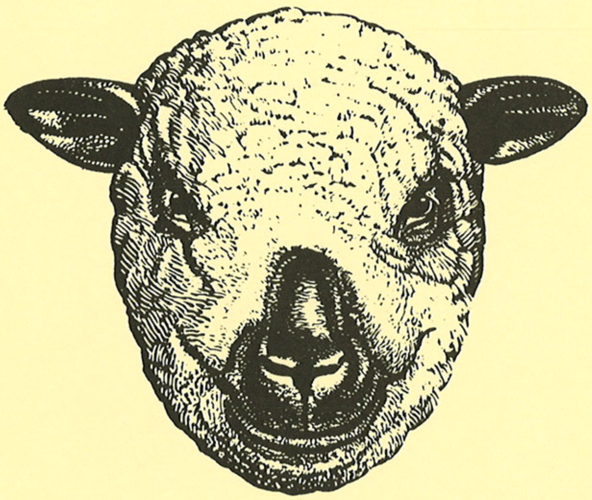
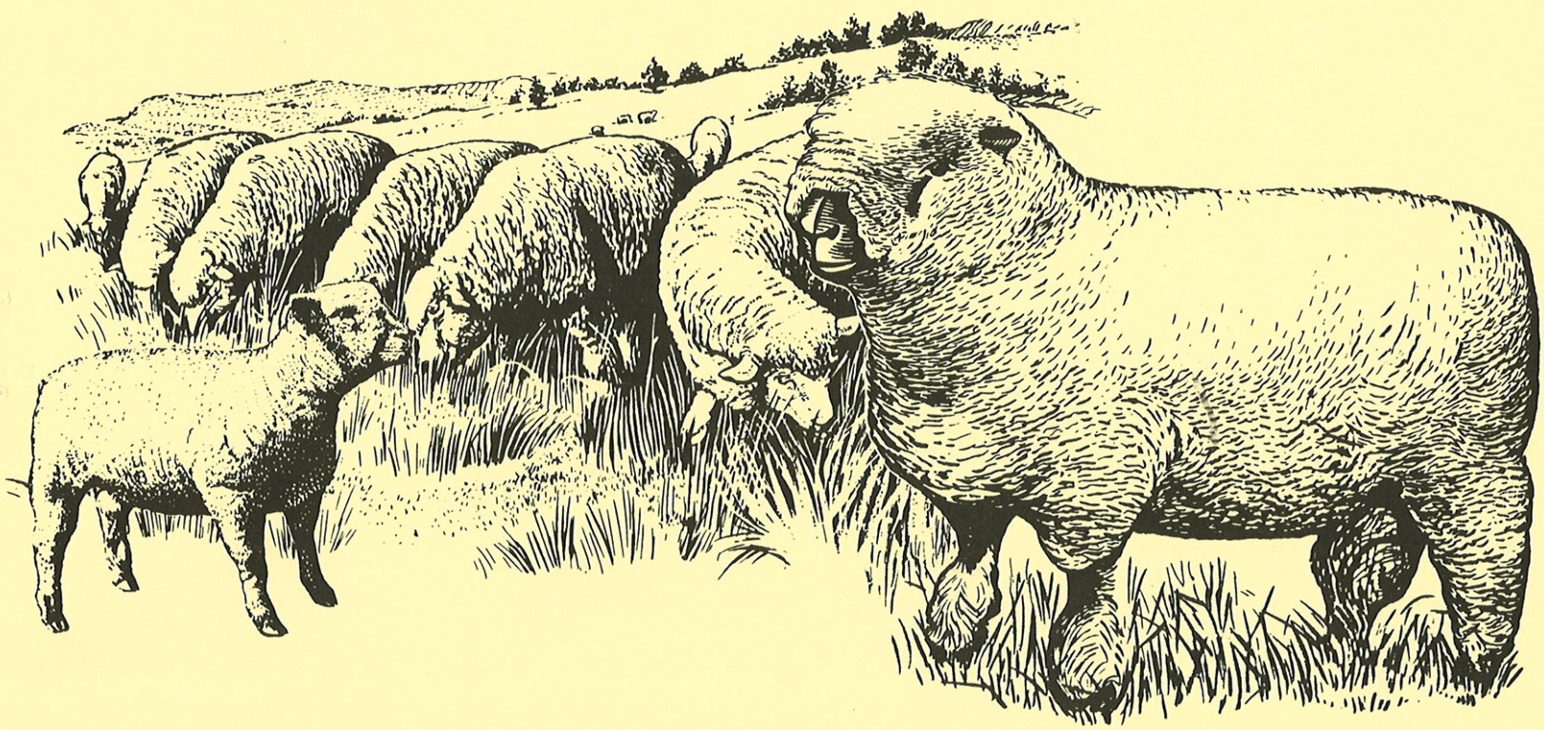
29th Annual Western Dakota

