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LAMB FEEDING IN SOUTHERN ALBERTA

WITH A SUPPLEMENT ON

The Utilization of the Forest Reserve for Summer Sheep Pasture

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FOREWORD

This bulletin has been prepared in order that the results of the feeding trials conducted with lambs at the Dominion Experimental Station, Lethbridge, Alberta, since 1911 might be presented to the sheep producers and lamb feeders of Alberta and other provinces in a condensed form. It is hoped that the results of the feeding trials summarized in this publication will be of assistance to all lamb feeders in planning for the most economical finishing of market lambs through the use of rations of the greatest efficiency and lowest cost. It is further hoped that the results of these trials and the section on lamb feeding practices will be of value to those farmers who may be planning to include lamb feeding in their farm program. The future of the lamb feeding industry is bright but it is only through a carefully planned program of economical production that the individual feeder can hope to achieve greatest success.

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LAMB FEEDING IN SOUTHERN ALBERTA

EIGHTEEN YEARS OF LAMB FEEDING TRIALS AT THE LETHBRIDGE EXPERIMENTAL STATION

By W. H. Fairfield, *Superintendent* and K. Rasmussen, *Assistant.*

Finishing range lambs for market is a phase of farm operations which has experienced steady growth in the irrigated districts of Alberta for a number of years, and has attained a pre-eminent position. A plentiful supply of good feeder lambs from the nearby ranges and an abundance of suitable feed on the irrigated farms are the two factors mainly contributing to this development. Lamb finishing in its present form is the result of gradual evolution during which considerable changes have taken place in types of lambs fed, weight and time of finishing, rations, methods of feeding, etc. These changes have been brought about by changing market demands and by improved knowledge of feed requirements for finishing.

The importance of lamb feeding as a link in the chain of farm operations was realized at the Dominion Experimental Station, Lethbridge, at an early date, and a series of feeding trials was inaugurated for testing the rations and methods of feeding most suitable and economical for finishing the sheep which were available. The first trials were instituted during the winter of 1911-12, and, with the exception of three post-war years, 1919, 1920 and 1921, trials have been conducted every year since that time. The nature of the trials has changed in many respects during these years, the changes following along the lines of the general evolution of the lamb feeding industry. In fact a study of the trials provides an insight into the history of the evolution of the industry in Southern Alberta.

Progress reports of these trials have been published from time to time, but in order to make the accumulated information more readily available to those who might benefit by it this bulletin has been prepared. The main purposes of this bulletin, therefore, can be enumerated as follows: (1) to summarize the results of the trials to date, (2) to analyze these results as much as possible, and (3) in so far as possible, to make suggestions which will be of value to those engaged in the lamb finishing business.

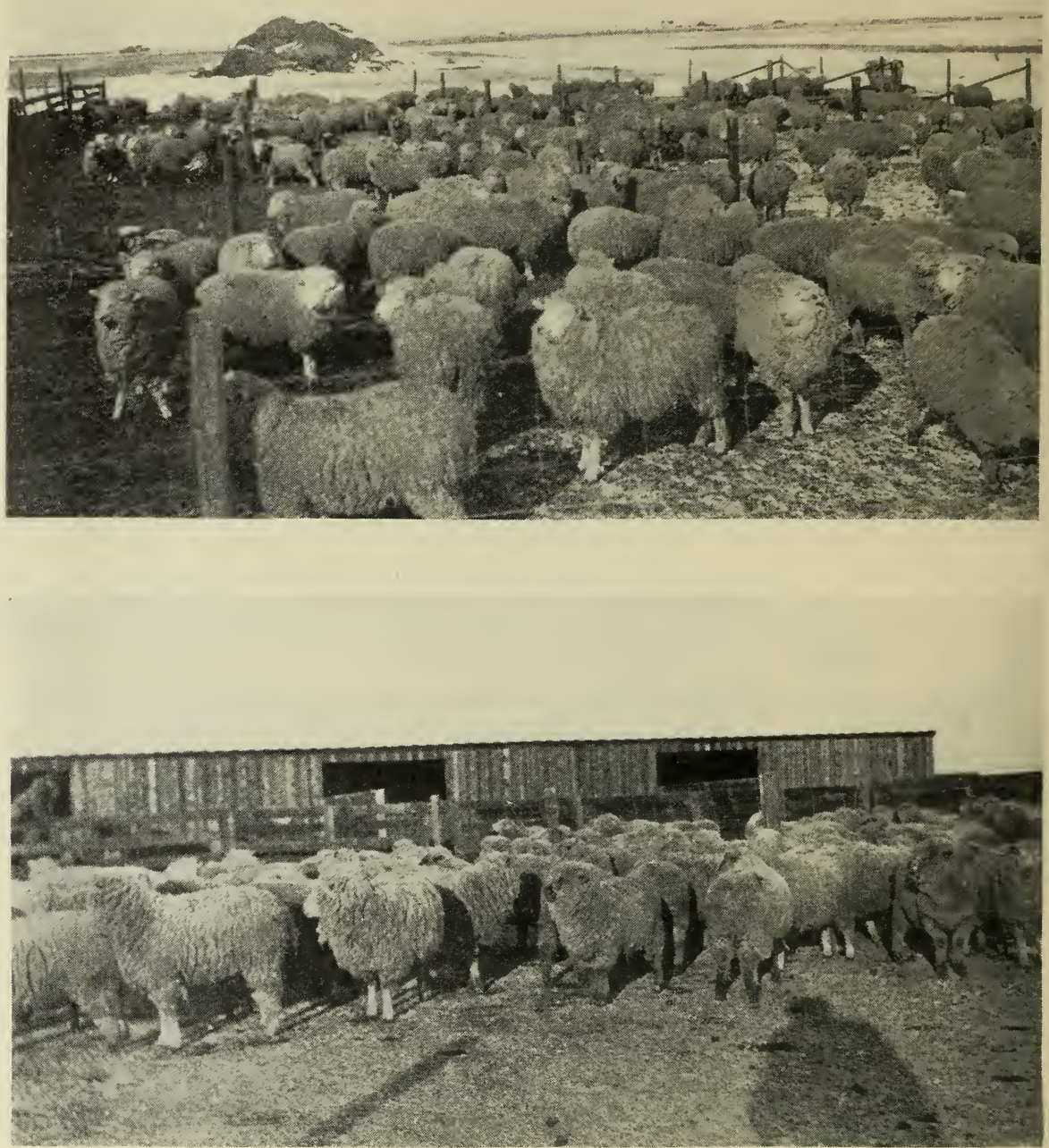
It is impossible and hardly desirable within the scope of this publication to give a résumé of each experiment but, by means of tabulated summaries and other methods of presentation, it is hoped that the essential facts may be presented in an acceptable manner.

During the first years under review, yearling wethers as well as lambs were fed but yearlings were not used after the 1913-14 feeding season. Range lambs were used in the first few years but when a breeding band was established at the Lethbridge Experimental Station, lambs from this band were used and have been used exclusively since 1922. These station lambs were produced under mixed farm and range conditions and were not entirely comparable to range lambs. They were born earlier and started under more favourable conditions for rapid development, and in addition were summer ranged on the forest ranges where the feed usually was more luscious than that growing on the prairies.

7254—2½

Consequently, their weights in the fall were considerably above those of range lambs and it was necessary, in nearly all cases, to finish them more rapidly in order not to exceed the most acceptable marketing weights of 95 to 100 pounds.

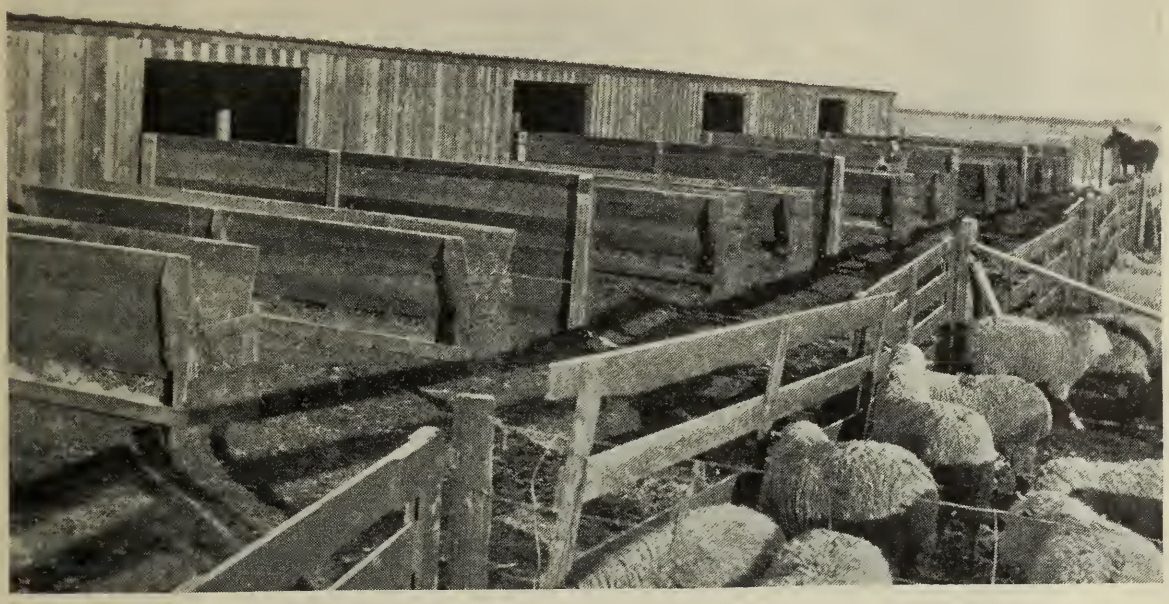
The majority of the lambs used in the trials were of grade Rambouillet breeding but a considerable percentage, at various times, were grade Oxfords, Shropshires and Corriedales. Despite these differences the results obtained in the trials will on the whole be applicable to feeding operations with range lambs and can be used as a basis for general recommendations with regard to desirable rations and methods of feeding.



Upper, sheep used in the feeding trials, 1911-12. Lower, sheep used in the trials 1912-13. Both these pictures indicate the variation in type and the mixed breeding of the sheep used. Unfortunately lack of uniformity in type and breeding is still too prevalent.

A set of corrals was used for confining the lambs during the feeding trials and a long frame shed, facing east and divided into pens to correspond to the corrals, was provided for shelter. The corrals were only sufficiently large to

accommodate about 50 lambs and when the trial groups were larger several corrals were used for each group. The feed racks, a combination hay and grain rack generally being used, were placed in the corrals and the sheep were usually fed both hay and grain twice daily. Water was always easily accessible in troughs and the water was kept open during frosty weather through the use of tank heaters. Salt was kept before the lambs at all times.



A view of the sheds and feed racks used during the early feeding trials. Open front sheds were used in later trials with equal success. The type of feed rack was altered slightly, although combination hay and grain racks were used throughout the trials.

Weights of the experimental lambs were taken at the beginning and conclusion of the trials. During the later years individual weights were used although group weights were also taken as a check. For some years, the initial individual weights were taken on three successive days and the average of these three used as the initial weight for the trial. This procedure was discontinued as it was found that the amount of handling of the individual lambs, brought about by the type of weighing facilities available, led to a general decrease in weights on successive days which was greater at the beginning of the trial than at the conclusion, and the average of three weighings was not as comparable as single weighings. Single individual initial and final weights were then used with satisfactory results.

In the first years, when yearlings and heavy lambs were acceptable to the market, some of the rations used were not designed for rapid finish but rather for growing the lambs and finishing them with only a small amount of grain near the end of the feeding period. The rations used at that time stressed the consumption of roughage with a minimum of grain, and consequently the average daily gains made were considerably lower than during the later years. For example, alfalfa was fed alone or with roots as a succulent supplement but such a practice is not acceptable under present conditions. The modern ration is far heavier, i.e., contains a much higher proportion of grain, thereby forcing a finish on the lambs without inducing excessive growth.

RATIONS USED

Thirty-seven different rations were tested in the trials and as these will provide a basis from which to carry on a discussion, they are listed herewith:—

RATIONS USED IN LAMB FEEDING TRIALS AT THE EXPERIMENTAL STATION, LETHBRIDGE*

Ration Number	*Description*
1.	Alfalfa alone.
2.	Alfalfa and roots.
3.	Alfalfa—roots—2 parts ground oats, 2 parts injured wheat and 1 part bran.
4.	Alfalfa—roots—1 part wheat, 1 part oats and 1 part barley.
5.	Alfalfa—screenings.
6.	Alfalfa—2 parts ground oats, 2 parts injured wheat and 1 part bran.
7.	Alfalfa—1 part wheat, 1 part oats and 1 part barley.
8.	Alfalfa—oat sheaves—1 part oats and 1 part barley.
9.	Alfalfa—1 part oats and 1 part barley.
10.	Alfalfa—sunflower silage—oats.
11.	Alfalfa—corn silage—oats.
12.	Alfalfa—oats.
13.	Alfalfa—corn silage—1 part oats and 1 part barley.
14.	Alfalfa—sunflower silage—1 part oats and 1 part barley.
15.	Alfalfa—2 parts barley and 1 part oats.
16.	Alfalfa—corn silage—2 parts barley and 1 part oats.
17.	Alfalfa—sunflower silage—2 parts barley and 1 part oats.
18.	Alfalfa—oat sheaves—2 parts barley and 1 part oats.
19.	Alfalfa—2 parts barley and 1 part oats ($\frac{1}{2}$ fed).
20.	Alfalfa—corn silage—2 parts barley and 1 part oats ($\frac{1}{2}$ fed).
21.	Alfalfa—oat sheaves—2 parts barley and 1 part oats ($\frac{1}{2}$ fed).
22.	Alfalfa—2 parts barley and 1 part oats ($\frac{2}{3}$ fed).
23.	Alfalfa—beet molasses—2 parts barley and 1 part oats ($\frac{1}{2}$ fed).
24.	Alfalfa, 2nd cutting—2 parts barley and 1 part oats.
25.	Alfalfa—2 parts frozen wheat and 1 part oats.
26.	Alfalfa, 2nd cutting—2 parts barley and 1 part oats.
27.	Alfalfa—beet pulp—2 parts barley and 1 part oats.
28.	Alfalfa—beet pulp—3 parts barley and 1 part oats.
29.	Alfalfa—beet pulp—barley.
30.	Alfalfa—2 parts wheat (No. 3) and 1 part oats.
31.	Alfalfa—3 parts barley and 1 part oats.
32.	Alfalfa—3 parts barley and 1 part oats (self fed).
33.	Alfalfa—3 parts ground barley and 1 part ground oats.
34.	Alfalfa—1 part barley and 1 part wheat (self fed).
35.	Alfalfa—1 part barley and 1 part wheat.
36.	Alfalfa—barley.
37.	Alfalfa—wheat.

*Whole grain was used unless otherwise stated.

A considerable number of the rations contain barley and oats but in different proportions, and the results from these various rations cannot be combined in summaries. These grain rations are further differentiated by the addition of succulents, roughages, or variations in methods and rates of feeding. While they are somewhat similar they are sufficiently different to preclude grouping. The ration containing screenings (ration 5) has not been discussed in comparison with other rations as the results obtained in the trials with this ration appear to have no practical application at the present time. This ration was used previous to the time when screenings were properly graded, and before grading was instituted the term "screenings" might designate almost any mixture of waste grains and weed seeds without any standardization.

TABLE 1.—TABULATED SUMMARY OF RESULTS OF SHEEP FINISHING TRIALS

conducted at

LETHBRIDGE EXPERIMENTAL STATION 1911-34.

