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by

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Because of drought and large number of grass hoppers in 1931 farmers in many sections of South Dakota were without adequate roughage feed for their livestock. The cost of shipping and handling roughages such as hays, makes them rather expensive to ship any great distance. The problem, therefore, of providing roughage which would carry the livestock through the feeding season of 1931 and 1932 at a reasonable cost was a vital one.

One solution to the problem was the use of oat feed which could be purchased in most sections of South Dakota at about the price of wild hay. Wild hay is fed very extensively in this state and provides a large portion of the dry roughage used. When hay could not be obtained many farmers purchased oat feed. Organizations assisting with the feed problem also shipped in many carloads of the oat feed. Questions concerning the feeding value of oat feed were soon coming to the college. These questions prompted the organization of the above experiment.

Because wild hay is so generally used in the state, and its feed value pretty well understood, it was thought best to compare the feeding value of oat feed with wild hay. Another reason why wild hay was used in the comparison is the similarity of composition of the two feeds.

Several experiment stations have compared oat feed with concentrates and as part of the roughage, but very little data are available in which oat feed has been used as the sole dry roughage for dairy cows, as in these trials.

Wild hay is the native hay, grown and fed extensively in South Dakota. Its quality and feeding value vary greatly, depending on the variety of grass, the type of soil on which it is grown, and the time and method of cutting and curing. The wild hay used in these trials was upland wild hay. It was fine stemmed, good quality and cut in July. It was wild hay that would be classed as of very good quality hay for feeding.

The following definition of oat feed is taken from circular material issued by the Livestock Service Department of the Quaker Oats Company: "Oat feed is the mill run by-product in the manufacture of table oatmeals. It comes entirely from cleaned, graded, sweet, sound oats yielding approximately 60 per cent oat meals of the various grades and 35 per cent oat feed. To this mill run by-product of the Quaker Oats Company nothing is added and from it nothing is taken. It is therefore, free from weed seeds, cleaning house offal, screenings if any, or other extraneous matter."

Review of Literature

Linsey and Beals (1) found in trials with milking cows that oat feed was slightly superior to timothy and mixed grass hay, when about one-third of the hay components of the ration were replaced by oat feed.

In a special circular from College of Agriculture, University of Wisconsin, (2) in which oat feed was substituted for a good grade of timothy hay for milk cows, the silage and grain ration remaining the same, the cows ate from 10 to 12 pounds of oat feed daily, or about the same amount as they ate of hay. No differences were observed in the amount of milk production or body weight obtained from the two feeds.

Beam, Pennsylvania Station, (3) found when oat feed was substituted for one-half of the daily mixed hay ration of a group of growing heifers over 126 days, the gain in weight was 1.16 pounds for the oat feed group and 1.24 pounds for the mixed hay fed group. The gain in height at withers was 10.22 and 10.25 centimeters respectively for the oat feed and mixed hay groups.

The Maryland Station (4) reported a 120-day feeding trial with two groups of seven heifers. The results showed that oat feed could be substituted pound for pound for alfalfa meal when the difference in protein was made up by the addition of cotton seed meal. The cost of the alfalfa meal was much greater than the oat feed, and so the latter was a more economical feed under the conditions of these trials.

Wisconsin Experiment Station Report 1930 (5) on trials in which oat feed was compared to wheat bran, indicated that oat feed has at least 70 per cent the feeding value of wheat bran when fed to dairy cows in amounts not to exceed one-fourth of the grain ration.

The 1931 Annual Report of the Wisconsin Station, states that oat feed has shown that it can be satisfactorily used as a substitute for hay.

Method of Procedure

Two trials were run by the double reversal plan. Six cows were used in each trial. The cows were weighed at ten day intervals; milked with a machine, and handled in very much the same way as the regular herd. They were allowed to run in a dry lot when the weather was fit, with water and salt before them at all times.

The ration of the first trial consisted of corn silage, and a grain mixture of 3 parts of ground oats, 4 parts of ground corn, 3½ parts of linseed oil meal. Grain was fed according to milk production, allowing one pound of the mixture to 3 pounds of milk for Holsteins, and one pound of the grain mixture to 2½ pounds of milk for Jerseys and Guernseys. The silage was fed according to live weight, allowing three pounds of silage to 100 pounds live weight. The cows were fed all the wild hay or oat feed that they would eat. The refused feed in each case was weighed back.

