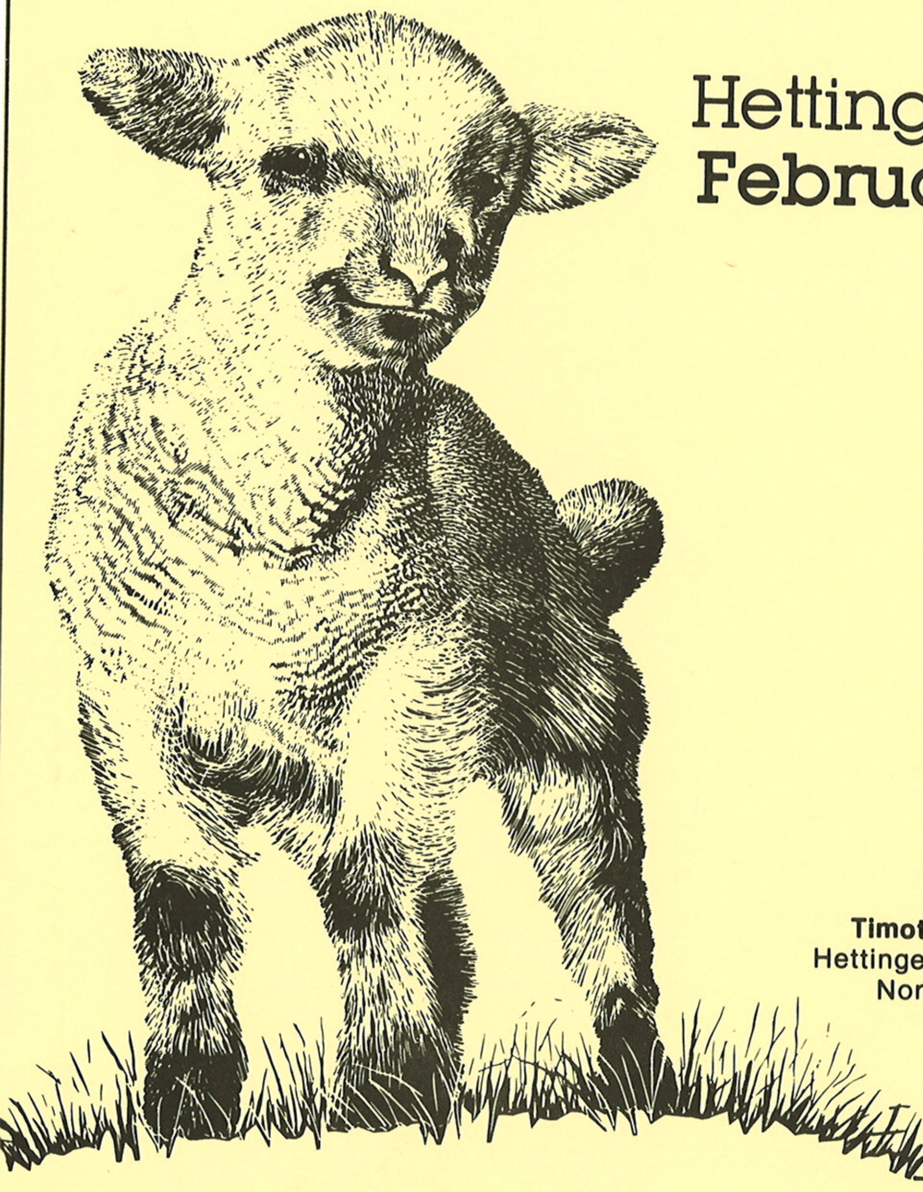
27th Annual
Western Dakota

SHEEP DAY



Hettinger Armory
February 12, 1986

Timothy C. Faller, Superintendent
Hettinger Research & Extension Center
North Dakota State University

PROGRAM

9:00 AM (MST)	Tours at the Station
9:40 AM	Working Sheep Dog Demonstration
10:00 AM	Coffee
10:30 AM	HETTINGER & FARGO STATION REPORTS Dr. Duane Erickson Dr. Paul Berg Dr. Kris Ringwall Mr. Timothy Faller
12:00 NOON	LUNCH: ROAST AMERICAN LAMB
1:10 PM	WELCOME Dr. H.R. Lund, Director Agriculture Experiment Station North Dakota State University
1:20 PM	SPIDER LAMBS Dr. Bert Moore Animal & Range Science Department North Dakota State University
1:50 PM	THE KED FREE PROGRAM Dr. Rodney Kott Montana State University Bozeman, MT
2:20 PM	ELECTRIC FENCING FOR SHEEP Mr. Tim Sorteberg Minneapolis, MN
2:50 PM	A BANKER LOOKS AT THE SHEEP BUSINESS Mr. Lee Buffington, President First Bank of Lemmon Lemmon, SD

*There will be a program for the ladies in the afternoon featuring, "MAKING SAUSAGE" and "A LAMB CUTTING DEMONSTRATION."

SHEEP DAY DIGEST
by
Timothy C. Faller, Superintendent
Hettinger Research and Extension Center
North Dakota State University

SECTION I

REPORTS OF RESEARCH IN PROGRESS

AT THE

HETTINGER RESEARCH & EXTENSION CENTER

AND MAIN STATION

PRESENTED BY

TIMOTHY C. FALLER
SUPERINTENDENT

DR. DUANE ERICKSON
ANIMAL & RANGE SCIENCE DEPT.
NORTH DAKOTA STATE UNIVERSITY

DR. KRIS RINGWALL
HETTINGER RESEARCH & EXTENSION CENTER

DR. PAUL BERG
ANIMAL & RANGE SCIENCE DEPT.
NORTH DAKOTA STATE UNIVERSITY

AT THE

27TH ANNUAL SHEEP DAY

HETTINGER RESEARCH & EXTENSION CENTER
HETTINGER, NORTH DAKOTA

FEBRUARY 12, 1986

WHEAT STRAW AS A FEED FOR CONFINED EWES
(PROJECT 3729)

T.C. Faller, C.N. Haugse and D.O. Erickson

Summary

Performance of ewes offered rations containing varying levels of straw continues to be variable with the group fed 60% straw/ 40% alfalfa having the better overall production. The percent ewes lambing and the percent lambing rate per ewe exposed has decreased each year. This may relate to some long term effect of this type of ration. Death loss in lambs is higher than desired.

Experimental Procedure

Two hundred and four yearling grade Columbia crossbred ewes were allotted into four treatment groups. Each treatment group was subdivided into three groups and placed in 12' x 24' pens on July 7, 1982. Treatment groups were as follows:

1. 100 percent ground alfalfa
2. 80 percent ground alfalfa + 20 percent ground straw
3. 60 percent ground alfalfa + 40 percent ground straw
4. 40 percent ground alfalfa + 60 percent ground straw

The ground roughage was mixed with water to alleviate dust and was fed with a mixer-feeder wagon three times weekly according to appetite. A salt mineral mixture was self fed.

All ewes were scored for body condition when the project was initiated and at intervals during the production year. Body scores of 5 = fat, 4 = good, 3 = medium, 2 = thin, and 1 = emaciated. All ewes were fed common rations during the flushing, breeding, pre-lambing, and the lactation period. Straw rations are fed from April 15 to July 25-30. Ewes are then fed a flushing ration for 2-3 weeks. Breeding takes place from August 20 to September 20. Ewes are returned to straw rations from September 20 to November 15-25. All ewes are then fed the same pre-lambing and lactation ration. The number of days on the straw ration has varied from year to year averaging from 160-180 days.

Results and Discussion

Initial weights (July 84) were all very similar (table 1). Weights taken mid-gestation (November 84) indicated a very slight gain in the 60% straw group (6#) and minor losses in the other groups (-21, -.3, -2#, respectively). All groups showed slight weight gains from mid-gestation to weaning (1.7, 3.8, 3.7, and 5.4 pounds).

Ewes were in generally satisfactory condition throughout the year. The number of thin ewes in the 60 percent straw, 40 percent alfalfa feed group exceeded the other groups (30%, 33%, 26%, and 20%).

TABLE 1. EWE WEIGHT AND PRODUCTION 1984-85

	100% Alfalfa	80% Alfalfa 20% Straw	60% Alfalfa 40% Straw	40% Alfalfa 60% Straw
Pre-breeding wt. (7-05-84)	160.2	165.0	160.4	157.4
Post breeding wt. (11-20-84)	158.2	164.7	158.3	158.0
Weaning wt. (4-05-85)	163.6	167.4	162.1	160.3
Fleece wt.	10.4	11.3	9.8	10.0
Ewe Score				
Pre-breeding wt. (7-05-84)	3.00	3.22	3.07	2.73
Post breeding wt. (11-20-84)	3.17	3.21	2.76	2.83
Weaning wt. (4-19-85)	2.95	3.03	2.70	2.69
Number of ewes	42	43	48	43
% Ewes lambing	79	67	71	74
% Lambing rate	164	155	182	150
% Lambing rate/ewe exposed	129	105	129	112
% Single births	45	55	32	50
% Twins	45	34	50	50
% Triplets or more	10	11	18	0
% Death loss	13	11	13	15
Lbs. of lamb/ewe exposed	64	40	57	61

TABLE 2. THREE YEAR SUMMARY - EWE PRODUCTION

Production Items	RATION							
	100% Alfalfa 0% Straw		80% Alfalfa 20% Straw		60% Alfalfa 40% Straw		40% Alfalfa 60% Straw	
	3 Yr. Ave.	85	3 Yr. Ave.	85	3 Yr. Ave.	85	3 Yr. Ave.	85
% Ewes Lambing	(81)	79	(83)	67	(78)	71	(87)	74
% Lambing rate	(150)	164	(154)	155	(150)	182	(157)	150
% Lambing rate per Ewe exposed	(120)	129	(128)	105	(116)	129	(134)	112
% Death loss (lambs)	(21)	13	(28)	11	(23)	13	(18)	15
Lbs. lamb per ewe exposed @ 90 days	(56)	64	(52)	40	(52)	57	(65)	61
% Single births	(35)	45	(30)	55	(36)	32	(33)	50
% Twin births	(63)	45	(70)	34	(62)	50	(60)	50
% Triplet (+) births	(02)	10	(00)	11	(02)	18	(07)	00

Varied levels of ewe performance indicated no pattern related to treatments imposed. Conception based on lambing data improved in all lots except for the ewes fed the 60 percent straw and 40% alfalfa rations during maintenance periods.

TABLE 3. AVERAGE YEARING EWE PERFORMANCE

	1982	1983	1984	1985
% Ewes Lambing	93	85	69	73
% Lambing Rate	144	151	164	163
% Lambing Rate Per Ewe Exposed	132	129	112	119
*% Death Loss (Lambs)	30	17	20	13
Lbs. of Lamb Per Ewe Exposed	52	63	54	56
% Single Births	41	35	23	46
% Twins	55	62	74	44
% Triplets (+)	3	2	3	10

A summary of four years performance is presented in table 2. Death loss is higher than desired. A summary indicating causes of death is not available at this time although it apears that a number of losses are due to pneumonia related conditions.

As ewes have increased in age there has been an increase in the number of multiple births and decrease in number of single lambs. Ewes fed the 60% straw /40% alfalfa ration have better performance than ewes fed other rations.

Performance of ewes on a yearly basis is presented in table 3. Percent ewes lambing had decreased in the years 1983 and 1984 and then increased slightly in 1985. Although the number of multiple births has increased the percent lambing rate per ewe exposed has also decreased. This decrease in performance may be related to some long term effect of this type of feeding regime, or it may be related interference of normal light patterns related to breeding indoors.

* 1985 only included those lambs that were actually lost not those that were orphaned as in years past.

Wheat as a Partial Replacement for Corn in Finishing Lamb Diets

D. O. Erickson, T. C. Faller and W. D. Slanger

Hettinger Research Station 1985

Summary

Wheat weighing 53 pounds per bushel was substituted for corn at four levels (0,15,30 and 45%) in high energy lamb finishing diets. The diets were corn/alfalfa with sunflower meal (SFM 40+) as the protein source and all were balanced for vitamins and minerals to meet or exceed the NRC requirements for finishing lambs. All diets were balanced to contain 69% TDN and 14.6% protein. Lambs were fed ad libitum complete ground diets. Two experiments using the same diets and feed sources were conducted with lambs with average initial weights between 60 and 70 pounds. In experiment one lambs gains decreased with the addition of wheat (.70, .68, .66 and .60 pounds/d) with a significant P<05 difference between no wheat and 45% wheat. The lambs dressed at about 50% in all treatments. In experiment two there was no difference in lamb response in gain, feed/gain, or dressing percentage among the 4 diets. The data would suggest that wheat can comprise up to 45% of a corn/alfalfa diets for finishing lambs. Less protein supplement is required when wheat is added, therefore this economic factor should be taken into consideration as well as the value of wheat and corn.