Year of trial	Class of sheep	Ration number	Number of days in trial	Original number of sheep	Death loss: Number	Death loss: %	Average original weight	Average final weight	Average total gain	Average daily gain	Feed consumed per lamb: Roughage	Feed consumed per lamb: Succulents	Feed consumed per lamb: Grain	Feed required per pound of gain: Roughage	Feed required per pound of gain: Succulents	Feed required per pound of gain: Grain	Pounds of nutrients per pound of gain*: Dry matter	Pounds of nutrients per pound of gain*: Crude protein	Pounds of nutrients per pound of gain*: Total digestible nutrients	Nutritive ratio	Cost of feed per sheep	Feed cost per pound of gain	Initial value per 100 pounds	Selling value per 100 pounds	Spread	Net profit or loss per sheep	Net profit per group
		1	2	3	4		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
							Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	1:	$	c	$	$	$	$	$
1911-12	Range lambs	6	112	50	1	2·00	70·4	112·1	32·7	0·29	244·1	.....	123·7	7·5	.....	3·8	10·2	1·2	6·0	4·6	2 48	7·52	3 80	6 25	2 45	1 02	49 98
	" "	5	112	50	.....	.....	78·5	101·8	23·3	0·21	244·1	.....	101·6	10·5	.....	4·4	.....	.....	.....	.....	1 47	6·32	3 80	less	2 45	1 51	75 48
	" "	3	112	50	1	2·00	78·1	115·0	36·9	0·33	236·7	203·8	123·7	6·4	5·5	3·4	9·4	1·1	6·2	4·7	2 68	7·27	3 80	5%	2 45	1 02	49 98
	" "	2	112	50	1	2·00	78·6	108·4	29·8	0·27	209·6	203·8	44·9	9·0	0·8	1·5	10·3	1·2	6·3	4·3	2 05	6·88	3 80	shrink	2 45	1 23	60 27
	" "	1	112	60	1	2·00	79·3	103·6	24·3	0·22	279·9	.....	44·9	11·5	.....	1·8	12·2	1·4	7·3	4·2	1 85	7·62	3 80	.....	2 45	1 12	54 88
1912-13	Range lambs	3	117	41	.....	.....	69·9	103·8	33·9	0·29	186·8	147·6	109·6	5·5	4·4	3·2	8·4	0·9	5·5	4·8	2 44	7·19	5 25	***6 50	1 25	0 44	18 04
1913-14	Range lambs	4	135	60	1	2·00	69·6	102·2	32·6	0·24	214·4	207·3	115·3	6·6	6·4	3·5	9·9	1·1	6·6	5·0	2 77	8·50	4 68	7 00	2 32	0 96	47 04
"	" "	2	191	50	3	6·00	69·0	100·7	31·7	0·17	392·2	363·7	36·0	12·4	11·4	1·1	13·4	1·5	8·1	4·3	3 29	10·36	4 68	7 91	3 23	0 94	44 18
	" "	7	135	50	.....	.....	60·3	98·9	29·6	0·22	240·4	.....	111·6	7·8	.....	3·8	10·5	1·2	6·9	4·9	2 52	8·52	4 68	7 00	2 32	0 86	43 00
	" "	6	135	50	2	4·00	60·7	103·1	33·4	0·24	213·4	.....	162·4	6·4	.....	4·8	.....	.....	.....	.....	2 06	6·17	4 68	7 00	2 32	1 80	86 30
	" "	1	191	50	4	8·00	69·8	100·2	30·4	0·16	479·2	.....	36·8	15·7	.....	1·2	15·5	1·8	9·0	4·1	3 26	10·72	4 68	7 92	3 24	0 84	38 64
1914-15	Range lambs	9	80	240	.....	.....	67·0	83·9	10·9	0·21	178·2	.....	28·7	10·6	.....	1·7	11·2	1·3	6·7	4·2	1 36	8·08	10 16	7 96	1 80	0 96	230 40
	" "	8	80	240	.....	.....	67·9	87·7	19·8	0·25	182·3	.....	28·7	9·2	.....	1·4	7·3	0·9	6·7	5·2	1 33	6·74	6 07	2·16% sbrink	1 89	1 29	309 60
1915-16	Range lambs	9	110	237	.....	.....	68·2	99·9	31·7	0·29	245·9	.....	109·7	7·8	.....	3·5	10·2	1·0	6·6	4·8	2 58	8·15	7 33	9 72	2 39	1 62	383 94
1922	Range lambs	10	96	40	.....	.....	67·0	80·1	22·1	0·23	195·2	75·5	72·6	8·8	3·4	3·3	11·8	1·3	7·6	4·9	1 83	8·28	7 25	11 10	3 85	2 80	112 00
	" "	11	96	40	.....	.....	67·2	88·0	20·8	0·22	196·1	75·5	72·6	9·4	3·6	3·5	12·5	1·4	8·1	4·0	1 84	8·82	7 25	11 10	3 85	2 66	106 40
	" "	12	96	40	.....	.....	67·0	85·9	18·9	0·20	214·4	.....	72·5	11·4	.....	3·8	13·9	1·6	8·9	4·7	1 78	9·41	7 25	11 10	3 85	2 49	99 60
1922-23	Station lambs	9	97	50	.....	.....	75·1	104·8	29·7	0·31	214·7	.....	114·2	7·2	.....	3·8	10·1	1·1	6·6	4·9	2 68	9·03	7 00	11 25	4 25	3 14	157 00
	" "	13	97	50	.....	.....	74·9	110·0	35·1	0·36	174·3	167·0	114·2	5·0	4·8	3·2	8·5	0·9	6·7	5·5	2 82	8·02	7 00	less	4 25	3 57	178 50
	" "	14	97	50	.....	.....	74·7	105·6	30·9	0·32	171·4	167·0	114·2	5·5	5·4	3·7	9·6	1·0	6·3	5·4	2 80	9·06	7 00	5%	4 25	3 13	156 50
	" "	8	97	50	2	4·00	74·6	106·3	31·7	0·33	246·4	.....	117·8	7·8	.....	3·7	10·4	1·0	6·6	5·7	2 80	8·85	7 00	sbrink	4 25	2 78	133 44
1924	Station lambs	15	101	50	.....	.....	77·7	116·2	38·5	0·38	218·7	.....	145·0	5·7	.....	3·7	8·6	0·9	5·8	5·1	2 10	5·46	9 00	13 27	4 27	5 47	273 50
	" "	16	101	50	1	2·00	79·7	120·6	40·9	0·40	216·0	128·8	146·8	5·3	3·2	3·6	8·6	0·9	5·9	5·4	2 33	5·70	9 00	less	4 27	5 31	260 19
	" "	17	101	60	.....	.....	76·9	116·9	40·0	0·40	211·0	127·5	145·0	6·3	3·2	3·6	8·8	0·9	5·9	5·4	2 33	5·84	9 00	4½%	4 27	5 39	269 50
	" "	18	101	50	.....	.....	79·6	118·4	38·8	0·38	213·7	.....	145·0	5·6	.....	3·7	8·4	0·8	5·6	5·8	2 08	5·35	9 00	shrink	4 27	5 59	279 50
	" "	16	101	95	.....	.....	64·6	106·9	42·3	0·42	123·9	134·4	152·9	2·9	3·2	o·6	6·6	0·7	4·8	6·0	2 14	5·57	8 00	13 10 less 4½%	5 10	5 96	566 20
1924-25	Station lambs	15	88	50	.....	.....	71·6	107·4	35·8	0·41	185·0	.....	135·9	5·2	.....	3·8	8·2	0·9	5·6	5 3	2 90	8·09	10 10	14 78	4 90	5 11	255 35
	" "	19	88	50	.....	.....	70·0	94·4	24·4	0·28	228 4	.....	67·9	9·4	.....	2·8	11·1	1·3	7·0	4·5	2 07	8·49	10 10	13 72	4 57	3 22	163 08
	" "	20	88	50	.....	.....	73·4	97·2	23·8	0·27	224·6	67·7	67·9	9·4	2·8	2·8	11·8	1·3	7·4	4·8	2 19	9·21	10 10	14 06	4 67	3 49	174 59
	" "	21	88	50	.....	.....	72·8	95·4	22·6	0·26	227·1	.....	67·9	10·0	.....	3·0	11·8	1·1	7·3	5·4	2 07	9·14	10 10	13 71	4 53	3 11	155 27
1925-26	Station lambs	19	90	50	2	4·00	74·2	102·1	27·9	0·31	260·1	.....	73·1	9·3	.....	2·6	10·9	1·2	6·8	4·5	2 15	7·83	10 00	10 38	0 38	0 51	24 48
	" "	22	90	50	1	2·00	74·0	107·4	33·4	0·37	221·1	.....	97·2	6·6	.....	2·9	8·7	1·0	5·6	4·8	2 28	6·82	10 00	10 42	0 42	1 20	58 80
	" "	15	90	50	.....	.....	74·9	110·8	35·9	0·40	194·0	.....	143·5	5·4	.....	4·0	8·6	0·9	5·8	5·2	2 69	7·50	10 00	10 62	0 52	1 52	76 00
	" "	20	90	50	.....	.....	74·4	102·8	28·4	0·32	185·2	128·5	71·7	6·5	4·5	2·5	9·2	1·0	5·7	4·9	2 12	7·46	10 00	10 41	0 41	0 98	49 00
1926-27	Station lambs	19	92	50	.....	.....	72·6	95·6	23·0	0·25	249·8	.....	84·2	10·8	.....	3·6	13·2	1·5	8·4	4·6	2 77	12·03	8 50	10 13	1 63	0 63	31 50
	" "	22	92	60	.....	.....	72·9	102·0	29·1	0·32	208·2	.....	109·9	7·2	.....	3·8	9·9	1·1	6·6	4·9	2 91	9·99	8 60	10 28	1 78	1 23	61 50
	" "	15	92	50	.....	.....	72·9	110·0	37·1	0·40	171·2	.....	163·4	4·6	.....	4·4	8·2	0·9	5·7	5·4	3 49	9·40	8 50	10 45	1 95	1 58	79 00
	" "	23	92	50	.....	.....	72·5	98·6	26·1	0·28	209·8	33·4	84·2	8 0	1·3	3·2	11·2	1·2	7·4	5·2	2 86	10·97	8 50	10 18	1 68	0 84	42 00
1927-28	Station lambs	19	64	60	.....	.....	75·7	89·2	13·5	0·21	138·8	.....	64·0	10·2	.....	4·7	13·7	1·5	8·9	4·8	1 69	12·47	9 60	11 92	2 42	1 65	82 50
	" "	22	64	50	.....	.....	75·7	89·2	13·5	0·21	138·8	.....	64·0	10·2	.....	4·7	13·7	1·5	8·9	4·8	1 69	12·47	9 60	11 92	2 42	1 65	82 50
	" "	15	64	50	.....	.....	75·7	97·4	21·7	0·34	116·4	.....	100·6	5·4	.....	4·9	9·3	1·0	6·5	5·4	2 23	10·27	9 50	12 39	2 89	2 53	126 50
1928-29	Station lambs	24	51	50	.....	.....	78·0	98·1	20·1	0·39	94·0	.....	89·5	4·7	.....	4·4	8·4	0·9	5·9	5·3	1 58	7·88	8 50	12 30	3 80	3 41	170 50
	" "	15	51	50	.....	.....	73·6	95·0	16·4	0·32	111·0	.....	89·5	6·8	.....	5·4	11·1	1·1	7·5	5·7	1 66	10·14	8 50	12 30	3 80	2 91	145 50
	" "	25	51	50	.....	.....	77·3	98·7	21·4	0·42	94·6	.....	89·5	4·4	.....	4·2	7·8	0·9	5·6	5·3	1 46	6·83	8 50	12 30	3 80	3 66	183 00
1929-30	Station lambs	15	104	50	.....	.....	80·4	119·2	38·8	0·37	220·2	.....	178·6	5·7	.....	4·6	9·4	1·0	6·3	5·6	4 03	10·39	8 25	8 15	−0 10	−2 07	−103 50
	" "	24	104	50	.....	.....	80·7	118·8	38·1	0·36	237 0	.....	178·6	6·2	.....	4·7	10·0	1·1	6·9	5·1	4 10	10·87	8 25	8 16	−0 09	−2 23	−111 50
	" "	26	104	50	.....	.....	77·3	106·2	28·9	0·28	269·4	.....	97·9	9·3	.....	3·4	11·8	1·4	7·4	4·4	3 15	10·89	8 25	7 96	−0 29	−1 93	− 96 50
1930-31	Station lambs	15	58	50	.....	.....	80·0	104·4	24·4	0·42	111·4	.....	111·0	4·6	.....	4·5	8·3	0·9	5·8	5·5	1 31	5·37	5 40	6 90	1 50	1 51	75 50
	" "	27	58	50	.....	.....	79·9	105·3	25·4	0·44	98·6	120·5	111·0	3·9	4·7	4·4	8·0	0·8	5·7	5·8	1 43	5·64	5 40	6 90	1 50	1 46	73 00
	" "	30	58	50	.....	.....	80·0	105·9	25·9	0·45	105·4	.....	111·0	4·1	.....	4·3	7·6	0·8	5·4	5·5	1 27	4·91	5 40	6 90	1 50	1 65	82 50
1931-32	Station lambs	32	78	40	1	2·50	70·7	101·0	30·3	0·39	108·7	.....	159·6	3·6	.....	5·3	8·1	0·9	5·9	5·8	1 69	5·58	4 10	4 45	0 35	−0 37	− 14 43
	" "	31	78	40	.....	.....	70·7	100·8	30·1	0·38	170·5	.....	131·9	5·7	.....	4·4	9·2	1·0	6·3	5·3	1 70	5·63	4 10	4 47	0 37	−0 32	− 12 80
	" "	28	78	40	1	2·50	70·8	106·2	35·4	0·45	152·6	346·6	131·9	4·3	9·8	3·7	8·3	0·9	5·9	5·7	2 09	5·91	4 10	4 49	0 39	−0 52	− 15 28
	" "	33	78	40	3	7·50	70·9	94·2	23·3	0·30	156·6	.....	132·8	6·7	.....	5·7	11·3	1·2	7·9	5·4	1 86	8·01	4 10	4 42	0 32	−0 98	− 36 20
1932-33	Station lambs	34	96	50	3	6·00	76·5	99·6	23·1	0·24	161·3	.....	154·1	6·8	.....	6·5	12·4	1·3	8·9	5·6	1 48	6·41	3 00	3 93	0 93	−0 11	− 5 17
	" "	35	96	50	.....	.....	70·8	95·4	19·6	0·20	165·4	.....	121·5	8·4	.....	6·2	13·3	1·5	9·3	5·4	1 29	6·59	3 00	3 78	0 78	0 01	0 50
	" "	36	96	50	.....	.....	77·7	96·6	18·9	0·20	171·8	.....	124·4	9·1	.....	6·6	14·3	1·3	9·9	5·3	1 37	7·26	3 00	3 87	0 87	0 05	2 50
	" "	29	96	50	.....	.....	77·7	99·6	21·9	0·23	168·2	219·5	124·4	7·7	10·0	5·7	13·2	1·4	9·2	5·6	1 61	7·34	3 00	3 85	0 85	−0 08	− 4 00
	" "	37	90	50	.....	.....	77·3	97·0	19·7	0·20	176·8	.....	124·0	9·0	.....	0·3	13·9	1·5	9·7	5·3	1 31	6·65	3 00	3 82	0 82	0 10	5 00
1933-34	Station lambs	29	96	50	.....	.....	68·4	107·0	38·6	0·40	122·2	261·9	143·7	3·2	6·8	3·8	7·0	0·7	5·2	6·1	1 95	5·15	2 60	4 88	2 28	1 32	60 00
	" "	34	96	50	1	2·00	68·3	103·0	34·7	0·36	117·9	.....	185·8	3·4	.....	5·4	8·5	0·8	6·0	6·1	2 11	6·19	2 60	4 98	2 38	1 04	50 96
	" "	35	96	50	.....	.....	68·3	101·2	32·9	0·34	132·9	.....	144·8	4·0	.....	4·4	7·7	0·8	5·5	5·7	1 80	5·57	2 60	5 06	2 46	1 38	69 00
	" "	36	96	50	.....	.....	68·5	104·4	35·9	0·37	136·2	.....	157·6	3·8	.....	4·4	7·4	0·8	5·4	5·8	1 78	5·06	2 60	4 98	2 38	1 47	73 50
	" "	37	96	50	.....	.....	68·4	101·1	32·7	0·34	141·0	.....	148·0	4·3	.....	4·5	8·0	0·9	5·8	5·7	1 98	6·16	2 60	5 10	2 50	1 23	61 50
						4x100 / 3	5 / 3	6 / 3-4	7 / 3-4	7 / 2x3-4	9 / 3	10 / 3	11 / 3	9 / 7	10 / 7	11 / 7					19 / 3	19x100 / 7	21: 97 x 5 / 100	100	21: 97 x 6 / 100	100	22-2	25 / 3-4	
Total (64 trials, lambs)**		6,098	3,733	28	.....	271,819	373,337	103,609	.....	.....	718,735	156,745	379,807	.....	.....	.....	.....	.....	.....	.....	7,887·41	.....	17,704·19	32,175·27	.....	.....	6,235·15
Average, (64 trials, lambs)		.....	88·4	58·3	.....	0·75	72·8	100·8	28·0	0·32	192·5	44·1	101·7	6·9	1·5	3·7	.....	.....	.....	.....	2·11	7·61	6·71	8·88	2·17	1·68	.....

*Based on Henry and Morrison's Tables.
**Totals for columns 5, 6, 7, 9, 10, 11, 19, 21 and 22 were obtained from original summaries as given in the annual reports.
***Except where otherwise indicated, the lambs were sold on the basis of 3% shrink.

KEY TO RATIONS USED

Number	Ration	Number	Ration	Number	Ration	Number	Ration
1	Alfalfa alone.	11	Alfalfa + corn silage + oats.	20	Alfalfa + corn silage + 2 barley + 1 oats (½ fed).	29	Alfalfa + beet pulp + barley.
2	" + roots.	12	" + oats.	21	" + oat sheaves + 2 barley + 1 oats (½ fed).	30	" + 2 parts No. 3 wheat + 1 oats.
3	" + " + 2 ground oats + 2 injured wheat + 1 bran.	13	" + corn silage + 1 oats + 1 barley.	22	" + 2 barley + 1 oats (½ fed).	31	" + 3 barley + 1 oats.
4	" + " + 1 wheat + 1 oats + 1 barley.	14	" + sunflower silage + 1 oats + 1 barley.	23	" + beet molasses + 2 barley + 1 oats (½ fed).	32	" + 3 barley + 1 oats (self fed).
5	" + screenings.	15	" + 2 barley + 1 oats.	24	" (second cutting) + 2 barley + 1 oats.	33	" + 3 ground barley + 1 ground oats.
6	" + 2 ground oats + 2 injured wheat + 1 bran.	16	" + corn silage + 2 barley + 1 oats.	25	" + 2 frozen wheat + 1 oats.	34	" + 1 barley + 1 wheat (self fed).
7	" + 1 wheat + 1 oats + 1 barley.	17	" + sunflower silage + 2 barley + 1 oats.	26	" (second cutting) + 2 barley + 1 oats (½ fed).	35	" + 1 barley + 1 wheat.
8	" + oat sheaves + 1 oats + 1 barley.	18	" + oat sheaves + 2 barley + 1 oats.	27	" + beet pulp + 2 barley + 1 oats.	36	" + barley.
9	" + 1 oats + 1 barley.	19	" + 2 barley + 1 oats (½ fed).	28	" + beet pulp + 3 barley + 1 oats.	37	" + wheat.
10	" + sunflower silage + oats.						

TABLE 1A.—COST PER TON OF FEEDS USED IN THE VARIOUS TRIALS

Year	Feed Cost per Ton								
	Oats	Barley	Wheat	Screenings	Bran	Alfalfa	Oat hay	Salt	Succulent feeds
	$	$	$	$	$	$	$	$	$ Roots
1911-12	20 00	.....	20 00	5 00	20 00	10 00	.....	.....	2 50
1912-13	20 00	.....	20 00	5 00	20 00	12 00	.....	.....	3 00
1913-14	20 00	20 00	20 00	9 00	.....	12 00	.....	.....	3 00
1914-15	35 00	35 00	.....	.....	.....	8 00	10 00	.....	.....
1915-16	20 00	20 00	.....	.....	.....	12 00	.....	.....	.....
									Ensilage
1922	18 25	.....	.....	.....	.....	10 00	.....	40 00	4 00
1922-23	27 50	27 50	.....	.....	.....	10 00	10 00	32 50	4 00
1924	20 59	18 75	.....	.....	.....	6 00	6 00	32 80	4 00
1924-25	30 00	30 00	.....	.....	.....	9 00	9 00	30 00	4 00
1925-26	27 00	22 00	.....	.....	.....	10 00	.....	30 00	5 00
									Molasses
1926-27	36 00	27 00	.....	.....	.....	12 00	.....	30 00	20 00
1927-28	32 25	30 00	.....	.....	.....	10 00	.....	.....	.....
1928-29	30 00	24 00	20 00	.....	.....	9 00	.....	.....	.....
1929-30	31 20	28 80	.....	.....	.....	12 50	.....	30 00	.....
									Beet pulp
1930-31	14 40	15 60	15 30	.....	.....	8 00	.....	27 00	2 85
1931-32	15 00	15 00	.....	.....	.....	8 00	.....	25 00	2 50
1932-33	14 82	12 84	.....	.....	.....	6 00	.....	27 00	2 30
1933-34	16 20	15 20	18 66	.....	.....	7 00	.....	26 00	2 40
Totals	428 21	341 69	113 96	19 00	40 00	171 50	35 00	330 30	.....
Averages	23 79	22 78	18 99	6 33	20 00	9 53	8 75	30 03	.....

GENERAL RESULTS

The results obtained in the trials are tabulated in considerable detail in table 1 which, in a general way, contains the information used in making all the comparisons and tabulations which follow, although recourse has been made, for the purpose of checking, to original data not contained in this bulletin. Due to its size, table 1 has been attached to the report as an appendix. The totals and averages at the foot of the table can be said to be a summation of what may be expected from the average feeder, although the best feeders might do better and the poor feeders worse.

Results with lambs are tabulated for eighteen years with a total of 64 groups or 3,733 lambs fed. Of this number 28 died in the course of the feeding periods making a death loss of only 0·75 per cent. This can be considered well below the usually accepted normal feed-yard loss of about 2 per cent and speaks well for the general excellence of the rations, the methods of feeding, and the quality and vigour of the lambs used.

