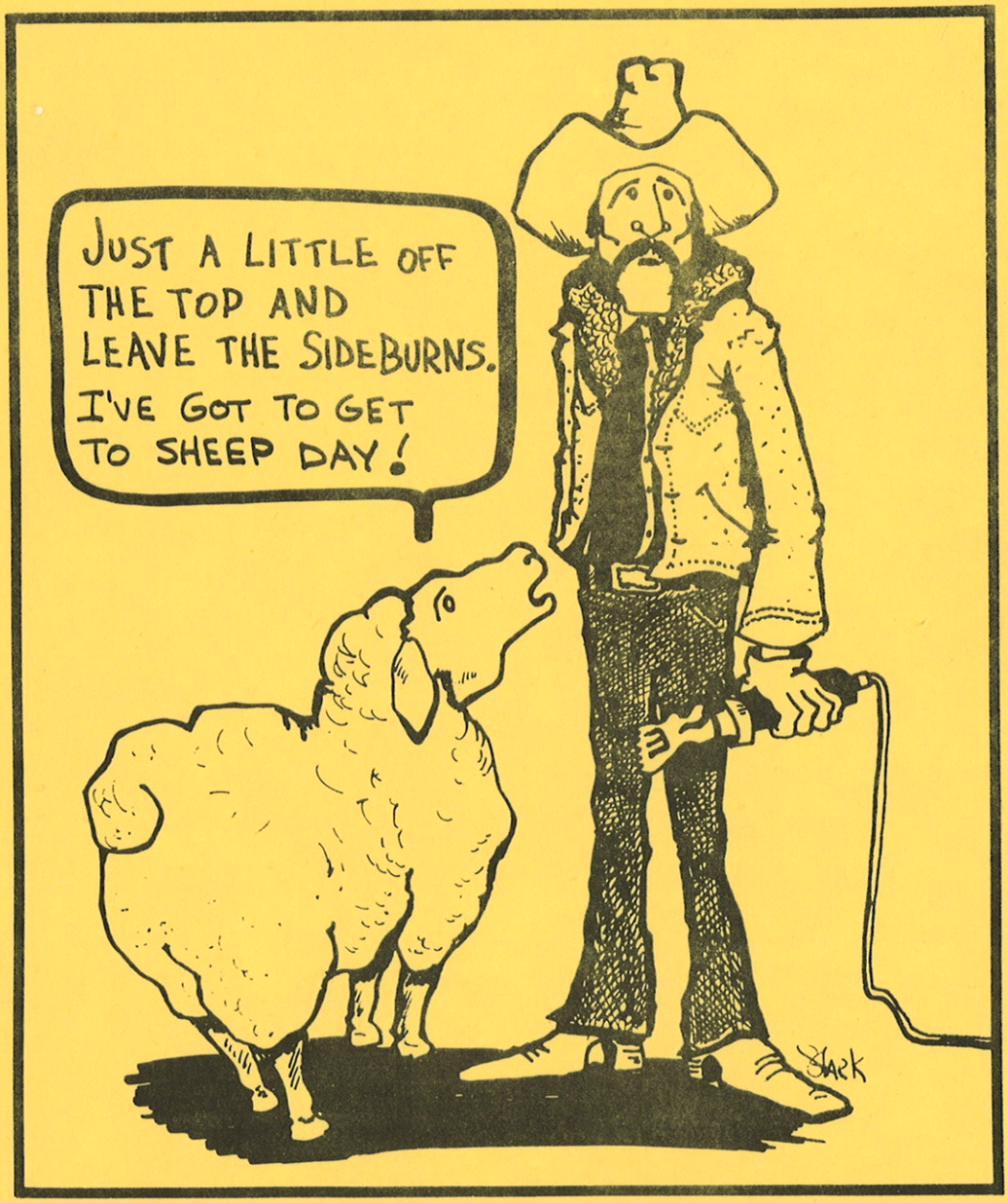
22nd ANNUAL
WESTERN DAKOTA
SHEEP DAY

WEDNESDAY, FEBRUARY 11, 1981, HETTINGER ARMORY



TIMOTHY C. FALLER, SUPT.

HETTINGER BRANCH EXPERIMENT STATION
NORTH DAKOTA STATE UNIVERSITY

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P R O G R A M

10:15 a.m.	Coffee BOW WOWS AND BOOM BOOMS Rick Severson Bureau of Sport Fisheries and Wildlife Bismarck, North Dakota
11:00 a.m.	PROGRESS REPORTS Hettinger Station Reports Timothy C. Faller Superintendent Fargo Station Reports Prof. Merle Light Animal Science Dept. North Dakota State University
12 Noon	LUNCH: Roast American Lamb Dinner
1:15 p.m.	WELCOME Dr. H. R. Lund, Director Agriculture Experiment Station North Dakota State University
1:30 p.m.	PROTEIN LEVELS FOR FINISHING LAMBS Dr. Duane Erickson Animal Science Dept. North Dakota State University
1:50 p.m.	LIVESTOCK RESEARCH -WHERE IS IT? Clayton Haugse, Chairman Animal Science Dept. North Dakota State University
2:10 p.m.	PRODUCTION RECORDS - HOW TO USE THEM Glenn Brown, Rancher Buffalo, South Dakota
2:40 p.m.	EARLY LAMB NUTRITION AND MANAGEMENT Dr. Frank Hinds Animal Science Dept. University of Wyoming Laramie, Wyoming
3:30 p.m.	Drawing and Coffee

* There will be a "Ladies Program" beginning at 1:30 p.m. at the Hettinger Armory

SHEEP DAY DIGEST

by
Timothy C. Faller, Supt.
Hettinger Experiment Station

SECTION I

Reports of

Research in Progress

at the

Hettinger Experiment Station

Presented by

Timothy C. Faller
Superintendent

Dr. Paul Berg
Animal Science Department
North Dakota State University

Dr. Duane Erickson
Animal Science Department
North Dakota State University

Professor Merle Light
Animal Science Department
North Dakota State University

Dr. James Tilton
Animal Science Department
North Dakota State University

at the

22nd Annual Sheep Day

Hettinger Experiment Station
Hettinger, North Dakota

February 11, 1981

CONFINEMENT SHEEP PRODUCTION

Timothy C. Faller

Introduction

What can we afford to put into facilities for sheep confinement? Will total confinement increase or decrease ewe productivity? Will ewes under total confinement require less feed? What effects will confinement have on ewe health?

These and many other questions revolving around the potential of confinement sheep production stimualted the Advisory Committee of Hettinger Branch Experiment Station to include: farmers, ranchers, businessmen and various legislators in a plea to the 1979 legislative session for a facility to evaluate the feasability and management of confinement sheep facilities.

Objectives

1. Explore feasability of Confinement Sheep Production
2. Investigate feed requirements of confined sheep
3. Attempt to increase lambing frequency of the ewe.

Summary to Date

The information concerning confinement will be expanding on a yearly basis. Initially beginning with this report we will be exposing problems that exist with confinement and attempting to find management solutions to these problems. These management corrections will be aimed at designing improved facilities as there is no information available on ventilation, insulation needed, confinement management in general under this northern latitude. First information on feasability of confinement will be published in the 24th annual sheep day publication.

Procedure

The barn will be divided in thirds to properly evaluate each of the three major objectives:

Objective 1. Feasability of Confinement

A group of aged range Rambouillet ewes was purchased in the fall of 1979 to generate stock for the confinement barn. They were bred as follows:
1/3 to purebred Finnish Landrace rams
1/3 to 1/2 Finn, 1/2 Border Leicester rams
1/3 to Suffolk rams.
From the 210 ewe lambs produced initially, 50 percent will go into total confinement for their lifetime, the other 50 percent will go into a traditional farm flock managment system for their lifetime. An additional group of ewe lambs will be added the following year.

Objective 2. Feed Requirements of Confined Ewes

A group of ewes of similar genetic make-up will be purchased to go into the confinement barn to evaluate the use of straw as a feedstuff and for evaluating feeding levels below N.R.C. standards. Productivity and longevity of the ewe will be used as measures of success.

Objective 3. Increasing Lambing Frequency

A group of 1/4 Finn 1/4 Border Leicester ewes will be used initially. Pessories and chemicals will be used to attempt ovulation control. In the future other controls may include light stimulation. This portion of the confinement project will be under the direction of Dr. Tilton, Physiologist from the Main station, Animal Science Department.

DATA: November 1980 to Present

	Nov. 18 to Dec. 18	Dec. 18 to Jan. 18
Dry feed fed/ewe/da.	3,33	3.42
Water fed	1.23	1.22
Total daily feed as fed	4.56	4.64
Total Bales Straw	122.5	119
Total Hours (bedding, feeding, care)	40 hr. 14 min.	39 hrs. 27 min.+ 53 hrs shearing
Total hours cleaning	25.0	0
Total hours other	1 hr. 30 min.	2 hrs. 35 min.
Total Electricity need Kw	1172	1473
Total water consumed gallons	9790 gallons	8640 gallons

* Shearing took additional time due to wool data collection (possibly double)

Early Considerations

1. Selection of fan size and speeds to adequately ventilate under various climatic conditions.

2. Shearing management

3. Cleaning management

PRODUCTIVITY OF AGED WESTERN WHITEFACED EWES UNDER NORTH DAKOTA CONDITIONS

Timothy C. Faller

Introduction and Objective

What can you afford to pay for short term ewes? What lambing percents can be expected of aged western ewes? How long will short term ewes stay productive?

These and many similar questions stimulated the following cost accounting to get a handle on the levels of productivity income, and expenses that could be expected from short term ewes purchased from the western range area and subjected to North Dakota's tame grasses and climatic conditions.

Procedure

100 western ewes were purchased in August 1977 and bred to lamb during March. Records will be kept concerning expenses and income originating from these ewes. The ewes will be used until they are deemed unproductive and will then be sold to slaughter. Complete records will be kept concerning all problems associated with lamb production from aged ewes: including health, milk production, weights, etc.

1978 REPORT

No. ewes purchased	100	
No. ewes lambing	89	
Lambs born	119	
% lambs born per ewe bred	119	
% lambs born per ewe lambing	133.7	
Lambs weaned	96	
% lambs weaned per ewe bred	96	
% lambs weaned per ewe lambing	107.9	
Ave. wool production per ewe purchased	9.5#	
No. ewes died August 20, 1977 to June 1, 1980	7	
No. ewes died June 1, 1978 to present	6	
No. ewes culled and sent to market as unproductive	22	
No. ewes bred to lamb in 1979	65	
Original purchase price of ewes	2,000.00	
Trucking	165.00	
Ewe feed from August 20, 1977 to August, 1978	3,000.00	
Lamb feed to finish lambs to market	1,200.00	
	6,365.00	Expenses

INCOME

Sale of 96 lambs at 100# and 65¢/lb.	6,240.00	
Sale of ewes culled	792.00	
Sale of Wool 950# x .99	940.00	
	7,972.00	

Returns above purchase price, trucking and feed $1,607.00

1979 REPORT

No. ewes bred to lamb 1979	65
No. ewes lambing	60
Lambs born	84
% born per ewe bred	129
% born per ewe lambing	140
Lambs weaned	70
% lambs weaned per ewe bred	108
% lambs weaned per ewe lambing	117
Ave. wool production 7 months fleece	6.6#
No. ewes died August 1, 1978 to July 1, 1979	8
No. ewes culled and sent to market as unproductive n July 1, 1979	23
No. ewes bred to lamb in 1980	34

EXPENSES

Ewe feed - August 1, 1978 to July 1, 1979	1,787.50
Lambs fed to finish lambs to market	780.00
Shearing - 60 x 1.10	66.00
	2,633.50

INCOME

Sale of 60 lambs at 103# at 64¢/lb.	3,955.20
Sale of ewes culled	667.00
Sale of wool 384# x 1.11	426.24
	5,048.44
1979 returns over direct costs	2,114.94

1980 REPORT

No. ewes bred to lamb 1980	34
No. ewes lambing	28
Lambs born	43
% born per ewe bred	126.5
% born per ewe lambing	153.7
Lambs weaned	41
% lambs weaned per ewe bred	120.6
% lambs weaned per ewe lambing	146.4
Ave. wool production (12 month fleece)	10.7#
No. ewes died July 1, 1979 to June 1, 1980	2
No. ewes culled and sent to market June 1	32

EXPENSES

Ewe feed July 1, 1979 to June 1, 1980	1,300.86
Lamb feed weaning to market (40-103#)	697.41
Shearing 32 x 1.30	41.60
	2,039.87

INCOME

Sale of 41 lambs at 103# and 64¢/lb.	2,702.72
Sale of 32 ewes culled at 127# and 13.5¢/lb.	548.64
Sale of wool including Incentive 343.1 x 1.21/lb.	415.15
	3,666.51
1980 returns over direct costs	1,626.64
Total Direct Expenses (3 years)	11,038.37
Total Income (3years)	16,687.45
Net Income over direct costs for 3 years	5,649.08

* Note: This is not replicated research only a cost accounting.