Introduction and Justification

There are occasions when the price of wheat makes it a competitive viable energy and protein source for livestock feeds. Light wheat and wheat screenings quite often are used as feed. Previous work has shown that digestive disturbances may occur if wheat constitutes a fairly large part of the diet. It is recommended that wheat be used only as a part of the grain mix for most species. Recommendations resulting from work done at NDSU with finishing cattle are that wheat should not make up over 50% of the grain mix or not over 6 pounds/head a day as the only grain fed along with a predominantly roughage ration. There is a need to establish the optimal level of wheat in a corn-alfalfa-SFM diet for finishing lambs. The resulting information will be useful to lamb feeders in making feeding management decisions. There is no information available on the feeding of wheat to finishing lambs when the protein supplement is SFM. The objective of these experiments are to determine the effect of various levels of wheat in a corn-alfalfa-SFM diet on lamb performance and carcass characteristics.

Experimental Procedures

Two experiments were conducted. The first, utilizing 320 lambs, in early spring and the second, utilizing 256 lambs, in late summer. The average initial weights of the lambs were 68 and 63 pounds (Table 5), respectively, for the two experiments. The design of both experiments was a 2X4 with 2 replicates and 4 dietary treatments in each. Lambs were allotted by breed, weight and sex. The dietary treatments were the substitution of wheat at 0, 15, 30 and 45% of corn/alfalfa/sunflower meal diets (Table 2). The nutritional composition of the feedstuffs were analyzed (Table 1) before the diets were calculated. All diets were calculated to contain 69% TDN and 14.6% protein (Table 2) with vitamins and minerals supplemented to meet or exceed the NRC requirements. The diets were sampled several times during each experiment and the resulting analysis are shown in Tables 3 and 4. Lamb weights were recorded bi-weekly and were taken off experiment at an average weight of 105 and 97 pounds in experiments one and two respectively (Table 5). Representative lambs were taken from each treatment and were analyzed for dressing percentage in each experiment.

Results and Discussion

Based on the analysis of the feed ingredients (Table 1), the four diets (Table 2) were calculated to contain 69% TDN and 14.6% protein. Twenty samples of each diet were taken during experiment one the results of the analysis of these samples are shown in Table 3. The diets contained about 15.3% protein and 75% digestible dry matter (IVDMD). As the % of wheat was increased, there was a decrease in fiber (ADF) and lignin (ADL), but this had no effect on the digestibilities. Lamb weight gains were similar when diets contained up to 30% wheat and decreased ($P<.05$) when 45% wheat was added in experiment one. Dressing percentage remained the same at about 50% for all diets. In experiment two the same feedstuffs (Table 1) and the same diets (Table 2) were used. The average nutritional composition of the samples taken during the experiment are shown in Table 4. The protein content averaged 14.8% except for the corn (control) diet which was somewhat lower. The digestible drymatters (IVDMD) for all diets averaged about 74%. The lambs gained .6 pounds per day on the corn (control) diets and slightly under .6 on the other diets. There were no real differences ($P>.05$) in gain. The lambs required about 7 pounds feed/pound gain with no differences among diets. The lambs dressed out at about 53% on all diets. The data resulting from these two experiments indicate that wheat is a satisfactory ceral grain in high energy diets up to 45% of the diet. The use of wheat lowers the amount of protein supplement needed.

Table 1

Composition of the Feedstuffs Used In
Both Lamb Feeding Experiments at Hettinger (1985)

	Percent (90% dry)			
Feedstuff	Protein[a]	TDN	Calcium	Phosphorus
Corn	9.0	80	.006[a]	.350[a]
Wheat[b]	17.5	74	.003[t]	.380[t]
SFM	34.0	68	.300[t]	1.250[t]
Alfalfa	15.0	52	1.200[a]	.250[a]
Limestone			.380[t]	

[a] analyzed
[b] bushel wt 53#
[t] table value

All diets contained TM salt .5%, limestone .5%, ammonium chloride .5%, super pellets 1.25% and ADE supplement .05% (or .025% if Elanco is used).

Table 2

Diets and Calculated Nutritional Composition
For Both Lamb Feeding Experiments at Hettinger (1985)

	Diet			
Feedstuff	1	2	3	4
	Percent			
Corn	53	44	35	25
Wheat	–	15	30	45
Alfalfa	32	31	30	30
SFM	15	10	5	–
Nutrient Fraction (calculated)				
%Protein	14.67	14.64	14.60	14.63
% TDN	69.2	69.3	69.2	69.0
% Ca	.622	.599	.531	.580
% P	.452	.414	.374	.334

Table 3

Analyzed Average Nutritional Composition[a] of
Diets Used In Experiment One At Hettinger Along With Standard Deviations

	Dietary Treatments			
Nutrient	Corn	Wheat(15)	Wheat(30)	Wheat(45)
		% and SD		
Protein	15.4 ± 1.55	15.0 ± .99	15.1 ± 1.07	15.7 ± .80
IVDMD (dig.)	74.6 ± 2.90	75.8 ± 2.09	76.4 ± 1.60	76.0 ± 1.90
ADF (fiber)	15.3 ± 1.99	14.6 ± 1.72	13.6 ± 1.66	13.0 ± 1.67
ADL(lignin)	3.32 ± .509	2.92 ± .416	2.64 ± .469	2.51 ± .506
Ash	6.30 ± 1.071	5.48 ± .671	5.43 ± .727	5.14 ± .905
P	.357 ± .038	.350 ± .027	.359 ± .062	.347 ± .044
Ca	.896 ± .329	.560 ± .220	.628 ± .197	.668 ± .212
Mg	.223 ± .066	.154 ± .047	.164 ± .032	.178 ± .044

N = 40 observations per mean

[a] All nutrients expressed on "as is" basis except minerals on the dry basis.

Table 4

Analyzed Average Nutritional Composition[a] of
Diets Used In Experiment Two at Hettinger With Standard Deviations

	Dietary Treatments			
Nutrient	Corn	Wheat(15)	Wheat(30)	Wheat(45)
Protein	13.5 ± 1.54	14.8 ± .74	14.8 ± .93	14.8 ± .92
IVDMD(dig.)	74.5 ± 2.30	74.2 ± 1.34	73.8 ± 3.23	74.3 ± 2.52
ADF(fiber)	13.9 ± 2.09	13.4 ± 3.61	15.2 ± 2.84	13.0 ± 1.90
ADL(lignin)	3.17 ± .801	3.78 ± 1.004	5.27 ± 2.916	2.88 ± 6.00
Ash	4.74 ± .833	5.08 ± .907	5.44 ± 1.062	4.57 ± .812
P	.328 ± .027	.358 ± .016	.326 ± .029	.332 ± .024
Ca	.599 ± .237	.765 ± .237	.817 ± .163	.588 ± .200
Mg	.193 ± .026	.234 ± .030	.209 ± .027	.190 ± .030

N = 8 observations per mean

[a] All nutrients expressed on "as is" basis except minerals on the dry basis.

Table 5

Results of Both Experiments Utilizing Wheat From Zero to Forty Five Percent With Lambs at Hettinger (1985)

	Dietary Greatments			
Experiment 1	Corn	Wheat(15)	Wheat(30)	Wheat(45)
Initial weight	68.25[a]	69.00[a]	69.20[a]	68.30[a]
Final weight	107.95[a]	107.60[a]	106.80[a]	102.60[b]
Total gain	39.7[a]	38.6[a]	37.6[a]	34.3[b]
Daily gain	.696[a]	.677[a]	.660[a]	.600[b]
Dressing %	50.1	50.1	50.5	49.8
Experiment 2				
Initial weight	64.90[a]	62.50[a]	61.60[a]	63.85[a]
Final weight	99.55[a]	95.40[a]	95.05[a]	97.50[a]
Total gain	34.65[a]	32.90[a]	33.45[a]	33.65[a]
Daily gain	.607[a]	.577[a]	.587[a]	.590[a]
Feed/day	4.17[a]	4.14[a]	4.12[a]	4.30[a]
Feed/gain	6.87[a]	7.18[a]	7.02[a]	7.28[a]
Dressing %	53.8[a]	52.7[a]	53.7[a]	52.4[a]

[a,b] Means with different superscript within a row are different $P<.05$

Urea and Urea/Sulfur as a Protein Substitute for Sunflower Meal for Finishing Lambs

D. O. Erickson, W. Limesand, W. D. Slanger and B. L. Moore

Sheep Barn NDSU 1985

Summary

Two experiments (3 treatments and 2 replicates) utilizing primarily purebred Suffolk, Hampshire and Columbia lambs of both sexes were conducted to determine the feasability of substituting urea or urea/sulfur to corn/alfalfa diets in place of sunflower meal (SFM) for finishing lambs. The initial and final weights of the lambs were 60 and 109 pounds respectively. Diets were fed ad libitum in pellet form and were iso-caloric (72% TDN) and isonitrogenous (14.1% protein). The dietary treatments were SFM or urea or urea plus sulfur to equal the sulfur in the SFM diet. Lamb performance was unaffected by dietary treatment in either experiment. Daily gains of the combined experiments were .79, .83 and .81 respectively for SFM, urea and urea/sulfur. The feed/gain values also were similar among treatment being 5.40, 5.09, and 5.15 respectively. None of the performances parameters were different at the 5% level of confidence. These data support the invivo and invitro data concerning the use of urea as a substitute for SFM which was previously reported resulting from research at NDSU. The data also indicates that corn/alfalfa/urea diets are not deficient in sulfur. The results from these experiments and from previously reported experiments supports the conclusion that protein supplements (SBM, SFM, urea or combinations of the supplements) can be used interchangeably and their uses would depend on economic considerations.

Introduction and Justification

Sunflower meals (SFM) 28, 35 and 41% protein are satisfactory protein supplements for feeder/finisher lambs. When fed in diets on an equal energy and protein basis the lambs perform similarly on SFM, soybean meal (SBM) or combinations of these. Previous work has shown that urea can replace either all or some of the SBM without affecting growth and efficiency provided sulfur is added. The sulfur can be added either as organic sulfur (sulfur containing amino acids) or as inorganic sulfur. The rumen microbes have the ability to utilize inorganic sulfur sources for the synthesis of the organic sulfur compounds that they require.

Abandano (NDSU) and Wanapat (NDSU) each have demonstrated by invitro and invivo methods that when urea replaces some of the SFM that digestibility and nitrogen balance were not appreciably affected. Little or no work has been reported concerning the affects on growth rate and feed efficiency by the replacement of SFM meal with urea or with urea and sulfur in diets fed to rapid gaining lambs. Information generated from these experiments will allow the producers to utilize urea as a substitute for SFM if economics warrant. The major objective of these experiments is to determine the affects of replacing SFM with urea or with urea and sulfur in high energy corn/alfalfa diets for lambs.

Procedure

Several samples of shelled corn, sunflower meal (SFM) and alfalfa were taken from the available feedstuff sources at the NDSU farms. They were analyzed for nutrition composition (Table 1) so that experimental diets could be calculated on an equal nutrient basis (Table 2). Iso-caloric (72% TDN) and iso-nitrogenous (14.1% protein) diets were formulated. Dietary treatments of SFM or urea or urea and sulfur (S to equal the SFM diet) were fed in two (3X2) experiments with 2 replicates in each experiment. The diets were sampled several times during the experiments and the analyzed average means with standard deviations are shown in Table 3. The protein and digestibility values were similar to the calculated values (Table 2). Sulfur in dietary treatment three was added in the form of sodium sulfate to equal the sulfur in treatment one (SFM). The calcium and phosphorus levels were higher in the diets than the calculated values but were in the desirable ratio range and levels. Diets were fed ad libitum in the pellet form. For experiment one Suffolk, Hampshire and Columbia lambs (72) were allotted by weight, sex and breed into 6 lots. The average initial weight was 58 pounds and they were fed to an average weight of 113 pounds (Table 4). Lambs were weighed every 14 days and feed intake was recorded by lot for the entire experiment. For experiment two, 42 primarily purebred lambs of the same breeds were allotted in 6 lots using the same design and procedures as outlined in experiment one. Lambs were put on experiment with an average weight of 62 pounds and were taken off when all lambs in the experiment averaged 104 pounds (Table 4). The data from each experiment were analyzed separately and with experiments combined (Table 4).

