.40	
1921		Hay, alfalfa	403.86	1562.10	.....	.....	.....
		Grain	311.22	2012.67	.....	.....	.....
		Silage	128.64	1861.01	.....	.....	.....
		Total	843.72	5435.78	9.28	69.10	17.94	
1922		Hay, clover	221.16	1260.03	.....	.....	.....
		Grain	196.56	1271.16	.....	.....	.....
		Silage	80.06	1217.62	.....	.....	.....
		Total	497.78	3748.81	9.21	78.57	17.35	
		Grand total and average	1865.81	13838.62	9.34	78.59	19.66	
Sunflower		1920	Hay, clover	190.03	1602.56
			Grain	172.90	1116.15
	Silage		99.94	1097.47	.....	.....	.....
		Total	462.87	3816.18	8.72	80.65	20.46	
	1921	Hay, alfalfa	403.86	1562.10	.....	.....	.....
		Grain	311.22	2012.67	.....	.....	.....
		Silage	112.03	1228.99	.....	.....	.....
		Total	827.11	4803.76	8.64	58.82	15.05	
	1922	Hay, clover	221.16	1260.03	.....	.....	.....
		Grain	196.56	1271.16	.....	.....	.....
		Silage	72.16	791.08	.....	.....	.....
		Total	489.88	3322.27	10.18	79.22	17.81	
		Grand total and average 3 years	1779.86	11942.21	9.03	69.67	17.18	

This table was calculated from our own analyses of the feeds, using the digestion coefficients given in Henry and Morrison's Feeds and Feeding.

When considered from this standpoint the sunflowers rank first, with oats-and-vetch second, and corn third, in total digestible nutrients required to produce 100 pounds of milk or 1 pound of fat. The difference is not great, however, and when we recall that on oats-and-vetch and corn the cattle gained we can only reach the conclusion that for milk production they are practically equal.

TABLE XX. SUMMARY OF TABLE XIX

Feed	Protein per 100 pounds milk	TDN per 100 pounds milk	TDN per 1 pound fat
Sunflowers	9.03	69.67	17.18
Oats-and-vetch	9.63	75.01	18.47
Corn	9.34	78.59	19.66

In the three trials 37 animals were started, comprising 32 individuals. One was lost by death and one eliminated for other reasons, making 30 different individuals included in averages. This should be enough to eliminate individual errors.

PALATABILITY

The lack of palatability of sunflower silage has been mentioned several times. This was much more noticeable with some individuals than with others, but it was noticed with nearly every cow under observation. Any of the cows could be changed abruptly from corn to oats-and-vetch silage or vice versa without apparent ill effect or loss of appetite. An abrupt change from either corn or oats-and-vetch to sunflower silage resulted in refusal to eat in all but one case.

The ten-day transition period was none too long to get the animals on to a full feed of the sunflower silage. With the exception of cows 432 and 442, none of the cows cleaned up the sunflower as ravenously as they did the other kinds. They would nose it around for some time before they would clean it up.

The appetite of cow 431 was affected the worst by the sunflower silage as it knocked her completely off feed both years she was used. Subsequent observation has shown her to be especially fastidious in her appetite whether sunflowers are concerned or not, but most of the cows showed their dislike for the sunflowers to a greater or less extent.

The accompanying graphs, Figs. 1 and 2, show the daily production of cow 431. Before being placed on experiment in 1920 (Fig. 1), she was receiving oats-and-vetch silage, alfalfa hay, and our regular herd mixture of grain. She was producing nearly 33 pounds of milk per day. In five days after starting sunflower feeding she was down to 21 pounds of milk per day. From this she recovered gradually back to nearly 27 pounds of milk, then took another tumble to less than 14 pounds fourteen days after starting the test. She refused not only her silage, but her grain as well. She finally became hungry enough to eat her rations and averaged 20.7 pounds per day for the sunflower period.

In her transition period from sunflowers to oats-and-vetch she averaged 22.2 pounds of milk, while for the next thirty days, on oats-and-vetch, she made 23.7 pounds of milk per day. The next forty days, on corn silage, she averaged 24.6 pounds per day, showing still further recovery.

Fig. 2 shows the corresponding facts for 1921-22, only she started on oats-and-vetch, tumbled when changed to sunflowers, and recovered again on corn.