SHEEP DAY

Hettinger Armory
February 10, 1988





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 Dorrance Eikamp, Bentley, ND
10:00 AM	Coffee
10:20 AM	HETTINGER & FARGO STATION REPORTS Dr. Kris Ringwall Mr. Roger Haugen Dr. Duane Erickson Mr. Timothy Faller
12:00 NOON	LUNCH: ROAST AMERICAN LAMB
1:10 PM	WELCOME Dr. Don Anderson, Associate Director Agriculture Experiment Station North Dakota State University
1:25 PM	BONDING Dr. Clarence Hulet, Scientist Jornada Experimental Range New Mexico State University
2:10 PM	CUTABILITY Dr. Jeff Savell Texas A&M Research Extension Center San Angelo, Texas
3:00 PM	NEW HEALTH LAWS THAT MAY AFFECT THE SHEEP INDUSTRY Dr. Robert Velure State Veterinarian ND Livestock Sanitary Board Bismarck, North Dakota
3:20 PM	CLOSING REMARKS Dean Swenson, President ND Lamb & Wool Producers Assoc. Harwood, North Dakota

*There will be a program for the ladies in the afternoon beginning at 1:10 PM featuring "Lamb and Mutton Sausage Products", "Fats in the Diet" and "Yesteryear's Savings: Tomorrow's Profit"

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

ROGER HAUGEN
EXTENSION LIVESTOCK SPECIALIST
FARGO, NORTH DAKOTA

AT THE

29TH ANNUAL SHEEP DAY

HETTINGER RESEARCH & EXTENSION CENTER
HETTINGER, NORTH DAKOTA

FEBRUARY 10, 1988

SHEEP PRODUCTION AND GROWTH
PROJECT ND3732
1988 UPDATE

K.A. RINGWALL, T.C. FALLER, P.T. BERG,
D.O. ERICKSON, B.L. MOORE, D.A. REDMER AND L.D. YOUNG

INTRODUCTION

The 1988 update of the current sheep research involving reproductive genetics and growth of sheep at the NDSU Research Extension Center - Hettinger covers the third year for project ND3732. The data is presented to illustrate developing trends in the data but complete statistical analysis has not been done. Early trends in the data can lead to speculation of the end conclusions, however caution must be applied to any early results. Project ND03732 - SHEEP PRODUCTION AND GROWTH is a cooperative effort between the Department of Animal and Range Science and the NDSU Research Extension Center - Hettinger within the North Dakota State University Agricultural Experiment Station.

The project has served a two-fold purpose. Many producers have taken advantage of the educational opportunities available through the sheep involved in the project. Five indepth three day sheep schools have been held and a sixth one is scheduled and already full. Three, 12 hour long lambing workshops have also been held and five more are scheduled to meet the demand for quality education for sheep producers. The demand for both the three day schools and lambing workshops exceeds our capacity both in time and facilities. Daily visitors and those people attending Sheep Day each year routinely view proper sheep management techniques. All of these activities have not interfered with the detailed scientific questions that are being proposed and answered concerning the biological mechanisms that cause the outward appearances producers see.

This project continues to be dedicated to overcome the factors that decrease the efficiency of sheep production, primarily seasonal infertility and low lifetime 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 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 project was modified for 1987 since feed restrictions during maintaince were dropped, both groups were mated at the same time and lambs weaned at the same time. Prior to breeding in 1988, the confined ewes were removed from the confinement barn and combined with the outside ewes. The ewes will be maintained to continue to evaluate longivity and performance, however the ewe numbers within breed groups were getting to small to justify continuing the separate groups. The ewes are still being fed according to National Research Council (NRC) requirements. All ewes are now under semi-range, and placed on native or tame grass pastures each spring and wintered in drylot. All groups are allowed free access to a mineral mix of equel parts trace mineral salt, dicalcium phosphate and iodized salt. These ewes were mated from November 6 to December 10, 1987 to Rambouillet rams. All lambs will be weaned at approximately 56 days and finished to a market weight of 120 pounds.