In the second trial the same grain mixture was used, and the entire feeding procedure was identical, except for the amount of wild hay and oat feed fed. The hay and oat feed were fed according to live weight instead of feeding all the cows would eat. One pound of the dry roughage was fed per one hundred pounds live weight. The amount of oat feed was limited in the second trial because of the heavy consumption of the oat feed by several of the cows during the first trial.

In both trials we noted that some cows refused to eat the oat feed at first, although after the cows got used to it, they ate it readily. The oat feed was fed in bushel baskets. Because of its fineness it needs to be handled in this manner. Where cows are stall fed this is of no practical significance. However, many farmers in this state feed in feed-racks, and feed roughage once a day. Under such an arrangement, the oat feed cannot be handled as conveniently as the coarser roughages.

Analysis of Oat Feed and Two Well Known Dry Roughages

	Water	Ash	Pro. Cr.	Fiber	Ext. N. F.	Fat	
Oat Feed	6.5	6.2	5.5	27.4	52.4	2.0	Wisc. Sta. Bul. 410
Timo'y Hay	11.6	4.9	6.2	29.8	45.0	2.5	Wisc. Sta. Bul. 410
Wild Hay	16.1	8.4	5.5	31.7	51.7	2.7	South Dakota Sta.

Discussion of Results

Weight of Cows

The cows were weighed at ten-day periods on three successive days. It was felt that the gain or loss in weight would be a check on the nutritive value of the feed.

Tables 1 and 2 indicate that the two feeds had no appreciable influence on the weight of the cows, even when the cows were allowed to eat all they wanted of the hay and oat feed. The average weight per cow on the oat feed in the first trial was 1248 pounds as against 1219 pounds on wild hay. In the second trial, in which the dry roughage feeding was limited to approximately one pound to 100 pounds of live weight the difference in weight for the six cows on the oat feed was 1378 pounds, as against 1381 pounds for the cows on wild hay. The average weight for the 12 cows on the two trials was 1313pounds on the oat feed and 1300 pounds on the wild hay, an average of 13 pounds in favor of oat feed.

TABLE 1.—FIRST TRIAL
Weight of Cows by 10 Day Periods*

Cow No.		1	2	3	4	Av.		5	6	7	8	Av.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	1013	1042	1040	1050	1044	Oat feed	1052	1063	1090	1095	1083
273		1072	1077	1070	1070	1072		1005	1110	1125	1127	1121
352		1507	1462	1470	1485	1472		1493	1526	1553	1597	1559
						1196						1254
110	Oat feed	1005	1007	1023	1012	1014	Wild hay	1008	1013	1017	1017	1016
356		1293	1273	1265	1263	1267		1267	1250	1257	1247	1251
332		1473	1423	1452	1457	1444		1463	1467	1458	1457	1461
						1242						1245

TABLE 2.—SECOND TRIAL
Weight of Cows by 10 Day Periods

Cow No.		1 Lbs.	2 Lbs.	3 Lbs.	4 Lbs.	Av. Lbs.		5 Lbs.	6 Lbs.	7 Lbs.	8 Lbs.	Av. Lbs.
272	Oat feed	1142	1130	1135	1130	1132	Wild hay	1105	1165	1195	1160	1173
222		1167	1135	1140	1160	1145		1175	1180	1225	1165	1190
357		1590	1590	1595	1600	1595		1630	1610	1690	1625	1642
						1291						1335
355	Wild hay	1652	1645	1610	1625	1627	Oat feed	1615	1640	1660	1628	1643
360		1522	1490	1470	1530	1497		1605	1575	1590	1600	1588
215		1175	1155	1150	1170	1158		1155	1140	1190	1165	1165
						1427						1465

*Average of three successive days weighings.

Effect on Production

The test of oat feed as a substitute for wild hay for dairy cows is indicated in the production of milk and fat.

In a study of tables 3, 4, 5 and 6 we note that the cows produced a total of 5381.6 pounds of milk on the wild hay as against 5062.6 pounds of milk on the oat feed.

The difference in milk production for the 12 cows over a 30-day period is not great, representing a 6.33 per cent increase in favor of the wild hay. The decrease in milk when the cows were changed from the wild hay to the oat feed was somewhat greater than when the reverse change was made. When the cows were changed from wild hay to oat feed there was a total loss of 754 pounds of milk. When the reverse change was made, that is, from oat feed to wild hay, there was a total loss of 435 pounds of milk. The decrease in milk production in changing from one feed to the other indicated that the wild hay probably is somewhat better than the oat feed in keeping up milk production.