Professor G. R. Hyslop, of the Farm Crops department of the Experiment Station, states that his experiments show this lack of pal-

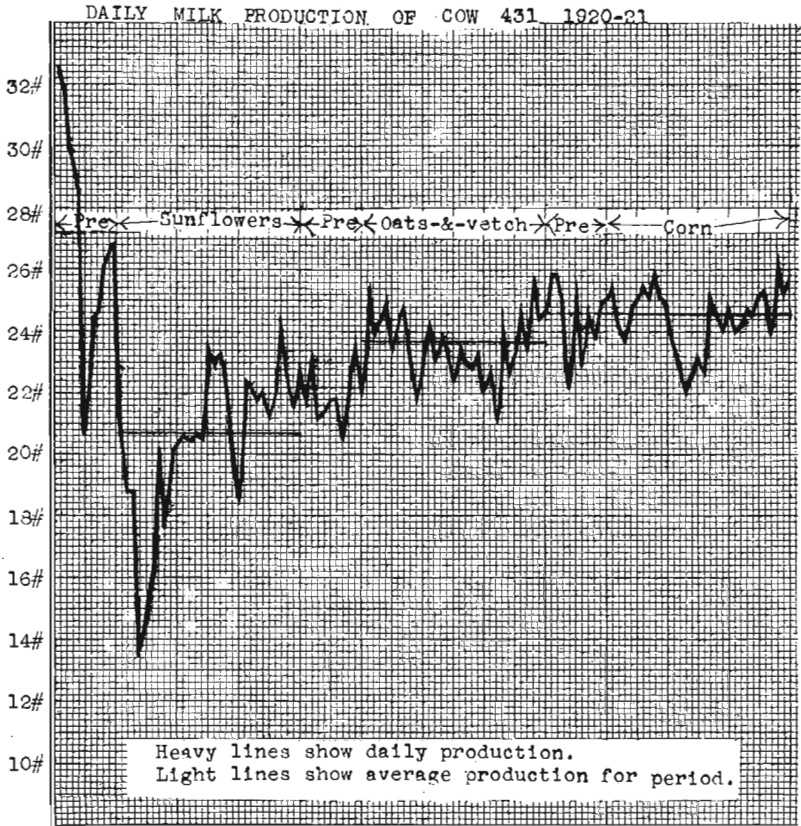


Fig. 1.

atability to be due to lack of the proper fermentation and that it can be overcome by adding a small amount of corn, twenty to twenty-five percent, to the sunflowers when they are put into the silo. We have not tried this in our Dairy Investigations as yet.

The seeds of the sunflowers were in the milk when they were cut.

THE EFFECT OF DIFFERENT KINDS OF SILAGE ON THE COMPOSITIONS AND CONSTANTS OF BUTTER-FAT

In order to determine if the various kinds of silage produced feed flavors or changed the properties of the butter-fat in any way, two days'

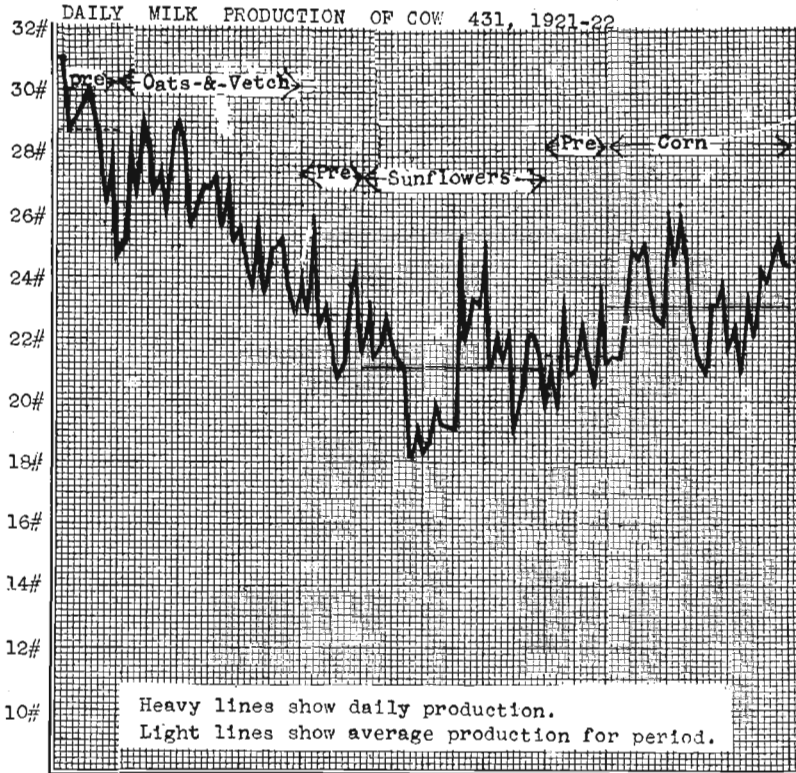


Fig. 2.

milk was saved from each group after it had been on each kind of silage for 30 days. This milk was separated and the cream churned into butter. The butter was packed in crocks scoring for flavor when two days old, and during the last two trials was scored again when three weeks old. The following table shows the results of the scoring.