Results and Discussion

The lamb performance information is shown in Table 4. None of the parameters of lamb performance were different when tested at the 5% level of confidence. Lamb gains (#/d) were excellent, .85, .94 and .93 for experiment one and .74, .72 and .69 for experiment two; respectively for the SFM, urea and urea/s diets. Feed efficiency was also very good for each of the dietary treatments. The feed required/gains were 5.09, 4.80 and 4.83 for experiment one and 5.75, 5.43 and 5.52 respectively for SFM, urea and urea/s diets. Feed consumption was also unaffected by diet. When combining the results of the two experiments, the gains (.80#/d) and feed/gain (.5.2#) were similar (P>.05) among the dietary treatments and all diets supported excellent lamb performance. These results support those results previously reported (NDSU) that urea can substitute SFM as a protein source for lambs. Previous work also shows urea can substitute SBM in corn/alfalfa diets for lambs. The data generated in these experiments indicate that corn/alfalfa/urea diets have sufficient sulfur. This data (and previously reported data) support the conclusion the SFM, SBM and urea can be used interchangeably or in combination in corn/alfalfa diets of equal energy and protein for lambs. The feeding management decisions can be based on economic considerations.

TABLE 1

Composition of Feed Stuffs Used In Experiments
One & Two At The Sheep Barn 1985

Feedstuff	Protein[a]	TDN[T]	Ca[a]	P[a]	N[T]	S[T]
			%			
Corn	8.9	80	.008	.28	1.47	.12
Alfalfa	16.0	52	1.40	.25	2.72	.27
Sunflower meal	41.0	72	.28	.69	6.56	.38
Limestone	-	-	38.0[T]	-	-	-

TABLE 2

Diets and Calculated Nutritional Composition For Lamb
Experiments One and Two at the NDSU Sheep Barn 1985

	Protein Source		
Feedstuff	SFM	Urea	Urea/Surfur
		%	
Corn	65	72	72
Alfalfa	24	26.8	26.8
SFM	11	-	
Urea	-	1.2	1.2
Sodium Sulfate	-	-	.142
Protein	14.1	14.1	14.1
TDN	72.0	72	72
S	.19	.158	.19
Ca	.55	.56	.56
P	.32	.27	.27

All diets contained .5% TM salt, .5% limestone, .5% ammonium chloride, 1.25% super pellets (Rumensin) and .05% ADE.

TABLE 3

The Average Nutritional Composition[a] and Standard Deviation of the Diets Used in Experiments One & Two at the NDSU Sheep Barns Based on Analysis

Treatment	SFM	Urea	Urea/S
		%	
Protein	13.8 ± .74	13.8 ± .92	13.6 ± .46
IVDMD (dig.)	72.0 ± 2.15	71.8 ± 2.58	71.6 ± 2.56
Sulfur	.19	.16	.19
Ash	6.38 ± .94	6.56 ± 1.22	6.05 ± .79
Fiber (ADF)	15.0 ± 1.05	14.7 ± 1.33	14.9 ± 1.19
Lignin (ADL)	2.89 ± .409	2.65 ± .399	2.65 ± .369
P	.410 ± .165	.315 ± .069	.298 ± .047
Ca	.809 ± .170	.844 ± .189	.816 ± .141
Mg	.242 ± .033	.212 ± .046	.216 ± .036

[a] All values expressed on 90% dry basis except the minerals.

11 observations for each mean.

TABLE 4

Average Results[1] and Standard Errors From Experiments One and Two and the Combined Results of Lambs Fed Sunflower Meal or Urea or Urea/Sulfur

NDSU Sheep Barn 1985

	SFM	Urea	Urea/Surfur	SE
Experiment One				
Initial weight	58.0	57.6	57.2	.72
Final weight	111	115	115	
ADG	.851	.941	.932	.02
Feed/gain	5.09	4.80	4.83	.12
Feed/day	4.33	4.52	4.50	.07
Experiment Two				
Initial weight	62.2	62.1	61.9	1.26
Final weight	104	103	102	
ADG	.736	.720	.694	.02
Feed/gain	5.75	5.43	5.52	.14
Feed/day	4.23	3.91	3.83	.09
Both experiments combined (weighted means)				
Initial weight	60.1	59.6	59.8	.73
Final weight	108	110	110	
ADG	.794	.831	.813	.015
Feed/gain	5.40	5.09	5.15	.096
Feed/gain	4.29	4.23	4.19	.055

[1] expressed in pounds

None of the means within a row were different (P<.05).

ALFALFA/STRAW DIETS FOR CONFINED EWES AND SUBSEQUENT REPRODUCTIVE PERFORMANCE
Project No. 1756

J.T. Schmidt, R. Wasson, D.O. Erickson and J.E. Tilton

Objective

To relate nutritional parameters of chopped alfalfa/straw diets to subsequent ewe reproductive performance. Selected hormone concentrations will be determined by R. Wasson.

Summary

Laparascope examination revealed 23 pregnant ewes and 1 open ewe (one ewe not checked because of illness). Dietary intakes tended to decrease as % straw increased (table 1) and tended to follow a standard energy:intake curve. Soybean oil meal was supplemented to all ewes at a rate of .5#/ewe/day to correct the protein deficiency of the 60% straw diet. Ewes gained weight each period from weaning to early gestation on the all alfalfa diets compared to no change in weight of the ewes on the 60% straw diet with the exception of a weight loss shown from weaning to preflushing. There were no appreciable weight changes of the ewes on the other diets. Ewe reproductive performance is unavailable at this time.

Justification

Self feeding chopped straw/alfalfa diets can reduce feed costs and save labor. Past experiments (Light et al., 1984) involving alfalfa diets with 0, 20, 40, and 60% straw have indicated that ewes can perform satisfactorily on high straw diets. Much of the straw used in those studies were of higher nutritional quality than average straws. It has been shown (Barry and Johnstone, 1976; Brown and Johnson, 1985) that dry matter intake and digestible energy rapidly decrease below recommended levels (NRC. 1975) as percent straw increases. Additional research is needed to determine the relationships of several dietary nutritional components to levels of selected reproductive hormones in the blood and to relate the levels of nutrition and reproductive hormones to reproductive efficiency.

Materials and Methods

This project will continue through two reproductive cycles. Twenty five 2-3 year old ewes that had lambed at least once were randomly assigned to five groups of 5 ewes each. The ewes were penned individually in adjacent pens. The groups were fed as follows:

1. 100% alfalfa
2. 80% alfalfa/20% straw
3. 60% alfalfa/40% straw
4. 40% alfalfa/60% straw
5. 60% alfalfa/40% straw (negative control to be fed treatment diet from April 20 to November 25)

Soybean oil meal was supplemented equally to all ewes and the amount was based on the protein of the 60% straw diets. The treatment diets were self fed from April 20 - August 21 and continued from October 8 - November 25 for a total of about 167 days. During flushing (prebreeding) (August 21 - September 4) and breeding (September 4 - October 8) all ewes except the negative control pen were fed a common diet. The ewes were taken off the flushing diet after 2 heat cycles (October 8) and returned to the treatment diets. The negative control pen was fed the treatment diet from April 20 - November 25. After November 25 all ewes will be fed a gestation diet (alfalfa). Lambing should begin around February 1. After the lambs are weaned (March 31 - April 15) the ewes will be placed back on the same treatments as before. An additional 50 ewes were randomized in groups of 10 and fed identical diets as the 25 ewes. They will be used only to collect lambing data.

Blood samples were taken from all ewes three times each during maintenance and flushing/breeding. Fecal samples were collected rectally from each ewe three times each during maintenance and early gestation and once during flushing and breeding. Representative diet samples (about 9) were collected throughout the experiment and ewe weights were recorded at weaning, flushing, and mid-gestation (December 5.) Diets and feces will be analyzed as follows. Dry matter, protein, ash, calcium, magnesium and phosphorous will be determined by AOAC (1984) methods. Acid insoluble ash (AIA), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), cellulose, and hemicellulose were determined by methods of Goering and Van Soest (1970). In vitro dry matter digestibility (IVDMD) will be determined using modifications of the Tilley-Terry (1963) procedure. Dry matter (DM) protein, NDF, ADF, ADL, cellulose, and hemicellulose digestibilities were determined using AIA as an internal indicator. Blood phosphorous will be determined by AOAC (1984) methods. The weight data of lambs and ewes, feed intake, and digestibilities will be analyzed as a completely randomized design (Gill 1978). Orthogonal contrasts will be used to test hypotheses about treatment comparisons (Gill 1978). The reproductive data such as conception and lambing rates will be analyzed using the chi-square statistic (Gill 1978).

Approximate feeds needed/year (at 5#/head/day) are:

A. Treatment diets

1. Alfalfa	23.4 tons
2. Straw	11.4 tons
3. Salt	313#
4. Mineral Mix (20% P)	525#
5. Soybean Oil Meal	6270# (1/2#/head/day)

B. Flushing and breeding diets:

	amount needed	% of diet
1. Alfalfa	2.4 ton	86
2. Barley (or other grain)	.375 ton	14
3. Salt	90#	.5 self fed
4. Mineral mix (20% P)	160#	.9 self fed

Conclusions

Conclusions can not be made until completion of this project.

TABLE 1. DIET INTAKES[a]

Diet	Feeding period: Maintenance 4/20 - 8/19	Early gestation 10/16 - 11/27	Entire treatment 4/20 - 11/27
	#/day/ewe		
100% Alfalfa	4.6	4.4	4.5
80% Alfalfa:20% straw	3.7	3.6	3.7
60% Alfalfa:40% straw	3.2	2.9	3.2
60% Alfalfa:40% straw (neg. control)	3.2	3.0	3.3
40% Alfalfa:60% straw	2.5	3.0	2.7

[a]On an as fed basis.

TABLE 2. DIET INTAKES[a]

Diet	Feeding period: Maintenance 4/20 - 8/19	Early gestation 10/16 - 11/27	Entire treatment 4/20 - 11/27
	as % of body weight		
100% Alfalfa	3.1	2.7	3.0
80% Alfalfa:20% straw	2.6	2.4	2.5
60% Alfalfa:40% straw	2.2	2.2	2.2
60% Alfalfa:40% straw (neg. control)	2.2	2.2	2.2
40% Alfalfa:60% straw	1.9	2.3	2.0

[a]On an as fed basis.

TABLE 3. EWE WEIGHTS

	Weigh period			
	Weaning 4/23/85	Preflushing 8/23/85	Post breeding 10/22/85	Mid gestation 12/5/85
	Pounds			
100% Alfalfa	142	150	162	166
80% Alfalfa:20% straw	146	141	149	150
60% Alfalfa:40% straw	147	141	155	157
60% Alfalfa:40% straw (neg. control)	152	143	155	157
40% Alfalfa:60% straw	139	121	134	134

TABLE 4. MAINTENANCE DIET COMPOSITION[ab] (April 20–July 28)

	Treatment diet				
	Alfalfa	Straw	80% alfalfa 20% straw	60% alfalfa 40% straw	40% alfalfa 60% straw
	%				
DM	79.3±1.7	88.9±.7	80.2±2.8	82.6±2.5	85.4±1.1
CP	13.6± .4	1.6±.0	11.3± .3	8.2± .4	6.0± .5
Ash	8.4± .1	7.5±.7	9.4±1.3	8.7± .7	7.9± .2
ADF	38.1± .4	54.0±.8	42.2±1.0	46.6±1.5	49.4±1.7
P	.25± .03	.035±.006	.21± .02	.16± .01	.11± .01
Ca	1.36± .23	.31±.09	1.23± .4	.89± .07	.69± .01
Mg	.37± .02	.09±.03	.31± .07	.25± .02	.18± .01

[a]Other feedstuffs include 1/2# SBOM/ewe/day and trace mineral salt and 20% phosphorous mineral mix free choice.
[b]n=4.

TABLE 5. MAINTENANCE DIET COMPOSITION[ab] (July 29–August 19)

	Treatment diet				
	Alfalfa	Straw	80% alfalfa 20% straw	60% alfalfa 40% straw	40% alfalfa 60% straw
	%				
DM	85.0±0	85.3±.05	83.7±.03	86.6± .03	81.5± .007
CP	20.0±.4	5.5±.11	15.9±.1	13.9± .4	10.8± .1
Ash	12.3±.1	12.1±.1	12.1±.01	12.2± .01	12.0± .2
ADF	23.0±.3	47.8±.6	37.2±.4	37.5±1.3	40.6±1.5
P	.3±0	.145±.007	.27±0	.225± .007	.21±0
Ca	1.48±.03	.435±.007	1.17±.03	1.06± .007	.97± .02
Mg	.52±.02	.285±.007	.435±.007	.385± .02	.365± .007

[a]Other feedstuffs include 1/2# SBOM/ewe/day and trace mineral salt and 20% phosphorous mineral mix free choice.
[b]n=2.