The average weight of the lambs going into the feed lots was 72·8 pounds or from 7 to 10 pounds more than the average range lamb going on feed. The average finished weight was 100·8 pounds or an average gain of 28 pounds per lamb. As the average feeding period was 88·4 days the average daily gain per lamb worked out to 0·32 pound. This average includes lambs on good as well as poor rations and, when one considers that the lowest daily gain made in a trial was 0·16 pound and a considerable number were below 0·25 pound, it becomes evident that some of the rations produced exceptionally favourable results.

Dealing in terms of feed requirements, it is found that, for each pound of gain produced, 6·9 pounds of roughage, 1·5 pounds of succulent feed and 3·7 pounds of grain were required. However, on closer examination of results for individual groups, it is seen that the requirements on various rations and for different years deviated quite widely from these average figures. For example,

with ration 2 (alfalfa and roots), the highest feed requirement was shown to be 12·4 pounds of hay, 11·4 pounds of roots and 1·1 pounds of grain for each pound of gain. The highest feed requirement, when no succulent feed was fed, was in ration 1 (alfalfa alone) when 15·7 pounds of hay and 1·2 pounds of grain were fed for each pound of gain. The lowest feed requirement was on ration 36 (alfalfa and barley) which required only 3·8 pounds of hay and 4·4 pounds of grain for each pound of gain.

In terms of total feed required per lamb it is found that each lamb consumed an average of 192·5 pounds of roughage, 44·1 pounds of succulent feed, and 101·7 pounds of grain to finish it for market. This is a proportion of nearly two parts of hay to one of grain and was the ratio generally accepted a few years ago. A closer study of individual results will show that during the later years under review the ratio has gradually been tending more nearly towards one part of hay to one of grain.

Coming now to the matter of costs, we have presented figures realizing fully that these may be open to criticism. They do provide a picture of the past but may not be applicable to the future as they are based on unit feed prices. The cost of feed per lamb averaged $2.11 for the period under discussion and the average cost of producing a pound of gain was 7·61 cents. The profit per lamb, after feed costs and interest charges at 8 per cent had been deducted, was $1.68. More significant is the fact that only in three of the years reported has a loss been shown. Considering the fact that feed prices have always been charged well up to market value, it would seem that practically every year it has been more profitable to feed the farm products on the farm than to sell them. No consideration has been given to the value of the manure produced by the lambs, but its high value, particularly on irrigated land, would do much to cover any labour charges entailed in the feeding operations.

DETAILED TABULATIONS AND COMPARISONS OF RATIONS

In making most of the tabulations and comparisons which are to follow, results from rations used during the same year only have been used. For example, ration 15 was fed in 1923-24 and ration 22 in 1925-26, but no comparison could be made between the two as the results obtained from the same ration varied so much from year to year that this variation might be greater than the difference between rations. Consequently if a ration fed for three years was to be compared with one fed two years, only the results obtained in the two comparable years were used.

Full versus Two-thirds versus One-half Grain Ration

Four trials were conducted for comparing rates of grain feeding and results of four trials are available for a comparison of a full versus a one-half ration but results of only three trials are available for a comparison of a full versus a two-thirds ration. The results have been tabulated in table 2, which gives the three- and four-year averages, which have been used for comparative purposes.

The figures given in table 2 indicate that the rate of gain is directly related to the rate of grain feeding, the heaviest feeding producing the greatest gains. It is also noted that the hay required per pound of gain decreases as the rate of grain feeding increases whereas the amount of grain required per pound of gain follows an inverse trend. Therefore, it might be assumed that if grain was high in price it would be more economical to feed it less generously. In order to determine more clearly the point at which less than a full feed of grain might be economical, table 3 has been prepared and is presented herewith.

Table 2.—Results Obtained in Feeding Trials to Determine the Comparative Economy of Feeding a Full Ration of Grain, a Two-Thirds Ration and a One-Half Ration.

Ration	Ration number	Year of trials	Number of trials	Number of days in trial	Original number of lambs	Number of lambs completing trial	Average initial weight	Average final weight	Average gain	Average daily gain	Feed required per pound gain	
											Roughage	Grain
2A				Average	Total	Total	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Hay—full grain ration	15	1925–28	3	82	150	150	74·5	106·1	31·6	0·385	5·1	4·4
Hay—$\frac{2}{3}$ grain ration	22	1925–28	3	82	150	149	74·2	101·8	27·6	0·336	6·8	3·5
Difference in favour of full ration						1	−0·3	4·3	4·0	0·049	1·7	−0·9
2B												
Hay—full grain ration	15	1924–28	4	83·5	200	200	73·8	106·4	32·6	0·390	5·1	4·2
Hay—$\frac{1}{2}$ grain ration	19	1924–28	4	83·5	200	198	73·1	95·5	22·4	0·268	9·9	3·3
Difference in favour of full ration						2	−0·7	10·9	10·2	0·122	4·8	−0·9
2C												
Hay—$\frac{2}{3}$ grain ration	22	1925–28	3	82	150	149	74·2	101·8	27·6	0·336	6·8	3·5
Hay—$\frac{1}{2}$ grain ration	19	1925–28	3	82	150	148	74·2	95·5	21·3	0·260	10·1	3·4
Difference in favour of $\frac{2}{3}$ ration						1		6·3	6·3	0·076	3·3	−0·1

TABLE 3.—COST, IN CENTS, TO PRODUCE A POUND OF GAIN IN LAMBS ON FULL GRAIN RATION, TWO-THIRDS GRAIN RATION, AND ONE-HALF GRAIN RATION WITH HAY AND GRAIN PRICES AT VARIOUS LEVELS, BASED ON THREE TRIALS, 1925-28.

Grain at (per ton)	Treatment	Hay at (per ton)					
		$6	$8	$10	$12	$14	$16
		ct.	ct.	ct.	ct.	ct.	ct.
$10	Full ration	3·7	4·2	4·8	5·2	5·8	6·2
	⅔ ration	3·8	4·5	5·2	5·9	6·6	7·2
	½ ration	4·7	5·7	6·7	7·8	8·8	9·8
$15	Full ration	4·8	5·3	5·9	6·3	6·9	7·3
	⅔ ration	4·7	5·4	6·1	6·8	7·5	8·1
	½ ration	5·6	6·6	7·6	8·7	9·7	10·7
$20	Full ration	5·9	6·4	7·0	7·4	8·0	8·4
	⅔ ration	5·5	6·2	6·9	7·6	8·3	8·9
	½ ration	6·4	7·4	8·4	9·5	10·5	11·5
$25	Full ration	7·0	7·5	8·1	8·5	9·1	9·5
	⅔ ration	6·4	7·1	7·8	8·5	9·2	9·8
	½ ration	7·3	8·3	9·3	10·4	11·4	12·4
$30	Full ration	8·1	8·6	9·2	9·6	10·2	10·6
	⅔ ration	7·3	8·0	8·7	9·4	10·1	10·7
	½ ration	8·1	9·1	10·1	11·2	12·2	13·2

From table 3, it can be seen that at certain grain and hay price relationships the full grain ration is most economical and at other relationships the two-thirds ration appears to be more desirable, whereas the one-half ration is practically outside the bounds of serious consideration. Where the difference in feed cost per pound of gain between a full grain ration and a two-thirds ration is not very much in favour of the lighter ration, the full ration is to be recommended. It will be noted from table 2 that the rate of gain is considerably greater for the full fed ration and on the basis of these figures it would require twelve additional days of feeding to produce the same amount of gain on the two-thirds ration. It can be safely assumed that this would be required to assure an equally good finish.

This longer feeding period would mean an increase in labour costs and interest charges which might easily outweigh a slight saving in feed cost per pound gain. As a matter of fact, profits indicated in table 1 show that the full fed groups were more profitable than the two-thirds fed groups for the same years. It can be quite safely stated that under ordinary price levels the full grain ration will be more economical than the two-thirds grain ration or the one-half grain ration.

One factor to be considered in relation to the choice of method to be used, i.e., either full or partial grain ration, is the possibility of partly controlling the time at which the lambs will be ready for market. If it appears that a late season market will provide a higher selling price it may be advisable to use the slower finishing method of feeding even though the cost per pound gain might be greater. The original weight of the lambs will also be a determining factor in the choice of method as lambs of high original weight must be finished rapidly in order to acquire the required degree of fatness before becoming too heavy for the market.

Self-Feeding Grain versus Full Hand-Feeding Grain

This comparison of methods of feeding which can also be considered a comparison of rate of feeding is closely related to the one just made, i.e., full feeding versus two-thirds and one-half feeding, and while not strictly comparable does show continuity of results. Full hand-feeding versus self-feeding trials were conducted for three years, but with two different rations. The results from the two rations are quite similar and the summary has been provided in table 4.

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Table 4.—Data Obtained in Lamb Feeding Trials to Compare the Economy of Self-Feeding and Full Hand-Feeding Grain for Finishing.

Ration	Ration number	Year of trials	Number of trials	Number of days in trial	Original number of lambs	Number of lambs completing trial	Average initial weight	Average final weight	Average gain	Average daily gain	Feed required per pound gain	
											Roughage	Grain
4A				Average	Total	Total	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Alfalfa—3 parts barley and 1 part oats (self-fed)	32	1931–32	1	78	40	39	70·7	101·0	30·3	0·388	3·6	5·3
Alfalfa—3 parts barley and 1 part oats (hand-fed)	31	1931–32	1	78	40	40	70·7	100·8	30·1	0·386	5·7	4·4
Difference in favour of hand-fed group	.....	.....	.....	.....	.....	1	.....	−0·2	−0·2	−0·002	−2·1	0·9
4B												
Alfalfa—1 part barley and 1 part wheat (self-fed)	34	1932–34	2	96	100	96	72·6	101·3	28·7	0·300	4·8	5·9
Alfalfa—1 part barley and 1 part wheat (hand-fed)	35	1932–34	2	96	100	100	72·5	98·8	26·3	0·274	5·7	5·1
Difference in favour of hand-fed group	.....	.....	.....	.....	.....	4	0·1	−2·5	−2·4	−0·026	−0·9	0·8
4C												
Self-feeding	32 & 34	1931–34	3	90	140	135	71·9	101·2	29·3	0·326	4·5	5·8
Hand-feeding	31 & 35	1931–34	3	90	140	140	72·0	99·4	27·4	0·304	5·7	4·9
Difference in favour of hand-fed group	.....	.....	.....	.....	.....	5	−0·1	−1·8	−1·9	−0·022	−1·2	0·9

While the self-fed groups made slightly greater daily gains than the hand-fed groups the death losses were higher, and from figures given in table 1 it will be seen that the cost of feed per pound of gain was higher and the total profits less. With regard to feed consumption, upon which the cost of gains naturally depends, it must be noted that roughage consumption per pound of gain was much less and grain consumption greater for the self-fed lambs. Consequently, the economy of self-feeding will be largely determined by the relationship between hay and grain prices.

Table 5, showing the feed cost of producing a pound of gain by the two methods of feeding, is submitted herewith. From this table it can readily be determined at which prices, for grain and hay, self-feeding might be considered economical. Hand-feeding will be most economical with grain prices at high levels and it will be evident that at any given price for hay the advantage of self-feeding decreases with an increase in grain prices. Conversely, it may be stated that with grain prices at any given value the advantage of self-feeding grain increases with an increase in hay costs.

TABLE 5.—FEED COST, IN CENTS, OF PRODUCING A POUND OF GAIN IN LAMBS BY HAND-FEEDING AND SELF-FEEDING GRAIN, WITH HAY AND GRAIN PRICES AT VARIOUS LEVELS, BASED ON THREE TRIALS, 1931-34.

Grain at (per ton)	Method	Hay at (per ton)					
		$6	$8	$10	$12	$14	$16
		ct.	ct.	ct.	ct.	ct.	ct.
$10	Hand-fed	4·1	4·7	5·2	5·8	6·4	7·0
	Self-fed	4·3	4·7	5·1	5·6	6·1	6·5
$15	Hand-fed	5·4	6·0	6·5	7·1	7·7	8·3
	Self-fed	5·8	6·2	6·6	7·1	7·6	8·0
$20	Hand-fed	6·6	7·2	7·7	8·3	8·9	9·5
	Self-fed	7·2	7·6	8·0	8·5	9·0	9·4
$25	Hand-fed	7·8	8·4	8·9	9·5	10·1	10·7
	Self-fed	8·6	9·0	9·4	9·9	10·4	10·8
$30	Hand-fed	9·0	9·6	10·1	10·7	11·3	11·9
	Self-fed	10·1	10·5	10·9	11·4	11·9	12·3

As far as death losses are concerned it can be stated that while these have been relatively high with self-feeding, they were reduced in the last year of the trials. While death losses with self-feeding may possibly always be slightly above the average for hand-fed lambs, proper feeding methods during the early feeding period will do much toward reducing them to a point where they will not be burdensome.

Results in these trials, as already mentioned, have been obtained with lambs averaging considerably more in weight than range lambs. It is possible that the results with lighter lambs, where a longer feeding period would be required, would be somewhat different, although it is believed the comparison between hand-feeding and self-feeding would not be altered materially.

Value of Corn Silage, Sunflower Silage, and Oat Sheaves

Considerable difficulty has been experienced in putting the results of these trials in a form which would indicate truthfully the difference in the rations and make the comparisons legitimate and clear. Several tabulations have been made but, for this discussion, only sections C, D, and E of table 6 will be used. Section C is really a summary and average of sections A and B in which the difference in the grain rations has not been considered, as only a comparison between the roughage supplements was desired.

TABLE 6.—RESULTS OBTAINED IN LAMB FEEDING TRIALS FOR COMPARING THE VALUE OF CORN SILAGE, SUNFLOWER SILAGE, AND OAT SHEAVES AS SUPPLEMENTS TO HAY AND GRAIN RATIONS.

Ration	Number of ration	Years of trial	Number of trials	Number of days in trials	Original number of lambs	Number of lambs completing trials	Average initial weight	Average final weight	Average gain	Average daily gain	Feed required per pound of gain			Hay replaced by 1 pound supplement	Grain replaced by 1 pound supplement
											Hay	Supplement	Grain		
6A				Average	Total	Total	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Alfalfa—															
1 part barley and 1 part oats	9	1922–23	1	97	50	50	75·1	104·8	29·7	0·306	7·0	.....	3·8	.....	.....
Corn silage—1 part barley and 1 part oats	13	1922–23	1	97	50	50	74·9	110·0	35·1	0·362	5·0	4·8	3·2	0·417	0·125
Sunflower silage—1 part barley and 1 part oats	14	1922–23	1	97	50	50	74·7	105·6	30·9	0·318	5·5	5·4	3·7	0·278	0·018
Oat sheaves—1 part barley and 1 part oats	8	1922–23	1	97	50	48	74·6	106·3	31·7	0·327	4·9	2·9	3·7	0·724	0·034
6B															
Alfalfa—															
2 parts barley and 1 part oats	15	1924	1	101	50	50	77·7	116·2	38·5	0·381	5·7	.....	3·7	.....	.....
Corn silage—2 parts barley and 1 part oats	16	1924	1	101	50	49	79·7	120·6	40·9	0·405	5·3	3·2	3·6	0·125	0·031
Sunflower silage—2 parts barley and 1 part oats	17	1924	1	101	50	50	76·9	116·9	40·0	0·396	5·3	3·2	3·6	0·125	0·031
Oat sheaves—2 parts barley and 1 part oats	18	1924	1	101	50	50	79·6	118·4	38·8	0·384	3·8	1·7	3·7	1·118	0·000
6C															
Alfalfa—															
Grain	9 & 15	1922–24	2	99	100	100	76·4	110·5	34·1	0·344	6·35	.....	3·80	.....	.....
Corn silage—grain	13 & 16	1922–24	2	99	100	99	77·3	115·2	37·9	0·383	5·14	3·90	3·43	0·31	0·10
Sunflower silage—grain	14 & 17	1922–24	2	99	100	100	75·8	111·2	35·4	0·358	5·40	4·16	3·66[1]	0·23	0·03
Oat sheaves—grain	8 & 18	1922–24	2	99	100	98	77·1	112·4	35·3	0·357	4·25	2·25	3·73	0·93	0·03
6D															
Alfalfa—															
Oats	12	1922	1	96	40	40	67·0	85·9	18·9	0·197	11·4	.....	3·8	.....	.....
Corn silage—oats	11	1922	1	96	40	40	67·2	88·0	20·8	0·217	9·4	3·6	3·5	0·556	0·083
Sunflower silage—oats	10	1922	1	96	40	40	67·0	89·1	22·1	0·230	8·8	3·4	3·3	0·765	0·147
6E															
Alfalfa—															
2 parts barley and 1 part oats (full fed)	15	1924–25	1	88	50	50	71·6	107·4	35·8	0·406	5·2	.....	3·8	.....	.....
2 parts barley and 1 part oats (½ fed)	19	1924–25	1	88	50	50	70·0	94·4	24·4	0·277	9·4	.....	2·8	.....	.....
Corn silage—2 parts barley and 1 part oats (½ fed)	20	1924–25	1	88	50	50	73·4	97·2	23·8	0·270	9·4	2·8	2·8	.....	.....
Oat sheaves—2 parts barley and 1 part oats (½ fed)	21	1924–25	1	88	50	50	72·8	95·4	22·6	0·256	6·9	3·1	3·0	.....	.....
6F															
Alfalfa—															
Grain (full fed)	15	1924–26	2	89	100	100	73·2	109·1	35·9	0·403	5·28	.....	3·90	.....	.....
Grain (½ fed)	19	1924–26	2	89	100	98	72·1	98·2	26·1	0·293	9·35	.....	2·70	.....	.....
Corn silage—grain (½ fed)	20	1924–26	2	89	100	100	73·9	100·0	26·1	0·293	7·86	3·76	2·68	.....	.....

The figures in table 6, section C, indicate that the use of corn silage led to greater total gains and greater average daily gains than when no succulent was fed. It also produced greater gains than either sunflower silage or oat sheaves added to a similar ration. Less hay and grain were required per pound of gain than in the no succulent ration but 3·9 pounds of ensilage were fed for each pound of gain. Thus, one pound of ensilage was equal in feed value to 0·31 pound of hay and 0·10 pound of grain. From table 1 it has been determined that, at prices prevailing during the years of these trials, the corn ensilage ration produced the cheapest gains. However, due to the comparatively high cost of producing corn ensilage it may be questioned whether it would be an economical feed under price conditions differing widely from those which existed at that time.

Comparing corn silage with sunflower silage it is seen that the sunflower silage was inferior in all respects and, at the prices given in table 1, was the most expensive ration used during the years under consideration.

The comparison between corn silage and oat sheaves indicates that the silage was superior from the standpoint of producing gains. Its hay replacement value was not as great as that of oat sheaves but it had a higher grain replacement value. The hay replacement value of oat sheaves was shown to be high, alfalfa hay and oat sheaves being practically equal in value in terms of units required per pound of gain. The slight difference in their values was further reduced by the grain replacement value of the oat sheaves. No trials were conducted to determine the value of oat sheaves when fed as the only roughage and it is possible that, fed alone, they would have a lower value.