POINTS TO CONSIDER

1. This is not based on statistically proven replicated research, it is only a cost accounting.

2. Feed costs represent costs for feed actually fed to the ewes and lambs. Hay was based on $50./T and grain at $82./T.

3. Wool sales represent total wool marketed. The 6.6# shearing average only represents a seven months fleece growth during 1979.

4. 34 ewes remained productive for a third lambing.

5. The price of aged western ewes has risen from origination of this study to 60 dollars per head or even higher in 1979 and then fell to $35-40 in 1980 depending on the quality and time of purchase.

6. No attempt was made to evaluate labor, veterinarian costs, buildings, depreciation, etc.

SUMMARY

The ewes in this accounting were bred for use in other research projects and this cost accounting results from numerous requests on what income and productivity you could expect from aged western ewes. 2200 ewes from the same area of Wyoming were imported to North Dakota and the 100 ewes delivered to the Hettinger Station represent a sample of this group of ewes.

The ewes had short ground off teeth and were able to graze adequately if grass conditions were good. They were fed and maintained similar to the rest of the ewes at the Hettinger Station. They were shorn in May prior to purchase and again in May for wool production information, and then resheared in January prior to their second lambing in 1979 and finally in January of 1980. The ewes were traditional May lambers in Wyoming and

this may have contributed to lowered fertility as 11% remained open. The severity of the winter of 1977-78 affected lamb survival. The ewes had adequate milk production, lambed easily and the lambs born were vigorous. Anyone purchasing ewes of this type should consider treating the ewes for internal and external parasites on arrival. It appeared that the milder winter of 1979-80 improved total performance of these aged ewes over previous years, especially considering their advanced age.

Ewes of the age, type, and quality of those involved in this cost accounting would probably perform at a higher level if subjected to a management program specifically designed for 6-9 year old gummer ewes. The ewes involved were manged in traditional systems going to tame grass pastures during summer and being confined from flushed till lambs were weaned.

It would appear that you could expect 2 lambings for each ewe purchased when purchasing good quality aged ewes and that initial price of the ewe would be a major determinate of profitability under similar price situations, (for feed, lamb, and wool) as those experienced during the course of this accounting.

Accelerated Lambing Programs Or Their Influence on Ewe Longevity (Project 1768)

J.E. Tilton, M.R. Light, T. Faller and W. Limesand

Numerous studies have been conducted with accelerated lambing as a goal with considerable variation in success noted. This range is associated with the stage of anestrous in the ewe and different hormonal regimes. Little information has been gathered to assess the effect of repeated hormonal administration on longevity of the ewe or her fertility at times other than periods of controlled mating activity.

Experimental Procedure

The experiment called for a continuation of the five year planned project. With this objective, 48 ewes at Fargo and 21 ewes at Hettinger were administered progestogens for 12 days. Following termination of progestogen treatment, gonadotropins (1000 iu HCG) were given 48 hours later. Half of the Fargo ewes were given a 5 mg. testosterone injection at the time of progestogen termination. The ewes were exposed to rams, and breeding marks were recorded as was subsequent lambing dates.

Following review of the results of this experiment, 64 Suffolk and 44 Hampshire ewes were exposed to a progestogen treatment (12 days) followed by either no subsequent treatment, a 5 mg. testosterone injection or 25 Mcg of GnRH or a combination of both.

The latter experiment was conducted during late anestrous with rams maintained with the ewes for only 10 days following progestogen treatment. All ewes were evaluated for plasma progesterone levels approximately ten days post treatment to assess nonsurgically whether ovulation has occurred. Mating records were taken daily with lambing response evaluated subsequently.

Results

Utilization of progestogens and an ovulatory hormone HCG) alone or in combination produced varying degrees of response depending on location. HCG following progestogen treatment at Hettinger resulted in 17 of 21 ewes mating but only three of twenty-four treated exhibited mating activity at the Fargo station. Adequate numbers of rams were available at both locations thus the physiological explanation is not readily available. When the HCG treatment was combined with a 5 mg. testosterone proprionate injection at the time of termination of the progestogen treatment, 17 of 24 ewes responded by exhibiting mating behavior. The testosterone apparently stimulated estrual activity. With all the recorded mating activity only three ewes lambed. These lambing results were significantly less than has been witnessed in previous experiments with hormonally stimulated mating in anestrual ewes.

In a second experiment, 64 Suffolk and 44 Hampshire ewes in late anestrous were treated with progestogens for 12 days followed by:

1. no treatment
2. 5 mg. Testosterone at the time of progestogen termination
3. 25 mcg. GnRH 48 hours after progestogen termination
4. a combination of 2 and 3 above.

Percent mating activity and interval of occurrence are presented in table 1. All treatments involving testosterone and GnRH supplemental injections were highly effective in stimulating mating activity with a precise degree of synchrony. Approximately ten days post mating, peripheral plasma samples were collected and progesterone concentrations assessed (table 2). A significant difference ($P < .05$) was observed when all mated ewes were compared with the plasma progesterone concentrations of the non-mated ewes. This would indicate the occurrence of ovulatory activity with subsequent progesterone secretion by the corpus luteum. Examination of lambing records revealed only 13 total ewes lambed with approximately equal numbers in each group lambing. A gain mating behavior can be stimulated out of season but does not result in adequate numbers of lambs to justify the cost or labor inputs. As evidenced by the latter study, mating activity and ovulation do occur but whether the failure to lamb is a result of ram infertility, fertilization failure or embryonic death is not readily available from these results.

Summary

Two experiments were conducted with an ultimate goal of out-of-season lambing. Mating activity was stimulated in both experiments with subsequent ovulation indicated by increased progesterone levels detected in one experiment. Lambing results achieved very limited success. If out-of-season mating is to become a routine management procedure, new methods or products will be needed, probably with more information needed on male fertility.

Work planned for next year:

1. Utilization of hormonal regimes and light to influence male reproduction.

2. Repetition of hormonal treatments to evaluate the occurrence of year effects.

TABLE 1. INFLUENCE OF TESTOSTERONE AND GnRH DURING LATE ANESTROUS IN PROGESTOGEN TREATED EWES (JULY, 1980)

Breed	Hampshire				Suffolk			
Treatment	C	T	GnRh	T+ GnRH	C	T	GnRH	T+ GnRH
No. Treated	12	11	10	11	19	13	16	15
No. Mated	8	9	7	10	9	13	16	15
% Mated	66.7	81.8	70.0	90.0	47.4	100	100	100
Interval - (PR*-E)	-	2.0	2.6	2.1	-	1.9	2.4	1.7
+ Sem	-	0.2	0.2	0.3	-	0.2	0.3	0.2

*Progestogen Removal to Estrus (Day)

TABLE 2. PROGESTERONE LEVELS OF HORMONALLY TREATED LATE ANESTROUS EWES (July, 1980)[a]

Treatment	N	ng/ml	+SEM
Control			
Mated	14	2.08	0.34
Not Mated	17	1.33	0.23
Progestogen + 5 mg Testosterone			
Mated	23	2.93	0.12
Not Mated	2	3.06	0.28
Progestogen + GnRH (50 ug)			
Mated	23	2.81	0.08
Not Mated	3	2.43	0.41
Progestogen + Testosterone + GnRH			
Mated	25	2.88	0.10
Not Mated	1	3.26	---
All Sheep			
Mated	85	2.74*	0.08
Not Mated	23	1.71*	0.23

[a]Progesterone estimated approximately 10 days after mating occurred.

THE AFFECTS OF VARYING PROTEIN LEVELS ON FEEDLOT LAMB PERFORMANCE

D.D. Erickson, M.R. Light, T. Faller, W. Limesand and W. Slanger

Summary:

Two experiments were conducted to determine the affect of feeding protein levels above the NRC requirements for finishing lambs. Protein levels of 12, 16 and 20% were fed along with corn or corn/oats in rations containing 70% TDN to 44 pound feeder lambs that were finished at 105 pounds at Fargo. Lambs gained faster (P .001) on the 16 and 20% protein levels when fed wither corn or corn/oats. There was no advantage in gain on the 20% over the 16% protein rations when comparing both the corn and corn/oats rations. Lambs gained faster (P .001) on corn than corn/oats and feed efficiencies were 5.43 and 5.88 respectively. Protein levels of 13, 15 and 17% were fed along with corn or corn/oats in a ration containing 65% TDN to 54 pound feeder lambs finished at 97 pounds at Hettinger. Lambs gained faster (P .01) on the 15 and 17% protein rations but there was no advantage in gain for the lambs on the 17% protein ration over the 15% protein ration. The lambs on the corn/oats rations gained faster (P .01) than those on the corn. The feed efficiencies were 7.27, 7.09, and 6.80 respectively for the 13, 15, and 17% protein rations. In both experiments the wether lambs gained faster than the ewe lambs. These data indicate that feeder lambs gaining between .6 and .8 of a pound a day will have improved performance when protein levels above the NRC (11%) are fed. Improved response was observed on protein levels of 15 and 16%.

Introduction:

Protein levels for lambs with potential high feed lot performance have not been established. In past experiments it has been observed that fast gaining lambs gain better on protein levels above the NRC requirements. It is of economic importance to determine the protein requirements for feeder lambs with varying gain potential and especially lambs that have the potential for rapid daily gain.

Experimental Procedure:

Two experiments were conducted to determine the effects of varying protein levels for feeder lambs. Twenty feeder lambs were allotted by sex and weight (44 pound average) to each of six lots at Fargo. The rations are shown in Table 1 and the nutritional compositions are shown in Table 2. Rations were sampled 10 times in the experiment at Fargo and 11 times in the experiment at Hettinger. Rations were fed in the pelleted form for most of the 84 day experiment. The ration treatments include Protein Levels of 12, 16, and 20% with corn or corn/oats mixed in equal parts as the grain and alfalfa was the roughage. The lambs were weighed at 14 day intervals and feed intake was recorded. In the Hettinger Experiment 30 lambs were allotted by breed,

sex and weight (average about 54 pounds) to each of 6 lots. The ration treatments were 13, 15, and 17% protein with corn or corn/oats mixed in equal parts as the grain and alfalfa was the roughage. Lambs were weighed at 14 day intervals during the 69 day experiment and feed intake was recorded. Rations were fed in the ground form.

Results and Discussion:

The average daily gains by lot and by sex for the experiment at the main station are shown in Table 3 along with the standard error of each mean. In all comparisons the lambs gained faster on corn than on corn/oats except the ewe lambs on the 16% protein rations which had the same daily gains. The wether lambs gained faster than the ewe lambs in all comparisons except the gains were the same between sexes on the 16% protein ration. The lambs gained faster (P .001) on the 16 and 20% protein rations compared to the 12% ration in both the corn and corn/oats comparisons (Table 4). There was no advantage in the gains to feed a 20% protein ration compared to the 16. The lambs gained faster on corn than corn/oats, which was observed in last years lamb finishing trials at Fargo. The feed required per pound of gain for the protein levels of 12, 16 and 20% were 5.72, 5.73, and 5.71 respectively, and corn or corn/oats 5.43 and 5.88 respectively. These data indicate that lambs gaining between .6 and .8 of a pound a day require a ration protein level close to 16% for maximum gain. The economics of course will have to be considered.