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ALFALFA-WHEAT STRAW RATIONS FOR EWES AND THEIR EFFECT ON SUBSEQUENT REPRODUCTIVE PERFORMANCE

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Summary

Twenty-five ewes were randomly assigned on April 25 to one of five groups of five ewes each. One of five dietary treatments was assigned to each group. Fifty additional ewes were randomized into treatment groups on June 21 to provide additional reproductive data. Our data indicated there was no significant difference between treatments in body weight change for all dates weights were recorded. There was also no significant difference among treatments on number of ewes bred, number of matings per ewe or time of mating. Of 24 ewes laparoscoped to date, one was not pregnant. Stage of gestation at time of laparoscope was day 30 to day 60. At this point radioimmunoassay (RIA) of the hormones has not been completed.

Justification

In a sheep operation feed constitutes the largest production cost, representing approximately 60% of the budget. One method to lower this cost would be to substitute low cost roughages for more expensive dietary components. Past experiments at the Hettinger Experiment Station demonstrated that partial substitution of straw for alfalfa during pre and post-breeding periods could be achieved without hindering reproductive performance of the ewe flock. All ewes were fed a common flushing diet which may have masked any nutritional deficiencies of the treatment diets. Additional research is needed to evaluate hormonal differences among groups.

Procedure

Twenty-five ewes (3 or 4 years of age, lambed at least once) were randomly assigned on April 25 to five groups of 5 ewes each. One of 5 dietary treatments was assigned to each group. These ewes were individually penned to obtain detailed hormonal and nutritional data. Fifty additional ewes were randomized into treatment groups on June 21 to provide additional reproductive data. These were penned in groups of 5 and treatments applied in the same manner as for the other ewes except no blood samples taken and nutritional data not collected. Years will be used as replicates.

The dietary treatments are:

1. 100% alfalfa
2. 80% alfalfa/20% straw
3. 60% alfalfa/40% straw
4. 40% alfalfa/60% straw
5. 60% alfalfa/40% straw (negative control)

The treatment diets, 1-4, were self fed from April 15 - Aug. 15 and from Oct. 8 through Nov. 26 for a total of 186 days. From flushing through breeding (Aug. 15 - Oct. 8), all ewes except the negative controls were fed a common diet. The negative control group was fed the treatment diet the entire period, (April 15 - Nov. 26). Body weight was recorded at four times throughout the experiment:

April 25 - post weaning
August 21 - prebreeding
October 14 - postbreeding
December 5 - midgestation

On Aug. 15 the negative control ewes, (group 5), were allotted to one pen for the duration of breeding. The remaining 60 ewes were assigned to one of 3 pens for the flushing/breeding period. Flushing began at this time and a teaser ram was allowed fence-line contact with all ewes. On Sept. 4 the teaser ram was removed and four intact rams were painted and released, one in each pen of ewes, (1:15 or 1:20 ram to ewe ratio). Throughout the breeding period all ewes except the negative control group received one pound of barley per day and were self-fed alfalfa. Breeding dates were recorded and each ewe was allowed time to cycle twice in the presence of an intact ram. On Oct. 8 the rams were removed, and the ewes returned to their treatment diet until Nov. 26 when all 75 were placed on a gestation ration for the remainder of pregnancy. These ewes will be laparoscoped to determine pregnancy status. At parturition the number of lambs born/ewe and birthweight will be recorded. Immediately following weaning the ewes will be re-randomized.

Throughout the straw-feeding period blood samples were taken to estimate hormone secretion rates. The hormones to be evaluated are progesterone (P4) and luteinizing hormone, (LH). P4 requires only one 4-5 ml sample per day, but LH analysis requires "windows", or repeated sampling procedures to more accurately determine pulsatile release. For a period of six hours, a one ml sample is taken every 20 minutes. This was changed to every 10 minutes for four hours on July 31 to obtain a more detailed profile. Windows were collected on the following days:

April 24, May 17, June 18, July 31, August 19,
September 3, September 17 and October 1

Single samples were collected by veni-puncture using vacutainer tubes on the same dates as the windows and Oct. 1 through Nov. 8, taken biweekly. The analysis of P4 will utilize the procedure of Schneider et al. (1983). The LH assay used will be that of Ziecik et al. (1978).

Results

TABLE 1. CHANGE IN BODY WEIGHT (POUNDS±SEM) WITHIN GROUP OVER TIME

Date:	4/25/85	8/23/85	10/22/85	12/5/85
TRT	wt. s.e.	wt. s.e.	wt. s.e.	wt. s.e.
1	173.20(7.56)	181.47(7.41)	185.73(6.39)	198.78(7.89)
2	173.00(8.61)	168.93(8.94)	172.13(8.85)	177.67(9.72)
3	171.33(7.00)	171.53(8.13)	178.80(7.90)	182.13(7.19)
4	166.33(8.17)	159.07(9.46)	173.73(9.96)	177.20(10.27)
5	177.20(6.33)	173.67(6.73)	181.73(6.04)	183.87(5.99)
	n=75	n=75	n=75	n=74

TABLE 2. BREEDING DATA WITHIN GROUPS

TRT	n	mean days until first mark	marks per ewe
		s.e.	
1	15	10.47(1.95)	1.36
2	15	10.43(1.97)	1.40
3	13	9.56(2.05)	1.33
4	15	8.90(2.08)	1.33
5	14	5.28(0.81)	1.00

72=total number of ewes marked

Conclusion

At this point we cannot demonstrate a significant difference between treatments for weight change, but there was a difference in feed costs between treatments. If there is no reduction in lambing efficiency this savings in feed will benefit the producer.

SHEEP PRODUCTION AND GROWTH
PROJECT ND3732
1985 UPDATE

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INTRODUCTION

Following is an update of the current sheep research involving reproductive genetics and growth of sheep at the Hettinger Research Extension Center. Trends in the data our discussed but have not been fully subjected to statistical analysis. The project is ND03732 - SHEEP PRODUCTION AND GROWTH and is a cooperative effort between the Department of Animal and Range Science and the Hettinger Research Extension Center within the North Dakota State University Agricultural Experiment Station. This research encompasses several aspects of past and previously planned research.

The intent of this project is to serve a two-fold purpose. Outwardly, the sheep within this project demonstrate proper sheep management techniques that can be utilized for educational purposes to serve the taxpayers of North Dakota. However, the makeup and structure of each flock is such that detailed scientific questions are being proposed and answered concerning the biological mechanisms that cause the outward appearances producers see.

Currently, the potential for North Dakota sheep producers has not been achieved since a 180% or higher lamb crop marketed is achievable. Ewes weighing 140 pounds can produce a 180% lamb crop and market 180 pounds of fat lamb within an eight month period. The efficiency of edible protein production for sheep from conception to market cannot be matched by other herbivores. The major problem with sheep is the lack of edible protein production the remaining four months of the year. This project is a dedication of the North Dakota Experiment Station to overcome the factors that decrease the efficiency of sheep production, primarily seasonal infertility and low prolificacy. The end result of this project will improve the profitability of agriculture for individual North Dakota producers and, in turn, increase the efficiency of North Dakota agriculture.

PROJECT OBJECTIVES

1. Evaluate ewe production and offspring performance of specific crosses of Booroola Merino, Finnish Landrace, Rambouillet, Border Leicester and Suffolk breeds of sheep under different management systems.

2. Determine the effect of season on scrotal circumference of Rambouillet rams and reproductive characteristics of their offspring. Evaluate ewes lambing during January, March, and May under total confinement exposed to natural versus artificial light.

3. Evaluate the genetic mechanism which determines increased prolificacy of Booroola Merino ewes and develop breeding schemes to introduce Booroola fertility into North Dakota fine wool flocks. Evaluate the Columbia breed for a similar genetic mechanism.

PROJECT PROCEDURE

OBJECTIVE ONE

EVALUATION OF BREEDS UNDER DIFFERENT MANAGEMENT SYSTEMS

TRIAL ONE EXPERIMENTAL PROCEDURE. Reproductive performance and longevity of Suffolk x Rambouillet, Rambouillet x Finnish Landrace and Rambouillet x Finnish Landrace x Border Leicester ewes under total confinement versus semi-range management are being evaluated. The effects of warm barn confinement on longevity, health, lamb production and breed cross suitability are being monitored on two hundred thirty two crossbred ewes composed of 81 1/4 Finn x 1/4 Border Leicester x 1/2 Rambouillet (1/4 Finn), 76 1/2 Suffolk x 1/2 Rambouillet (1/2 Suff), and 81 1/2 Finn x 1/2 Rambouillet (1/2 Finn). Crosses to obtain these ewes were made in 1980 and 1981 utilizing a group of Wyoming white-faced range ewes and Finn, Suffolk or 1/2 Finn X 1/2 Border Leicester rams.

Two hundred seven ewes were placed on trial during the summer of 1981 and 25 ewes were added during the summer of 1982. The ewes in total confinement are being fed 75% of the nutritional requirements of sheep during maintenance (established by the National Research Council, referred to as NRC) and 100 percent of NRC requirements at other stages of production. The ewes under semi-range are placed on native or tame grass pastures each spring and wintered in drylot. Outside ewes are fed the same ration as confined ewes during gestation and lactation. All groups are allowed free access to a mineral mix of equel parts trace mineral salt, dicalcium phosphate and iodized salt. All ewes are mated to Suffolk rams with lambing starting about January 1 for confined groups and lambs are weaned at approximately 56 days. Semi-range management ewe groups start lambing in April and lambs are weaned at approximately 100 days of age. All lambs are finished to a market weight of 120 pounds.

TRIAL ONE RESULTS AND DISCUSSION. Although this trial will continue for two more years, preliminary trends can be noted in the data. Average maintenance and post-weaning body weights are presented in Table 1. The results are averaged over all four years of the trial and the 1/2 Suffolk ewes have consistently been the heaviest ewes. All crossbred groups under both management systems have had a fairly constant mature body weight during maintenance periods throughout the four years. The confinment ewes tend to weigh less following weaning and produce less wool than do the semi-range ewes. The difference in weight loss at weaning may be due to the time of weaning. The lambs from confinement ewes are weaned at eight weeks, while the outside lambs were not weaned until 14 weeks.

After four years of production under two different management systems an obvious trend in the number of ewes that were culled or died within each system can be noted (Table 2). Out of the 120 ewes that started in the confinement system, 50 ewes (41.7%) have died or have been culled. Twenty-one ewes (17.8%) have died or have been culled from the 118 ewes that started in the semi-range system. The 1/2 Finn group under confinement conditions have had the greatest loss in ewe numbers. Table 3 indicates at which stage of production the ewes died (excluding culls) within each system. Under confinement conditions, a substantial number of ewes died during the four months after lambing from complications during pregnancy and parturition. This same trend was not noted in the semi-range group of ewes.

TABLE 1

Average maintenance and post-weaning body weights (lbs) and wool weight (lbs) of ewes within each management system and crossbreed type over four years of production.

	Confined			Semi-Range		
	1/2 Suff	1/2 Finn	1/4 Finn	1/2 Suff	1/2 Finn	1/4 Finn
Maintenance	151.4	129.7	134.6	150.7	136.3	140.2
Post-Weaning	142.7	123.3	127.0	153.7	138.7	140.0
Wool	8.7	8.9	8.8	9.8	10.1	10.3

TABLE 2

Number of ewes within each management system and crossbred type that were culled or died during four years of production.

	Confined			Semi-Range		
Year	1/2 Suff	1/2 Finn	1/4 Finn	1/2 Suff	1/2 Finn	1/4 Finn
Initial Number	38	43	39	38	38	42
1982 Loss	1	4	1	2	2	5
1983 Loss	5	5	3	2	0	2
1984 Loss	6	1	2	2	2	0
1985 Loss	3	12	7	0	2	2
Total Loss	15	22	13	6	6	9

TABLE 3

Number of ewes within each management system that died during four months prior to lambing, four months after lambing or four nonlactating months.

Months	Confined	Semi-Range
Four Months Prior to Lambing	7	8
Four Months After Lambing	23	5
Four Nonlactating Months	6	2

Reproductive performance is listed in Table 4. All of the crossbred ewe groups under both systems of management have had similar fertility when expressed as a percentage of the ewes exposed that actually lambed. Over four years of production, the confined 1/2 Suffolks were the lowest at 80%. The most prolific crossbred group has been the 1/2 Finn ewes within each type of management. The 1/4 Finn and 1/2 Suffolk have had similar prolificacy under confinement, but the 1/4 Finn produced 21% more lambs than the 1/2 Suffolk under semi-range conditions. The same trends are noted in the percentage of lambs weaned per ewe lambing. When fertility and prolificacy are combined and expressed as the percentage of lambs weaned per ewe exposed, the differences between the crossbred groups are not as evident. Under confinement, the 1/2 Finn is producing the most lambs to sell, while under semi-range conditions, the 1/2 Finn and 1/4 Finn are both producing similar numbers of lambs to sell. The 1/2 Suffolk produces the least lambs at weaning, based on the number of ewes exposed.