Sunflower silage appeared to be the least desirable of all the supplements and, while slightly greater gains were made when sunflower silage was added to the hay and grain ration than when no succulent was used, the cost per pound of gain was increased.

In table 6, section D, are given the results of a trial in which whole oats constituted the only grain. In this trial, sunflower silage showed to considerably better advantage than in the other trials but as the results are limited to one trial they cannot be taken as conclusive evidence. The feature most noticeable with all three rations of that year is the low daily gains produced. It would appear that oats alone do not constitute a satisfactory grain ration for producing finish in lambs.

The results of a trial tabulated in table 6, section E, indicate no advantage in feeding a roughage supplement when grain is fed only as a half ration. Best results in all respects were obtained, in the trials of that year, from full grain feeding. A further tabulation of two years' results, excluding the oat sheaf ration, has been presented in table 6, section F.

From this table can be gathered the fact that, when lambs were on a half ration of grain, the addition of corn silage resulted in a saving of hay for each pound of gain produced, though the average daily gain was not increased. In this case one pound of silage was equal to 0·39 pound of hay, and the silage ration was more economical than the no silage ration, at the prices which prevailed. However, the corn silage half grain ration group did not compare favourably in any respect with the full grain ration no silage group.

Wet Beet Pulp as a Succulent

The use of wet beet pulp as a succulence is a practice which has followed the development of the beet sugar industry. The first trials at this station for determining the value of the pulp in a lamb finishing ration were inaugurated during the winter of 1930-31 and four trials have been conducted. The grain rations used were slightly different in three of these years and the results for each ration are tabulated in sections A, B, and C of table 7. In table 7, section D, the results of the four trials have been combined into a summary table.

TABLE 7.—RESULTS OBTAINED IN LAMB FEEDING TRIALS TO DETERMINE THE VALUE OF BEET PULP IN A FATTENING RATION. ALSO A COMPARISON OF RESULTS OBTAINED FROM FEEDING PULP AND CORN SILAGE.

Ration	Number of ration	Year of trial	Number of trials	Number of days in trials	Original number of lambs	Number of lambs completing trials	Average initial weight	Average final weight	Average gain	Average daily gain	Feed required per pound of gain			Hay replaced by 1 pound succulent	Grain replaced by 1 pound succulent
											Hay	Succulent	Grain		
7A				Average	Total	Total	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Alfalfa—3 parts barley and 1 part oats	31	1931-32	1	78	40	40	70·7	100·8	30·1	0·385	5·7	.....	4·4	.....	.....
Alfalfa—beet pulp—3 parts barley and 1 part oats	28	1931-32	1	78	40	39	70·8	106·2	35·4	0·454	4·3	9·8	3·7	0·14	0·07
Difference in favour of beet pulp	.....	.....	.....	.....	.....	−1	−0·1	5·4	5·3	0·069	1·4	−9·8	0·7	.....	.....
7B															
Alfalfa—2 parts barley and 1 part oats	15	1930-31	1	58	50	50	80·0	104·4	24·4	0·421	4·6	.....	4·5	.....	.....
Alfalfa—beet pulp—2 parts barley and 1 part oats	27	1930-31	1	58	50	50	79·9	105·3	25·4	0·438	3·9	4·7	4·4	0·15	0·02
Difference in favour of beet pulp	.....	.....	.....	.....	.....	.....	0·1	0·9	1·0	0·017	0·7	−4·7	0·1	.....	.....
7C															
Alfalfa—barley	36	1932-34	2	96	100	100	73·1	100·5	27·4	0·285	5·6	.....	5·2	.....	.....
Alfalfa—beet pulp—barley	29	1932-34	2	96	100	100	73·0	103·3	30·3	0·316	4·8	8·0	4·4	0·10	0·01
Difference in favour of beet pulp	.....	.....	.....	.....	.....	.....	0·1	2·8	2·9	0·031	0·8	−8·0	0·8	.....	.....
7D															
Alfalfa—grain	15-31-36	1931-34	4	82	190	190	74·4	101·6	27·2	0·332	5·4	.....	4·8	.....	.....
Alfalfa—pulp—grain	27-28-29	1931-34	4	82	190	189	74·3	104·4	30·1	0·367	4·5	7·7	4·3	0·12	0·06
Difference in favour of beet pulp	.....	.....	.....	.....	.....	−1	0·1	2·8	2·9	0·035	0·9	−7·7	0·5	.....	.....
7E															
Alfalfa—pulp—grain	27-28-29	1931-34	4	82	190	189	74·3	104·4	30·1	0·367	4·5	7·7	4·3	0·12	0·06
Alfalfa—corn silage—grain	13-16	1922-24	2	99	100	99	77·3	115·2	37·9	0·383	5·1	3·9	3·4	0·31	0·10

The results of the trials presented in table 7 show that the addition of beet pulp to a hay and grain ration led to increased gains and reduced the hay and grain requirements per pound of gain made by the lambs. One pound of pulp replaced 0·12 pound of hay and 0·06 pound of grain in producing a pound of gain, or, stated in larger units, one ton of wet pulp replaced 240 pounds of hay and 120 pounds of grain, and its monetary value can be estimated from these figures. It should be stated that the pulp used was hauled from the silo at the factory in lots of about five tons and stored in a practically frost-proof bin until used. The first year it was hand-fed, but in subsequent years the lambs had free access to the pulp in a trough, at all times.

In table 7, section E, a comparison has been attempted between beet pulp and corn silage but the figures in this table are not truly comparable, as the trials were conducted in different years. They do provide some indication of what might be expected from the two rations and it is evident that the corn silage ration produced greater daily gains than the beet pulp ration and the corn silage had a higher hay and grain replacement value per pound. This is to be expected when one considers the difference in dry matter content of the two feeds, beet pulp containing far less than corn silage.

On the basis of the hay and grain replacement values, obtained from the trials and presented in table 7, the monetary value of pulp and silage has been calculated for hay and grain prices at various levels. These values are presented in table 8. It must be admitted that the figures for silage are not as conclusive as those for the pulp as they are based on the results of only two trials, whereas the pulp figures are based on the results of four trials.

Table 8.—Value of Beet Pulp and Corn Silage, in Dollars per Ton, for Fattening Lambs, with Hay and Grain Prices at Various Levels, based on Replacement Values determined in Feeding Trials.

Grain at (per ton)	Feed	Hay at (per ton)					
		$6	$8	$10	$12	$14	$16
		$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
$10	Beet pulp	1 32	1 56	1 80	2 04	2 28	2 52
	Corn silage	2 86	3 48	4 10	4 72	5 34	5 96
$15	Beet pulp	1 62	1 86	2 10	2 34	2 58	2 82
	Corn silage	3 36	3 98	4 60	5 22	5 84	6 46
$20	Beet pulp	1 92	2 16	2 40	2 64	2 88	3 12
	Corn silage	3 86	4 48	5 10	5 72	6 34	6 96
$25	Beet pulp	2 22	2 46	2 70	2 94	3 18	3 42
	Corn silage	4 36	4 98	5 60	6 22	6 84	7 46
$30	Beet pulp	2 52	2 76	3 00	3 24	3 48	3 72
	Corn silage	4 86	5 48	6 10	6 72	7 34	7 96

As pulp is a bulky feed, of high water content, its value per ton is comparatively low. Transportation charges are an important factor and the use of the wet pulp will be limited to a relatively small area surrounding the sugar factory, where these charges will not be excessive. The actual cost of the pulp at the factory has in the past been quite reasonable and it has been an economical feed to use where transportation charges have not exceeded $1 per ton. Exception might be taken to this latter statement for the year 1933 and early 1934, when feed prices reached their low point. However, in a normal year pulp can be considered an economical feed if the costs of moving it do not become too high.

Comparison of Barley and Wheat, Singly and in Mixture

Results of two trials are available in which true comparisons can be made of wheat versus barley; wheat versus 1 part barley and 1 part wheat, and barley versus 1 part barley and 1 part wheat. The results of these trials are presented in tabular form in table 9. From table 1 it can be observed that the results from one of the two trials comparing these three rations were much poorer than any obtained from other trials for a number of years. The gains were abnormally low and feed requirements exceptionally high and while no logical reason can be ascribed for these facts it does not appear reasonable that the blame can be laid entirely to the ration. Therefore, while the comparisons made by means of the tables are true comparisons the average results are below what we believe would be normal.

Using barley as a standard or check group in table 9 we see in 9c that the barley ration produced slightly, though not significantly, greater gains than wheat. Further, the cost of grains in terms of hay and grain required per pound of gain was in favour of barley. Comparing barley with a mixture of equal parts of barley and wheat, 9A, we find a similar relationship with regard to rate of gain, but the advantage of barley in terms of feed cost is considerably reduced. The results of the trials comparing wheat with the mixture of barley and wheat, 9B, show that there was practically no difference in the rate of gain made by the lambs in these groups, but the barley and wheat ration produced cheaper gains in terms of feed requirements per pound of gain.

These results would indicate that barley and a mixture of equal parts of wheat and barley are of practically equal value, and while both these rations displayed some advantage over a straight wheat ration, it will be noted that this advantage was small and perhaps not very significant. Consequently the relative prices of these two grains on a per pound basis might be the determining factor in the selection of either as the grain ration for fattening lambs. For the inexperienced feeder, barley is a slightly safer grain to use and for that reason alone might at times be recommended in preference to wheat.

It is of interest to note that no oats were included in these rations. Oats were fed for a few days at the beginning of the trials to get the lambs on feed but after that only the heavy grains were used. No ill effects were noticeable from this procedure, although it was difficult to get the lambs to consume as much grain by weight as had been possible in previous years with rations containing oats. The lambs receiving straight barley consumed larger daily amounts of grain than those receiving wheat or a mixture of wheat and barley, fed under similar conditions.

TABLE 9.—RESULTS OF LAMB FEEDING TRIALS TO COMPARE THE VALUE OF BARLEY AND WHEAT SINGLY AND IN MIXTURE.

Ration	Ration number	Year of trials	Number of trials	Number of days in trial	Original number of lambs	Number of lambs completing trials	Average initial weight	Average final weight	Average gain	Average daily gain	Feed required per pound gain	
											Hay	Grain
9A				Average	Total	Total	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Alfalfa—1 part barley and 1 part wheat	35	1932–34	2	96	100	100	72·6	98·8	26·2	0·273	5·7	5·1
Alfalfa—barley	36	1932–34	2	96	100	100	73·1	100·5	27·4	0·285	5·6	5·1
Difference in favour of barley							−0·5	1·7	1·2	0·012	0·9	0·0
9B												
Alfalfa—1 part barley and 1 part wheat	35	1932–34	2	96	100	100	72·6	98·8	26·2	0·273	5·7	5·1
Alfalfa—wheat	37	1932–34	2	96	100	100	72·9	99·0	26·1	0·272	6·1	5·2
Difference in favour of barley and wheat							0·3	−0·2	0·1	0·001	0·4	0·1
9C												
Alfalfa—barley	36	1932–34	2	96	100	100	73·1	100·5	27·4	0·285	5·6	5·1
Alfalfa—wheat	37	1932–34	2	96	100	100	72·9	99·0	26·1	0·272	6·1	5·2
Difference in favour of barley							−0·2	1·5	1·3	0·013	0·5	0·1

The Value of Roots as a Succulent Feed when Added to a Ration of Hay and Grain

Two trials were conducted in which a comparison could be obtained between a ration without roots and one with roots. These were conducted in 1911-12 and 1913-14, and the results have been combined and presented in table 10.

TABLE 10.—DATA OBTAINED IN TWO TRIALS FOR DETERMINING THE VALUE OF ROOTS IN THE FINISHING RATION FOR LAMBS.

Ration	Ration number	Years of trials	Number of trials	Number of days in trial	Original number of lambs	Number of lambs completing trial	Average final weight
				Average	Total	Total	Lb.
Hay—grain	6 & 7	1911-12 and 1913-14	2	124	100	99	74·3
Hay—roots—grain	3 & 4	1911-12 and 1913-14	2	124	100	98	73·9
Difference in favour of roots						−1	0·4

Ration	Average final weight	Average gain	Average gain daily	Feed required per pound gain			Hay replaced by 1 pound roots	Grain replaced by 1 pound roots
				Hay	Roots	Grain		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Hay—grain	105·4	31·1	0·251	7·6	.....	3·8	.....	.....
Hay—roots—grain	108·6	34·7	0·280	6·5	5·9	3·4	0·19	0·07
Difference in favour of roots	3·2	3·6	0·029	1·1	−5·9	0·4	.....	.....

From the data presented, it will be seen that the addition of roots to the ration of hay and grain increased the rate of gain and decreased the hay and grain required per pound of gain. The hay replaced by 5·9 pounds of roots was 1·1 pounds and the grain replaced was 0·4 pound for each pound of gain made. In other words a ton of roots equalled 380 pounds of hay and 140 pounds of grain, and from these figures the monetary value can be easily calculated, with hay and grain at various prices. These calculations have been made for a number of prices and are presented in table 11.

TABLE 11.—VALUE OF ROOTS, IN DOLLARS PER TON, IN THE RATION FOR LAMBS, WITH HAY AND GRAIN AT VARIOUS PRICES, BASED ON TWO TRIALS, 1911-12 AND 1913-14.

Grain at (per ton)	Hay at (per ton)					
	$6	$8	$10	$12	$14	$16
	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
$10.00	1 84	2 22	2 60	2 98	3 36	3 74
$15.00	2 19	2 57	2 95	3 33	3 71	4 09
$20.00	2 54	2 92	3 30	3 68	4 06	4 44
$25.00	2 89	3 27	3 65	4 03	4 41	4 79
$30.00	3 24	3 62	4 00	4 38	4 76	5 14

Referring to table 11 and to table 8 it will be seen that roots have a value per ton about half way between beet pulp and corn silage. The cost of producing or laying down these various feeds on the farm would be the main factor determining the use of either one.

Having now dealt at some length with all the rations for which the results of more than one trial are available and for which true comparisons can be made, it might be of interest to touch on some of the other rations which were used. As already indicated these are quite numerous and, while definite conclusions regarding their value can be drawn in only a few cases, they do afford a basis for some discussion.

Comparison of First and Second Cutting Alfalfa

Two trials were conducted to compare the value of first and second cutting alfalfa. The results of the two trials were diametrically opposite and no further replication was attempted. A general knowledge of alfalfa would lead one to suggest that when first and second cutting alfalfa are of equal grade for the class, there would be no real difference in their value for fattening lambs. The total amount of hay fed is relatively small and the grain portion of the ration is more important than the hay. One disadvantage of high quality second cutting alfalfa is that it has a tendency to cause bloat due to its comparatively fine stems and proportionately high leaf content. First cutting alfalfa, therefore, can be considered a safer hay to use under normal conditions.

Comparison of Whole and Ground Grain

One trial was conducted to compare whole grain with ground grain. The results were so clear cut and definite that no further trials appeared necessary. The ground grain proved very unsatisfactory as it appeared to be less palatable to the lambs. In addition, the dust from the ground grain caused a catarrhal condition in the lambs which was directly responsible for the death of three and impaired the health of several more. The 23·3 pounds average gain made by the ground grain group was less by 6·8 pounds than in the whole grain group, and the amount of feed required per pound of gain was considerably greater than in the group receiving whole grain.

The ground grain used in this trial had been ground in an ordinary grain grinder and while no modulus of fineness was determined it can be described as medium fine. The grinding produced a large amount of dust which might not have been produced if the grain had been crushed.

The Value of Betalasses

Betalasses, the sugar beet molasses from the Raymond sugar factory, was used in one trial to determine its value when added to a ration of alfalfa and a half feed of grain consisting of two parts barley and one part oats. From the standpoint of increasing gains and reducing the hay and grain required per pound of gain, the betalasses seemed to be quite effective. In this trial one pound of molasses replaced 2·15 pounds of hay and 0·31 pound of grain in producing a pound of gain. Just how it would react in a full grain ration has not been determined at this station, but results from other sources indicate that it is quite satisfactory.

The Value of Frozen Wheat and No. 3 Northern Wheat

Frozen wheat was fed in one trial in which it constituted two-thirds of the grain ration and oats one-third. The wheat appeared to be quite satisfactory in all respects and the average daily gains as well as the feed requirements per pound of gain resulting from its use placed it in the category of desirable rations. It should be pointed out that the degree of frost damage would be a factor

determining the value of frozen wheat as there might be as much difference between various frozen wheats as there is between No. 1 Northern and No. 6.

In a trial similar to that just mentioned, No. 3 Northern wheat was used, with even better results, indicating that wheat unable to command a top grade and price may constitute a satisfactory finishing grain for lambs. This is well in line with the results and conclusions drawn from trials already reviewed in which wheat was fed and was shown to be equal to barley in value.

Oats as the Complete Grain Ration

Three other rations already mentioned, in which oats constituted the only grain, were shown to be unsatisfactory. The rate of gain was too low and the finish acquired by the lambs was deficient. Oats produce growth but when fed as the only grain do not promote fattening and consequently should not be used as the only grain. The addition of sunflower silage or corn silage improved the oat ration to a slight extent but not enough to put it into the class of desirable rations.

The gradual evolution of rations has been more or less indicated in the foregoing discussions but the latter would not be complete without reference to two of the earliest rations used. Neither of these is acceptable under modern conditions of rapid finishing to a high degree. One of these rations was alfalfa alone, with a small amount of grain near the end of the feeding period only. The rate of gain was low and while no notes were made in the original report regarding the matter it can be assumed that the degree of finish was not as great as is required in market lambs to-day.

Another early ration no longer in use was one in which roots were added to the above-mentioned ration. This too was a slow finishing ration and did not prove very satisfactory, but when a full feed of grain was added to alfalfa and roots the ration was greatly improved in its ability to produce gains.

RANKING OF RATIONS

To provide a further comparison of the various rations, they have been tabulated in the order of the best daily gains made by any group fed the ration. This figure was used in preference to the average daily gain made by all the groups completing trials on any specific ration, as some of the rations were tested only once while others were tested several times. While the procedure followed is not completely satisfactory it at least presents the maximum gains made on each ration used in the trials.

By means of this tabulation continuity of type in rations has largely been obtained in the ranking. It places low grain rations, light grain (oats alone) rations, and light rations (no grain) in their proper order. One discrepancy does appear to occur with the ration in which ground oats, injured wheat and bran constituted the grain mixture, but as ground grain has been found to be unsatisfactory and no statement was made in the original report with regard to the quality of the injured wheat, it is quite possible that these results are not as much out of line as they would at first appear.

As the basic purpose of all the feeding trials has been to obtain information for feeders, the object of this report is to make recommendations regarding desirable and undesirable rations in order that lamb feeders, particularly those who are inexperienced, might benefit from them. As the basis for making these recommendations, we have classified all rations which produced 0·32 pound daily gain or more as desirable rations, and those producing less than this as undesirable rations. This figure was used as it was the average daily gain produced by all lambs on all rations, as given in table 1.