The results from the finishing trial at the Hettinger Station are shown in Tables 7 and 8. The lambs on rations with 15 and 17% protein gained faster (P .01) compared to rations with 13% protein when combining the corn and corn/oats data. Gains were not improved when 17% protein rations were fed compared to 15%. Feed efficiencies for the protein levels of 13, 15 and 17% were 7.27, 7.09, and 6.80 respectively which indicate higher protein levels increased the feed efficiency. The feed efficiency was unaffected by ration protein level in the experiment at Fargo. Additional research is needed to establish recommended protein levels for the increased levels of daily gain. The information resulting from these two experiments indicate that lambs gaining between .6 and .8 pound per day require a higher than 11% protein as recommended by the NRC. In order to obtain maximum gain it appears that ration protein should be from 15 to 16%. Additional research is planned both at Hettinger and Fargo to refine the protein recommendations as they relate to gain. Included in these experiments will be various protein sources, especially sunflower meal.

TABLE 1. RATION COMPOSITION WITH CALCULATED TDN AND PROTEIN USED FOR FINISHING LAMBS AT FARGO

Feedstuff	Ration 1	2	3	4	5	6
Corn (shelled)	63.5	52.0	41.0	36.0	30.0	24.0
Oats	-	-	-	36.0	30.0	24.0
SBOM	6.0	17.5	28.5	2.5	14.5	26.5
Alfalfa (pellets)	20.0	20.0	20.0	15.0	15.0	15.0
Calculated TDN	70.0	70.0	69.0	69.0	69.0	69.0
Calculated Protein	12.0	16.0	20.0	12.0	16.0	20.0

Common to all rations %: liquid molasses 6.5, limestone 1.0, TM salt .5, vitamins A,D, & E .05 and terramycin.

TABLE 2. NUTRITIONAL COMPOSITION (AVERAGES AND STANDARD DEVIATIONS) OF RATIONS (FARGO 1980)

Nutrient %	RATION 1	2	3	4	5	6
Protein[a]	12.57±.26	16.65±.58	20.18±.66	12.69±.62	17.2±.32	21.24±.45
Fiber[a]	12.58±.59	13.54±.71	14.2 ±.98	16.78±1.49	15.73±1.08	15.62±.81
Ash[a]	4.95±.38	5.69±.28	6.40±.36	5.81±.43	6.06±.35	6.61±.25
Drymatter[a]	89.72±1.37	89.64±1.23	89.82±1.17	90.34±1.28	90.10±1.01	90.17±1.42
P[b]	.305±.025	.355±.032	.412-±027	.388±.019	.407±.076	.441±.028
Ca[b]	.841±.150	.840±.162	.981±.103	.826±.137	.815±.078	.920±.064
Mg[b]	.171±.030	.190±.038	.209±.044	.185±.029	.197±.022	.226±.039

[a] Expressed on as fed basis

[b] Expressed on dry basis

10 observations for each value
Fiber = acid detergent fiber

TABLE 3. AVERAGE DAILY GAINS AND STANDARD ERRORS OF WETHER AND EWE LAMBS FED 3 PROTEIN LEVELS ALONG WITH CORN OR CORN/OATS AS THE GRAIN MAIN STATION FARGO

		% Ration Protein					
		12		16		20	
sex		M(14)[b]	F(6)	M(13)	F(7)	M(11)	F(8)
	gain	.750	.679	.777	.735	.823	.729
corn	SE±	.0112	.0161	.0119	.0150	.0124	.0142
		(13)	(7)	(14)	(6)	(13)	(7)
corn	gain	.655	.608	.733	.737	.770	.687
oats	SE±	.0116	.0150	.0112	.0161	.0116	.0150

[a]Gains were regressed against days on feed

b( ) refers to animal numbers in a group

TABLE 4. DIFFERENCE IN AVERAGE DAILY GAINS AND THE PROBABILITY LEVELS FOR THE VARIOUS RATION COMPARISONS MAIN STATION FARGO

Ration Treatment	Difference in Gain	Probability Level
Corn vs corn/oats	.050	.0001
Corn vs corn/oats 12% Protein	.083	.0001
Corn vs corn oats 16% Protein	.021	.1020
Corn vs corn/oats 20% Protein	.047	.0001
12% vs 16% Protein (corn)	-.041	.0012
12% vs 20% Protein(corn)	-.061	.0001
16% vs 20% Protein (corn)	-.020	.1036
12% vs 16% Protein (corn/oats)	-.103	.0001
12% vs 20% Protein (corn/oats)	-.097	.0001
16% vs 20% Protein (corn/oats)	.006	.6088
12% vs 16% Protein (across grains)	-.072	.0001
12% vs 20% Protein (across grains)	-.079	.0001
16% vs 20% Protein (across grains)	.007	.4380

TABLE 5. RATION COMPOSITION WITH CALCULATED TDN AND PROTEIN USED FOR FINISHING LAMBS AT HETTINGER

	Ration					
Feedstuf	1	2	3	4	5	6
Corn (shelled)	46.4	40.7	35.0	27.25	24.25	21.25
Oats	-	-	-	27.25	24.25	21.25
SBOM	1.6	7.3	13.0	-	6.0	12.00
Alfalfa	51.0	51.0	51.0	44.50	45.5	44.5
Calculated TDN	64.9	64.4	64.5	64.8	64.9	64.9
Calculated Protein	13.0	15.0	17.0	13.0	15.0	17.0

Ingredients common to all rations: .5% limestone, .5% TM salt, and Vitamins A,D,E and antibiotics.

TABLE 6. NUTRITION COMPOSITION (AVERAGES AND STANDARD DEVIATIONS) OF RATIONS (HETTINGER 1980)

Nutrient	Ration					
%	1	2	3	4	5	6
Protein[a]	13.82±1.47	15.94±1.46	17.76±2.75	14.18±1.15	15.58±1.38	17.45±1.43
Fiber[a]	19.00±2.06	19.72±.214	19.38±2.61	19.95±2.14	20.85±4.57	21.02±1.93
Ash[a]	5.56±.69	6.19±.548	6.35±1.17	5.69±.48	6.25±.81	6.72±.55
Drymatter[a]	90.72±1.24	90.62±.790	90.98±.94	90.22±1.18	90.61±.544	91.89±.49
Cell walls[a]	32.82±.4.24	31.72±3.19	31.42±2.88	33.96±2 73	33.99±.327	35.77±3.12
Lignin[a]	3.69±.40	4.00±.65	3.76±.61	4.04±.47	4.11±.32	3.99±.41
p[b]	.242-±.014	.257-±.021	.270-±.020	.260-±.011	.287-±.034	.287-±.019
Ca[b]	.697±.126	.784±.156	1.097±.163	9.09±.168	.867±.154	.862±.088
Mg[b]	.240±.027	.256±.030	.299±.036	.250±.037	.257±.022	.258±.038

a Expressed on as fed basis

b Expressed on dry basis

22 observations
fiber = acid detergent fiber

TABLE 7. AVERAGE DAILY GAINS[a] AND STANDARD ERRORS OF WETHER LAMBS FED 3 PROTEIN LEVELS ALONG WITH CORN OR CORN/OATS AS THE GRAIN
HETTINGER EXPERIMENT STATION

		% Ration Protein					
		13		15		17	
Sex		M(10)[b]	F(20)	M(13)	F(16)	M(11)	F(19)
corn	gain	.599	.592	.696	.602	.656	.611
	SE±	.0160	.0119	.0142	.0130	.0153	.0121
		(11)	(17)	(11)	(18)	(12)	(18)
corn	gain	.686	.603	.684	.611	.684	.635
oats	SE±	.0153	.0127	.0153	.0124	.0147	.012

[a] Gains were regressed against days on feed

[b] ( ) refers to animal numbers in a group

TABLE 8. DIFFERENCE IN AVERAGE DAILY GAINS AND THE PROBABILITY LEVELS FOR THE VARIOUS RATION COMPARISONS
HETTINGER EXPERIMENT STATION

Ration Treatment		Difference in Gain	Probability Level
Corn vs corn/oats		-.024	.0012
Corn vs corn/oats	13% protein	-.049	.0002
Corn vs corn/oats	15% protein	.002	.8684
Corn vs corn/oats	17% protein	-.025	.0458
13% vs 15% protein	(corn)	-.053	.0001
13% vs 17% protein	(corn)	-.038	.0031
15% vs 17% protein	(corn)	.015	.2368
13% vs. 15% protein	(corn/oats)	-.002	.8507
13% vs 17% protein	(corn/oats)	-.038	.0031
15% vs 17% protein	(corn/oats)	-.015	.2368
13% vs 15% protein	(across grains)	-.028	.0023
13% vs 17% protein	(across grains)	-.027	.0035
15% vs 17% protein	(across grains)	.001	.8860

SELF FEEDING STRAW IN RATIONS FOR GESTATING EWES

Mr. R. Light and T. C. Faller

SUMMARY

A three-year study of self-feeding ground wheat straw with ground alfalfa from the end of mating until six weeks prior to lambing are reported. Replicated groups of Suffolk were fed rations containing straw at levels of 0, 20, 40 and 60 percent until approximately six weeks prior to lambing. Fertility levels for all groups were poor. Dry ewes in groups ranged from 11.6 to 14.7 percent. The percent lambs dropped per ewe exposed ranged from 129 to 140. Survival rates for lambs in all groups ranged from 73 to 80 percent. It appears that there were no significant differences in production between groups. Rations containing straw were more economical.

INTRODUCTION

Self-feeding sheep is a management technique that can substantially reduce daily labor requirements for the ewe flock. This experiment was designed to study the feasibility of utilizing straw in rations for self-fed ewes during the interval from breeding until 4 to 6 weeks prior to lambing. Straw is an abundant and inexpensive roughage source. Its successful incorporation into self-fed roughage rations could materially reduce feeding and labor costs during certain periods of the sheep management year.

EXPERIMENTAL PROCEDURE

One hundred thirty-five Suffolk ewes were assigned to a completely randomized design experiment on the basis of age, weight and condition at the Hettinger Experiment Station. Ewes were placed in four replicated lots and were self-fed rations containing 0, 20, 40 and 60 percent wheat straw for a period of 59 days post-breeding. All ewes were weighed and scored for condition. During the last six weeks of gestation, all ewes were self-fed a ration that more than met minimal NRC requirements.

Body scores for condition indicates the amount of fat over the rib. A condition score of 1 indicates less than .1 inch of fat or an emaciated ewe and a score of 6 would indicate more than .4 inches of fat or a very fat ewe.

RESULTS AND DISCUSSION

Condition scores, feed consumption, feed analyses, body weight changes, and lamb production and survival are presented in tables 1 through 7.

The condition scores for all ewes in all years have ranged from medium plus to thin plus at the conclusion of the 1977, 1978 and 1979 seasons. These condition scores reflect a slightly less than desired state of condition. In each of the years there was an increase in body fat during the trial in those groups consuming 100 percent ground alfalfa rations. Contrary to the 1977 results, those ewes consuming straw at the 20 percent level in 1978

lost body fat. Although ewes that were fed no straw and 20 percent straw gained weight, the weight gains were very slight and below what would be considered minimal. All lots consuming more than 20 percent straw lost weight during the 59-day feeding period in 1978. All lots gained weight in 1979 which is explained by the small differences in protein plus fiber content of rations fed in 1979.

Feed consumption was lower in 1978 than in 1977 and 1979. The lowered consumption can be explained by the quality of the roughage offered. Alfalfa hay, which was used during the first half of the 1978 feeding period, was very low in quality, containing 10.8 percent protein and 39.3 percent fiber as compared to 17.1 percent protein and 27.9 percent fiber in 1977 and 14.5 percent protein and 32.1 percent fiber in 1979. These observations reinforce the statement that if straw is to be used as a portion of the ration the alfalfa must be good quality. Climatic conditions would appear to greatly influence the performance of ewes when self-fed high fiber rations. Weather conditions during the course of the trial would be termed to be near average in 1977, much below average in 1978, and above average in 1979.