The greater loss in milk production when the cows were changed from wild hay to oat feed no doubt resulted partially from the fact that the oat feed was fed as a finely ground product and the cows were not accustomed to it, and therefore it was not as readily eaten as the hay to which they were accustomed.

It is interesting to note in tables 5 and 6 showing the fat production for the two trials, that when the cows were changed from wild hay to oat feed there was a loss of 2.8564 pounds of fat for the twelve cows. In the reverse change there was a gain of .1822 pounds of fat, again substantiating the previous statement that the wild hay was more effective in maintaining production.

TABLE 3.—FIRST TRIAL
Pounds of Milk by 10 Day Periods*

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	223.8	177.8	191.8	189.3	558.9	Oat feed	181.5	162.4	118.9	167.3	448.6
273	Wild hay	102.2	73.0	72.3	66.4	211.7	Oat feed	62.2	53.3	57.1	62.4	172.8
352	Wild hay	223.6	182.9	210.2	207.6	600.7	Oat feed	202.2	180.6	188.3	202.6	571.5
						1371.3						1192.9
110	Oat feed	116.2	93.1	89.5	86.2	268.8	Wild hay	89.3	80.6	80.7	80.4	241.7
356	Oat feed	329.1	267.1	288.0	297.9	853.0	Wild hay	288.6	273.4	262.9	257.2	793.5
332	Oat feed	173.6	118.3	132.0	144.2	394.5	Wild hay	138.5	130.1	138.1	130.8	399.5
						1516.3						1434.2

TABLE 4.—SECOND TRIAL
Pounds of Milk by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
272	Oat feed	129.9	114.2	100.7	90.4	305.3	Wild hay	87.4	79.6	55.6	48.4	183.6
222	Oat feed	206.5	180.1	161.9	152.7	494.7	Wild hay	134.6	124.4	119.7	116.6	360.7
357	Oat feed	174.2	151.8	144.7	139.8	436.3	Wild hay	132.0	121.0	107.9	110.2	339.1
						1236.3						883.4
355	Wild hay	256.7	231.4	233.4	215.7	680.5	Oat feed	198.8	178.3	158.8	176.8	513.9
360	Wild hay	170.2	155.6	151.1	124.5	431.2	Oat feed	99.2	76.6	72.5	44.2	193.3
215	Wild hay	203.4	211.1	185.3	184.6	581.0	Oat feed	167.6	142.2	135.5	132.2	409.9
						1692.7						1117.1

* 1 and 5 are transition periods. The data are not used in compiling results.

TABLE 5.—FIRST TRIAL
Pounds of Fat by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	9.3786	7.4676	8.0556	7.5720	23.0952	Oat feed	7.6230	6.8208	4.8749	7.3612	19.0569
273		5.1100	3.6500	3.6873	3.3200	10.6573		3.1100	2.7183	2.8550	3.1824	8.7557
352		7.6024	6.2186	7.5672	6.6432	20.4290		7.0770	6.6822	6.5905	7.2936	20.5663
						54.1815						48.3789
110	Oat feed	6.6234	5.3067	5.2805	4.8272	15.4144	Wild hay	5.1794	4.7554	4.5999	4.5828	13.9381
356		11.8476	9.6156	10.6560	10.6244	30.8960		10.3896	10.1158	9.4644	8.7448	28.3250
332		5.7288	3.9039	4.2240	4.3260	12.4539		4.5705	4.1632	4.5573	4.1856	12.9061
						58.7643						55.1692

TABLE 6.—SECOND TRIAL
Pounds of Fat by 10 Day Periods

No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
272	Oat feed	5.5857	4.9677	4.5315	4.2488	13.7480	Wild hay	4.1078	3.5024	2.6132	2.3232	8.4388
222		7.2275	6.1234	6.3141	5.6499	18.0874		5.1148	4.6028	4.1895	4.4308	13.2231
357		6.6196	5.7684	5.4986	5.4522	16.7192		5.0160	4.4770	3.9923	4.1325	12.6018
						48.5546						34.2637
355	Wild hay	7.9577	7.1734	7.7022	6.9024	21.7780	Oat feed	6.7592	6.0622	5.8756	6.5416	18.4794
360		5.2762	4.6680	4.8352	3.9840	13.4872		3.2736	2.5278	2.5375	1.6354	6.7007
215		7.3224	7.5996	5.9296	7.1994	20.7286		6.5364	5.1192	5.2845	5.2880	15.6917
						55.9938						40.8718