Preweaning growth performance and death loss are presented in Table 5. The 1/2 Suffolk ewes produced the heaviest lambs at birth under both management systems and also the heaviest lambs at weaning. Preweaning average daily gain (ADG) is similar across all the crossbred ewe groups under both management systems. The greatest preweaning death loss is with the 1/2 Finn under semi-range conditions.

In conclusion, total estimated annual lamb production based on 80 day old lambs and ewe annual replacement rate within each management system and crossbred group is as follows. Under confinement, the 1/2 Finn produced 1.24 48 pound lambs for a total of 60 pounds with a 13% ewe replacement rate; the 1/4 Finn produced 1.12 51 pound lambs for a total of 57 pounds with a 9% ewe replacement rate; the 1/2 Suffolk produced 1.02 54 pound lambs for a total of 55 pounds with a 10% ewe replacement rate. Under semi-range conditions, the 1/4 Finn produced 1.38 49 pound lambs for a total of 68 pounds and a 4% ewe replacement rate, the 1/2 Suffolk produced 1.27 53 pound lambs for a total of 67 pounds of lamb and a 4% ewe replacement rate; the 1/2 Finn produced 1.37 48 pound lambs for a total of 66 pounds of lamb and a 6% ewe replacement rate.

TRIAL TWO EXPERIMENTAL PROCEDURE. The reproductive performance, wool production, and longevity are being evaluated for F1 Booroola Merino x Rambouillet, F1 Finnish Landrace x Rambouillet and Rambouillet (control) ewes under confinement versus semi-range management. Crosses to obtain these ewes were made in 1984 and 1985 utilizing a group of Wyoming Rambouillet range ewes and Finn or Booroola Merino rams leased from USDA-Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebraska. The Rambouillet control ewes will be purchased from the same source as the ewes utilized in making the F1 crosses. The initial ewe numbers for the project are 36 Booroola cross, 36 Finn cross, and 36 control ewes born in 1985 and 36 Booroola cross, 36 Finn cross, and 36 control ewes born in 1986. The females from the F1 lamb crop and controls are managed as replacement ewe lambs. All ewes and lambs are fed by current NRC requirements for sheep.

Puberty is monitored as ewe lambs from August until December. On August 1, two wethers per 100 ewe lambs are placed with the ewe lambs. Wethers which have been implanted with testosterone are equipped with Sire-Sine marking harnesses and mating activity is recorded at alternate 16 day intervals. The implants were ten cm long and made from silicone tubing (6.4 mm internal diameter, 9.5 mm outside diameter) by sealing one end with silicone rubber adhesive, filling the tube with testosterone propionate and sealing the open

TABLE 4

Reproductive performance of ewes within each management system and crossbred type over four years of production.

	Confined			Semi-Range		
	1/2 Suff	1/2 Finn	1/4 Finn	1/2 Suff	1/2 Finn	1/4 Finn
% Ewes Lambing	80	86	88	89	89	84
% Lambs Born Per Ewe Lambing	156	180	159	177	217	198
% Lambs Weaned Per Ewe Lambing	127	144	124	143	154	164
% Lambs Weaned Per Ewe Exposed	102	124	112	127	137	138

TABLE 5

Average birth weight, weaning weight, ADG, (lbs) preweaning death loss of Suffolk sired lambs from ewes in each management system and crossbred type over four years of production.

	Confined			Semi-Range		
	1/2 Suff	1/2 Finn	1/4 Finn	1/2 Suff	1/2 Finn	1/4 Finn
Birth Weight	12.0	9.5	11.2	12.6	9.6	10.8
Adjusted 56-Day Weight	41	37	39			
Estimated 80-Day Weight	54	48	51	53	48	49
Adjusted 100-Day Weight				63	57	59
Preweaning ADG	.52	.49	.50	.51	.48	.48
% Preweaning Death Loss	17.3	20.1	19.4	19.4	29.1	17.1

end with adhesive (Endocrinology 78:208-211 1966). The wethers are not reimplanted from August until January. In an effort to monitor estrus activity, mating marks are recorded as light if no more than 2 marks are evident on the ewes rump, medium if three or more marks are evident and heavy if individual marks can not be counted because of excessive mounting by the teaser wether. Ovulation rates will be determined during January by laparoscope techniques.

During September, as long-yearlings, each breed group will be split in half. One half of the Booroola, Finn and control ewes will be placed in the confinement barn, and the other half maintained under semi-range conditions. Those ewes in confinement will be in a warm barn housing unit following breeding in October until weaning. The confinement ewes will be moved to outside drylots while dry. The two ewe groups will be mated as one group. Breed groups will be composed of 36 Booroola cross, 36 Finn cross, and 36 control ewes under confinement and 36 Booroola cross, 36 Finn cross, and 36 control ewes under semi-range conditions.

Once these two groups are established, the ewes will be mated during October to Suffolk rams yearly until an overall 40% attrition rate is reached for the ewes. Ewes will be removed from the study by posting any chronic health disorder or two consecutive failures to give birth to a lamb. At lambing, ewes producing greater than two lambs will have excess lambs removed by 24 hours. Lambs will be creep fed and weaned at 70 + 7 days. Standard data collected on each ewe throughout this trial are: 1. Prebreeding weight and condition score. 2. Weaning weight and condition score. 3. Lamb birth date and sex plus birth, weaning, and market weight. 4. Attrition cause for ewe and lambs. 5. Udder score and lambing ease. 6. Yearly fleece weight and a lifetime fleece grade.

TRIAL TWO RESULTS AND DISCUSSION. The Booroola and Finn crossbred ewelambs and Rambouillet control ewelambs born during 1985 are presently being grown out. Weaning weights and early growth data are not available on all breedgroups since the Rambouillet control ewelambs must be purchased and they are born and raised under range conditions, while the crossbred ewelambs are raised under drylot conditions. Differences between the two rearing systems are assumed to be nonsignificant when the ewes start the trial at eighteen months of age. The matings have been made to produce the 1986 ewelambs. Different sires within each breed were used each year.

On October 9, 1985 the Booroola and Finn crossbred ewelambs were weighed and the Booroola ewelambs averaged 91 pounds and the Finn ewelambs averaged 109 pounds. Both groups were approximately seven months of age. Puberty was monitored and the results presented in Table 5. The Finn ewelambs started extrus activity sooner than did the Booroola ewelambs. By November 19, only one Finn ewelamb had not expressed estrus, while 18 Booroola ewelambs had not.

LAMB FEEDING STUDIES

TRIAL FOUR EXPERIMENTAL PROCEDURE. Male lambs produced from Booroola, Finn, Suffolk and Rambouillet sires are fed out under various nutritional regimes using standard production and efficiency measures. Treatment comparisons of the lamb groups include protein levels, protein supplement sources (SFM, SBM, LSM, and combinations), grains (barley, oats, corn, wheat, and combinations), as well as non-protein N sources. Additional standard carcass parameters such as shrink, grade (streaking and conformation score) and 13th rib back fat depth are recorded and summarized on each market lamb. This trial is reviewed yearly and changed according to current research needs.

TABLE 6

Number of Fl Booroola x Rambouillet and Fl Finn x Rambouillet ewe lambs that expressed estrus from August through November 1985.

			Date			
		Total Ewe Lambs	Aug 30	Sept 16	Oct 9	Nov 19
Booroola	x	36	0	0	0	18
Finn	x	36	1	5	14	34

TABLE 7

Comparsion of Booroola Merino and Finn sheep for various production and carcass production.

Traits	Booroola	Finn	Suffolk***
Starting Weight	65.1	73.6**	68.25
Off Test Weight	98.3	108.7**	107.95
On Test ADG	.574	.615*	.658
Final Weight	99.1	109.6**	
Carcass Weight	51.3	54.6**	
Foresaddle Weight	24.7	26.3**	
Hindsaddle Weight	24.6	25.8*	
Leg Score	10.5	10.7	
Quality Grade	10.9	11.3*	
Kidney Percent	2.6	3.0*	
12th Rib Back Fat	0.203	0.204	
Rib Eye	2.03	1.91**	
Yield Grade	3.1	3.2	
% Hindsaddle	50.0	49.6	
Dress Percent	52.9	53.3	50.13

*P<.05
**P<.01
***Data from previous feedlot trials involving the same facilities and rations as used for the Booroola and Finn lambs. The Suffolk sired lambs were fed out three months before the Booroola and Finn sired lambs. The Suffolk data is included to serve as a bench mark to help put the Booroola and Finn data in perspective.

TRIAL FOUR 1985 EXPERIMENTAL PROCEDURE. F1 Booroola X Rambouillet and F1 Finnish Landrace X Rambouillet male lambs were weaned and placed on a finishing ration in which wheat was substituted for corn at four levels (0,15,30 and 45%) in a corn/alfalfa ration with sunflower meal (40% + protien) as the protein source. All rations were balanced for vitamins and minerals to meet or exceed the NRC requirements for finishing lambs. All rations were balanced to contain 69% TDN and 14.6% protien. Lambs were fed ad libitum complete ground diets.

As the F1 cross lambs reached slaughter weight, 102 lambs were sent to a slaughter facility in Iowa and standard carcass parameters were collected on all lambs (rams and wethers) with the exception of carcass weight. The failure to obtain hot carcass weight on these lambs forced us to make comparisons based on live rather than on the preferred carcass weight. Gut fill plays a very important roll if the comparison is on the live weight basis. One is forced to assume that there was no difference between the two crosses relative to gut fill as of the last weight obtained.

A group of 52 lambs (all wethers) was sent to the NDSU meat laboratory for slaughter and further processing. Some lambs within this group finished their feeding period at NDSU in order to accomodate transportation of lambs and kill capacity of the NDSU facility. In addition to the standard fat, loin eye, kidney percent, leg and quality score, the parameters of hind and fore saddle weight as well as hot and cold carcass weight were obtained. Statistical analysis included all animals from each of the crosses for the various traits however the numbers of observations for each trait varied because not all traits were measured in all lambs due to classroom use or simple oversite.

TRIAL FOUR RESULTS AND DISCUSSION. The comparison of the F1 Booroola and F1 Finn for growth and carcass parameters is presented in Table 7. The data is combined over all four rations since no significant difference was found between rations. Significant differences for live, carcass and fore saddle weight in favor of the Finn cross was demonstrated. The Booroola crosses were significantly superior for percentage of kidney fat and loin eye area. The Booroola lambs were also slightly less fat, had a higher percent hind saddle and slightly more desirable USDA yield grade scores, however the differences were too small to be deemed significant. The Finn crosses had a small nonsignificant advantage for leg score and dressing percent. The growth data of Suffolk sired lambs produced and fed under the same conditions as the Booroola and Finn lambs is included to demonstrate that average daily gain for both the Booroola and Finn sired lambs is comparable to the Suffolk sired lambs. Initial indications from one years comparision would suggest that both Booroola and Finn sired lambs have acceptable growth and carcass composition.

OBJECTIVE TWO

SEASONAL EFFECTS ON SHEEP REPRODUCTION

TRIAL FIVE. The influence of season on scrotal circumference of Rambouillet rams and reproductive characteristics of their offspring are being evaluated. A cooperative agreement was obtained with Glenn Brown, Buffalo, South Dakota to evaluate Rambouillet rams yearly and classify these rams as seasonal or nonseasonal rams. Seasonal rams are defined as those rams whose scrotal circumferences decrease dramatically from fall to spring while non-seasonal rams show little change in scrotal circumferences. Scrotal measurements are obtained in late February and late July from the Brown flock and ram selection is based on these two measurements. Two seasonal rams and two nonseasonal rams will be purchased each year and evaluated intensively for two years to verify if the rams are classified correctly. Blood analysis for testosterone, luteinizing hormone, gonadotrophin releasing hormone and melatonin will be done.

Initialy 100 Rambouillet ewes were purchased and were mated to seasonal and nonseasonal rams to produce 108 daughters. Divergent selection will be practiced by continually breeding seasonal sired ewes to seasonal rams and nonseasonal sired ewes to nonseasonal rams. The original source flock of the Rambouillet ewes will serve as a control flock and 30 ewes will be purchased every five years to evaluate seasonal reproduction in the flock.