Lamb production and survival rates are shown in table 6. Lambs born per ewe exposed varies between years as does the number of lambs born per ewe lambing. The overall average (table 7) shows little difference between these variables. Lamb survival rates do not vary significantly when the three-year average is examined although year-to-year differences do exist. By any standards, survival rates of 73 to 80 percent are considered poor and are no doubt a reflection of the inbred parental ewes' productive ability.

TABLE 1. EWE CONDITION SCORES

Groups	Ration (% straw)	Initial Score			Final Score		
		1977	1978	1979	1977	1978	1979
1 + 5	0	3.3	2.78	3.3	3.?	3.16	3.6
2 + 6	20	3.3	2.78	3.2	3.3	2.66	3.6
3 + 7	40	3.3	2.79	3.2	3.0	2.39	3.4
4 + 8	60	3.4	2.85	3.2	2.8	2.28	3.0

TABLE 2 FEED CONSUMPTION

Pen	Ration (% Straw)	Straw/head/day (lb)			Alfalfa/head/day (lb)			Feed/head/day (lb)		
		1977	1978	1979	1977	1978	1979	1977	1978	1979
1	0	0	0	0	6.58	5.62	6.43	6.58	5.62	6.43
2	20	1.27	1.15	1.39	5.07	4.58	5.58	6.34	5.73	6.97
3	40	2.20	2.01	2.70	3.29	3.02	4.05	5.49	5.03	6.75
4	60	2.72	2.81	3.64	1.81	1.88	2.42	4.53	4.69	6.06
5	0	0	0	0	7.13	6.11	6.72	7.13	6.11	6.72
6	20	1.26	1.03	1.33	5.02	4.11	5.32	6.28	5.14	6.65
7	40	2.43	1.86	2.61	3.65	2.80	3.92	6.08	4.66	6.53
8	60	3.03	2.51	3.37	2.01	.167	2.24	5.04	4.18	5.61
1 + 5	0	0	0	0	6.85	5.86	6.58	6.85	5.86	6.58
2 + 6	20	1.26	1.09	1.36	5.05	5.45	4.45	6.31	5.44	6.81
3 + 7	40	2.31	1.94	2.66	3.47	2.91	3.99	5.78	4.85	6.65
4 + 8	60	2.87	2.66	3.51	1.91	1.78	2.34	4.79	4.44	5.85

TABLE 3 FEED COSTS

Pen	Ration (% Straw)	Cost/Head/Day* (Dollars)			3-Year Average
		1977	1978	1979	
1	0	.164	.141	.161	.156
2	20	.146	.132	.160	.146
3	40	.125	.106	.142	.124
4	60	.086	.090	.115	.097
5	0	.178	.153	.168	.166
6	20	.144	.118	.153	.138
7	40	.129	.098	.137	.121
8	60	.096	.080	.107	.094
1 + 5	0	.171	.147	.165	.161
2 + 6	20	.145	.128	.156	.143
3 + 7	40	.121	.102	.140	.121
4 + 8	60	.098	.084	.111	.098

*Costs are computed on the basis of $50./ton alfalfa and $30./ton straw.

TABLE 4. FEED ANALYSES

Ration Description	Matter(%)				Fiber (%)				Protein (%)			
	1977	1978a*	1978b*	1979	1977	1978a*	1978b*	1979	1977	1978a*	1978b	1979
0% Straw	84.4	89.3	84.7	88.8	27.9	39.3	33.7	32.1	17.1	10.8	16.4	14.5
20% Straw	84.6	87.6	86.0	88.6	28.1	43.5	31.8	32.9	15.8	9.0	14.3	13.5
40% Straw	83.2	87.5	86.7	88.6	32.9	38.6	44.0	33.1	12.6	11.9	8.9	13.5
60% Straw	85.9	87.5	89.4	89.7	35.7	43.4	47.2	35.4	10.7	9.4	8.2	13.4

* 1978a - fed during last 30 days of trial;

* 1978b - fed first 30 days of trial.

TABLE 5. EWE WEIGHTS

Pen	Ration (% Straw	Initial Wt. (lb)			Final Wt. (lb)			Days			Change (lb)		
		1977	1978	1979	1977	1978	1979	1977	1978	1979	1977	1978	1979
1	0	149.8	159.7	141.2	172.2	167.1	160.4	59	59	59	+22.4	+ 7.4	19.2
2	20	149.1	156.9	140.1	167.0	161.9	155.6	59	59	59	+17.9	+ 5.0	15.5
3	40	147.8	156.8	142.9	151.7	153.5	160.1	59	59	59	+ 3.9	- 3.3	17.2
4	60	148.7	156.7	140.9	143.9	148.8	153.8	59	59	59	- 4.8	- 7.9	12.9
5	0	150.3	156.8	140.2	183.7	164.3	161.7	59	59	59	+33.4	+7. 5	21.5
6	20	150.8	156.9	142.5	173.2	160.8	163.0	59	59	59	+22.4	+ 3.9	20.5
7	40	152.7	156.9	142.2	165.3	155.9	160.4	59	59	59	+12.8	- 1.0	18.2
8	60	151.9	156.6	140.7	159.4	144.8	150.6	59	59	59	+ 7.6	-11.8	9.9
1 + 5	0	150.3	158.2	140.7	178.0	165.7	161.1	59	59	59	+27.9	+ 7.5	20.4
2 + 6	20	149.9	156.9	141.3	170.0	161.4	159.3	59	59	59	+20.1	+ 4.5	18.0
3 + 7	40	150.2	156.9	142.6	158.4	154.7	160.3	59	59	59	+ 8.2	- 2.2	17.7
4 + 8	60	150.3	156.7	140.5	151.4	146.8	152.2	59	59	59	+ 0.9	- 9.9	11.7

TABLE 6. Lamb Production and Survival

	1			2			3			4		
	Alfalfa			20% Straw			40% Straw			60% Straw		
	1978	1979	1980	1978	1979	1980	1978	1979	1980	1978	1979	1980
Number ewes	35	33	35	35	33	34	35	33	34	34	34	36
Number lambed	31	31	29	32	31	28	29	27	31	29	28	32
% Dry (ewes)	11.4	6.1	17.1	8.6	6.1	17.6	17.1	18.2	9.1	14.7	17.6	11.1
Lambs	44	47	46	48	51	47	41	42	49	41	44	55
% Born/ewe exposed	126	142	131.4	137	154.5	138.2	117	127.2	144.1	121	129.4	152.8
Lambs weaned	33	36	33	30	37	35	31	33	42	29	33	46
% Weaned/ewe exposed	94.3	109.1	94.3	85.7	112.1	102.9	88.6	100	123.5	85.3	97.1	127.8
% Survival (lambs)	75.0	76.6	71.4	62.5	72.5	74.5	75.6	78.6	85.7	70.7	75.0	83.6

TABLE 7. Lamb production (3-year average)

	1 Alfalfa	2 20% Straw	3 40% Straw	4 60% Straw
Number ewes	103	104	102	104
Number ewes lambed	91	91	87	89
% Dry	11.6	12.5	14.7	14.4
Number lambs born	137	146	132	140
% Born/ewe exposed	133	140	129	135
% Born/ewe lambing	151	160	152	157
Number lambs weaned	102	102	106	108
% Lambs weaned	99	98	104	104
% Lamb survival	74.5	72.9	80.3	77

THE RELATIVE RESPONSE TO SINGLE TRAIT SELECTION PRESSURE APPLIED TO COLUMBIA EWES

P. T. Berg, W. D. Slanger, M. R. Light,
C. L. Johnson and T. C. Faller

(Update)

A detailed discussion of this long-term selection project was presented in the 1980 Sheep Day book. The reader is referred to that book for the specifics of this project. A brief update is all that will be presented in the 1981 Sheep Day report.

Briefly, the objective of this study is to determine the effectiveness of selection for various triats if the selection is for a single trait and applied only to the ewe portion of a flock. Three traits were chosen to test the selection response: lamb production (Lot 1), Columbia breed type (Lot 2) and wool production (Lot 3).

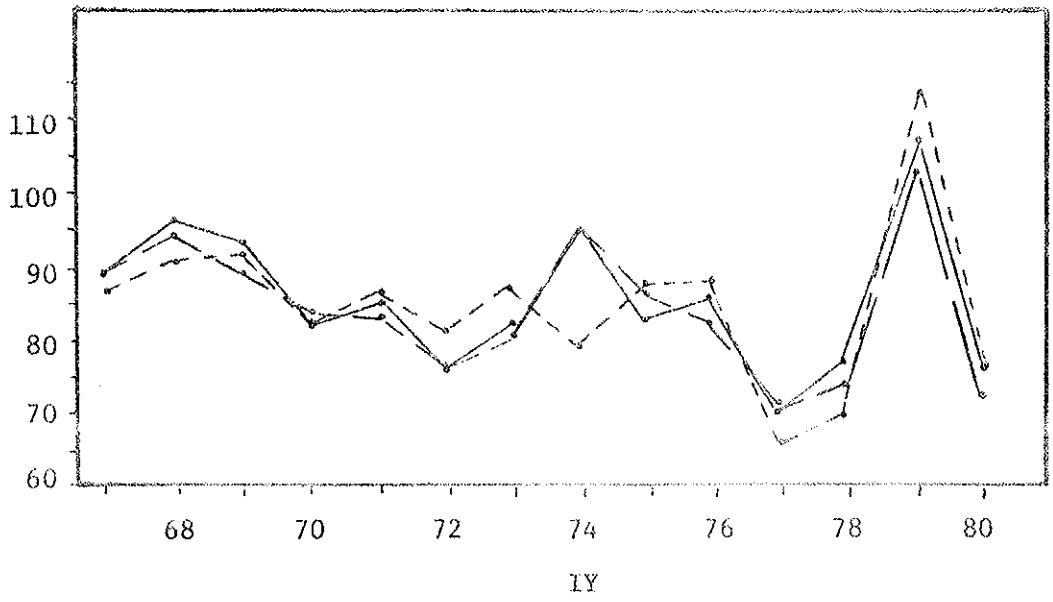
The following graphs depict the status of various means of analyzing the response to the selection pressure over the years. These graphs are similar to those presented in the 1980 summary with the exception that summaries for the years 1979 and 1980 have been added.

SUMMARY

The data summarizes 13 lambing seasons at the Hettinger Experiment Station, and analysis of this data conducted so far indicated the following: (1) selection based on adjusted weaned lamb produce of ewe has not been effective in increasing productivity of the ewes in this flock (Lot 1); (2) selection for Columbia breed type has not been effective in improving either body size, lamb production or wool production in this flock (Lot 2); (3) selection has been effective for wool production with the wool selection lot showing significantly greater wool production when compared to the other lots in each of the last three years: (4) the method of selecting ewe lamb replacements within Lot 1 (lamb production) has favored the retention of twin lambs. The retention of twin ewes has not, however, significantly increased the proportion of lambs born twin within this lot.