TABLE 12.—RATIONS RANKED ACCORDING TO HIGHEST AVERAGE DAILY GAINS MADE BY ANY GROUP ON EACH RATION.*

Average daily gain	Ration No.	Ranking	Ration
lb.			
0·45	28	1	Alfalfa, pulp, 3 parts barley, 1 part oats.
0·45	30	1	Alfalfa, 2 parts wheat (No. 3 Northern), 1 part oats.
0·44	27	2	Alfalfa, pulp, 2 parts barley, 1 part oats.
0·42	25	3	Alfalfa, 2 parts frozen wheat, 1 part oats.
0·42	15	3	Alfalfa, 2 parts barley, 1 part oats.
0·42	16	3	Alfalfa, corn silage, 2 parts barley, 1 part oats.
0·40	17	4	Alfalfa, sunflower silage, 2 parts barley, 1 part oats.
0·40	29	4	Alfalfa, pulp, barley.
0·39	24	5	Alfalfa, (2nd cutting), 2 parts barley, 1 part oats.
0·39	32	5	Alfalfa, 3 parts barley, 1 part oats (self-fed).
0·38	18	6	Alfalfa, oat sheaves, 2 parts barley, 1 part oats.
0·38	31	6	Alfalfa, 3 parts barley, 1 part oats.
0·37	22	7	Alfalfa, 2 parts barley, 1 part oats (2/3 ration).
0·37	36	7	Alfalfa, barley.
0·36	13	8	Alfalfa, corn silage, 1 part barley, 1 part oats.
0·36	34	8	Alfalfa, 1 part barley, 1 part wheat (self-fed).
0·34	35	9	Alfalfa, 1 part barley, 1 part wheat.
0·34	37	9	Alfalfa, wheat.
0·33	3	10	Alfalfa, roots, 2 parts ground oats, 2 parts injured wheat, 1 part bran.
0·33	8	10	Alfalfa, oat sheaves, 1 part barley, 1 part oats.
0·32	14	11	Alfalfa, sunflower silage, 1 part barley, 1 part oats.
0·32	20	11	Alfalfa, corn silage, 2 parts barley, 1 part oats (½ ration).
0·31	9	12	Alfalfa, 1 part barley, 1 part oats.
0·31	19	12	Alfalfa, 2 parts barley, 1 part oats (½ ration).
0·30	33	13	Alfalfa, 3 parts ground barley, 1 part ground oats.
0·29	6	14	Alfalfa, 2 parts ground oats, 2 parts injured wheat, 1 part bran.
0·28	23	15	Alfalfa, beet molasses, 2 parts barley, 1 part oats (½ ration).
0·28	26	15	Alfalfa (2nd cutting), 2 parts barley, 1 part oats (½ ration).
0·27	2	16	Alfalfa, roots.
0·26	21	17	Alfalfa, oat sheaves, 2 parts barley, 1 part oats (½ ration).
0·24	4	18	Alfalfa, roots, 1 part barley, 1 part wheat, 1 part oats.
0·23	10	19	Alfalfa, sunflower silage, oats.
0·22	1	20	Alfalfa.
0·22	7	20	Alfalfa, 1 part barley, 1 part wheat, 1 part oats.
0·22	11	20	Alfalfa, corn silage, oats.
0·20	12	21	Alfalfa, oats.

*Where not otherwise indicated the alfalfa was first cutting.

From table 12 it will be seen, that of the 36 rations tabulated (ration No. 5 is not included), 22 were able to produce the average daily gain of 0·32 pound or more and only 14 rations were below this figure. Having in mind that we have taken the best results from each ration, it is interesting to realize that almost any full ration composed of farm grown feeds will produce satisfactory gains in normal years. The only rations which definitely can be considered as unsatisfactory are those in which no grain is fed, those in which oats is the only grain, those in which less than a two-thirds grain ration is fed, and those in which the grain ration consists of half oats and half barley without a supplementary feed such as corn silage. In addition to these, the ground grain ration is unsatisfactory.

It is interesting to note that the best ranking obtained with corn silage was third and the best with self-feeding grain was fifth position. It is of further interest to note the ranking of rations containing no oats but only the heavier barley or wheat. From this, it may be assumed that a ration including no oats is inferior to one including oats and on the other hand one made up with too much oats might be less desirable. From the ranking of the various combinations it can be tentatively stated that a mixture of two to three parts of barley or wheat to one part of oats is the most desirable proportion.

One feature brought out by the tabulations in this report is the exceptionally high gains which lambs will make on proper rations under favourable conditions.

For a number of years the average gain expected in commercial feed lots was about 0·25 pound per head per day. It would appear that this figure can safely be raised to quite an extent when proper rations are employed. The average of 0·32 pound daily gain made in all the trials is in itself proof of this. When rations which are known to be definitely inferior are excluded, the average daily gain obtained will be considerably above that figure.

Despite the limitations of the trials reported, several definite and conclusive deductions can be made with regard to the results obtained and these are enumerated and listed below, not necessarily in their order of importance.

SUMMARY

(1) The finishing of lambs has, over a long term of years, provided a satisfactory profit over feed costs and interest charges.

(2) With proper rations and management death losses can be kept below 1 per cent, if the lambs used are healthy and vigorous.

(3) Average daily gains of over one-third of a pound per day can be expected when proper rations are used.

(4) Corn silage, added to a hay and full grain ration will increase the daily gains and decrease the hay and grain required per pound of gain. One pound of ensilage replaced 0·31 pound of hay and 0·10 pound of grain in producing a pound of gain.

(5) Wet beet pulp, when added to a hay and full grain ration, will increase the daily gains and reduce the hay and grain required per pound of gain. One pound of pulp replaced 0·12 pound of hay and 0·06 pound of grain.

(6) Roots (turnips) when added to a hay and full grain ration, will increase the daily gains and reduce the hay and grain required per pound of gain. One pound of roots replaced 0·1 pound of hay and 0·07 pound of grain.

(7) Sunflower silage is inferior to corn silage. It had a hay replacement value of only 0·23 pound and a grain replacement value of 0·03 pound per pound of silage.

(8) A full feed of grain will nearly always be superior in all respects to a two-thirds ration and will be definitely superior to a one-half ration. Only with abnormal price relationships between hay and grain will a two-thirds ration be economical.

(9) Oat sheaves have a high hay replacement value when added to alfalfa hay and a grain ration. Their value as the sole roughage was not determined.

(10) Self-feeding has not proved itself to be an outstanding success at this station, and only under certain price conditions can it be considered as an economical procedure.

(11) A grain ration of wheat alone was found to be only slightly less satisfactory than a ration of barley or equal parts of barley and wheat. An inexperienced feeder might have a little more difficulty in feeding wheat than barley.

(12) No difference was shown in the feed value of first and second cutting alfalfa.

(13) With a half ration of grain, sugar beet molasses was an economical supplement.

(14) Grinding grain to medium fineness for finishing lambs was not economical and produced very poor results. This practice cannot be recommended.

(15) Frozen wheat, of the quality used, and No. 3 wheat proved to be valuable feeds.

(16) Oats alone cannot be considered a satisfactory grain ration for finishing lambs, but it is the most desirable grain for starting lambs on feed.

GENERAL LAMB FEEDING PRACTICES

Lamb feeding is an art as well as a profitable industry and like all other arts cannot be circumscribed entirely by rules and recommendations. Some assistance can be given to the less experienced feeders by way of suggestions and advice based upon the experiences of other feeders and on trials conducted by experimental stations and other institutions, and the recommendations and suggestions set forth in the following pages are based on results from these sources. It should be definitely understood that not all men will qualify as successful lamb feeders even though they follow all the rules, for the personal element, the feeder's eye, so to speak, is fully as essential with this class of stock as with any other.

As an industry, lamb feeding can be considered profitable, and under proper management it will give as satisfactory returns on an investment as any other farm venture. It is a foregone conclusion that lambs will not be equally profitable every year and under all conditions, in fact losses will occur in some years, but as a long-time venture lamb feeding can be considered safe. Because of this fact it must be looked upon as a permanent venture so that any losses which might be incurred in unfavourable years may be made good in the better years. The in-and-outer, the man who plays the market with the idea of making a "killing" in certain years will in most cases suffer the losses which he richly deserves. The item of investment in equipment is another factor, making necessary a long-time program in order that the cost of the equipment may be spread over a large number of lambs and not be a burdensome item in any one year.

Three fundamental factors underlie the success or failure of any lamb-feeding venture and these are: (1) the quality and type of lambs fed; (2) the general management and feeding; and (3) last but not least, marketing. The feeder can maintain satisfactory control over the first two factors but must take his chances to a certain extent on the latter, though careful study will be of assistance in getting all the advantages possible from the marketing conditions which exist.

Selecting Lambs

Lambs selected for feeding must be vigorous, though considerable variation in size and weight can be tolerated, this being dependent to a certain extent on market conditions. If the feeder wishes to market early, large growthy lambs should be obtained, whereas, if late spring marketing is desired, smaller lambs should be used. Smallness does not necessarily mean that the lambs are not healthy and vigorous, though care should always be used in selecting small lambs as very often the small size is definitely associated with some unfavourable condition which will make them poor feeders. The smaller and lighter lambs will require a longer feeding period to fit them for market, and therefore will consume greater total amounts of feed than the larger lambs; this should be considered in relation to the available feed supply of the feeder. While the total amount of feed consumed will be greater for a small lamb the feed required per pound of gain will usually be less, the difference being most marked early in the feeding period. Finishing, i.e., fat production, requires a greater amount of feed per pound of gain than is required for the same amount of gain in the form of growth. This indicates the economy of disposing of lambs as soon as they are suitable for market, as overfinishing will be at increasing cost per pound of gain.

If only a small number of lambs are fed, it is desirable to have them uniform in size and condition in order that they may finish more evenly and be sold in as few drafts as possible. Lambs do not finish at the same rate and, even in a group which is very uniform at the beginning of the feeding season,

some will be ready for market considerably earlier than others. As the cost of putting on a pound of gain increases materially as the degree of finish becomes greater, it is poor economy to overfinish lambs or hold them after they are prime for market even though the weight may not exceed market limits. In most of such cases, the cost of putting on gain in the feed lot is greater than the selling price per pound so that any excess finish will reduce the possible profit. Because of these factors it is practically impossible to sell all the lambs at one time, and regardless of whether 100, 500, or 1,000 or more lambs are on feed they must be sold in several drafts if the most satisfactory net returns are to be obtained. It must be remembered that fat lambs are practically in the class of perishable products for when they have reached a certain weight, preferably 90 to 95 pounds, but with a maximum of 100 pounds in the feed lot, they must be sold regardless of the selling price at that time. The price cuts in effect for over-weight lambs are usually so great that it is unprofitable to hold them even though an increase in the price level might occur.

Feeding and Management

Under the heading of management, several items must be considered and it may be just as well to start with the first seasonal point. It is the practice of many range men to keep the lambs on the range as long as possible in the fall, but often this is detrimental both to the rancher and to the feeder who buys the lambs. After October 1, there is very little fattening value in the grass on the range and the ewes are dry so the lambs make no real progress. In addition, severe storms often occur soon after that date and any one who has seen the effects of a two or three day storm on the lambs will realize that they would be better off in the feed lot where they would be getting some feed. Consequently it would appear advisable for the feeder to get the lambs as early as possible in the fall.

Many feeders have followed the practice of using the lambs to clean up stubble fields, beet tops and other semi-waste feeds before putting them into the feed lots. Variations of this practice include feeding a small amount of grain once daily, or feeding hay to the lambs on stubble. While the utilization of stubble and beet top in this manner may appear to be economical several factors tend to make this doubtful, at least under some conditions, and of first importance in this regard is the size of the lambs. If a rapid finish is required to make them ready for market without overweight, they should be placed in the feed lots at once and on a full feed of grain as soon as possible. The cut for unfinished or overweight lambs will over-balance any gain made by using stubble or beet tops. In addition, there is always the danger of the lambs developing sore mouths on rough stubble grazing. The only lambs for which this practice may be satisfactory are small lambs which it is desired to grow before finishing for a late market and so avoid the necessity of having to sell them at a time when the bulk of the fed lambs are going forward.

One of several plans can be followed in accommodating and feeding the sheep during the feeding period but the primary objects must be to keep them comfortable and on a maximum amount of feed and to keep equipment costs and labour requirements per lamb at a low point.

In planning a feed yard, careful attention should be given to the selection of a suitable site. It is particularly important to have a site with good surface drainage, i.e. with good slope, to prevent the yards from becoming quagmires during the periods of the year when snow melts or rains occur. The yards should be no larger than will comfortably accommodate the lambs to be fed and it has been stated that about ten square feet per lamb, exclusive of space required by feed racks and troughs, should be allowed.

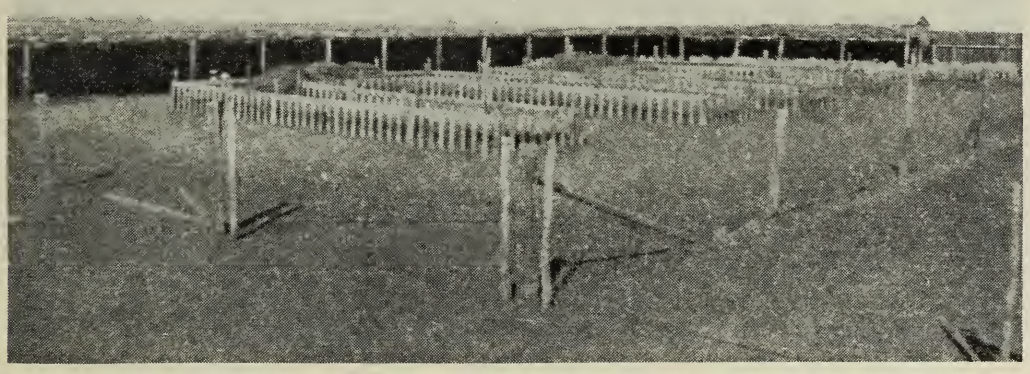
Shelter for the lambs will usually constitute the confining wall of the yards on at least part of two sides and the remainder can most cheaply be fenced with woven wire fencing. This should be of a medium mesh and should be high enough to prevent dogs from jumping into the corrals, as stray dogs can wreak untold damage in a feed lot. It has been found that expensive shelters are unnecessary under the climatic conditions which exist in Southern Alberta. As long as the lambs are protected from the prevailing winds by a tight fence or wall and kept well bedded no further shelter is required, though a roof is usually provided in permanent yards to keep snow off the bed ground. All the necessary shelter can be cheaply constructed with low grade lumber or with poles and straw but, in areas where heavy snowfalls or rains occur regularly, more expensive shelter must be provided.

A close-up view of a shelter in a farm feed lot in the Lethbridge district. The construction is simple and inexpensive. The brush cover is used to hold down the straw and this is quite essential to keep the straw in place in this district where strong winds are prevalent. The roof at the left of the picture had been covered but part of the straw had blown off.

A chute for cutting out lambs ready for market should be part of the equipment in all yards where a large number of lambs are being finished and this can be constructed easily and cheaply along one wall of the shelter.

Some feeders follow the practice of having the feed troughs and racks in the corrals with the lambs while others prefer to have only the hay racks in the corrals and have the grain troughs in a separate feed yard into which the lambs are turned twice daily for grain feeding. When a large number of lambs are being fed, they are usually kept in two or more groups and by using the separate grain feeding yard a smaller number of grain troughs are required, as the same troughs can be used for all groups. The type of troughs and feed racks used vary according to the method of handling and feeding followed. Several satisfactory types have been developed and plans of some of the more common of these will be found at the end of this section. The advantages and disadvantages of the various types of equipment and systems of feeding largely balance each other and the choice must be determined by several factors, including the number of lambs to be fed, the rate of grain feeding to be employed, and the personal preference of the feeder. The main point to be considered is that the arrangement must be such that the necessary feeding operations can be performed in the most convenient manner, thus ensuring a minimum of labour.

Water is of prime importance for successful lamb feeding. Mature sheep can do without water every other day if necessary but lambs consuming large amounts of dry feed must have water readily accessible at all times if they are to make rapid and economical gains. Very often lack of water is the one factor which spells failure to the feeder and, if full recognition is given to this



Views from farm feed lots in the Lethbridge district. Upper view shows a grain feeding yard with the corrals and shelters in the background. In this feed lot one grain feeding yard serves for two groups of lambs. Centre view shows a feed yard in which hay panels are used for hay feeding and grain is fed in a separate yard. Bottom view shows a yard in which a combination hay and grain rack is used. All these photos were taken in late spring when most of the lambs had been sold so only few lambs appear on the pictures.

most important point, success can almost be assured. Sufficient trough space should be provided so that there will be no crowding at any time. Tank heaters, though they add to the cost of equipment, are an economical investment and should be used during periods of cold weather to keep the water free from ice but no attempt should be made to unduly heat the water.

The practice of many feeders in the irrigated districts of using reservoirs as watering places cannot be too strongly condemned as a permanent practice. It appears to be a simple, cheap, and efficient manner of providing water but in practice it cannot be considered desirable, particularly if the small cost of other equipment is considered. In nearly all cases when reservoirs are used the lambs are forced to drink dirty water for a great part of the time. Before ice forms the water is made dirty by the lambs, and during the winter it is practically impossible to prevent manure, mud, and other foreign material, which is carried on to the ice by the lambs' feet, from running into the water when the ice melts during bright warm days which occur so regularly in the irrigated sections of Alberta.

A commercial feed lot operated by P. Burns & Co., at Lethbridge, where a a combination hay and feed rack is used.

The matter of feeding and choice of feeds will not be discussed in detail at this point as this subject has already been dealt with at some length in another section of this bulletin. Let it suffice to say that farm grown feeds in proper proportions will produce very satisfactory and economical gains. The use of wet beet pulp and beet molasses has become common in areas adjacent to the sugar factory and satisfactory results are being obtained from them.

When lambs are weaned off the range and placed in the feed lot they are subjected to a radical change and unless care is employed detrimental effects will result. During the first few days in the feed lot grain should be limited to no more than two or three ounces per lamb (oats are recommended) and this allowance should not be increased until all the lambs have learned to eat it. After that, increases in the grain allowance should be gradual but if the lambs are to be rapidly finished the increase to a maximum amount should be as rapid as the lambs will accept.

Grain can be fed to lambs at different rates with a maximum feed per day, when hand-fed, of somewhere near two pounds per head. More than this will be consumed by lambs being self-fed grain, particularly if hay feeding is somewhat limited, but self-feeding grain in this manner has not been found to be

entirely satisfactory. The rate of feeding to be used is dependent, for one thing, on the relative cost of hay and grain, and a reference to tables 3 and 5 in this bulletin will indicate the difference in cost of producing gain at various rates of grain feeding. These figures can serve as a guide in determining the cost of producing a pound of gain but the feeder must then determine or guess the best time of the year at which to market. In some cases, greater net returns might be obtained by using the more expensive method of feeding if it would result in getting the lambs on the market at a time when only few finished lambs would be available and a higher selling price would result.