As ewe lambs, teaser rams will be placed with them in August and estrus will be monitored as previously defined under trial 2 until the ewes are mated to seasonal and nonseasonal rams at 18 months of age. The flock of 108 ewes (two years old and older) will be maintained in confinement from October until June 1. One third of the mature ewes will be replaced annually with young ewes sired by nonseasonal rams or seasonal rams. The degree that a ewe is seasonally reproductive will be determined by the teaser ram, blood analysis for progesterone, and laparoscopy.

TRIAL FIVE RESULTS AND DISCUSSION. Four Rambouillet rams were purchased in August of 1985 after initial evaluation of Brown's Rambouillet rams. Two rams were selected each from two different age groups of rams. The ram with the greatest change in scrotal circumference and the ram with the least change in scrotal circumference was selected from each age group. These rams have had scrotal circumference measurements taken on a monthly bases since August, 1985 and are noted in Table 8. The March and August measurements were scrotal circumferences used to select the rams. Since the initial selection, the nonseasonal rams have remained fairly constant with the exception of the January measurement. The November measurement following one month of breeding was also decreased in nonseasonal rams. The seasonal rams progressively decreased in scrotal circumference from August until December and then increased in January. Body weight is also listed for each measurement time period. The January increases in scrotal circumference coincided with two months of weight gain following breeding during October. The mating performance of each ram class is presented in Table 9. Both seasonal and nonseasonal rams mated similar numbers of ewes.

OBJECTIVE THREE

GENETIC ENGINERING

DEVELOPMENT OF THE DAKOTA BOOROOLA

TRIAL EIGHT EXPERIMENTAL PROCEDURE. A flock of 100 Booroola x Rambouillet ewes as well as sufficient rams will be maintained under semi-range conditions at the Hettinger Research Extension Center. Initial crosses to obtain these ewes were made in 1984 and 1985 utilizing a group of Wyoming Rambouillet range ewes and Booroola Merino rams leased from USDA-Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebraska. Selection efforts will be for homozygousity of the Booroola fertility gene. All ewes and rams must have fleeces that grade 60s or higher and ewes and rams must be classified as homozygous or heterozygous for the Booroola fertility gene based on either production or ovulation rate.

TABLE 8

Nonseasonal and seasonal Rambouillet ram's scrotal circumference measurements and body weight.

	Ram Number	March	Aug	Sept	Oct	Nov	Dec	Jan
Scrotal Circumference (cm)								
Seasonal	2	28.5	39.1	37.2	35.6	32.1	31.7	34.2
Nonseasonal	2	31.7	33.3	33.7	34.3	31.5	33.7	37.0
Body Weight (lbs)								
Seasonal	2			207	224	212	230	246
Nonseasonal	2			202	219	211	232	246

TABLE 9

Number of ewes mated by nonseasonal and seasonal Rambouillet rams during fall breeding when exposed for two estrus cycles.

Ram Class	Number Ram	Number Ewe	1st Cycle	2nd Cycle	Both Cycle	Total
Seasonal	2	53	47	6	7	53
Nonseasonal	2	54	44	9	13	53

As ewe lambs and yearlings, ewes will have laparotomies done during January to determine ovulation rate. Those ewelambs with ovulation rates greater than five will be classified as homozygous and the ewelambs with ovulation rates of three or four will be classified as heterozygous. As yearlings, the ewes will have laparotomies to compare ovulation rate as ewelambs with ovulation rate as yearlings. Ewes will be culled for chronic health reasons. Stud rams will be progeny tested to determined if they are homozygous or heterozygous for the Booroola fertility gene.

TRIAL EIGHT RESULTS AND DISCUSSION. Currently 71 F1 ewelambs are present sired by five different Booroola Merino Rams. All ewelambs were exposed to Booroola Merino sires during the fall of 1985. January laparotomies revealed that 11 of the ewe lambs appeared pregnant. Table 10 reveals the results of the January laparotomies in terms of ovulation rates detected from ewelambs of each sire. The ovulation rates of sires 1 and 2 appear to be different from sires 3, 4 and 5, more numbers of ewes need to be tested to confirm these observations. The ewelambs have also contacted an acute to subacute dermatitis which is currently under study by the North Dakota State University Veterinary Science Department.

TRIAL NINE. The Columbia ewes (from former North Dakota Agricultural Experiment Station Project 6260) have been designated into two groups. The first group will function as controls. The basis for this line will be the Columbia type standards set by the Columbia breed association. The group will be maintained between 20 or 30 yearling ewes and older. A similar number of ewes will be maintained for a selected line. Selection efforts will be for homozygousity of a gene similar to that in the Booroola Merino breed. All ewes and rams must be registered Columbias and ewes and rams must be classified as homozygous or heterozygous for the "Columbia" fertility gene. A ewe which produced two or more sets of triplets prior to 4 1/2 years of age, had twins at her first lambing and has an average lifetime production of lambs born greater then 2 lambs per exposure to the ram will be classified as a homozygous ewe. A ewe will be classified as heterozygous if a ewe's average lifetime production of lambs is greater than 1.6 lambs per exposure to the ram and the ewe produced twins the first time she lambs. Stud rams will be progeny tested to determine if they are homozyous or heterozygous for the "Columbia" fertility gene.

Initially, ewes which produced three or more sets of triplets or had a set of quadruplets will be classified as potential carriers of the gene. These ewes and their progeny will be sorted into maternal family groups. Mating plans will be set to concentrate the potential gene. Ewes will be maintained and rams selected from within the flock as long as inbreeding remains below 20 percent. Different rams will be used between the two groups of Columbias and once ewes are culled from the group selected for reproductive performance, they are ineligable for the visually selected Columbias. All stud rams must be from ewes that have had three or more sets of triplets or had a set of quadruplets.

TRIAL NINE RESULTS AND DISCUSSION. One maternal line was dicovered within the present Columbia ewe flock that met the qualifications to be classified as potential carriers of a fertility gene. Ten ewes trace back to 79-341, plus 79-341 is still in production. In addition, several younger ewes also met the qualification including 80-348 who also has 5 offspring within the flock. Currently, their is a total of 12 mature ewes within the selected flock and nine ewe lambs born in 1985. These 21 ewes can be divided up into five maternal family groups. No sire has been identified to mate these ewes to at the present time.

TABLE 10

Number of ewe lambs with none, single, twin, triplet or quadruplet ovulation rate for five Booroola Merino sires.

	Sire				
Ovulation Rate	1	2	3	4	5
None	3	1	2	0	2
Single	10	6	2	4	2
Twin	1	1	5	10	3
Triplet	0	0	0	0	1
Quadruplet	0	0	0	1	0
Total Ewe Lambs	14	8	9	15	8
Average Corpus Luteum present excluding ewe lambs with none	1.09	1.14	1.71	1.87	1.83

SECTION II

REPORT ON

SPIDER LAMBS

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THE KED FREE PROGRAM

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AT THE

27TH ANNUAL SHEEP DAY

HETTINGER RESEARCH & EXTENSION CENTER
HETTINGER, NORTH DAKOTA

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Congenital Defects of Sheep (Spider Syndrome)

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Congenital defects in neonatal lambs have been identified as an increasing problem in sheep flocks nationwide. A pattern of skeletal defects has been observed. The most common of these is bowed front legs or a bilateral articular rigidity and rotation of the knee (carpal) joint. The next most frequent defect is a similar lesion in the hock (tarsal) joint. Others include spinal deviations (kyphoscoliosis and torticollis) and anomalies of the jaw and soft tissues. Defective hearts have also been observed in association with these skeletal problems.

The National Suffolk Sheep Society has funded research projects and a number of universities have projects underway to study the problem. Preliminary findings indicate a genetic basis to the problem. The NDSU project has been designed to rule out infectious and nutritional causes and attempt to identify if the condition is genetic. If the condition unquestionably proves to be genetic it is hoped that the mode of inheritance can be determined and a method of identifying possible carrier animals identified.

The program to investigate this problem is as follows. Considerable numbers of these lambs have been collected from cooperating breeders. Complete diagnostic autopsies of the lambs are performed if they are submitted dead or if they die or become unable to survive. Some individuals have been xrayed. Numerous dead individuals have been cleaned of flesh down to bare skeletons. A full scope of diagnoses have been done to eliminate any infectious (including some prominently mentioned viral diseases) causes. Blood mineral analysis has been performed and plans are to conduct cytoplasmic and kariotyping investigations. Pedigree information (if available) is gathered on all lambs but is kept confidential.

Obtaining normal appearing ewes that have produced affected lambs has been more of a problem than was previously expected. Twenty-two normal appearing ewes are bred to a ram that has proven to sire a high percentage of these lambs. These ewes will lamb in March. Also blood progesterone levels indicate that several severely affected individuals are pregnant to an affected fertile ram. These lambs are anxiously anticipated if the females are capable of carrying them to term.

The sheep industry has apparently not had the experience dealing with the problem of abnormalities that the beef industry has had. One of these significant problems in beef cattle was that of shorter dwarfism in Herefords and Angus during the 1950's. This was a problem with which these breeds wrestled for a number of years. For a time cowboys at some of the largest and most prestigious Hereford ranches carried rifles with them on all pasture checks to shoot these "runt" calves.

In the case of both breeds the problem was overcome but in different ways. Both breeds depended on the breeders to take initiatives. Once the problem was determined to be genetic in nature steps to control the problem were made. In the case of Herefords, they did an extensive search of pedigrees and were able to identify from where the problem came. Breeders were then asked to report incidence of the problem to the breed association and "pedigree checks" on cattle could be done to determine whether an individual traced to "known dwarf producers". Sales were conducted which were advertised as consigning cattle only containing "clean pedigreed" individuals. Contrary to some peoples' beliefs, registration certificates were not cancelled by the breed association. Any elimination of registration certificates that occurred was done by breeders who turned some of these cattle into commercial individuals. This was done in a number of cases.

Angus breeders took a different approach. Basically they put "teeth" into their standard guarantee. Breeders who sold cattle under this guarantee accepted that any individuals would not produce a dwarf offspring within a specified period of time. Of course this guarantee was subject to certain conditions which were clearly spelled out. It still came down to the breeder's responsibility to stand behind the cattle sold. Interestingly enough, both breeds worked out the problem in different ways and dwarfism is no longer a big concern to either breed. Other problems identified as genetic in nature have caused concern and been worked out in these and other beef breeds. Experience has taught them how to efficiently deal with the problems.

The problem is one not to be taken lightly nor to cause overreaction. As the percentages of affected lambs in specific flocks increased and incidence of them in a wider number of flocks across the nation has become more common, the concern about the problem has escalated. There are differing opinions as to the economic impact of the problem. Obviously the more common the problem the larger the impact. Throughout an entire breed the incidence might be low. However if an individual's flock is affected, chances are the incidence can be high and can have a most serious financial affect on that flock.

Many questions remain unanswered. The problem of "spiders" is something that the entire sheep industry needs to take very seriously. It is not merely a Suffolk problem or a black-faced sheep problem but rather an industry problem. No breeder of sheep needs to think he is immune to it but breeders likewise should not panic or become paranoid.

THE MONTANA KED-FREE PROGRAM

by
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The sheep ked is a wingless fly that is sometimes called the sheep tick, because, to most of us, it looks like a tick (Figure 1). It is a blood-feeder that lives permanently on the host and is specific to sheep. It cannot live on any other host animal. Also, a sheep ked can only live for short periods of time when separated from sheep.

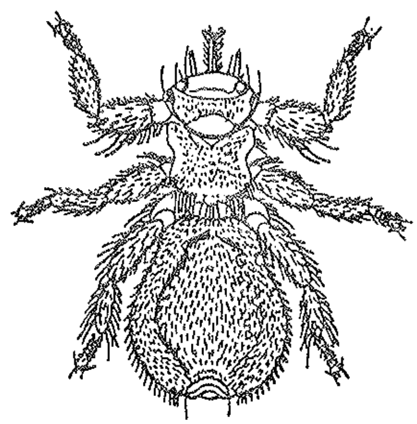

Figure 1. The adult sheep ked.

In the past, sheep producers have utilized many different types of treatments to control the sheep ked. Although a variety of insecticides are available for use to control the sheep ked, each has certain limitations.

Recent research has shown that the newer pyrethroid insecticides appear to be quite effective at low rates of application. Wyoming researchers (Lloyd, 1983) have extensively evaluated Fenvalerate or "Ectrin"™ against the sheep ked and found it to be quite effective. Initial claims are to be 100 percent effective when applied as a single treatment (Table 1). The product seems to be equally effective when applied as a dip, sprinkle, spray or pour-on. Because of the effectiveness of Ectrin™ against sheep ked, the potential exists to possibly eliminate the sheep ked.