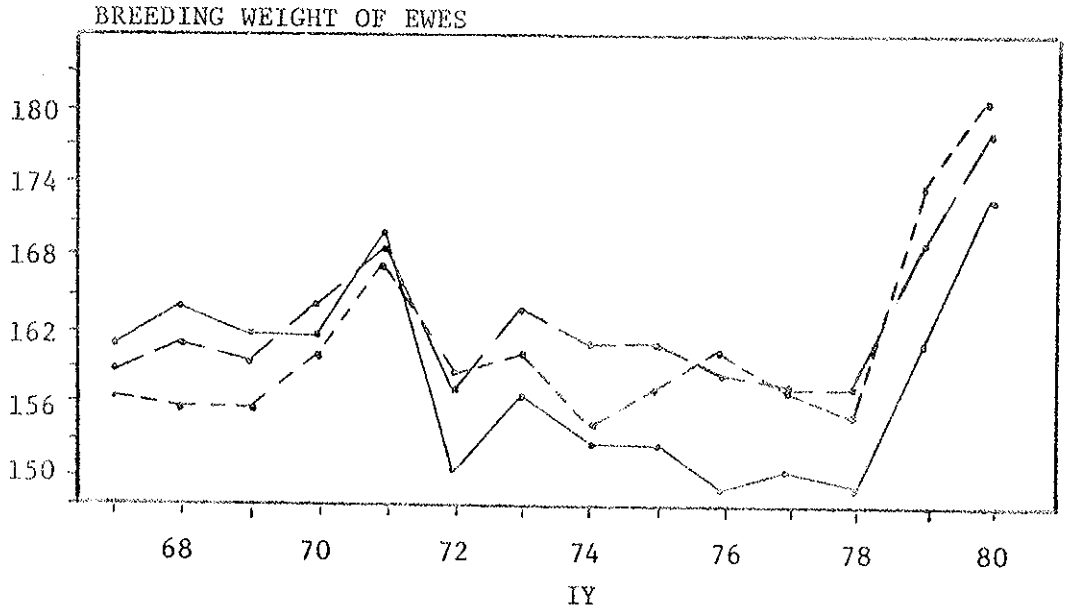
The method of ewe lamb replacement selection was changed effective with the 1981 season. The heaviest individual ewe lambs will be retained rather than the selection from total weight of a ewe. It is realized this may favor selection of singles, but twins have not increased lambing percent. Similarily, the age limitation imposed on each lot will be dropped - a productive ewe, as long as she is judged sound, will remain in the flock.

ADJUSTED WEANED POUNDS OF LAMB PER EWE

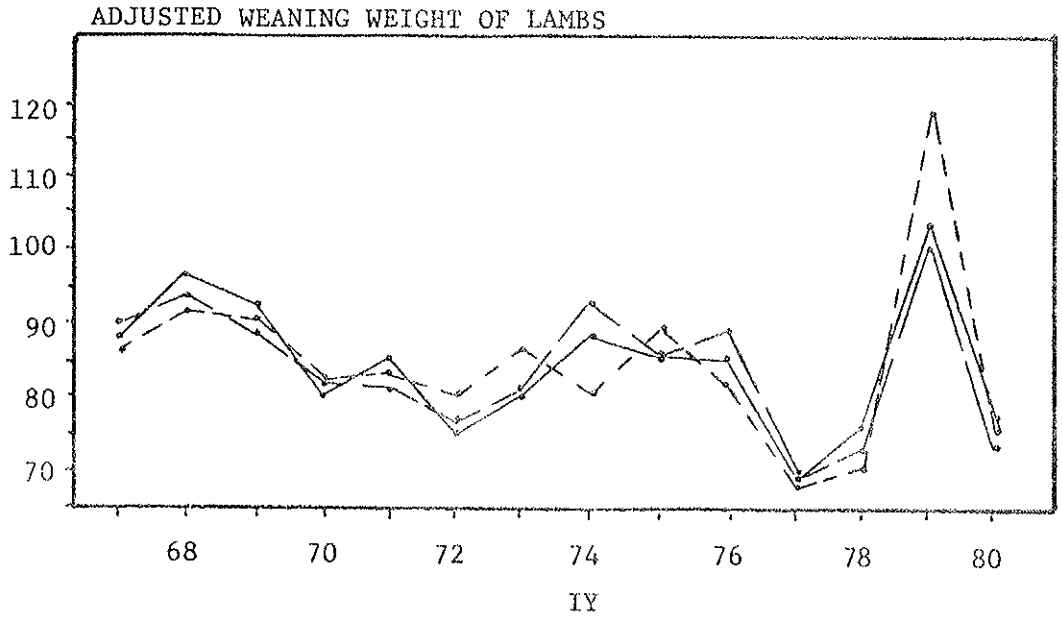


1 ——— = Group 1
2 — — = Group 2
3 ——— = Group 3

BREEDING WEIGHT OF EWES



1 ——— = Group 1
2 — — = Group 2
3 ——— = Group 3



1 ———— = Group 1

2 — — — = Group 2

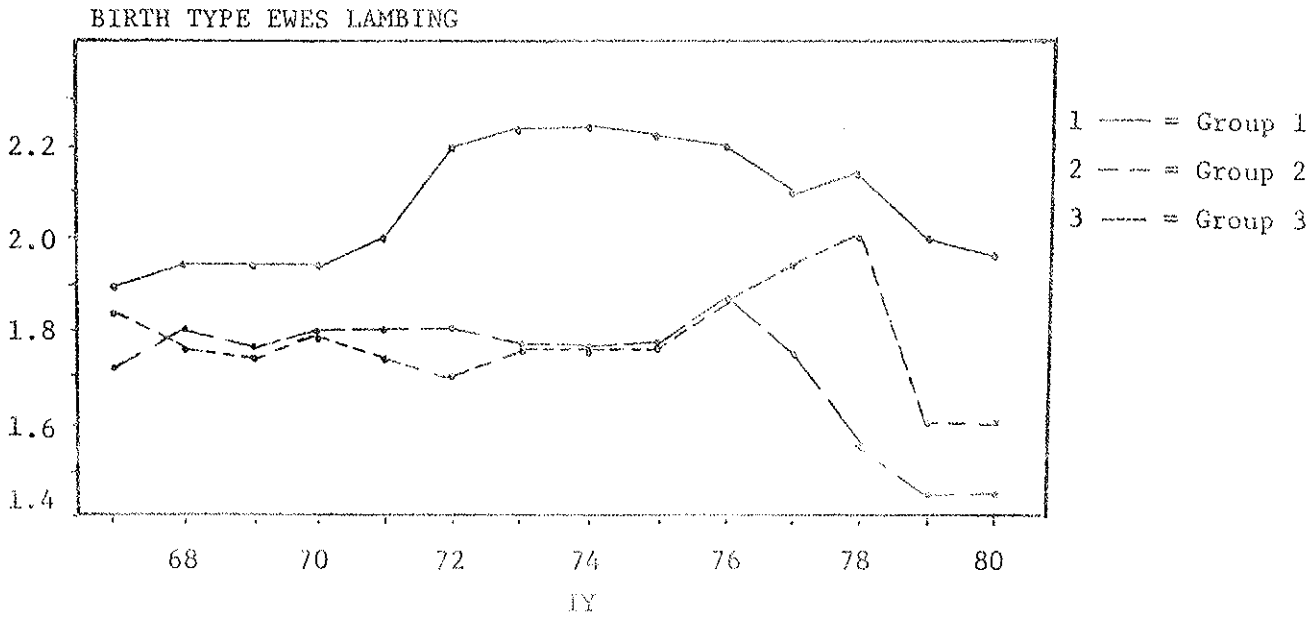
3 ----- = Group 3

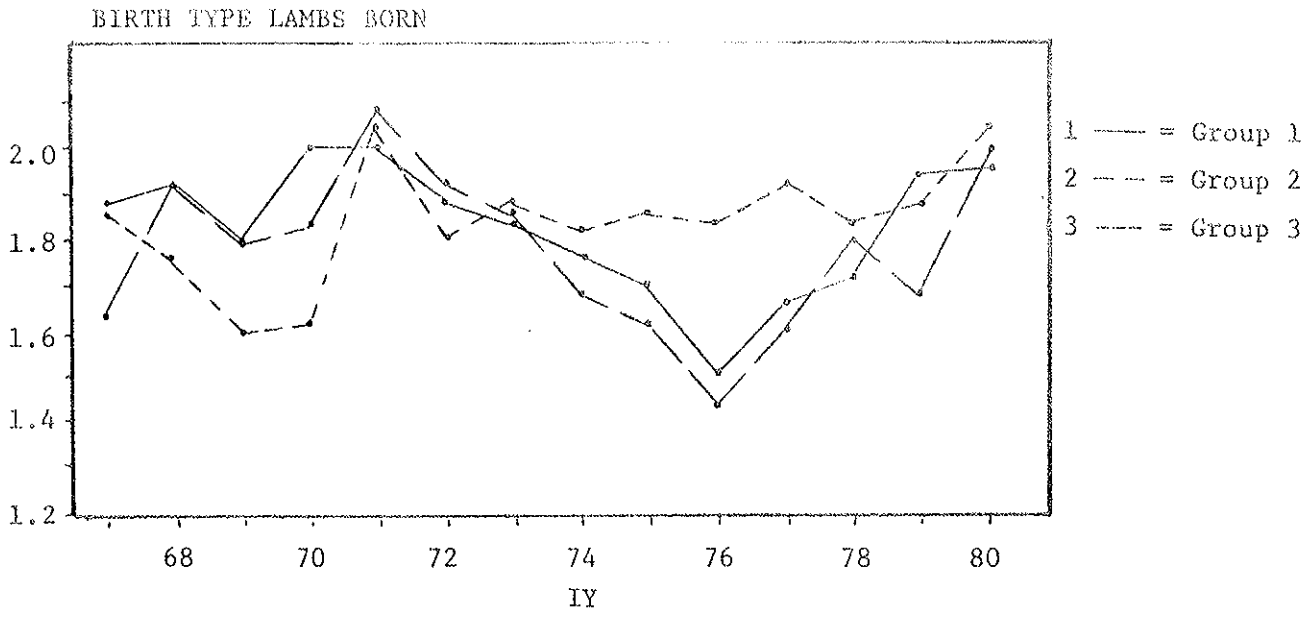
This series of weight graphs depicts the "progress" which has been made since 1967 in selection for weight of lamb. Lot 1 ewe lamb replacements were selected based on total pounds of lamb produced by their dams the year they were born. If this method of selection were effective, Lot 1 should have moved away from the other two groups. This did not happen as can be seen from the graph entitled, "Adjusted Weaned Pounds of Lamb Per Ewe".

Lot 2 replacement ewe lambs were selected for Columbia type. Current trends in type would favor larger ewes. In all probability, if the intended selection from within Lots 1 and 2 were effective, weights should have increased rather steadily from 1967 to the present. Except for the years 1979 and 1980, little progress in increasing ewe size can be seen. Whether the large increases in breeding weight of the ewes demonstrated in these two years will continue will only be answered with time.

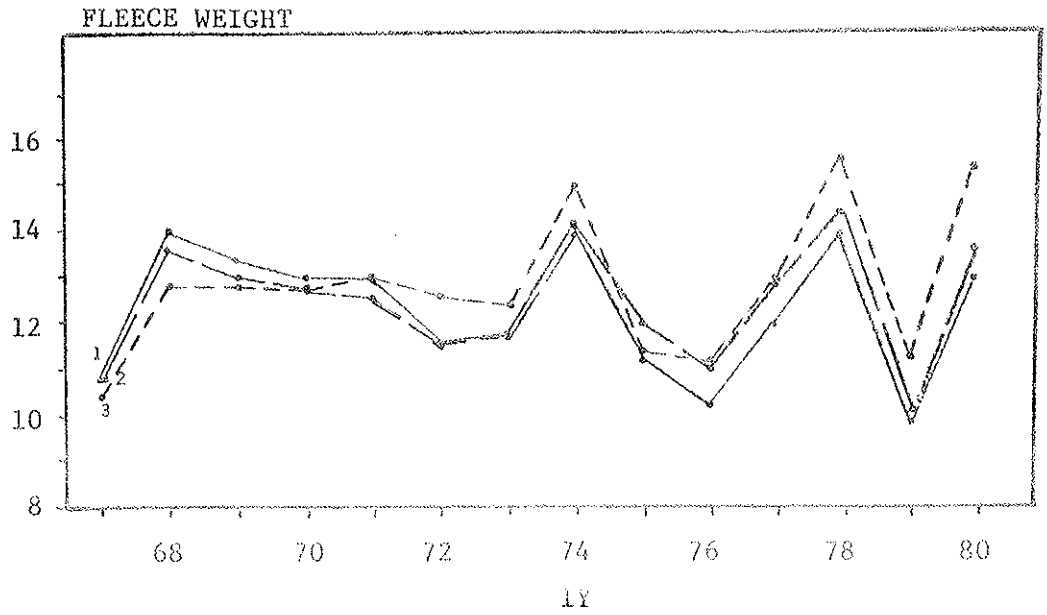
Lot 3, the wool selection lot, has not fallen behind in any of the weight measured traits, but this is not surprising because heavier wool production is also associated with larger body size.