Grain Consumption

Tables 7 and 8 indicate no appreciable difference in grain consumption during the feeding of the two roughages. During the wild hay periods a total of 1900 pounds of the grain mixture was consumed as against 1844 pounds for the oat feed periods, the grain mixture being the same in composition for the two trials. Expressed in terms of milk production this would indicate 2.83 pounds of milk for every pound of grain during the hay periods as against one pound of grain for 2.74 pounds of milk in the oat feed periods. The pounds of grain required per unit of milk produced was about the same for the two feeds.

TABLE 7.—FIRST TRIAL
Pounds of Grain Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	75	65	65	65	195	Oat feed	60	65	65	65	195
273		40	30	30	30	90		25	22	22	22	66
352		60	55	55	55	165		50	50	50	50	150
						450						411
110	Oat feed	50	45	45	45	135	Wild hay	40	32	32	32	96
356		95	80	80	80	240		80	80	80	80	240
332		50	40	40	40	120		40	40	40	40	120
						495						456

TABLE 8.—SECOND TRIAL
Pounds of Grain Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
272	Oat feed	60	50	45	38	133	Wild hay	36	33	32	23	88
222		80	81	70	64	215		60	53	50	48	151
357		60	57	49	47	153		47	44	42	37	123
						501						362
355	Wild hay	90	84	77	77	238	Oat feed	71	66	61	52	179
360		60	56	51	49	156		40	32	27	25	84
215		85	81	83	74	238		73	62	58	54	174
						632						437

Wild Hay and Oat Feed Consumed

The total consumption of wild hay and oat feed is signficant as these are the two feeds which are being compared. During tthe experimental trials these feeds were sold at the same delivered price. If the wild hay would have to be shipped any distance it would require baling which would add about $2.00 per ton to the price, or increase the price by 20 per cent. However, wild hay is grown so generally in South Dakota there is no need for shipping it any distance under normal seasonal conditions.

During the two trials the cows consumed 5250 pounds of wild hay and 6222 pounds of the oat feed, or 972 pounds more of oat feed than wild hay. The greater consumption of the oat feed occurred during the first trial when the cows were allowed all they would clean up. Tables 9 and 10 show that some of the larger cows ate up to 31 pounds a day of the oat feed, while the same cows ate about 18 pounds of the wild hay. The larger consumption of oat feed occurred with two Holstein cows.

Expressed in terms of milk it required 95.7 pounds of wild hay to produce 100 pounds of milk while 123.0 pounds of oat feed was required to produce 100 pounds of milk for the two trials.

During the first trial the six cows consumed 2772 pounds of wild hay. During this time they produced 2805.5 pounds of milk, or .988 pounds of wild hay was consumed for every pounds of milk produced.

During the oat feed feeding periods, the six cows consumed 3747 pounds of the oat feed, and produced 2709.2 pounds of milk. 1.384 pounds of oat feed were required to produce one pound of milk. In the first trial one pound of wild hay was equal to 1.4 pounds of oat feed for milk production.

In the second trial when both dry roughages were fed according to live weight the six cows consumed 2475 and 2478 pounds of oat feed and wild hay respectively. During this period the cows produced 2353.4 and 2576.7 pounds of milk on oat feed and wild hay. In the second trial, 1 pound of wild hay was equal to 1.09 pounds of oat feed or about 9 per cent more milk was produced on the wild hay than oat feed.

The pounds of grain mixture and silage fed were approximately the same for the two feeding periods; hence the difference in production can be attributed to the dry roughage.