Table 1 . Efficacy of Ectrin Insecticide for Sheep Ked Control[a]

Treatment	Flock Number	Fleece Length (in.) at time of Treatment	Keds/Animal Pre-trtmt count	Keds/Animal 6wk Post trtmt count	% Re-duction
NONE	1	.91	11.2	12.8	--
Spray (0.025%)	2	.87	11.8	0	100
	3	.35	24.4	0	100
Sprinkler (0.025%)	4	.91	42.4	0	100
	5	1.25	12.8	0	100
Pour-on (.1%)	6	.75	29.4	0	100
	7	1.50	5.4	0	100
Dip (0.025%)	8	.28	1.6	0	100
	9	1.50	24.8	0	100
Low Volume Spray (2.5%)	10	1.54	51.9	0	100
	11	1.30	43.3	0	100

[a] from Lloyd, 1983

Ectrin™ is the only known pyrethroid insecticide that has been properly tested and proven safe for use on sheep. There are several other pyrethroid insecticides available which might be as effective as Ectrin™; however, test data concerning these products are just now being generated. Comments concerning their usefulness in the sheep industry must await the results of these tests.

Because of the effectiveness of newer drugs against the sheep ked, ranchers and researchers began to discuss the possibilities of eradication of the sheep ked. In 1984, the Wyoming woolgrowers embarked on a program to eliminate the sheep ked from Wyoming within five years. Montana's program was initiated in 1985. It is coordinated by a six member task force: three producers, Montana Woolgrower Secretary-Treasure, the State Veterinarian and the State Extension Sheep Specialist.

Like Wyoming's program, the Montana ked-free program is voluntary with the objective of making Montana ked-free within five years. It should be emphasized that both programs are voluntary at this point; and therefore, their success depends entirely on the sheep producers. Wyoming's program is centered around increased profits by marketing lambs with "cockle" free pelts. However, since Montana has few feeding operations and thus fewer opportunities to gain from pelt premiums, program organizers are promoting the overall production benefits --- more pounds of lamb and wool (Figure 2).

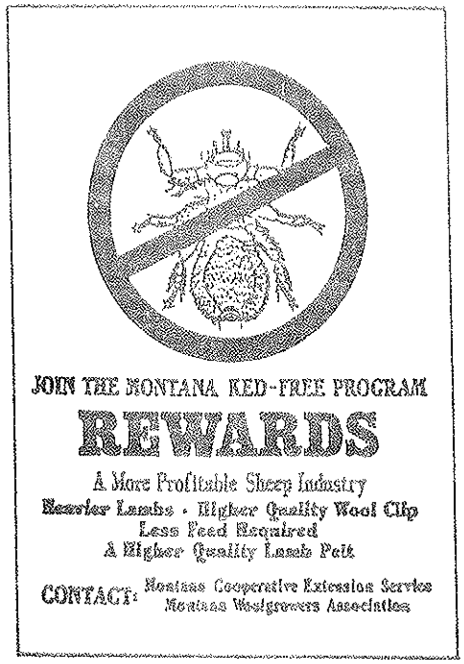

Figure 2. Montana's program emphasizes the rewards of being ked-free.

The first year of the Montana program (Table 2) involves education. Some demonstrations have been conducted to show producers how easy a control plan will fit into their operation. Education will continue into the second and third years. Efforts will be made to identify and encourage producers who have not yet entered the program to participate. In the fourth and fifth year, concentrated attempts will be made to clean up any trouble spots, so that by year 1989, Montana can officially be declared ked-free.

Table 2. The Montana Ked-Free Program

1985	Educational
1986	Continue educational efforts. Identify participating growers.
1987	Continue educational efforts. Identify non-participating growers; encourage them to join the program. Develop marketing system for ked-free skins.
1988	Strengthen efforts to encourage non-participating growers to treat sheep. Ask Montana Board of Livestock to require that imported sheep be treated or come from a designated ked-free area.
1989	Declare Montana a ked-free state.

A big part of the program is educational. Until now, many sheep producers did not realize the extent and economic importance of the ked problem.

Probably the most severe damage caused by the sheep ked may be a skin condition called "cockle". Cockle is a rash or blemish in the skin caused by the bite of the ked. It appears as light spots in the pelt. These spots cannot be softened, sueded or properly dyed. Therefore, there is a defect in the leather side which results in a very inferior product when the pelt is used in the garment industry. It is estimated that cockle may affect as many as 60 to 70 percent of the pelts in the United States. It is estimated that cockle costs the American sheep industry approximately $4 million per year in the form of reduced value and marketability of lamb pelts.

In addition to causing "cockle", ked infestations can result in lighter lambs, less wool production, lower quality wool clips and higher ewe death losses. Although these factors are not as evident as cockel, they represent a significant economic loss the sheep industry (Table 3).

Table 3. Advantages of a ked-free sheep.

Lamb gains	+ 4 lbs. (0 to 8 lbs.)
Wool production	+ 11% (11 to 20%)
Wool quality	+ PLUS +
EWE DEATH LOSS	- 1%
Pelt Quality	+ PLUS +

In 1917, a survey (Imes, 1917) of Utah sheep producers indicated annual losses of about 25 and 20 cents per head on lambs and ewes respectively, due to ked infestations. A series of experiments in Canada (Nelson and Slen, 1968) documented the losses that could be expected. In their studies they found that ked-free lambs gained about eight pounds more than infested lambs when fed an alfalfa hay diet (38.8 lbs. vs 30.4 lbs., respectively, $p < .01$). In another trial, where lambs were fed a high-energy diet, the ked-free lambs gained over three pounds more. Further tests with yearling ewes indicate that ked-free sheep produce about 11 percent more wool than infested ones. A 1971 study (Everett, et.al.) indicated that ked-infested lambs gained less (16 percent or about five pounds, in one trial), had lower carcass weights (2.4 pounds) produced less wool (about 20 percent) and had lower yielding wool (about seven percent) than ked-free lambs.

Some of the economic benefits that can be realized by having an affective ked control program are listed in Table 4.

Table 4. Benefits and Costs Per Ewe of a Ked Control Program

BENEFITS/EWE		
@ 4 lb. increase in lamb weight (4 lb x 70 cents x 100% lamb crop)		2.80
@ 11% increase in wool weight (10 lb x 11% x $2.00)		2.20
@ 1% decrease in ewe death loss (1 ewe x $35 ÷100)		.35
@ Increase in wool and pelt quality		??
	TOTAL	5.35
COSTS/EWE		
ECTRIN - 1 qt. will treat about 400 sheep (38 ÷ 400)		.10
LABOR - 1 person can treat about 64 sheep/hour (1 x $5/hr. ÷ 250)		.08
NET RETURN PER EWE		1.16

Implementing a ked-free program takes considerable cooperation from sheep organizations within each state, extension specialists, state departments of agriculture, and individual producers. It will take strong leadership to keep the momentum going. Each state has different problems to overcome in designing and implementing the vital educational and promotion programs, pilot demonstrations and monitoring and certification systems. However, there is no doubt that the sheep ked is currently robbing sheep producers of millions of dollars. It is time to do something about it.

SECTION III

MANAGEMENT SECTION

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27TH ANNUAL SHEEP DAY

HETTINGER RESEARCH & EXTENSION CENTER
HETTINGER, NORTH DAKOTA

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CROSSBREEDING for COMMERCIAL LAMB PRODUCTION

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Crossbreeding has some definite advantages over straight breeding for commercial lamb production. Crossbred lambs usually gain more rapidly; are usually more hardy and vigorous; and have a lower mortality rate than straightbred lambs.

Crossbred ewes offer additional advantages. Crossbred ewes are usually more fertile and raise a higher percentage of their lambs than do straightbred ewes. The lambing percentage and milk production of crossbred ewes are usually greater than the average of the breeds involved in the cross. Approximately half the advantage of crossbreeding lies with the crossbred lamb and the rest of the advantage is obtained from using crossbred ewes and breeding them to a growthy ram of a third breed. Research has shown that two-breed cross ewes mated to a ram of a third breed will wean approximately 35 percent more pounds of lamb per ewe mated than straightbred ewes producing straightbred lambs.

In evaluating breeds for crossbreeding, one usually divides the breeds into ewe and ram breeds. Among ewe breeds one should look for early lambing, lambing rate, ease of lambing, maternal instinct, milk production,longevity, and wool quality and quantity. Early sexual maturity and potential for accelerated lambing may also be important considerations. For the ram breeds, growthiness, carcass merit, sexual aggressiveness, testicle size at six months, male fertility, and lamb survival are important qualities.

Rambouillet, Corriedale, Columbia, Targhee, and Polypay are the ewe breeds usually considered for crossbreeding. Ram breeds are Suffolk, Hampshire, Shropshire, Oxford,and Southdown, with Suffolks and Hampshires the most widely used at the present. Dorsets and Montadales can fit into either category. Finnsheep must be considered a strong ewe breed because of the high lambing rate, even though inadequacies of fleece quality and quantity are a serious weakness of the breed. Finn crossbred lambs, though small at birth, are extremely hardy. Finn crossed with any of the other ewe breeds produce excellent F1 ewes that can be bred to Suffolk or Hampshire rams for excellent market lamb production. Well-managed, mature crossbred ewes that are half Finn commonly produce a 200 to 250 percent lamb crop. One-fourth Finn ewes commonly produce a 175 to 200 percent lamb crop, and their lambs will gain comparably to the off spring of most commercial ewes. Dorset-Rambouillet crossbred ewes also make excellent F1 ewes, especially for an accelerated lambing program. Of the breeds not already mentioned, Merino, Romney, Cotswold, Lincoln, Cheviot, North Country Cheviot, and Border Leicester would be considered more as ewe breeds than as ram breeds. Not all crosses or breeds will work equally well in all parts of the country.

Following a crossbreeding program poses some problems. You have to either buy crossbred ewes or produce your own. If you buy crossbred replacement ewes, you will not have your own production records to help with the selection process. If you produce your own F1 ewes, you will need some straightbreds to produce the desired crosses.

One way to simplify a crossbreeding program is to follow a two-breed or three-breed rotational crossing program, the latter being the most desirable. A two-breed rotational crossing program is possible where ewes of breed A are bred to a ram of breed B. The replacement ewes from this cross are then bred to a ram of breed A, and so the cycle continues. This system works well for small flocks, but does not provide as much benefit from heterosis (hybrid vigor) as does the three-breed rotational cross.

A good example of a three-breed rotational cross, using Rambouillets, Dorsets, and Suffolks is as follows: Rambouillet ewes are bred to a Dorset ram. The replacement ewes from this cross are bred to a Suffolk ram, with the resulting replacement ewes being bred to a Rambouillet ram and so on, so that the three breeds continue to rotate.

Here are some additional questions that you should consider when developing a crossbreeding program:

* How big a ewe do you want to work with?

* Do you want to breed ewe lambs?

* Do you plan to lamb early or late?

* Are you interested in accelerated lambing?

* Are you willing to work with ewes that have the potential of a 200 percent or larger lamb crop?

To be highly successful, a crossbreeding program must be well planned and well managed, and it must use superior rams (preferably performance tested). Moreover, an excellent set of records is necessary to measure the results of the crossing program. High-producing ewes are essential for a highly profitable operation.

HETTINGER RESEARCH & EXTENSION CENTER

FLOCK CALENDAR - OUTLINE

PRIOR TO BREEDING

1. Bag and mouth ewes and cull those that do not meet requirements.
2. Replace culled ewes with top-end yearlings saved for replacements.
3. Drench ewes (Phenothiazine).
4. Evaluate Sires:
    a. Be sure they are vigorous, healthy and in good breeding conditions (possibly production tested).
    b. Allow 3 rams to 100 ewes under range conditions and 2 when pen breeding, as in small lots or pastures.
5. Crutch ewes.
6. Flush ewes (if in thin condition).
    a. 1# grain 2 weeks to 5 weeks (usually 17 days).
    b. Moving ewes to a better quality pasture prior to breeding will serve as an effective flush.

        *If ewes are overconditioned the effect of flushing will be lessened.

BREEDING

1. Test rams with marking harness or water color paint on brisket to see if they are getting the job done (change colors at the end of the first 17 days).
2. Leave rams in NO LONGER than 57 days (38-40 days more desirable).
3. Remove rams (do not winter rams with ewes).

PRIOR TO LAMBING (First 15 weeks)
Early Pregnancy

1. Watch general health of ewes, if possible sort off thin ewes and give extra feed so they can catch up.
2. Feed the poor quality roughage you have on hand during this period saving the better for lambing.