If rapid finishing is desired, lambs must be fed a maximum of grain, and the feeding of lambs so that they will eat a maximum of grain and yet not go off feed is an art which must be developed by close and careful observation.

While oats cannot be considered a good finishing grain it is exceptionally suitable for starting lambs on feed. After the lambs are well started a gradual change should be made to the heavier grains, such as barley and wheat although oats form a satisfactory part of the finishing ration as long as they do not constitute more than one-third of the total by weight.

From the figures obtained in the feeding trials at this station, it can be stated that on the average the lambs required 6·9 pounds of roughage, 1·5 pounds of succulence and 3·7 pounds of grain to produce a pound of gain. For all groups fed without succulence the average requirement was 7·3 pounds of roughage and 3·7 pounds of grain per pound of gain made. These are average figures and the requirements for any one year might vary either above or below this figure and will be partly determined by the rate of grain feeding as well as by other factors. When a limited amount of grain is fed a proportionately greater amount of hay will be required.

From these figures it can be quite safely judged that for a gain of 30 pounds per lamb, 225 pounds of hay and 115 pounds of grain should be on hand for each lamb placed in the feed lots for finishing when full hand-feeding is to be employed.

In the area surrounding Brooks, tests with corn for "lambing down" have been conducted and some favourable reports have been recorded, although the practice has not yet come into general use.

Much has been said and written in recent years about the rôle of minerals in the ration for stock. Sufficient knowledge is not yet available to provide a basis for any definite recommendations for the use of minerals in the lamb fattening ration other than to state that salt is absolutely essential and should be kept before the lambs at all times. A trough raised off the ground so that the salt will not become dirty is the most desirable method of feeding. Bone meal was used in addition to salt one year at this station, but no conclusive results were obtained from its use.

Marketing

It is generally recognized that under normal price conditions the selling price per pound of the finished lamb should be greater than the purchase price of the feeder lamb. This difference or spread will vary from year to year, in fact in isolated instances the selling price has been less than the purchase price, but no definite rules can be stated with regard to the size of spread required to assure a profit to the feeder. Usually a low selling price per pound requires a greater spread than a high selling price though this depends to a certain extent on the cost of putting on the gains. It might be suggested that for a selling price of five cents or less per pound the spread should be from one to two cents, whereas at a higher selling price a smaller margin might be satisfactory.

Markets are factors of primary importance in the success or failure of a lamb feeding venture but fortunately they have been quite satisfactory in the majority of years under review in this publication. It is not feasible in

the scope of this bulletin to attempt to analyse the factors which must be considered in relation to marketing. Let it suffice to say that much information has been published regarding this subject and a close study of market conditions would no doubt be of benefit to the majority of feeders. The study of market fluctuations and conditions affecting such fluctuations has in the past been left too much to specialists, but in the future all feeders must be prepared to give more thought and attention to this subject if marketing of the finished product is to be reduced from a chance to a planned operation.

PLANS OF FEEDING EQUIPMENT

Mention has already been made of various types of equipment used in lamb feeding yards and for the benefit of prospective feeders and others, several plans are included on pages 33, 34 and 35. These plans should provide sufficient choice to meet any condition and the personal preference of the feeders.

The combination hay and grain rack can be used under nearly all conditions but will possibly serve its most useful purpose in the smaller feed lots, particularly where a feed such as ensilage is being fed. One disadvantage of the combination rack is that hay must be distributed at least once daily with a team and wagon, whereas, when hay panels are used for hay, it can be hauled at longer intervals. Another disadvantage of the combination racks is that they must be cleaned out quite frequently as it is impossible to feed so that no feed will be left, and if this is not cleaned out it will sour and the sheep will not feed properly. Despite these disadvantages combination racks are in considerable favour.

In the larger feed yards, and in some of the smaller yards as well, separate hay and grain feeding equipment is used. As the same grain troughs can be used for two or more groups of lambs the cost of equipment is lower than if combination racks were used. In addition, the time required for feeding the lambs is considerably reduced as hay need not be hauled every day but can be hauled at the most convenient time and small amounts moved in reach of the lambs every day.

To assist prospective builders of equipment the bills of material for the various items on plans 1 and 2 are given herewith:—

HAY PANEL—PLAN 1

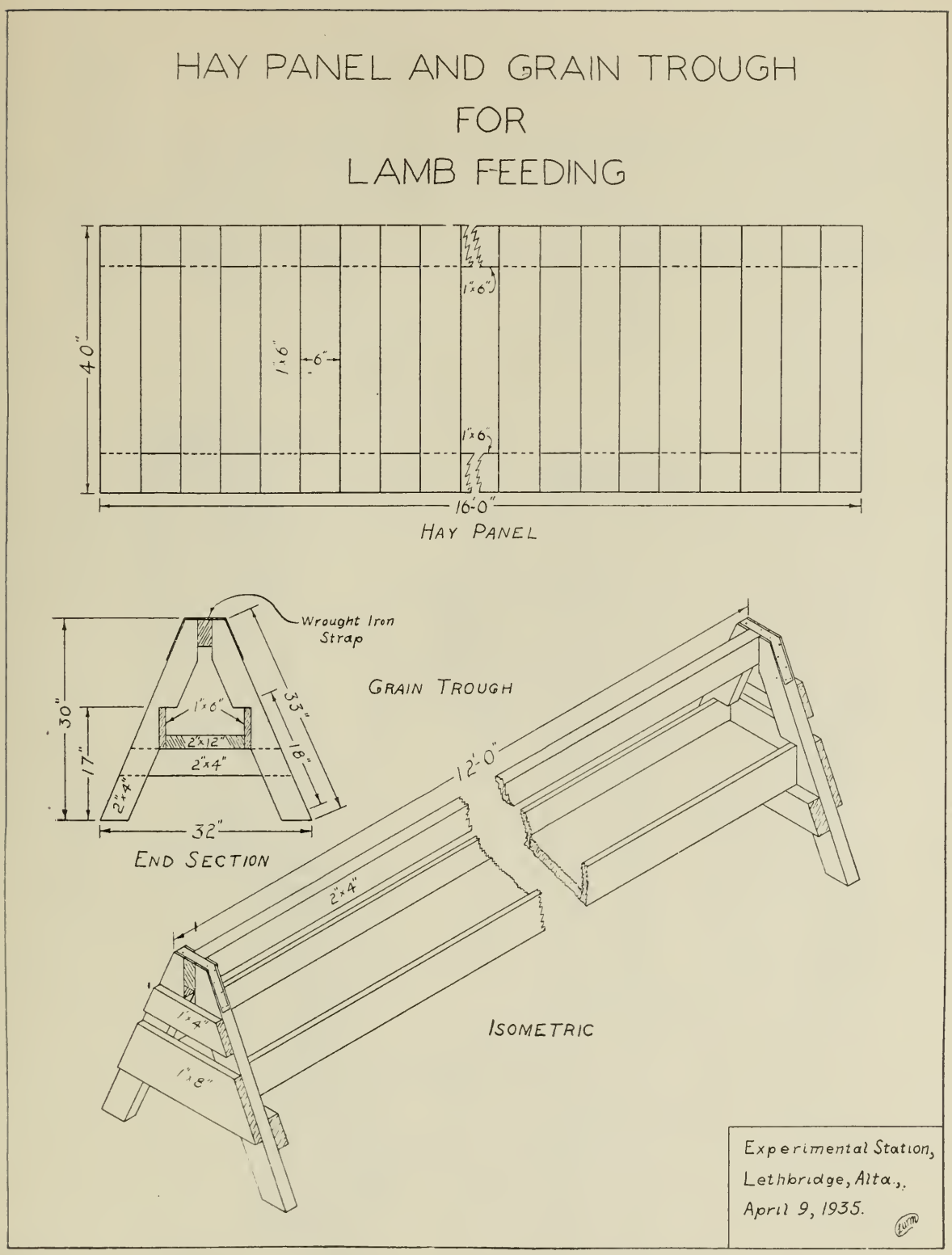
2 pcs., 1″ x 6″ x 16′
17 pcs., 1″ x 6″ x 40″

GRAIN TROUGH—PLAN 1

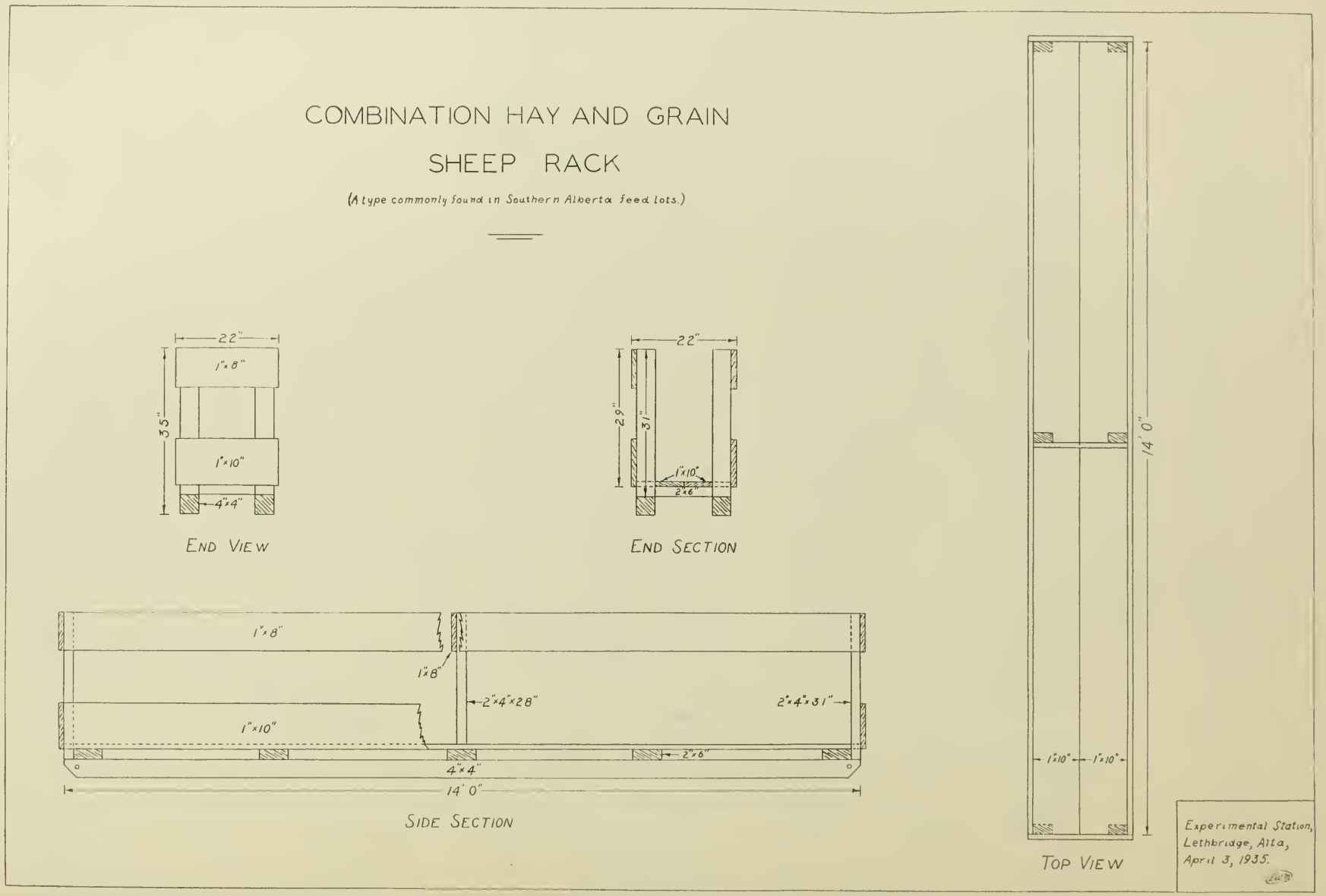
4 pcs., 2″ x 4″ x 33″
2 pcs., 2″ x 4″ x 26″
1 pc., 2″ x 4″ x 12′
2 pcs., 1″ x 6″ x 12′
1 pc., 2″ x 12″ x 12′
2 pcs., 1″ x 4″ x 13″
2 pcs., 1″ x 8″ x 24″
2 pcs. Strap iron 1¼″ x 18″

COMBINATION HAY AND GRAIN SHEEP RACK—PLAN 2

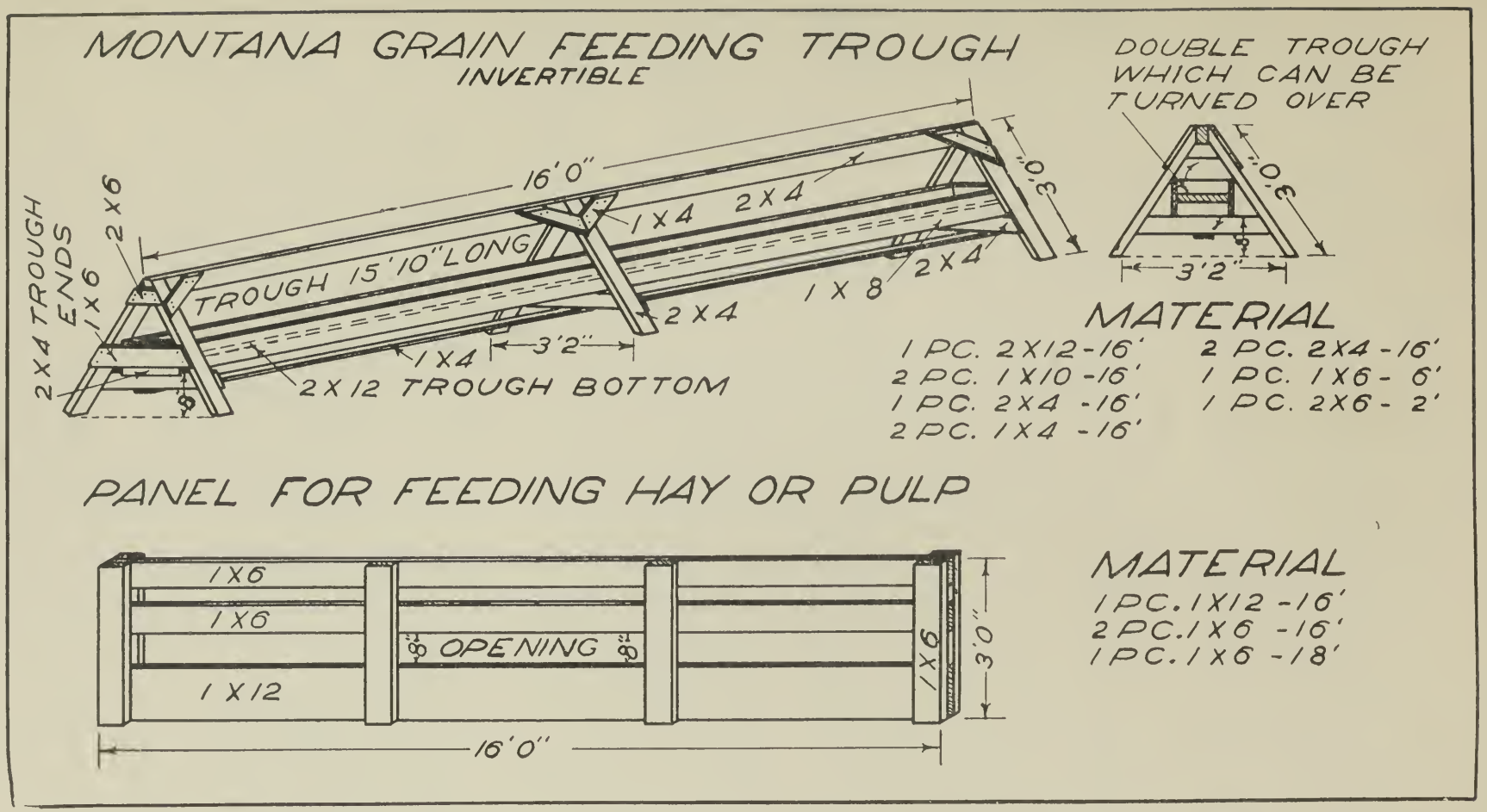
2 pcs., 4″ x 4″ x 14′
5 pcs., 2″ x 6″ x 20″
4 pcs., 1″ x 10″ x 14′
2 pcs., 1″ x 10″ x 22″
2 pcs., 1″ x 8″ x 14′
2 pcs., 1″ x 8″ x 22″
1 pc., 1″ x 8″ x 20″
4 pcs., 2″ x 4″ x 31″
2 pcs., 2″ x 4″ x 28″



Hay panel and grain trough for lamb feeding. These two items are often used in combination when hay and grain are fed separately. A series of panels as illustrated on page 29 can be made to accommodate any number of lambs.



Combination hay and grain sheep rack. This type of rack is used extensively and under certain conditions is quite satisfactory. It is comparatively inexpensive, easy to make, and with the runners or skids quite easy to move.



Hay panel and invertible grain trough. The type of trough illustrated above has gained favour in Montana feed lots and as it has many desirable features the courtesy of the Montana Experiment Station in permitting the use of this plan is greatly appreciated. A feature of special importance with this trough is that it is made so that either side may be used. When ice, snow, and litter accumulate in one side the trough may be turned over so that, on thawing, the refuse will drop out while the other side is being used.

UTILIZATION OF THE FOREST RESERVE FOR SUMMER SHEEP RANGE

This is a report on the procedure employed, the results obtained, and the conclusions drawn from a fourteen-year trial with the system of sheep production in which the sheep were pastured on the ranges of the Forest Reserve during the summer months and cared for during the fall, winter, and spring months under irrigation farm conditions.

A successful development of modern irrigation farming on this continent has been, and is yet, dependent on high soil productivity, and planned crop rotations emphasizing specialized crops. All of these factors imply the production of leguminous soil-improvement crops such as alfalfa and sweet clover, and the economical disposal of these crops through the medium of live stock. Furthermore, the consumption of roughage and other feeds by stock on the farm makes possible the return of considerable amounts of fertilizing elements to the soil. This minimizes the loss of the original soil fertility and also reduces the loss of any commercial fertilizer which may be applied. Therefore, if the irrigation farmer hopes to make a financial success of his business, it is essential that some class of roughage-consuming live stock be included in the general plan of production for the irrigation district.

Farmers following a well balanced rotation on irrigated land usually produce a liberal supply of winter feed such as alfalfa hay, sweet clover hay, corn, beet tops, etc. In addition, a large amount of feed annually goes to waste in grain and alfalfa stubble, and this waste can be materially reduced, if not entirely eliminated, by the use of sheep or cattle. Sheep in particular are well suited to this purpose, for, while they cannot be expected to thrive on waste and poor feed alone, they will consume and utilize large quantities of low quality hay, beet tops, stubble waste, etc. These products are generally unsaleable and when an additional income can be obtained from an otherwise waste product it assists greatly in making a business profitable.

For dairy farming or pure-bred stock raising, irrigated pastures can be used to advantage, but during the period of this trial it has appeared uneconomical to provide summer pasture on expensive irrigated land, except in special cases, for as much commercial stock as can be fed through the winter. Consequently, a large number of farmers with feed for disposal must purchase cattle or sheep for winter feeding which have been produced on cheaper range lands, or they must provide cheap summer pasture for stock which they wish to raise.