TABLE 9.—FIRST TRIAL
Hay and Oat Feed Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	100	110	130	130	370	Oat feed	114	140	140	129	409
273		100	123	130	130	383		144	144	136	154	434
352		150	285	174	180	639		246	316	302	300	918
						1392						1761
110	Oat feed	100	160	178	180	518	Wild hay	114	120	120	120	360
356		280	300	255	250	805		164	160	160	160	480
332		150	215	218	230	663		174	180	180	180	540
						1986						1380

TABLE 10.—SECOND TRIAL
Hay and Oat Feed Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
272	Oat feed	100	113	113	113	339	Wild hay	114	110	116	119	345
222	Oat feed	110	113	114	116	343	Wild hay	116	117	118	122	357
357	Oat feed	130	159	159	160	478	Wild hay	161	163	161	169	493
						1160						1195
355	Wild hay	150	164	161	162	487	Oat feed	162	161	164	166	491
360	Wild hay	140	149	147	153	449	Oat feed	154	160	157	159	476
215	Wild hay	110	115	115	117	347	Oat feed	118	115	114	119	348
						1283						1315

Silage Consumed

The silage consumed remained about the same for both periods. This would be true because the silage was fed according to live weight.

TABLE 11.—FIRST TRIAL
Silage Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
270	Wild hay	300	326	312	315	953	Oat feed	315	318	327	327	972
273	Wild hay	300	321	321	321	963	Oat feed	300	333	336	336	1005
352	Wild hay	400	438	431	444	1313	Oat feed	447	456	465	477	1398
						3229						3375
110	Oat feed	300	300	306	303	909	Wild hay	300	303	303	303	909
356	Oat feed	350	381	378	378	1137	Wild hay	378	375	375	372	1122
332	Oat feed	400	426	435	435	1296	Wild hay	438	438	435	435	1308
						3342						3339

TABLE 12.—SECOND TRIAL
Silage Consumed by 10 Day Periods

Cow No.		1	2	3	4	Total		5	6	7	8	Total
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
272	Oat feed	330	339	340	339	1018	Wild hay	344	331	349	358	1038
222	Oat feed	330	339	342	348	1029	Wild hay	349	352	354	367	1073
357	Oat feed	400	477	478	480	1435	Wild hay	485	489	483	507	1479
						3482						3590
355	Wild hay	450	493	483	487	1463	Oat feed	487	484	492	498	1474
360	Wild hay	450	447	441	459	1347	Oat feed	464	481	472	477	1430
215	Wild hay	330	347	345	351	1043	Oat feed	349	334	342	357	1033
						3853						3937

* 1 and 5 are transition periods. The data are not used in computing results.

SUMMARY TABLE

	Oat Feed Lbs.	Wild Hay Lbs.
Weight of Cows		
First trial 6 cows	1248	1219
Second trial 6 cows	1378	1381
Average for two trials	1313	1300
Total Milk Production (30 days)		
First trial	2709.20	2805.50
Second trial	2353.40	2576.10
Average for two trials	2531.30	2690.80
Total Fat Production (30 days)		
First trial	107.14	109.35
Second trial	89.42	90.25
Average for two trials	98.28	99.80
Total grain consumption (30 days)		
First trial	906	906
Second trial	938	994
Average for two trials	922	950
Total Roughage Consumption		
First trial	3747	2772
Second trial	2475	2478
Average for two trials	3111	2625
Total Silage Consumption		
First trial	6719	6568
Second trial	7419	7443
Average for two trials	7069	7005
Average Milk Production per 100 Pounds of Grain	274.54	283.24
Average Milk Production per 100 Pounds of Roughage	81.37	102.51
Average Fat Production per 100 Pounds of Grain	10.66	10.51
Average Fat Production per 100 Pounds of Roughage	31.59	38.02

Palatability of Oat Feed

Some of the cows did not eat the oat feed as eagerly as the wild hay. One cows refused to eat the oat feed and had to be taken off the experiment. In all cases the cows did not accept the oat feed as readily as wild hay, but with the one exception the cows ate it after becoming accustomed to the feed.

The oat feed was fed as finely ground material, it was also a feed to which the cows were not accustomed; both factors would no doubt have an effect on the readiness with which the cows would eat the oat feed.

Conclusions

1. Oat feed can be used as the sole dry roughage for dairy cows.
2. Oat feed is slightly less palatable than good quality wild hay.
3. Oat feed is comparable with wild hay in the maintenance of live weight.
4. Good quality wild hay is slightly more efficient than oat feed in maintaining milk and fat production.
5. When oat feed can be purchased at a price equal to or lower than that of good quality wild hay, its use for roughage for dairy cows can be recommended.
6. Oat feed must be fed in a tight container, and indoors to prevent waste.

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