Apparently the relatively mild winter of 1979 is reflected by the sharp rise in ewe production and lamb weaning weight for that year.





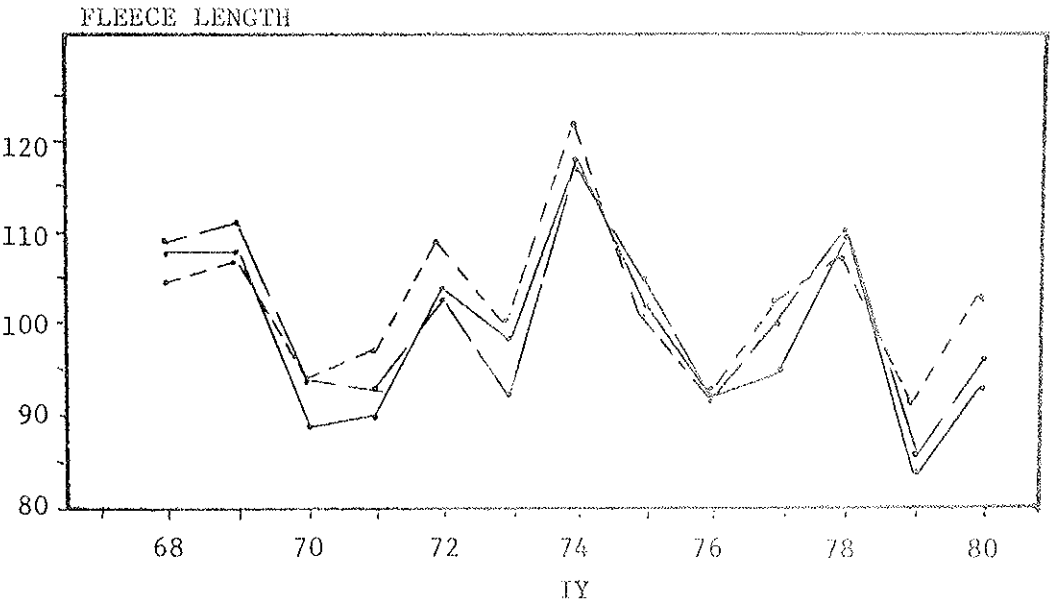
Selection within group 1 continues to favor twins. Group 2 shows a consistent drop in retention of twins since 1976. Although selection has favored twins in group 1, the graph of birth type of lambs born shows no advantage in numbers of lambs born per ewe to Lot 1. Most textbook values for heritability of multiple birth would be very near zero. The data from this experiment would corroborate the textbook values.



1 ——— = Group 1

2 — — — = Group 2

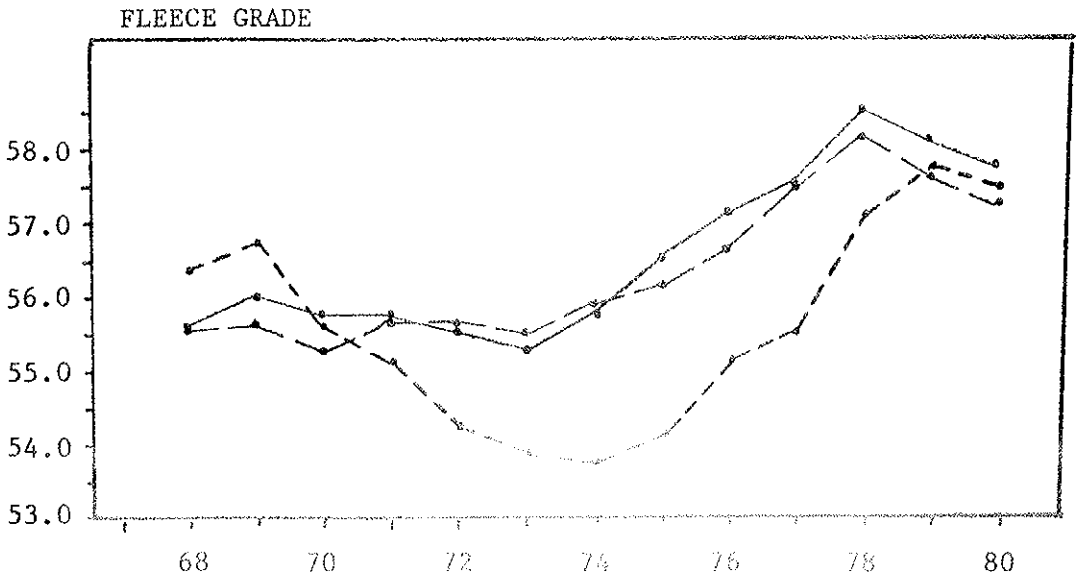
3 ——— = Group 3



1 ——— = Group 1

2 — — — = Group 2

3 ——— = Group 3



1 ——— = Group 1

2 — — = Group 2

3 ——— = Group 3

The update of the fleece graphs shows a dramatic decrease in wool clip in 1979 and an almost equally dramatic rebound in 1980. The net effect is still that selection for fleece production is effective even when the selection pressure is on the ewe side only. A statistically significant difference exists between Lot 3 (wool selection group) and the other two lots in 1972. 1978, 1979 and 1980. Lot 3 was significantly lower in fleece grade until 1979. In 1979 and 1980, no statistical difference was evident among the three lots for grade of wool. Staple length differences generally follow the trend shown in the fleece weight graph and generally no significant differences exist among the lots.

SECTION II

Reports of

Sheep Research in Progress

At the

Main Station, Fargo, N. D.

Presented by

Merle R. Light

at the

22nd Annual Sheep Day

Hettinger Experiment Station
Hettinger, North Dakota

February 11, 1981

SECTION II

Reports of

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Dickinson Experiment Station
Dickinson, North Dakota

February 11, 1981

OVINE PROGRESSIVE PNEUMONIA IN FARM SHEEP FLOCKS

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J.E. Tilton[1], and W.D. Slanger[1]

Progressive pneumonia is a chronic disease of adult sheep that can cause serious economic losses in affected sheep flocks. The clinical symptoms of OPP include a slow progressive weight loss, physical weakness, a lack of fever, increasing severe respiratory distress with a chronic cough and labored breathing and ultimately death (Siggurdsson et al.,1952) (Ressang et al., 1968).

The incidence of ovine progressive pneumonia was first described by Marsh (1923) who reported that 1 to 2 percent of sheep in affected Montana range flocks developed the disease. Since that time, affected individuals have been reported throughout world sheep producing areas including South Africa, Britain, France, Germany, India and America (Palsson, 1976). Cutlip et al. (1977b) surveyed cull slaughter ewes and reported up to 68 percent of old ewes were infected with OPP. Gates et al. (1978) after testing blood sera from Idaho range sheep reported an incidence of 58 percent in all ages to 90 percent of cull ewes had been infected. Light and Schipper (1979) surveyed seven North Dakota flocks and demonstrated through blood sera analyses that all had been infected. Incidence of infection ranged from 18 to 85 percent. Published reports concerning chronic progressive pneumonia together with personal communication to the author from pure breeders throughtout the United States lead to the speculation that chronic progressive pneumonia (lungers) is endemic within sheep flocks in the United States.

PROCEDURE - A

Efforts are being made to determine the route of transmission of ovine virus pneumonia from infected sheep to susceptible sheep by:

1. Feeding colostrum milk from infected ewes to lambs from clean flocks. Eleven newborn lambs from the NDSU clean flock were isolated from their dams and were fed colostrum milk from infected dams. These sheep are being maintained in isolation and monitored for the development of ovine progressive pneumonia.

2. Semen samples from a ram known to be positive (AGID test) for virus pneumonia are being tested for the virus.

3. Lambs are being reared in isolation and virus is administered to them by several techniques.

PROCEDURE - B

Creating a clean flock from an infected flock utilizing the AGID test. A cooperating flock owner has created two flocks of sheep on separate farms. Flock A (negative) was identified on the basis of utilizing the blood serum AGID test. Ewes that are positive to the test are from the infected (B) flock. Blood serum samples will be obtained and analyzed bi-annually.

PROCEDURE - C

Evaluation of inactivated vaccines. A flock of crossbred ewe lambs were randomly assorted into two groups (50 each). Group 1 was vaccinated with a killed virus and group 2 serves as a control group. These ewes are now approaching 3 years of age. All ewes are being maintained in an infected herd and being monitored through serum samples for the development of ovine progressive pneumonia.

DISCUSSION OF RESULTS

We have been able to create flocks of "clean" sheep utilizing an isolation technique. This technique was reported in the 1980 Western Sheep Day Report.

We have been unable to infect newborn lambs with ovine progressive through the use of colostrum milk from infected ewes to date nor have we been able to infect lambs by administration of the virus by other means. Efforts are still being made to elicit the method of transmission.

The effects of the use of a killed virus vaccine to prevent ovine progressive pneumonia are unknown at this time. Monitoring of this flock will continue until such time as those ewes are sacrificed and tissues and organs are examined. Experiments are continuing on the development of new vaccines.

The efforts to create clean flocks from infected flocks utilizing the AGID test are in the first year and the results of these attempts are not presently known.

SECTION III

MANAGEMENT SECTION

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22nd Annual Sheep Day

Hettinger Experiment Station
Hettinger, North Dakota

February 11, 1981

Circular AS-700

NOVEMBER 1980

Sheep Production in DRYLOT CONFINEMENT

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Prior to making a decision to begin a sheep operation and especially a confinement operation, whether partially or in total, there must be reasons to justify the operation. In addition, there are pros and cons of a confinement operation that must be examined.

JUSTIFICATION

Predatory animals, primarily the coyote, are increasing at a rapid rate in the state. As a result, sheep numbers have suffered because of economic loss to producers. Lamb and wool are in demand at the present time. Lamb is currently being imported to meet demands in the United States. The demand for wool as a natural fiber has increased, and increased production would decrease U.S. petrochemical depletion from production of synthetic fiber.

The national average lamb crop is approximately 98 lambs per 100 ewes and the potential is 200 plus lambs per 100 ewes under confinement. While North Dakota sheep numbers declined from 1973-79, the 1980 figure (236,000) showed an increase of 19%. Ewe lambs held for replacement increased 22% from 1979 to 1980. Number of sheep operators in 1979 was 2,200, a 5% increase over 1978.

Inventory value of North Dakota sheep flocks was estimated at 15.3 million dollars in 1979 and 22.5 million dollars in 1980, a 47% increase.

North Dakota farm land is more productive for sheep when feed is harvested and fed than when the animals are grazed on land.

Many prospective farmers and ranchers are interested in the confinement of sheep as a diversification of existing farm units and others are interested in the concept as a new enterprise.

With present stock sheep numbers, every additional 10% improvement in lamb crop generates $1 million new wealth for the state of North Dakota.

PROS AND CONS OF CONFINEMENT

Through research and on the farm experience, sheep have shown that they are a versatile animal. They can adapt to a wide range of environmental circumstances, including confinement.

Confinement production of sheep may offer a producer advantages such as: a virtual elimination of losses from predators; a lowered energy requirement due to limited activity; an opportunity to feed ewes according to their productivity and nutrient requirements rather than their appetites; a reduction in internal parasite problems in lambs and ewes; a greater lamb and wool production per acre on highly productive lands with the use of harvested forages; a reduction in fencing costs; and a somewhat closer supervision over the flock.

Some disadvantages in confinement are: a higher initial capital investment, especially in buildings and equipment; superior management ability is required; nutrition and feeding of the ewe flock will require closer monitoring; certain health problems may be enhanced, such as external parasites and pneumonia due to closely confined animals; and annual manure handling and bedding costs may be greater.

These are just some of the major pros and cons of confinement production. Farm experience and research data may add to or change these factors in the future.

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BREEDS IN CONFINEMENT

Sheepmen who intensify management techniques will be increasingly interested in sheep breeds that will maximize the return per dollar invested in the sheep enterprise.