TABLE XXI. FLAVOR SCORES OF BUTTER

		1920			1921			1922		
		Criticism	Score on flavor	Same at 3 weeks	Criticism	Score on flavor	Same at 3 weeks	Criticism	Score on flavor	Same at 3 weeks
Oats-and-vetch	A	Rancid putrid	34	....	Rancid 2d score	36½	34			
Oats-and-vetch	B	Combined with A	....	....		36	34½		36	35
Corn	A	Rancid	35	....		38	38		36	34
Corn	B	Slightly rancid	35	....		41	38	Slightly stale	36	35
Sun-flowers	A	Unclean, foreign	36	....		41	39	Tallowy	36	33
Sun-flowers	B	Musty, old cream	36	....	Tallowy rancid	36	31	Slight feed	35	34

Very little, if any, difference could be detected in the flavors of the two samples of butter made at the same time. A slight feed flavor was noticed in one of the samples from sunflower silage, but that is the only time that criticism appears. It is safe to say that no feed flavors were noticeable to any extent.

Samples of this butter were sent to the Experiment Station Chemist for determination of the constants of the butter-fat. Table XXII shows the results of these determinations.

TABLE XXII. *SUMMARY OF CHEMICAL RESULTS

Kind of Year	silage Kind	Hanus method iodine No.	Sapon. No.	Reichart Meissl No.	Melting point, centi-grade	Ref. index
1920	Corn	31.220	230.400	27.87	32.275°	.....
1921	Corn	29.640	230.950	28.295	31.925°	.....
1922	Corn	20.035	225.500	26.205	32.000°	1.45435
Average		80.895	686.850	82.370	96.200°	.....
		26.965	228.950	27.457	32.067°	.....
1920	Sunflower	33.200	228.400	27.06	32.125°	.....
1921	Sunflower	33.400	231.875	29.04	31.850°	.....
1922	Sunflower	21.350	224.000	25.775	32.035°	1.45485
Average		87.950	684.275	81.875	96.010°	.....
		29.317	228.092	27.292	32.003°	.....
1920	Oats-and-vetch	29.950	230.000	27.10	32.400°	.....
1921	Oats-and-vetch	30.360	235.000	29.85	31.230°	.....
1922	Oats-and-vetch	18.430	228.250	27.59	32.985°	1.4539
Average		78.740	693.250	84.54	96.615°	.....
		26.247	231.083	28.18	32.205°	.....

*Credit for the chemical work is due to Professor J. S. Jones, Experiment Station Chemist.

The only marked difference brought out by this table is in the iodine number, which shows the butter-fat from sunflower silage always higher than that from the other kinds. The average of all analyses shows the sunflower fat to have an iodine number of 29.317, corn 26.965, and oats-

and-vetch 26.247. This would indicate a larger content of olein in the sunflower butter-fat.

The 1922 determinations were all exceedingly low in iodine number as compared with the others. We cannot account for this, but their relation to each other seems to hold about the same as in other years.

As a basis for comparison the constants from nine samples of butter from all over the state as run by the Agricultural Chemistry department show the following average: Iodine No. 31.64, Saponification 228.7, Reichert Meissl No. 28.63, Melting Point 32.78°C.

MISCELLANEOUS FINDINGS

An apparatus similar to that worked out by the Kansas Station was obtained for taking a cubic foot of silage from the silo. It was planned to take the weights of a cubic foot of silage at two-foot intervals the entire depth of the silos. Through misunderstanding these weights were not all taken, but enough were taken to be of some value.