In the mountain ranges west of the irrigation block surrounding Lethbridge, a great abundance of summer feed annually goes to waste for lack of stock to consume it. This area is strictly a summer range as the type of vegetation which prevails and the weather conditions which exist during the winter make it practically impossible to winter stock there without shelter and feeding. Stock can be pastured to advantage on the mountain ranges during the summer, but due to the general topography of the terrain, the presence of timber and windfalls, and the type of vegetation which prevails, the higher mountain ranges are better suited to sheep than to cattle.

Due to the distinctive characteristics of the two areas, i.e., the irrigation district and the mountain ranges, it would appear that they might be complementary to each other, the mountain ranges to provide summer pasture and the irrigated district to supply winter feed. In theory this appeared to be logical but, in order to test it in practice, a trial was planned by the experimental station and arrangements were made in 1919 to conduct a long time trial to determine the practicability and economy of this method of production under

conditions which might normally be expected to vary from year to year. The general plan was to range sheep on the Forest Reserve during the four summer months of June, July, August, and September. They would then be pastured on grain and alfalfa stubble, beet tops and other waste feeds during the fall, winter, and spring when the weather would permit, and would be fed whenever necessary.

The original trial was begun in the fall of 1919, when 800 range ewes of Rambouillet breeding were purchased and added to a band of about 100 already at the station, and was concluded in 1928 when it was thought that sufficient information had been obtained. However, the radical change in financial conditions which was experienced subsequent to 1928 made it desirable to include later years in this report which covers the period to October, 1933.

Sheep Used

The sheep originally obtained for the trial were representative of the average range flock of predominantly Rambouillet breeding, and at the conclusion of the trial the band consisted largely of Rambouillets and a group of about 125 Corriedales. The Rambouillets were outstanding in type and quality as a result of careful selection of breeding stock and culling of undesirable individuals. During the course of the trial Oxford blood was introduced into the band on one occasion and Shropshire blood at another time. The sheep with the Down blood were improved in mutton characteristics but wool quality and yield were lowered and the ranging characteristics reduced. On the whole, it was found that the disadvantages of sheep carrying Down blood outweighed the advantages so they were considered unsatisfactory for range use and by the end of the trial had been eliminated from the band.

The average weight of fleeces from the sheep varied considerably during the duration of the trial. The introduction of Down blood led to a reduction in the average fleece weights, and annual variations were caused by several factors, including the amount of sand in the fleeces, changes from hand to machine shearing and vice versa, and also the proportion of mature ewes to yearlings in the band. The average fleece weights for 1931, 1932, and 1933, were 10·6 pounds, 9·2 pounds, and 10·8 pounds, respectively, which with one exception of 9·3 pounds, were the highest obtained during the fourteen years under review.

The Summer Range

Two different ranges were used during the years of the trial but as they were essentially alike a description of one will provide a fair picture of the other. The range used from 1920 to 1925, inclusive, was located almost due north of Coleman, Alberta, and covered a part of the Livingstone mountain range and adjacent territory. This range was very rough and not readily accessible so another range was obtained in 1926 and used till the end of the trial. This latter range was located a few miles west and north of Coleman and extended in a horseshoe-shape around the west, south, and east sides of the Crowsnest mountain.

The greater part of this range had been burned over by a forest fire in 1922 and when it was first taken over for grazing in 1926 very little new growth of trees had taken place. There was some green timber on the southern edge of the range, which had escaped the fire, but this area was used very little. The topography of the area was in general very rough with deep draws and gullies alternating with high steep ridges. Large and tangled windfalls, which became more numerous and extensive as the years went by, impeded the movement of the sheep and also reduced the grazing area. New growth of pine and spruce, as well as willows and poplars, appeared and gradually increased in extent

and superseded what had at first been grazing area. The estimate was made that there was a decrease of 40 per cent in the actual grazing area of the range from the time it was taken over in 1926 until 1933, the final year covered by this report.

A general view of the Crowsnest range as seen from the south with the Crowsnest mountain in the background. This picture was taken near the south edge of the reserve.

The vegetation found in the mountain areas differed radically from that of the prairies, and to a person inexperienced in mountain ranging it appeared to be of little value. Some native grass, called pine grass, grew extensively but this was not very palatable and was scarcely eaten by the sheep. Comparatively large areas of the range had fair stands of clover and timothy, the seeds of which had been brought in with the hay used in the logging camps which had operated there previous to the fire, and these provided excellent feed, but the largest volume of feed was supplied by peavine, vetches, fireweed, and other edible weeds. Some sustenance was also obtained by the sheep from the foliage of shrubs of various kinds particularly during short periods when snow covered the ground.

The full significance of the gradual reduction in grazing area, mentioned in an earlier paragraph, was not realized soon enough and the result was that the range was over-stocked and a change in the prevalence of the various types of plants took place. This was particularly true of the areas in closest proximity to the camp grounds as the sheep ranged over these in going to and from camp.

Views from the summer range showing different types of grazing areas found in the forest reserve used for the trial. Upper view shows sparse vegetation on a rocky slope. Centre view, a burned over area with very little new growth and with no shrubs nor trees. Note the fallen timber which takes up space and impedes grazing. Bottom view, sheep resting during the heat of the day on an area of sparse vegetation with no shade.

The topography of the range made it practically unfit for the one-night system of herding, in which permanent camps are not used and camps are changed daily, but the detrimental effects of the system employed and described below were quite evident. Rotational grazing appears to be a requisite of successful utilization of the mountain pasture, in order that annual plants may have an opportunity of reseeding, and it was particularly noticeable that peavines and vetches were gradually reduced in number from year to year, when they were not provided this opportunity.

A plentiful supply of water is a prerequisite of any good live stock range and in normal years the mountain ranges were well supplied with this necessity as the snow-fed streams and springs made it readily available, but in dry years, such as 1933, the smaller streams and springs dried up. This prevented the full utilization of the range as the distance the sheep could range from water was limited. This was doubly detrimental, as the growth of vegetation was also reduced, so that a larger grazing area was actually necessary but could not be utilized.

The climate of the mountains is quite different from that of the prairie. During the trial, frost occurred at practically all times of the year and snowstorms could be expected during any month, and almost every year they occurred as late as June and as early as September. However, the days were warm as a rule during the summer months, and growth of vegetation was rapid. After the first week in September, all growth usually ceased as heavy frosts occurred and this affected the vegetation so that from then on it was of value only for maintenance.

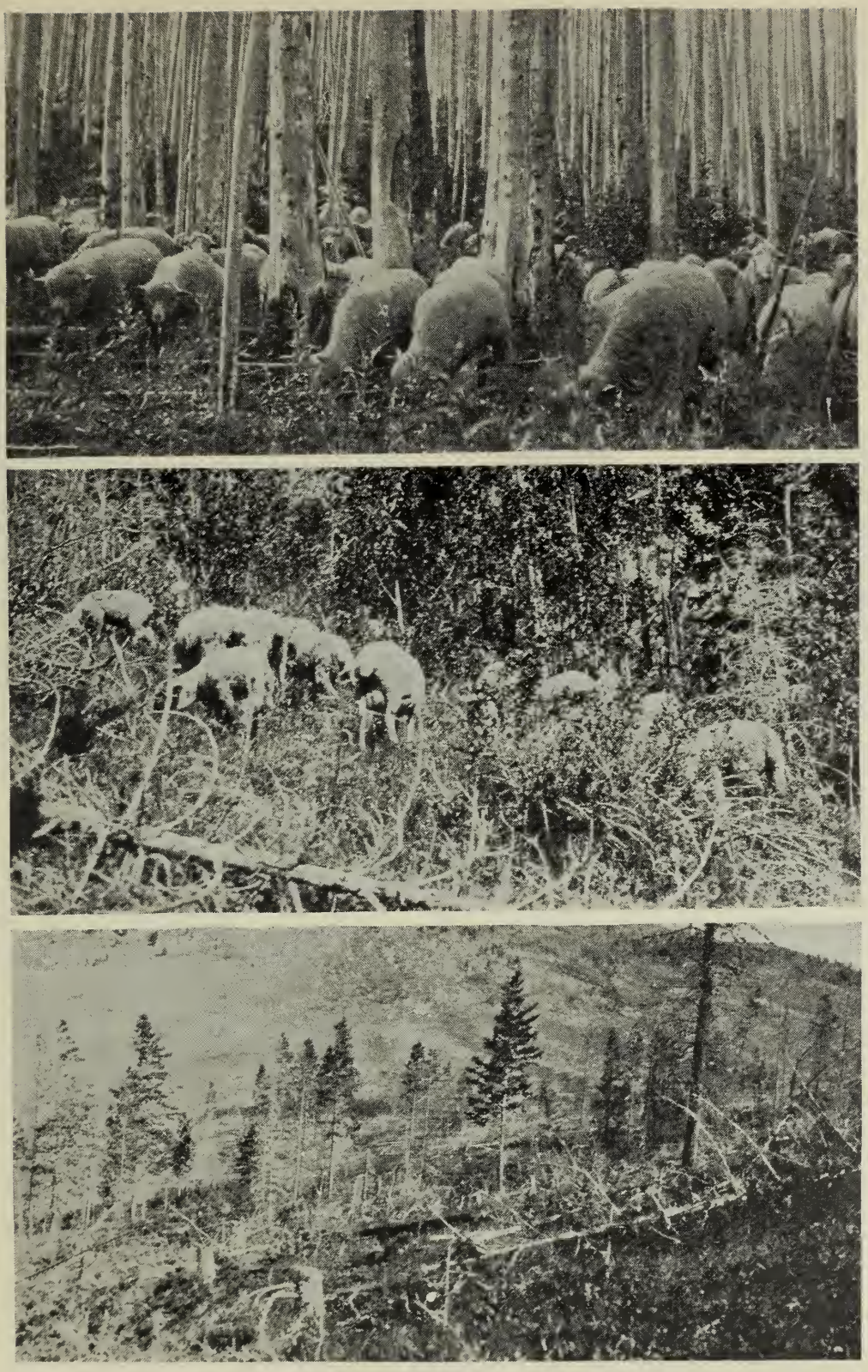
Seasonal Management

As the trial started in the fall of 1919 the financial year was from October to October, so in outlining the procedure followed in caring for the sheep it seemed logical to start when they were brought back from the summer range, usually early in October. They were at once turned out on grain stubble either at the station or on some neighbouring farm where pasture had been rented. Here they were kept until the middle of October when the ewe lambs and feeder lambs were removed from the band and the rams were turned in with the breeding ewes. The rams were left with the ewes for six weeks and were then removed for the remainder of the year.

During the breeding season, the main ewe band was maintained on stubble pasture, when weather permitted, and was fed hay and usually some grain if snow covered the ground sufficiently to prevent grazing. Smaller bands for special breeding work were fed in small corrals or fields. During this period the ewe lambs were either ranged in a separate band on stubble or confined to a corral and fed hay, but after the breeding season the ewe lambs and all the ewes were combined, until lambing time, when the ewe lambs were again separated. During the period between breeding and lambing, they were pastured on grain stubble and alfalfa stubble whenever possible and fed hay when the weather made it necessary. For the fourteen years of the trial the sheep were pastured on stubble on the average of 129 days each year and fed for 119 days.

Lambing started about the middle of March and continued through April. This was rather early in the year but it was necessary to have the lambs come at that time in order that shearing, dipping, and branding might be done before the sheep left for the mountain ranges. It also gave the lambs time to develop sufficiently to be able to endure the shipping by rail and the disagreeable weather which they often experienced in the mountains early in the summer.

For early lambing a good shelter was essential, so a large lambing shed, 140 feet by 64 feet, was built. This provided comfortable quarters for approximately nine hundred ewes even in cold and stormy weather, and was an important factor in making it possible to save a high percentage of lambs.



Views from the summer range in the Forest Reserve showing various types of vegetation and grazing areas. Upper view shows standing timber killed by fire. Fireweeds and other weeds are abundant and provide good feed. The trees will eventually blow down and form windfalls which will practically ruin the area for grazing. Centre view, young growth of poplar. Feed is limited in such areas as the shade depresses edible vegetation. Bottom view, a comparatively open area with some green timber, fallen timber, and unwooded slopes. Such an area provides good grazing.

While this building constituted an item of considerable expense and added to the overhead carrying charge for handling the sheep it was essential for successful early lambing and this method of sheep production could not have been followed without a good shed. The ewes which lambed were kept in pens in the shed for from ten days to two weeks after lambing and then both they and their lambs were allowed to be out of doors during good weather.

Sheep shed used for lambing at the Experimental Station. Lambs and ewes were kept in this shed for about ten days after lambing and were then given access to the yard.

During lambing time the ewes were fed hay, ensilage and grain in proportions determined to a large extent by their relative costs. This feeding was continued until the sheep were shipped to the mountains, although, in years of relatively high grain prices, grain was withheld after lambing and the amount of feed used was reduced considerably by pasturing the sheep during good days on pasture available at or near the station.

Between the conclusion of lambing and the time of shipping to the mountains the sheep were sheared, dipped, and branded. Shearing was usually completed by the middle of May and was always done by contract shearers. Blades were used in the first three and again in the last two years, while a double machine was employed in the remaining seasons. The price of shearing varied from a high of fifteen cents per ewe in 1928, 1929, and 1930, to a low of five cents in 1933, with fourteen cents being the common price previous to 1928. The first drastic reduction occurred in 1931, when ten cents per ewe was paid and this was further reduced to seven cents in 1932, and five cents in 1933.

Dipping took place about a week after shearing was completed and a warm, bright day was selected for this work. All sheep were dipped at this time except in one year, when, due to the small number of ticks in evidence, the lambs were not dipped. However, this was found to be unsound practice and after that year the lambs always had a bath with their mothers. In the early years it was found necessary to dip again in the fall but in the later years, when ticks had become a rarity, only one dipping annually was necessary. During the first years, coal tar products were used, but in the last few years a commercial powder dip was used with very satisfactory results.

The regulations governing grazing permits for the Forest Reserve required that all animals be branded with a distinguishing mark and, conse-

quently, the sheep were branded each year after they had been sheared and dipped. Ordinary blue branding paint was used and a large "EX" was placed high on the left side of all lambs and mature sheep.

The time of shipping the sheep to the mountains was largely determined by the weather which prevailed during the spring. A wet, cold, late spring retarded growth on the range so that no feed was available at an early date. The commonest time of shipping was early in June and in ten of the fourteen years under review the sheep were on the range before the 7th of June. The earliest date on record was May 29 and the latest June 24, with other late dates being June 9, 12, and 21.

The two earliest dates of return from the summer range were September 27 and 28 and the latest was October 9, with the most common time being the first week in October. The longest pasture period was 128 days and the shortest 103 days, while the average was 117 days for the fourteen years of trial. The cost of the pasture was 8 cents per head for the summer for mature sheep while no charge was made for lambs.

Double-deck cars, with shippers' decks, were used for transporting the sheep by rail and the loading always took place in the late afternoon or early evening so that the sheep might travel during the cool of night. They arrived at their unloading point the following morning and were at once unloaded and moved out on the range. Due to the early lambing the lambs were large and strong enough to endure the hardships of shipping without serious losses; in fact, death losses in shipping occurred only on two occasions, but no direct cause could be ascribed in either case.

When the Livingstone range was used the sheep were unloaded in the town of Coleman and trailed about three miles to the boundary of the summer range. The vegetation of the intervening territory included some poisonous plants, and as the sheep were hungry when unloaded and consequently not discriminating in their choice of feed, some usually died each year, due to the consumption of these plants. When the Crowsnest range was used the sheep were unloaded at Sentinel, a siding about five miles west of Coleman and about three miles from the main camp, but good grazing was available all the way to camp and no difficulty was experienced in covering this distance by mid-afternoon. The sheep were permitted to graze all the way but no losses occurred as on the first range used.

The range was divided into several districts, each with its camp site near a water supply, but it was only at the main camp that a corral and cutting chute was maintained. This was used for cutting out lambs and sheep for sale during the time they were on the range. The size of the areas served by each camp depended on the nature and abundance of the vegetation and the ease of access to it, the length of time each camp was used each year being determined by the same factors. Some of the better areas could be grazed twice each year while those higher up and largely covered with peavine and fireweed could only be used once.

Two men and their dogs accompanied the sheep during the summer. Dogs were absolutely essential to successful herding of sheep in the mountains as the sheep were often lost from sight in rough areas and the nature of the terrain made it impossible for a man to keep them under control without assistance. A barking dog was particularly desirable in gathering the sheep when the band was spread out for grazing and the sheep were hidden from view by trees, shrubs, rocks, or windfalls. In fact it would be sheer folly to attempt to range sheep on a mountain range without the assistance of at least one good dog.

One of the men accompanying the sheep was the herder, a permanent employee, who looked after the sheep all year. The other, a seasonal employee, was the camp tender, whose duties were to move camp whenever necessary,

obtain supplies, do the cooking and at times take a turn at herding. Their equipment consisted of a tent, a teepee, necessary bedding, cooking utensils, and supplies. Two pack horses were usually provided to move camp from place to place as moves were necessary to provide fresh grazing for the sheep. These horses were always kept shod as the nature of the soil surface made this necessary.

Supper time. Sheep dogs used on the range for herding the sheep.

The sheep bedded down at night on the bed ground surrounding the camp site, where salt was provided to induce them to come into camp and remain there at night. When daylight came they began grazing and the herder followed them out on the range, usually taking a lunch with him for noon if he was going far from camp, but if his day's range was not far from camp, the camp tender came out and relieved him at noon while he went for lunch. The sheep grazed freely during the morning and early forenoon and then rested during the heat of the day until late afternoon, when they again started grazing and the herder headed them towards camp so that no time or energy would be wasted in a long drive back to camp at night. Sometimes, if a good but small grazing area was far from the camp site the herders took the teepee and a few supplies and moved out from the camp for a day or two to utilize this area.

The grazing route followed by the sheep during the summer was alternated from year to year to prevent grazing the same area at the same time each year, the purpose of this being to give the annual plants an opportunity of reseeding occasionally. However, the number of sheep utilizing the range was too great and no areas could be avoided entirely, any year, with the inevitable result that the range was overgrazed and gradually depleted. In an attempt to partially remedy this condition the area of the reserve which had not been burned and had not previously been used was taken into use in 1932, but this had disastrous results as poisonous weeds grew there in considerable numbers and eighty sheep were killed at one time by these, so the area was again abandoned.

In the general plan of grazing, the areas farthest removed from the main camp and the railway were reached during July and August and as the time for return to winter quarters approached the sheep were ranged on areas nearer the railway. During the first year or two this practice was not followed, with the result that one year a September snowstorm caught the sheep at the remotest area of the range and great difficulty was experienced in getting them out without losses.

As the ram lambs raised from a limited number of pure-bred ewes were shipped to the mountains with the main band of grade ewes in the spring it was necessary to remove them before fall to prevent any breeding taking place. As a rule they were taken out about the middle of August as it was found to be unsafe to leave them with the ewes any later. When removed from the main band they were transported to the station and placed on a pasture there.