There are two broad categories of sheep being utilized in commercial sheep enterprises; they are the so called "ewe breeds" and sire breeds. Ewe breeds should be selected on the basis of (1) fertility (2) lamb survival (3) early puberty where ewe lamb replacements are being utilized in the breeding program, and (4) good wool production. Rams for use should be selected mainly on rate of gain because of the fairly high heritability of this trait. High growth rates are also associated with reduced feed requirements per unit of gain.

It would appear that some form of crossing scheme must be used to attain maximum productivity in commercial ewe flocks. Sheep producers have long recognized the value of cross breeding. Tables 1 and 2 show results on ewe prolificacy a Canadian sheep farmer obtained using various crosses in his breeding program under drylot-confinement rearing.

Table 1 indicates that breed differences do exist in conception rates, especially in ewe lambs bred to lamb at about one year of age. Finn and Finn-cross ewe lambs are definitely superior to Suffolk, Western and Suffolk-Western crosses. This superiority is also evident in the lambing rates of Finn and Finn-cross ewes as shown in Table 2. Table 2 also indicates that peak lambing rates occur in all breeds and crosses in ewes three years old and older.

Table 1

EWE PROLIFICACY - CONCEPTION

BREED OF EWE	EWE LAMBING AT AGE	EWES LAMBING/ 100 EWES EXPOSED ONE	TWO	THREE & OVER
Suffolk		61	94	97
Western*		42	95	96
Suffolk/Western		64	96	97
Finn/Western		94	98	98
Finn/Suffolk		96	97	99
Finn/Dorset		97	98	99
Finn		98	98	99

*Rambouillet, Columbia, and Targhee

Table 2

EWE PROLIFICACY - LAMBING RATE

BREED OF EWE	EWE LAMBING AT AGE	LAMBING RATE/ EWE LAMBING ONE	TWO	THREE & OVER
Suffolk		1.12	1.21	1.45
Western*		1.06	1.26	1.40
Suffolk/Western		1.14	1.30	1.52
Finn/Western		1.73	2.16	2.27
Finn/Suffolk		1.86	2.11	2.33
Finn/Dorset		1.89	2.25	2.28
Finn		2.24	3.08	3.48

*Rambouillet, Columbia, and Targhee

Lambing rates of various breeds and crosses at the Hettinger Branch Experiment Station of NDSU are presented in Table 3. The superiority of the Finn-cross ewe is evident again, but results also indicate that the Border Leicester cross ewes are very productive.

Table 3

CROSSBRED EWE PRODUCTIVITY, HETTINGER 1973-76

EWE TYPE	LAMBS BORN/ EWE BRED
Rambouillet × Rambouillet	1.57
Border Leicester × Rambouillet	1.86
N.C. Cheviot × Rambouillet	1.58
Finn × Rambouillet	1.90
Columbia × Columbia	1.63
Border Leicester × Columbia	1.57
N.C. Cheviot × Columbia	1.44
Finn × Columbia	2.18

The survival of lambs from birth to market is very important. Research information shows that most lamb deaths occur during the first week or two of life. Survival rates of various breeds and crosses are given in Table 4. Finns and Finn-cross lambs do show a slight tendency towards a higher survival rate. More importantly, the table indicates that high survival rates are possible under confinement production. Sheep producers don't have to be satisfied with the 15-20% death losses that some are experiencing.

Table 4

LAMB SURVIVAL

Ewe Group	Single		Twin		Triplet		Quads	
Days	2	90	2	90	2	90	2	90
Suffolk, Westerns, Suffolk/Western	95	93	94	93	92	86	82	77
Finn Crosses	96	96	95	93	95	92	86	80
Finns	98	95	97	95	96	92	92	87
Orphans (artificial milk replacer)	98	95	98	94	97	94	94	90

Growth rate is an important factor in the production of sheep. Next to prolificacy, it is probably second in importance as a selection factor. Table 5 indicates growth rates attained by Ransom Sheep Enterprises at Biossevain, Manitoba. Most commercial sheep producers should be able to attain these rates in their confinement operations. Under North Dakota conditions, lambs on experiment at NDSU have gained slightly faster.

NUTRITION

Given a chance, a ewe will eat three times what she needs. Fat breeding sheep are just as uneconomical to keep as are malnourished animals. Maximum profit is made only from ewes which are in optimum condition.

Table 5

RATE OF GAIN

Breed of Dam/Sire	Rate of Gain per Day			
	Males		Females	
Age (Days)	0 to 50	0 to 90	0 to 50	0 to 90
Suffolk/Suffolk	.80	.86	.72	.79
Western/Western	.68	.76	.56	.66
Suffolk-Western/Suff or Hamp	.81	.85	.69	.80
Finn-Western/Suff or Hamp	.76	.78	.62	.73
Finn-Suffolk/Suff or Hamp	.79	.90	.72	.84
Finn-Dorset/Suff or Hamp	.72	.83	.69	.77
Finn/Suffolk	.76	.80	.66	.72
Finn/Finn	.66	.74	.60	.70

Under confinement rearing, sheep are either a victim or beneficiary of whatever feed the sheepman chooses to give. Although the sheep, as a ruminant, has comparatively simple nutritional requirement, the confined sheep has no leeway to undo any nutritional mistake perpetrated against it. For this reason, the nutrition of sheep under confinement conditions must be done on a "required, needed, provided" basis. Sheep cannot be expected, in fact **cannot,** correct the nutritional mistakes made by man. Tables 6 and 7 list the daily nutrient requirements of sheep.

The nutrient requirements of a ewe during maintenance and the first 15 weeks of gestation are very similar. Under controlled feeding, as is the case in confinement, a producer can save considerable feed costs by feeding only the needed requirements during these periods. In regards to feeding lambs, it has been found that a minimum of 10% hay in an otherwise concentrated ration is necessary to avoid digestive disturbances and development of wool or wood chewing habits.

There is no one universal feedstuff for sheep. Availability usually dictates which feeds are used. Some general rules of thumb on feed compositions of different feedstuffs (as fed) are given.

Table 6

DAILY NUTRIENT REQUIREMENTS - 150 LB. EWE

PRODUCTION STAGE	PROTEIN LB.	TDN LB.	CALCIUM GM	PHOSPHORUS GM	VITAMIN A I.U.
Maintenance	.24	1.4	3.2	3.0	1200
1st 15 Weeks Gestation	.28	1.7	3.2	3.0	1800
Last 4-6 weeks Gestation	.43	2.7	4.5	4.3	6000
First 8 Weeks Lactation	.57	3.6	12.0	8.6	6000

Table 7

DAILY NUTRIENT REQUIREMENTS

	PROTEIN LB.	TDN LB.	CALCIUM GM	PHOSPHOROUS GM	VITAMIN A I.U.
Replacement Ewe Lambs	.29	1.8	6.3	3.5	2100
Rams	.55	3.4	8.3	4.6	4200
Early Weaned Lambs (40-50 days)	.3-.4	.6-.9	3-4	2-3	2-3000
Finished Lambs	.4	2.5	5	3.1	1020

HAYS	- 50% TDN
STRAWS	- 40% TDN
GRAINS	- 75% TDN
SCREENINGS	- 60% TDN
SILAGE	- 26% TDN

GRASSES	- 6-12% PROTEIN
LEGUMES	- 15% PROTEIN
STRAWS	- 4% PROTEIN
GRAINS	- 9-12% PROTEIN
SCREENINGS	- 13% PROTEIN
SILAGE	- 3% PROTEIN

GRAIN	- LOW CALCIUM, HIGH PHOSPHOROUS
SCREENINGS	- LOW CALCIUM, MEDIUM PHOSPHOROUS
LEGUMES	- HIGH CALCIUM, MEDIUM PHOSPHOROUS
GRASSES	- MEDIUM CALCIUM, LOW PHOSPHOROUS
STRAWS	- LOW CALCIUM, LOW PHOSPHOROUS
SILAGE	- LOW CALCIUM, LOW PHOSPHOROUS

These are average values and variations will exist within each feed. Looking at some of the feedstuffs more closely, the following comments can be made.

Alfalfa - Considering all feedstuffs, alfalfa is the closest to being a complete feed for sheep. Good quality alfalfa can provide almost all the daily nutrient requirements of a ewe. Removal of any portion of alfalfa from a ration requires replacing its nutritional equivalent. In short, alfalfa is a "magic" feed for sheep.

Grains - Outside of use in lamb feeding, grains are used in ewe rations during breeding, last 4 weeks of gestation, and first 8 weeks of lactation. Some general rules for feeding ewes during gestation and lactation, including grain feeding, follow.

"THUMB RULES" FOR FEEDING THE EWE

150 LB. EWE	TDN	PROTEIN
Early gestation	1.7 lb.	0.3 lb.
Late gestation	2.7 lb.	0.4 lb.
Lactation	3.7 lb.	0.6 lb.

GRAIN FEEDING/EWE DAILY

Late Gestation	0.5 lb.-1.0 lb.
Lactation	1.5 lb.-2.0 lb.

Straw - With the tremendous amount of grain produced in North Dakota, straw is available for feed use. Straw may be used to balance self-fed rations to prevent expensive overfeeding. Good quality straws will replace a portion of the roughage required to maintain a ewe on an annual basis. Feed analysis is valuable in estimating the feed value of your straws. Amount that can be used is dependent on ewe condition and quality of other feedstuffs.

Screenings - North Dakota has an abundance of different types of screenings. Their primary use should be to enhance the energy of poor quality roughages. Screenings are highly variable and should be used for what they are, an economical feed supply stretcher. Screenings will not replace alfalfa or whole grains. Be extremely cautious of the presence of ergot in screening supplies. Again, feed analysis may be of value.

FEEDING METHODS

Sheep are fed in many different ways. The following are comments on some of the pluses and minuses of different feeding methods.

HAND FEEDING
+ Low mechanical investment.
+ Allows maximum use of "The Eye of the Master."
– Labor intensive.

BUNK FEEDING
+ Less labor intensive than hand feeding.
– Requires larger mechanical investment than hand feeding.

SELF FEEDING
+ Even less labor intensive than bunk feeding.
– Larger mechanical investment than bunk feeding.

COMPLETELY AUTOMATED
+ Least labor requirement.
– Greatest capital investment in machinery and facilities.

FEEDER TYPES

The mode in which feed is fed to sheep also varies. Some pluses and minuses of different feeder types are presented.

FEEDING ON THE GROUND
– Out dated method, should be replaced.

SINGLE SIDED FENCELINE
+ Offers high level of convenience in per head consumption.
+ Sheep do not have to be moved prior to feeding.
– Most expensive for the work it does.
– Some designs allow small lambs to escape from the pen.

DOUBLE SIDED BUNKLINE
+ Most economical.
+ Works quite satisfactorily.
– Requires moving sheep prior to feeding.

ROUND 6-SIDED FEEDERS
+ Easy to move, handy in a storm.
+ Nice for small bunches, rams, sick pen, etc.
– Time consuming to build.
– Have to move sheep away for mechanized feeding.

SELF FEEDERS
+ Least labor intensive
+ Good way to utilize straw and poorer quality hays with less wastage.
– Requires ground roughage.
– Requires closer control of ration makeup to avoid overconditioning of animals.

SPACE ALLOTMENTS

The following are some guidelines on space requirements for sheep.

SHELTER SPACE	EWE	EWE & LAMBS	FEEDER LAMBS
Open-front building with lot	10-12 sq. ft.	12-16 sq. ft.	6- 8 sq. ft.
Lot	20-30 sq. ft.	25-35 sq. ft.	15-20 sq. ft.
Confinement	12-16 sq. ft.	16-20 sq. ft.	8-10 sq. ft.
FEEDER SPACE			
Hand feeding	16-20 inches	16-20 inches	9-12 inches
Self feeding	8-12 inches	8-12 inches	3- 4 inches
WATERER SPACE			
Open tank	15-25 ewes/foot	15-25 ewes/foot	25-40 lambs/foot
Automatic bowl	40-50 ewes/bowl	40-50 ewes/bowl	50-75 lambs/bowl
LAMB CREEP SPACE	1.5-2 sq. ft./lamb		

MANAGEMENT UNDER DRYLOT OR CONFINEMENT

Caliber of management of sheep under confinement obviously must be only of top level. Because more investment is made in buildings and equipment under confinement rearing, good facilities should generate better managers. The following are some management practices recommended for confinement or drylot production.