TABLE XXIII. WEIGHT PER CUBIC FOOT OF SILAGE, 1921

Kokeel (oats-and-vetch)				Concrete (corn)			
Height Weight		Dry matter	Date	Height Weight		Dry matter	Date
in silo	per cu.ft.			in silo	per cu.ft.		
ft.	lbs.	%		ft.	lbs.	%	
18	39	25.35	11- 6-20	18	48.0	22.1	2-14-21
13	41.5	28.60	11-30-20	16	50.0	23.63	2-26-21
10	40	28.95	12-18-20	14	50.0	23.40	4- 1-21
8	41	.....	12-27-20	8	53.5	21.16	4-30-21
6	45	27.66	1- 6-21	6	53.0	.....	5-12-21
4	45.5	28.20	2-20-21	2	59.0	.....	6-15-21
2	44.8	28.62	5-20-21	.....	.....	.....	.....
Average		42.4	27.9	52.3		22.57	

Filled to height of 58 ft., 4 in.,
settled to 31 feet
Two men were tramping all the time while filling these silos.

Filled to height of 33 feet,
settled to 28 feet

TABLE XXIV. WEIGHT PER CUBIC FOOT SILAGE, 1922

Kokeel (oats-and-vetch)				Concrete (corn)				Stave (sunflowers)			
Ht.	Wt.	DM	Date	Ht.	Wt.	DM	Date	Ht.	Wt.	DM	Date
ft.	lbs.			ft.	lbs.			ft.	lbs.		
34	31.5	.....	7-20-21								
30	35	27.84	8- 3-21								
28	37.5	.....	8-16-21								
26	37.5	.....	8-31-21								
24	38	.....	9- 9-21								
22	38	.....	9-20-21								
20	41.5	.....	10- 2-21								
18	44	26.85	10-15-21								
16	45	28	11- 3-21								
14	45.5	28.28	11-17-21								
12	45	30.06	11-29-21								
10	51.5	33.23	12-13-21	10	53	20.75	3-29-22				
8	50	29.52	12-28-21	8	50	22.93	4-25-22	8	46	18.05	3-29-22
6	51	31.87	1-12-22					6	49	19.65	4-25-22
4	51	31.75	2-15-22	4	53	26.16	5- 5-22	4	53	20.28	5-5-22
2	51	31.66	3- 2-22	2	50	24.65	5-29-22	2	55	18.01	5-29-22
Avg.		43.3	29.91	51.5		23.62		50.7		19.00	

Filled to 38 feet, settled to 34 feet. Automatic packer used on first half.

Filled to 34 feet
Settled to 29 feet
Two men tramping

Filled to 10 feet with sunflowers and then up to 15 feet with corn. Two men tramping.

Through misunderstanding samples were not taken in concrete and stave silos until nearly empty. It is interesting to compare the weights

of oats-and-vetch in the Kokeel silo with the year before, when it was tramped. The average weight in the lower half after machine packing was 48.8 pounds, while after tramping with men it was only 42.4 pounds.

The packer used in the Kokeel silo did very good work when it could be made to run. It gave a great deal of trouble in this respect, however, and was finally dismantled and thrown out when the silo was about half full. It cost too much to hold a crew idle while the packer was being repaired.

CONCLUSIONS

1. Sunflower silage lacks in palatability.
2. There is very little difference in feeding value of the three kinds of silage as measured by milk yield.
3. The sunflower has yielded the largest tonnage per acre over a series of years, with the oats-and-vetch second, and the corn third.
4. During the years with a favorable season the oats-and-vetch yielded the highest tonnage.
5. Determination of chemical and physical constants of butter-fat indicates a slightly higher olein content of sunflower butter.
6. A cubic foot of oats-and-vetch silage weighs about four-fifths that of corn or sunflower silage.
7. The automatic packer increased the capacity of the silo 15.1 percent, but is not perfected sufficiently to be practical.

APPENDIX

ANALYSES OF SILAGE USED

Feed	Water	D.M.	Ash	C. Pro.	C. Fibre	N. F. E.	Ether extract
	%	%	%	%	%	%	%
Oats-and-vetch, 1920	76.87	23.13	1.64	2.20	7.99	10.62	.68
Oats-and-vetch, 1922	70.29	29.71	2.20	2.09	9.70	15.20	.52
Average	73.58	26.42	1.92	2.15	8.85	12.91	.60
Corn, 1920	73.00	27.00	1.39	2.64	4.45	17.55	.97
Corn, 1922	76.38	23.62	1.30	1.89	6.08	13.93	.42
Average	74.69	25.31	1.35	2.27	5.27	15.74	.70
Sunflower, 1920	77.62	22.38	1.55	2.24	6.22	11.52	.85
Sunflower, 1922	81.34	18.66	2.15	1.87	5.58	7.71	1.35
Average	79.48	20.52	1.85	2.06	5.90	9.64	1.10