LAST SIX WEEKS BEFORE LAMBING

1. Drench ewes (Thiabendazole).
2. Six-four weeks before feed 1/4 - 1/3 lb. oats per ewe per day.
3. Shear ewes, trim hoofs, and vaccinate ewes for example: Exterotoxemia, Vibriosis, and Soremouth.
4. Four weeks before lambing increase grain by 1/2 - 3/4 lb per head per day. (Usually done immediately after shearing).
5. Check facilities and equipment to be sure everything is in order.
6. Two weeks before lambing increase grain to 1 lb per head per day.

LAMBING

1. Watch ewes closely as extra effort will be repaid with more lambs at weaning time.
2. Put ewe and lambs in lambing pen (jug) after lambing (not before).
3. Be available to provide assistance if ewe has troubles.
4. Disinfect lambs navel with iodine as soon after birth as possible.
5. Use heat lamps in cold weather.
6. Be sure both teats are functioning and lambs nurse as soon as possible.
7. Brand ewes and lambs with identical numbers on same side.
8. Turn ewes and lambs out of pen as soon as all are doing well. (24 hours - 6 days)
9. Bunch up ewes and lambs in small groups 4-8 ewes and then combine groups until they are in workable size unit.
10. Castrate and dock lambs 1-2 weeks after birth.

SUPPLIES THAT MAY BE NEEDED DURING SEASON

1. Good disinfectant.
2. Forceps or balling gun.
3. Syringe and needles.
4. Hoof trimmer.

5. Sulfa urea Boluses for ewes that were assisted in lambing.

6. Iodine for disinfecting needles.

7. Soap and mineral oil.

8. Tri-sulfa pills for treatment of early pneumonia symptoms.

9. Mastitis ointment.

10. Branding paint and irons.

11. Heat lamps for severe weather.

12. Docking and castrating tools.

13. Surgical scissors.

14. Needle and thread in case a suture is needed.

15. Crate for mothering-up lambs and adopting.

END OF LAMBING TO WEANING

1. Feeding practices will vary depending on the time that lambs were born.

   a. Dec. 15 - March 1 - lambs are usually creep fed and not allowed to go on pasture before market.

   b. Lambs born after March 1 are usually not creep fed and allowed to go on pasture during summer.

2. Drench ewes before turning them on pasture (Phenathiazine).

   *Try and drench according to a program that works for you, (do not wait until signs of wormines appear, it is too late then).

WEANING TO PRE-BREEDING

1. Time of rest for ewes.

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

ORPHAN LAMBS - MANAGEMENT IDEAS

1. Buy a good milk replacer, should be 30% fat. Good replacers available from:
   a. K & K Mfg., Rogers, Minnesota
   b. Land O'Lakes
   c. G T A

   It will cost approximately 50¢ per pound and each lamb will require from 15 to 20 pounds.

2. Use good equipment. NDSU has had good sucess with the LAMB Bar, K & K Mf., sells a self priming nipple and tube assembly that we have found to be excellent for starting orphans.

3. 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.

4. Self feed cold milk replacer after lambs are started. Milk replacers should be mixed with warm water for best resluts and then cooled down. Lambs fed cold milk grow well with less problems from scours and other digestive disturbance. Cold milk keeps better too.

5. There is a Formaldahyde solution commercially available that retards bacterial growth in milk (1 cc/gallon milk).

6. Vaccinate to protect against overeating. For immediate protection use antitoxin. For long term protection use bacterial (cl. per fringens type C & D).

7. Vaccinate to protect against "white muscle" disease. Use 1 SE or Bo Se.

8. Best results have been obtained when lambs are fed in groups of 3 or 4. This would be advisable when lambs are just being started. After lambs are successfully trained, they can be handled in groups of 25.

9. Orphan lamb pens should be heated. A plastic tent can easily be devised and heated. Extra heat will save extra lambs.

10. Provide colostrum milk for all orphans. Colostrum should be provided as quickly as possible. Colostrum milk is rich in fats, vitamins, and anti-body globulins to protect against disease organisms. Cow colostrum milk can be substituted for ewe colostrum milk. It can be kept frozen in 1-4 oz. containers.

11. Provide supplemented feed immediately. Use high energy, highly palatable feed. Where few lambs are being fed it may be advisable to purchase a good commerical lamb creep fed.

12. Provide clean, fresh water.

13. Wean lambs abruptly at 21-30 days of age. When to wean depends upon whether lambs are eating creep feed and drinking water. Newly weaned lambs will go backwards for several days. Do not worry -- lambs will make compensating gains later on.

SHEEP BARNS AND EQUIPMENT PLANS

January 1986

Dexter W. Johnson
Extension Agricultural Engineer
North Dakota State University

NOTE: These and other plans are available through county agents or from Extension Agricultural Engineering, NDSU, Fargo, ND. The drawings show construction details and include a materials list for estimating. Due to changes in lumber sizes, lumber grades, plywood quality, and other developments in building materials, some adjustments are required for older plans. (Present charge is shown or $1.00 per sheet.)

CORRALS AND BARNS

Plan No.	Plan Title	Sheets
MW 72050	Pole Utility Buildings	$ 2.00
MW 72505	Slatted Floor, 40'x 72', Feeder Lamb Barn	3.00
MW 72506	240 Ewe and Lambing Barn, 40' x 104'	3.00
MW 72507	500 Ewe and Lamb Feeding Barn, 74' x 256'	3.00
MW 72508	12' x 16' Portable Lamb Feeding Shed	2.00
MW 72509	40 Ewe and Lambing Barn, 24' x 32'	2.00
ND Plan	Confinement Sheep Barn & Hay Storage (at Hettinger)	1.00
Reprint #759	Practical Sheep Housing for North Dakota	No Charge
USDA 6096	Shearing Shed & Corral Arrangement	1
USDA 6236	Portable Handling Corral for Sheep (Metal Wood)	1
AE-683	Sheep Barn Layout	No Charge
AED-13	Insulation and Heat Loss	No Charge
AED-19	Slip Resistant Concrete Floors	No Charge
AED-25	Earth Tube Heat Exchange System Planning	No Charge
MWPS-3	Sheep Housing and Equipment Handbook (This 116 page booklet was revised in 1982. It includes barn and layout planning plus plans for fences and sheep equipment.)	$ 6.00
MWPS-9	Designs for Glued Trusses	$ 5.00

FEED HANDLING & FEEDERS

Plan No.	Plan Title	Sheets
USDA 5917	Fencing, Feeding, and Creep Panels	1
Reprint #409	Chopped Hay Feeder for Sheep	No Charge
Reprint	16 ft. Collapsible Fenceline Feedbunk for Sheep	No Charge
ND 872-1-1	Stationary Roughage Self Feeder for 70 Ewes or 160 Lambs	No Charge
ND 872-1-2	Portable Roughage Self Feeder for 40 Ewes or 80 Lambs	No Charge

Plan No.	Plan Title	Sheets
MW 73110	24 ft. Wide Clearspan Pole Frame Hay Shed	$ 3.00
MW 73111	36 ft. Wide Clearspan Pole Frame Hay Shed	3.00
MW 73112	48 ft. Wide Clearspan Pole Frame Hay Shed	3.00
MW 73113	32 ft. & 48 ft. Wide Pole Frame Hay Shed (Interior Poles)	3.00
MW 73210	Moveable Grain Storage Walls, 6' to 12' High	2.00
MW 73217	20, 45, 170, and 340 Bu. Hoppered Grain Bins	3.00
MW 73220	48 ft. Wide Pole Frame Grain Storage	2.00
MW 73250	Grain Storage Buildings, 600, 1000, 1200, 1500, or 2000 Bu.	3.00
MW 73293	Grain-Feed Handling Center, Work Tower Across Drive	4.00
MW 73294	Grain-Feed Handling Center, Work Tower Beside Drive	4.00
APA	10 Ton Hoppered Feed Bin	No Charge
APA	4 Compartment Bin for Feed Mill	No Charge
AED-15	Horizontal Bunker Silos, Concrete Tilt-up	No Charge
USDA 6090	5500 Bushel Wooden Grain Bin	2
MWPS-13	Planning Grain-Feed Handling Handbook	$ 5.00

Fenceline Feedbunks for Sheep Replaced

Tim Faller, Superintendent
Hettinger Research & Extension Center

Dexter W. Johnson
Extension Agricultural Engineer

In summer 1985, replacement was made of the old fenceline feedbunks constructed in 1964 at the Hettinger Experiment Station. They were replaced with a new collapsible model which costs less and is simpler to repair and clean out. (Figure 1) Further design improvements to the neckrail, sheep lockout door, lumber and bunk dimensions were made as were used with the pilot model of the collapsible design used in the confinement barn since 1980. The 4 x 4 x .25 inch mesh prevents small lambs from crawling through the bunk, yet lets feed readily drop through into the bunk.

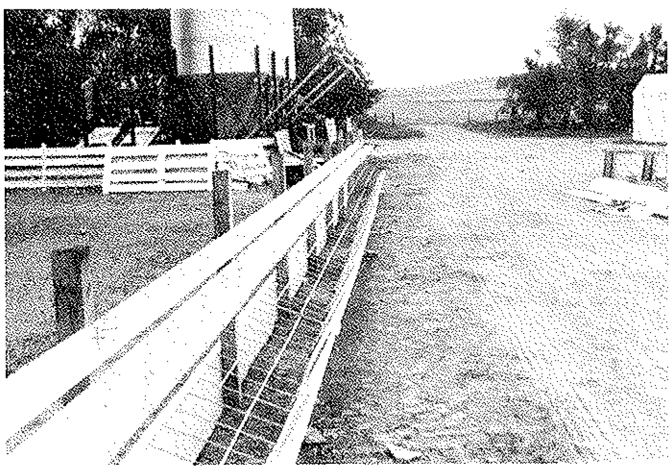

Figure 1. The collapsible feedbunk design constructed for fenceline feeding. Dressed 1-inch lumber, galvanized 8d nails and 4 x 4 PPT posts 8 ft. on centers were used.

The old fenceline feedbunk is shown in Figure 2. Cracking, splintering and broken boards were a major failure. Constructed from pine lumber and 8d common nails, rust and rot had also taken its toll—especially at lumber joints, corners, knots, etc. The bunk exterior had been regularly painted with oil base and, in later years, latex white paint.

Over the years the old feedbunks had been used to feed oats, corn, barley, pellets, ground hay and straw for rams, ewes and lambs of different ages.

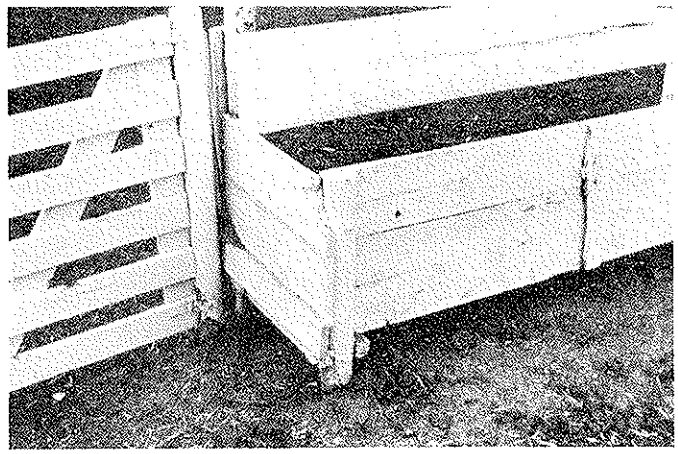

Figure 2. Photo shows typical deterioration of lumber and joints of 30 year old fenceline feedbunks.

Abuse by machinery exceeded that caused by the sheep.

According to records, the 1964 materials cost (no labor) was about $2.05 per foot (est). The new knockdown design cost $1.13 per foot. Labor costs for constructing bunks of the new design are less than those with floors in them.

Bunks of the collapsible type were constructed at the Hettinger Research Extension Center. They required .3 hours labor per running foot of bunk constructed, providing a level site was available. One concern was the ability of bunks of this type and 64' long to stay in place with only gravity to maintain their form. When the initial bunk was constructed and put to satisfactory use, additional bunks were completed. The sandwich used to joint the 16' sections is essential to the ease of moving the bunk for cleaning in case of storms and debris buildup.

Questions came up about use of preservative treated lumber with feedbunks. The current recommendation is to use chromated copper arsenate (CCA) pressure preservative treated lumber for these type uses. A few contamination problems have occurred from livestock in contact with wood that has excessive treatment of certain formulations of preservatives. To be sure, check with the treated lumber or wood treatment suppliers.

Feeding space per head varies with animal age or size, ration and feeding frequency. More details about this are in the MWPS-8, "Sheep Housing and Equipment Handbook," available for $6.00 through County Extension Agents.