PRIOR TO BREEDING

- Bag and mouth ewes and cull those that don't meet requirements.
- Replace culled ewes with top-end yearlings or ewe lambs saved for replacement.
- Keep replacement ewe lambs on good growing ration.
- Evaluate Sires:
  - -Be sure they are vigorous, healthy and in good breeding conditions (possibly production tested).
  - -Rams should be conditioned 2 to 3 weeks before breeding season. Flush poor conditioned rams.
  - -Allow 2 mature rams or 4 buck lambs per 100 ewes.
- Crutch ewes.
- Flush ewes (if in thin condition).
  - -1 pound grain 2 weeks to 5 weeks (usually 17 days).
  - -If ewes are overconditioned the effect of flushing will be lessened.
- Vaccinate ewes for vibriosis.

BREEDING

- The ovulation rate of a ewe is lowest at the first of the breeding season. Vasectomized or teaser rams run with the breeding ewes through the first heat period tend to stimulate them and increase the ovulation rate at the second heat period.
- Test rams with marking harness or paint on brisket to see if they are getting the job done. Soft gun grease with paint pigment mixed in works good for painting brisket. A color sequence of yellow, red and black is recommended with colors being changed every 17 days.
- Leave rams in NO LONGER than 57 days (38-40 days more desirable).
  - -An exception may be with ewe lambs. Allowing them four heat cycles or 68 days may be beneficial.
- Remove rams (don't winter rams with ewes).

PRIOR TO LAMBING (First 15 weeks)

Early Pregnancy

- Watch general health of ewes. If possible sort off thin ewes and give extra feed so they can catch up.
- Feed the poor quality roughage you have on hand during this period saving the better for lambing.
- An exception to the above is feeding pregnant ewe lambs. They should receive good quality roughages and grain during this period.

LAST SIX WEEKS BEFORE LAMBING

- Drench ewes.
- Six to four weeks before, feed ¼-1/3 pound grain per ewe per day.
- Shear ewes, trim hoofs, and vaccinate ewes for enterotoxemia and soremouth. If vibriosis has been a problem, give ewes second vaccination for vibrio.
- Four weeks before lambing increase grain by ½-¾ pound per head per day (usually done immediately after shearing).
- Check facilities and equipment to be sure everything is in order.
- Two weeks before lambing increase grain to 1 pound per head per day.

LAMBING

- Be prepared for the first lamb some 142 days after turning the rams with the ewes, even though the average pregnancy period is 147 days.
- Watch ewes closely as extra effort will be repaid with more lambs at weaning time. Saving lambs involves a 24-hour surveillance. Additional help at this time is money well spent. Every lamb saved means a $50 bill.
- Put ewe and lambs in lambing pen (jug) after lambing (not before).
- Be available to provide assistance if ewe has troubles.
- Disinfect lambs navel with iodine as soon after birth as possible.
- Use heat lamps in cold weather.
- Be sure both teats are functioning and lambs nurse as soon as possible.
- Brand ewes and lambs with identical numbers on same sides.
- Turn ewes and lambs out of pen as soon as all are doing well (24 hrs. to 6 days).
- Bunch up ewes and lambs in small groups 4-8 ewes and then combine groups until they are in a workable size unit.
- Castrate and dock lambs 1-2 weeks after birth.
- Provide a place for orphaned lambs. Only one lamb should be left on ewe lambs and two left on older ewes. Very few ewes can successfully raise more than two lambs. Below are some management ideas for orphan lambs.

ORPHAN LAMBS - MANAGEMENT IDEAS

- Buy a good milk replacer, should be 30% fat.
- Each lamb will require from 12 to 15 pounds.
- Use good equipment. NDSU has had good success with the LAMB bar. Also, a self priming nipple and tube assembly is found to be excellent for starting orphans.
- Start on nurser quickly. Young lambs start easier. Check ewes udder right after she lambs and make decision. Lambs from ewes that are questionable in any manner should be put on artificial milk. Lambs will take to nurser best at young age.
- Self feed cold milk replacer after lambs are started. Milk replacers should be mixed with warm water for best results and then cooled down. Lambs fed cold milk grow well with less problems from scours and other digestive disturbance. Cold milk keeps better too.
- Vaccinate lambs to protect against overeating. For immediate protection use antitoxin. For long term protection use bactaria (cl. per fringens type D)
- Vaccinate to protect against "white muscle" disease.
- Best results have been obtained when lambs are fed in groups of three or four. This would be advisable when lambs are just being started. After lambs are successfully trained, they can be handled in groups of 25.
- Orphan lamb pens should be heated. A plastic tent can be devised and heated. Extra heat will save extra lambs.
- Provide colostrum milk for all orphans. Colostrum should be provided as quickly as possible. Colostrum milk is rich in fats, vitamins and antibody globulins to protect against disease organisms. Cow colostrum milk can be substituted for ewe colostrum milk.
- Provide supplemented feed at 7 days. Use high energy, highly palatable feed. Where few lambs are being fed it may be advisable to purchase a good commercial lamb creep feed.
- Provide clean fresh water.
- Wean lambs abruptly at 21-30 days of age. When to wean depends upon whether lambs are eating creep feed. Newly weaned lambs will go backwards for several days. Don't worry—lambs will make compensating gains later on.

END OF LAMBING TO WEANING

- Feed ewes according to number of lambs suckling with ewes having twins receiving a high plane of nutrition.

- Provide creep feed for lambs.

WEANING

- Wean ewes from lambs, not lambs from the ewes (ewes are removed from the pen). If lambs have to be moved to new quarters, leave a couple of ewes with them for a few days to lead the lambs to feed and water locations.

- Lambs should be weaned between 40-60 days of age or when they weigh approximately 50 lbs. and are eating creep and drinking water. The advantages of early weaning are that the ewe's milk production drops off to almost nothing after 8 weeks of lactation. In addition, big lambs butting the ewe's udder could damage the tissue, leading to mastitis.

- Restriction of hay and water to the ewe following weaning may lesson the chance for mastitis to occur.

WEANING TO PRE-BREEDING

- Drench ewes.

- Time of rest for ewes. Feed a maintenance ration.

- Time for shepherd to adjust ewes conditions so they can be effectively flushed, for next breeding season.

BREEDING EWE LAMBS

Confinement or drylot rearing has increased the practice of breeding ewe lambs. The reasons are:

- **Reduced maintenance costs before start of production.**
- **Shortened generation interval that results in more rapid genetic gains from selection.**
- **Increased lifetime production.**

This last statement is one of the reasons why producers for many years were skeptical about breeding ewe lambs. They felt that breeding ewe lambs at such a young age would reduce their body size and thereby decrease their future production. Research has shown that early breeding of **well managed** and **adequately nourished** ewe lambs has no detrimental effect on their subsequent reproductive efficiency. However, there is a tendency for ewes lambing as yearlings to be lighter and have poorer reproductive performance at 2 years of age than those that did not lamb as yearlings. This difference, however, disappears at 3 years of age.

Several factors influence the fertility of 7-8 month old ewe lambs.

Size and Condition at Breeding Time.

The health, vigor and physiological well-being of the ewe lamb is positively correlated with estrous response. Good condition of the ewe lambs means not getting them too fat. They should be 65% of their mature body weight at breeding time.

Breed Makeup.

The breed or breed makeup of the ewe lamb influences her fertility. The following indicates research results of various conception rates of different breed or breed combinations.

Suffolk, Hampshire, Specklefaced	*60%*
Rambouillet, Columbia, Targhee, Whitefaced	*40%*
Finn or Finn-Crosses	*95%*

Season of Birth.

Early born lambs (Jan-Feb) are better than late born lambs (April-May).

Time of Year Bred.

Higher fertility rate if bred during the end of October and November than September and first of October.

Ewe lambs that are bred at 7-8 month ages to lamb at about a year of age should be fed to gain 35 to 40 pounds during gestation. A pregnant ewe lamb should never experience hunger.

MONEY MANAGEMENT

For many years, producers could buy good yearling ewes for the price of a choice 100 lb. market lamb. Not any more! Today, yearling ewes are bringing over $100 and fat lambs are at $65-70/hundred weight. From the standpoint of the sheep industry these high prices for ewes do have a positive effect in the commitment one must make to sheep. Now, a $100 ewe represents more wealth, more security and greater borrowing power. Hopefully, this should result in better management and profit potential in the sheep industry. The old saying of "a sick sheep is a dead sheep" has a different meaning today as far as management is concerned when you're looking at $100 ewes versus $20-25 ewes.

A comparison of interest and depreciation costs of purchased ewes is given in Table 8.

Ewes normally are productive through 7 years. Very few ewes remain productive after 8 years. Interest and depreciation are calculated as if the loan were amortized, as most banks would expect. Mortality at 4% for ewe lambs means if you started with 100 ewe lambs, after 7 years 72 would be left to sell for slaughter. This data suggests that mature ewes are seldom worth more than 50% the value of yearling ewes. In the case of purchased ewe lambs, they must be bred to lamb at 12 to 14 months of age to realize their advantage in lower annual capital costs.

Confinement or drylot rearing of sheep creates increased building and equipment costs. Following are some estimated annual non-feed costs for a ewe.

Buildings (Deprec. plus int.)	$5.50
Equipment (Deprec. plus int.)	3.50
Vet/medicine	3.00
Ram costs	2.00
Shearing	1.25
Fuel, repairs, misc.	2.00
	$17.25

Building costs are figured on an allowance of 20 sq ft/ewe at $4/sq ft on a 20-year depreciation @ 10% interest. Equipment includes feed bunks, waterers, pens, etc., with interest calculated @ 13% on a 10-year depreciation. Both values represent 2/3 of the total annual building and equipment costs. The other 1/3 should be charged against another unit utilizing the barn, such as purchased feeder lambs. These estimates are highly variable and can change according to building costs, material costs, labor and interest charges.

Table 8

COMPARISON OF INTEREST AND DEPRECIATION COSTS OF PURCHASED EWES

	EWE LAMBS	YRLGS	MATURE EWES (5-7 YEAR OLDS)					
COST/HD	$95	$115	$50		$60		$70	
Production Yrs.	7	6	2	3	2	3	2	3
Annual Interest Cost/Ewe	8.14	10.06	5.63	5.00	6.75	6.00	7.88	7.00
Annual Deprec. Cost/Ewe Plus Mortality	11.51	16.63	16.60	11.60	21.60	14.93	26.60	18.27
Total Annual Capital Costs/Ewe	19.65	26.69	22.23	16.60	28.35	20.93	34.48	25.27

Interest @ 15%.
Mortality @ 4% annually for ewe lambs and yearlings, 8% for mature ewes.
Slaughter ewe value of $20/hd.

With inflated building and equipment expenses, these nonfeed costs now represent more of the cost of production than before. More importantly, these costs are independent of the level of production and are the same whether you raise a 100% lamb crop or a 150% lamb crop.

Annual feed costs/ewe used to represent about 70-75% of the total cost per year. Now with confinement or drylot, they represent about 60-65%. An estimated annual feed cost/ewe is:

1700 lbs hay equivalent @ $35/ton	$29.75
100 lbs grain @ 3.5/lb.	3.50
	$33.25

The grain includes that required the last 4 weeks of gestation and approximately 8 weeks of lactation.

By adding the annual non-feed and feed costs per ewe, it costs approximately $50 to keep that ewe. This is independent of the cost of the ewe herself.

Estimated feed costs for raising a lamb to market are:

80 lbs of creep @ 8¢/lb (10-50 lbs at 2 to 1 FE)	$6.40
270 lbs of grain @ 4.5¢/lb (50-110 lbs at 4.5 to 1 FE)	12.15
	$18.55

Looking at the increased costs involved with raising sheep in confinement, top management is a key to making it a profitable enterprise. Financial rewards from rearing sheep in drylot or confinement will not be realized by a producer weaning 100-130% lamb crop. Mediocre management that results in high mortality, inefficient production, high costs, and sub-par productivity per ewe will not pay the bills in confinement rearing.

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