In favourable years it was possible to sell a carload or two of fat lambs directly off the range in August or September. This was particularly true in the first years while in the later years of the trial the lambs did not acquire sufficient finish to be classed as fat lambs and, consequently, had to be sold as feeders. One reason for this was the depletion of the more desirable types of vegetation on the range, which prevented the lambs from acquiring the necessary finish. A factor accentuating this condition was the comparatively dry years which were experienced during the latter years of the trial. Another factor of some importance in this regard was the change from sheep of Oxford and Shropshire breeding to sheep of predominantly Rambouillet blood. Rambouillet lambs were slower in developing and did not put on fat as readily as did lambs sired by Oxford or Shropshire rams.

As previously mentioned, frosts occurred early in the fall in the mountains and after the middle of September the vegetation was usually frozen so much that it was deprived of its succulency and had lost its fattening value for lambs. As a consequence, if the lambs were not fat by that time they came off the range as feeder lambs although the ewes could maintain and even gain in condition on such feed.

The following outline, compiled from available records, provides a fair indication of the general movement of the lambs off the mountain range to market.

	pounds
1920—August 24—250 lambs—Calgary off car	73
1921—August 20—251 lambs—Calgary off car	71
1922—August 24—222 lambs—Calgary off car	66.6
1924—No lambs sold from the range.	
October 17—365 at Lethbridge	81.8
1925—No lambs sold off range.	
October 24—209 at Lethbridge	92.58
1926—August 14—200 off car Calgary	85.55
September 11—204 off car Winnipeg	82.06
1927—August 26—228 off car Calgary	80.57
1928—No lambs sold off range.	
October 30—116 at Lethbridge	86.18
1929—September 6—106 at Lethbridge	81.32
Some ewes were also sold.	
1930—September 11—280 feeder lambs—Lethbridge	70.50
1931—No lambs sold off range.	
1932—September 21—240 feeder lambs—Winnipeg	75.94
1933—September 28—225 short keeps off car Lethbridge	80.89

Generally speaking, lambs came off the mountain range with better finish than the average lambs from the prairie ranges. This was no doubt due to the greater succulency of the vegetation in the mountains, which had the effect of increasing the milk production of the ewes, as well as of providing high quality grazing for the lambs.

The day before the main band was to be shipped home in the fall it was moved to the camp nearest the railway, if it was not already there. On the day of shipping the sheep were started from camp early in the morning and permitted to graze their way to the railway where they arrived by mid-forenoon. Loading started about noon and required from one and one-half to three hours, depending on the number of sheep to be loaded and the readiness with which they entered the cars. Loading and unloading at Sentinel were not difficult operations, as a chute had been built by the railway company for this purpose.

The train carrying the sheep generally left Coleman in the late afternoon and arrived in Lethbridge shortly before midnight. The sheep were unloaded the following morning and turned on the stubble pasture for fall grazing. No losses were ever incurred in shipping the sheep back from the range.

Losses of sheep were anticipated and some deaths occurred every year on the range. The average loss for the summer months was 3·15 per cent for mature sheep and 4·53 per cent for lambs or a loss of 3·76 per cent for all sheep. This was based on a total of 20,135 sheep shipped to the mountains and a total loss of 758 head. As might be expected the total loss of lambs was higher than that of ewes, though in some years the loss of ewes was higher than that of lambs, but as a whole the losses could not be considered abnormal. Losses differed considerably in number from year to year and had a great variety of causes. The lightest loss was experienced in 1931 when 2·08 per cent of the ewes and 0·91 per cent of the lambs, or 1·18 per cent of the total sheep were lost. The highest loss was in 1932 when 4·32 per cent of the ewes and 10·09 per cent of the lambs, or a total of 6·56 per cent of the sheep died. This heavy loss was due to poisonous weeds and practically all occurred at one time. Very few losses occurred by the sheep straying from the band but among the causes of death losses may be mentioned the following:—

1920—September 23. A heavy snowstorm at night caused the sheep to pile and twenty-three were smothered.
1925—Three ewes and 15 head of lambs died on one deck during shipment to mountains—no reason suggested in the report.
1933—Nine lambs died during shipment to mountains. No reason could be ascribed.

These were the only losses incurred in shipping.

1923—Ten died from poison the first night.
1925—Three died from poison the first night.
1928—Heavy losses due to sheep piling at night after being frightened by coyotes.
1932—Exceedingly heavy loss due to poisonous weeds. About 80 lost at one time.

In addition to these exceptional instances occasional sheep died from poisonous weeds, snagging, bad udders, general debility, and possibly a few of old age.

Financial Statement

Now that the practical side of this method of sheep production has been discussed, a survey of the economics of the method seems in order, for the final decision on the feasibility of the method must be determined by the financial statement. The period of time covered by the trial has been one of extremes, as agricultural products have been at both maximum and minimum values. The sheep producers have felt keenly the changes which have taken place and the financial results of this trial have been influenced by the same forces.

In arriving at the inventory value of the flock each fall the average price prevailing was credited to each class of sheep on hand, but in the financial statement embodied in this report only the ewe values have been shown individually, though the total value of all sheep is given. The value of ewes varied from a high of $13.25 in 1928 to an extreme low of $3.50 in 1932, with other classes of sheep following in sympathy and wool prices showing similar extreme fluctuations. In some respects it would have been more desirable, for the purpose of this report, to have maintained a set unit value for each class of sheep and shown a profit or loss on production only. However, in order to follow the practice of the sheep producers it was necessary to include inventory appreciations and depreciations.

For the first nine years covered in this report accurate accounts were kept of all expenses and returns. However, the remaining five years were an unplanned continuation of the trial and no separate accounts were kept for this project during that time, so the total expenses for these years are partly an estimate. For the last five years the summer range was only used as a means of maintaining the sheep for other experimental purposes and not for testing the feasibility of this method of production. Estimates of the feed consumption for each of these years were based on the average consumption per sheep for the first nine years and the number of sheep carried through the winter in each of the last five. The cost of feed for each year was determined from these estimates and the actual unit feed cost for each particular year. Consequently, the total cost of feed for these five years would be a very close approximation of the actual cost. The expense items of labour charges, shearing costs, freight, summer pasture, and purchase of stock were accurately ascertained from the station records of disbursements and returns from the sale of sheep and wool were also accurately ascertained from the revenue ledger. In this manner a satisfactory expense and income as well as profit and loss account was obtained for the last five years.

During all except the last year of the trial, the number of breeding ewes was maintained at between 800 and 900 head, but considerable variation occurred from year to year in the number of ewe lambs kept for replacement as well as in the number of feeder lambs on hand in the fall. Consequently the number of sheep at inventory time each fall showed some rather extreme differences.

In order to facilitate the study of the economical aspect of this method of production, a fairly detailed account of expenditure and revenue for a full year is presented herewith. One of the early years of the trial, 1922, was chosen for this purpose and can be considered to be fairly representative of an average for the period.

TABLE 13—ITEMIZED ACCOUNT OF EXPENDITURE AND REVENUE FOR 1922

The expenses for the year were as follows:	
Winter pasture on stubble fields	$ 856 37
Alfalfa hay, 56·7 tons at $10 per ton	567 00
Alfalfa hay (mostly weeds, very low grade), 10 tons at $5 per ton	50 00
Russian thistles, wheat and other poor roughage, 7·8 tons at $4 per ton	31 20
Oat sheaves, 2·2 tons at $10 per ton	22 00
Silage, 82·85 tons at $4 per ton	331 40
Grain, whole oats and barley, 11·44 tons at $27.50 per ton	314 60
Whole oats, 4·4 tons at $30 per ton	132 00
Salt, 1·75 tons at $32.50 per ton	56 87
Summer pasture on Forest Reserve	89 00
Total freight to and from Forest Reserve	690 24
Shearing, including hire of machine	154 78
Purchase of 9 bucks	190 00
Labour, total for 12 months	1,724 93
	$ 5,210 39
Inventory, October, 1922, and current year's expenses:	
Number of ewes to be bred, 826, valued at $6.50	$ 5,369 00
Number of cull ewes to be sold, 337, at $3.25	1,095 25
Number of ewe lambs on hand, 315, at $6	1,890 00
Number of wether lambs on hand, 222, at $5	1,110 00
Number of bucks on hand, 15, at $25	375 00
Expenses, October, 1922, to October, 1923	5,210 39
	$15,049 64

TABLE 13—ITEMIZED ACCOUNT OF EXPENDITURE AND REVENUE FOR 1922—*Concluded*

Sales:	
468 ewes, net receipts	$ 2,876 92
454 lambs, net receipts	4,727 66
7 bucks, net receipts	64 15
Net wool receipts, less dip and supplies	2,311 65
Inventory, October, 1923:	
Number of ewes to be bred, 901, at $8	$ 7,208 00
Number of ewe lambs on hand, 133, at $7	931 00
Number of feeder lambs on hand, 302, at $6.50	1,963 00
Number of bucks on hand, 17, at $15	255 00
	$20,337 38
Profit	$ 5,287 74

From this it will be seen that a great deal of low grade roughage was included in the winter ration, thereby providing a return for a low quality product which would be difficult to sell. On the other hand it should be observed that under proper farming conditions such low grade roughage should not be produced to any considerable extent. Another point to observe is the credit for winter pasture. Some of this was actual expenditure for the rent of pasture on neighbouring farms but a credit of considerable amount would accrue annually on the average farm.

As a further guide in analysing costs under this method of production it can be stated that the average annual consumption per sheep of the various feeds for the duration of the trial were as follows: hay 230 pounds, silage 141 pounds, grain 34 pounds. The maximum consumption in any one year was: hay 324 pounds, silage 216 pounds, grain 50 pounds. The minimum consumption was: hay 97 pounds, silage 88 pounds, grain 26 pounds. In the year of maximum consumption the credit for pasture was relatively low as the winter was such as to prevent much pasturing. Conversely in the year of minimum consumption the credit for pasture was comparatively high.

In order to provide a comprehensive review of the financial possibilities of this method two statements covering the entire trial have been prepared. One is an annual financial statement condensed from the itemized accounts as illustrated in table 13, and the other is a summary of profits and losses for the fourteen years of the trial.

ANNUAL FINANCIAL STATEMENT OF SHEEP PASTURING IN FOREST RESERVE

Inventory, October, 1919		$10,050 00
Expenses, October 1, 1919, to September 30, 1920		6,572 08
		$16,622 08
Sales, October 1, 1919 to September 30, 1920	$ 4,864 62	
Inventory, October, 1920	7,431 00	
	$12,295 62	
Loss	4,326 46	
	$16,622 08	$16,622 08
Inventory, October, 1920 (ewe values $6.25)		$ 7,431 00
Expenses		4,452 19
		$11,883 19
Sales, October 1, 1920 to September 30, 1921	$ 3,635 07	
Inventory, October, 1921	7,898 00	
	$11,533 07	
Loss	350 12	
	$11,883 19	$11,883 19

ANNUAL FINANCIAL STATEMENT OF SHEEP PASTURING IN FOREST RESERVE—*Continued*

Inventory, October, 1921 (ewe values $6)		$ 7,898 00
Expenses		4,722 88
		$12,620 88
Sales	$ 4,248 62	
Inventory, October, 1922	9,839 25	
	$14,087 87	
Profit		1,466 99
	$14,087 87	$14,087 87
Inventory, October, 1922 (ewe values $6.50)		$ 9,839 25
Expenses		5,210 39
		$15,049 64
Sales	$ 9,980 38	
Inventory, October, 1923	10,357 00	
	$20,337 38	
Profit		5,287 74
	$20,337 38	$20,337 38
Inventory, October, 1923 (ewe values $8)		$10,357 00
Expenses		5,881 78
		$16,238 78
Sales	$10,530 40	
Inventory, October, 1924	14,515 00	
	$25,045 40	
Profit		8,806 62
	$25,045 40	$25,045 40
Inventory, October (ewe values $12)		$14.515 00
Expenses		6,222 95
		$20,737 95
Sales	$13.035 92	
Inventory, October, 1925	14,705 00	
	$27,740 92	
Profit		7,002 97
	$27,740 92	$27,740 92
Inventory, October, 1925 (ewe values $13)		$14,705 00
Expenses		6,274 28
		$20,979 28
Sales	$10.469 35	
Inventory, October, 1926	13,523 50	
	$23,992 85	
Profit		3,013 57
	$23,992 85	$23,992 85
Inventory, October, 1926 (ewe values $13)		$13,523 50
Expenses		6,299 54
		$19,823 04
Sales	$ 9,246 09	
Inventory, October, 1927	14,686 25	
	$23,932 34	
Profit		4,109 30
	$23,932 34	$23,932 34

ANNUAL FINANCIAL STATEMENT OF SHEEP PASTURING IN FOREST RESERVE—*Concluded*

Inventory, October, 1927 (ewe values $13)		$14,686 25
Expenses		5,622 88
		$20,309 13
Sales	$ 5,713 38	
Inventory, October, 1928	16,676 35	
	$22,389 73	
Profit		2,080 60
	$22,389 73	$22,389 73
Inventory, October, 1928 (ewe values $13.25)		$16,676 35
Expenses		5,911 30
		$22,587 65
Sales	$ 7,249 90	
Inventory, October, 1929	13,406 48	
	$20,656 38	
Loss	1,931 27	
	$22,587 65	$22,587 65
Inventory, October, 1929 (ewe values $10)		$13,406 48
Expenses		5,840 07
		$19,246 55
Sales	$ 5,250 26	
Inventory, October, 1930	12,166 10	
	$17,416 36	
Loss	1,830 19	
	$19,246 55	$19,246 55
Inventory, October, 1930 (ewe values $8.50)		$12,166 10
Expenses		4,945 31
		$17,111 41
Sales	$ 4,014 46	
Inventory, October, 1931	7,838 50	
	$11,852 96	
Loss	5,258 45	
	$17,111 41	$17,111 41
Inventory, October, 1931 (ewe values $5)		$ 7,838 50
Expenses		4,779 16
		$12,617 66
Sales	$ 4,481 24	
Inventory, October, 1932	3,919 45	
	$ 8,400 69	
Loss	4,216 97	
	$12,617 66	$12,617 66
Inventory, October, 1932 (ewe values $3.50)		$ 3,919 45
Expenses		3,033 14
		$ 6,952 59
Sales	$ 2,678 67	
Inventory, October, 1933	2,841 75	
	$ 5,520 42	
Loss	1,432 17	
	$ 6,952 59	$ 6,952 59

STATEMENT OF PROFITS AND LOSSES FOR THE FOURTEEN YEARS IN WHICH SHEEP WERE PASTURED ON THE FOREST RESERVE

	Profit	Loss
1919-20		$ 4,326 46
1920-21		350 12
1921-22	$ 1,466 99	
1922-23	5,287 74	
1923-24	8,806 62	
1924-25	7,002 97	
1925-26	3,013 57	
1926-27	4,109 30	
1927-28	2,080 60	
1928-29		1,931 27
1929-30		1,830 19
1930-31		5,258 45
1931-32		4,216 97
1932-33		1,432 17
	$31,767 79	$19,345 63
Total profits	$31,767 79	
Total losses	19,345 63	
Gross profits	$12,422 16	
Difference in inventory value	$ 7,208 25	
Net profit	$ 5,213 91	

An analysis of the first statement indicates that a large part of the profits shown was due to appreciation of the inventory values and conversely a large part of the losses shown was due to depreciation of the inventory values. Total expense and total income showed great variation from year to year and it is interesting to note that some of the greatest profits were shown during years of greatest expense. This was not always the case but the chances of showing a profit were better in years of great expense as the returns obtained were usually proportionately larger for the same years.

The gross profit shown in the summary statement is the difference between total profits and total losses. From this is deducted the difference in inventory value of the sheep on hand at the beginning of the trial and this gives a net profit of $5,213.91. In computing expenses no charges were made for buildings, equipment, depreciation, interest, and supervision, so these charges must be met from the net profit shown. It is quite apparent that $5,213.91 cannot cover these charges over a period of fourteen years so that actually a loss has occurred on the operations for that period.

However, there are two factors in the financial statement which must be given further consideration in order that a true picture of the situation may be presented. One of these is the returns from stubble pasture and the other is the item of freight charges. The total amount charged in the expense account for winter pasture during the fourteen years was $8,690.45. As the size of the band used for this trial was far too large to be wintered on the station the greater part of this amount was actual expenditure for rental of pasture but it does indicate a return to neighbouring farmers for a waste product. However, the band can be considered as a composite of several small bands owned by several farmers and the charge for pasture considered as a credit for a waste product.

Viewed in that manner a credit of $8,690.45 should be added to the profit of $5,213.91 shown in the statement or a profit of $13,904.36 for this method of production.

This is practically $1,000 per year but from this must be deducted the items of interest on investment, sheep, buildings and other equipment, depreciation on buildings and equipment, and a charge for supervision. With interest at six per cent the total interest charge on the sheep for the fourteen

years, based on inventory values each fall, was $9,420.71. Buildings and equipment were valued at $4,800 on which the annual interest and depreciation charges were $384, or a total for fourteen years of $5,376. Interest charges, therefore, totalled $14,796.71, or more than the total profit without providing any returns for supervision.

A second item which should be considered before the final decision is made with regard to the financial possibilities of the method is that of freight charges for shipping the sheep to and from the mountains. The total expenditure on this account for the fourteen years was $8,937.47, or an average of $638.53 per year. The rate varied, but was around 20½ cents per hundredweight plus the usual charge for cleaning cars. If this cost should be largely eliminated by trailing the sheep to and from the summer pasture the profits would be increased accordingly. However, some of the practical difficulties involved in trailing, particularly if it became widespread practice, would be quite serious and would require considerable attention.

Summary and Conclusions

While no real practical difficulties were encountered in the method of sheep production under review the financial results were not entirely favourable for the full period. The results of the trial have indicated that the item of transportation costs has been an important factor in limiting possible profits. If suitable avenues of approach to the range were available so that the sheep could be trailed from the irrigated districts to the summer pastures in the mountains, thereby eliminating the cost of rail transportation, the combination of the two sections could possibly be successful. The accessibility of the forest reserve ranges is limited, as a large area of occupied land intervenes between the irrigated district and the ranges. This has been successfully negotiated by isolated bands but, if the movement were to become general, special arrangements not now in effect would have to be made in order to avoid trouble between the sheep owners and the owners of the occupied land.

Possible Use for The Mountain Range

It appears that the Forest Reserve range will be of greatest importance as an emergency range in years when, for one reason or other, there is an acute shortage of summer feed on the prairies. Experience has shown that in such years the mountain range can be of real value to ranchers, who without this reserve would be faced with a serious pasture shortage and might be forced to liquidate their holdings.

Farm sheep production on the irrigated farms apparently will have to depend largely on feed raised on the farms, or else prairie range, in close proximity to the irrigation block, will have to be used for summer pasture. For the utilization of surplus feed the farmers apparently will have to depend largely on the obtaining of feeder lambs and cattle produced on the cheap range lands for feeding during the winter.

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