TRIAL ONE RESULTS AND DISCUSSION. This trial is in the process of being terminated. Currently 28 1/4 Finn x 1/4 Border Leicester x 1/2 Rambouillet, 32 1/2 Suffolk x 1/2 Rambouillet, and 23 1/2 Finn x 1/2 Rambouillet remain as productive ewes at eight years of age. Total attrition rate is 64% since 1980. A final report on this trial is pending.

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 were purchased from the same source as the ewes utilized in making the F1 crosses. In the falls of 1986 and 1987, a minimum of 36 Booroola cross, 36 Finn cross, and 36 control ewes were randomly selected from those lambs born during 1985 and 1986. All ewes and lambs are fed by current NRC requirements for sheep.

Those ewes born during 1985, were further sub-divided randomly following lambing as two year old ewes, between drylot and pasture groups. Fifteen ewes of each breed type were place in drylot prior to lambing until November breeding. Their lambs are raised under total confinement. An additional 15 ewes were assigned to a pasture system with the lambs raised on pasture. Both groups of ewes are combined from breeding to just prior to lambing and allowed to stubble graze until winter and then fed under drylot. Rambouillet rams were used during 1987 breeding season from November 6 to December 10. Those ewes born during 1986 were also exposed to Rambouillet rams from November 6 to December 10. The 1986 ewes will be sub-divided following the 1988 lambing season the same as the 1985 ewes. The first lamb crop produced from the ewes at two years of age is raised under total confinement for all ewes in the trial.

Each succeeding year the same cycle will be imposed on the two groups of ewes 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 from 50 to 63 days of age. Standard data collected on each ewe throughout this trial are: 1. Prebreeding weight 2. 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. Weaning weights and early growth data are not available on all breed groups since the Rambouillet control ewe lambs were purchased and were born and raised under range conditions, while the crossbred ewe lambs were raised under drylot conditions. Differences between the two rearing systems are assumed to be nonsignificant as the ewes start the first year of the trial at eighteen months of age.

Table 1 presents the completed early growth data concerning the three types of sheep involved. The Finn ewe is the largest at all ages. Throughout summer grazing, the Rambouillet ewes gained more weight than either the Booroola or Finn. Prior to breeding at 20 months of age, the Finn is still the heaviest ewe, followed by the Rambouillet and the Booroola is the lightest. The influence of the Booroola Merino on lamb carcass traits is presented in Table 12. Although lambs that are 1/2 Booroola Merino are less than desirable for growth and carcass traits, carcass traits for 1/4 Booroola Merino lambs are very similar to Rambouillet lambs.

The April reproductive performance and subsequent lamb growth is presented in Table 2. These data only include the first years performance of those ewes born during 1985. The ewes were split into drylot and pasture groups following the 1987 weaning. Currently, both the Booroola and Finn cross ewes have greater fertility and prolificacy than the Rambouillet. Although the Booroola and Finn appear similiar, previous work has suggested that not all the sires that produced the Booroola crossbred ewes were homozygous for the Booroola fertility gene and that one of the sires did not carry the gene at all. Therefore, the Booroola performance would be expected to be lower than anticipated if all the ewes carried the Booroola fertility gene. Growth rate appears to be lower for the Booroola cross than the Finn cross or Rambouillet ewes, but greater in wool production.

Average birth weight and percentage survival rate through 56 days of age for various combinations of Booroola Merino, Rambouillet and Finnish Landrace breeding are presented in Table 6. As Birth weight decreases with increased prolificacy, lamb survival tends also to decrease. However, a strong trend is not very evident within the data. The Rambouillet ewes actually had greater survival rate for the twins than for the single.

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. Rambouillet rams are evaluated yearly and classified 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 no seasonal trend to change in scrotal circumferences. Scrotal measurements are obtained in late February and late July from the Glenn Brown flock, Buffalo, SD and ram selection is based on these two measurements. Seven seasonal rams and five nonseasonal rams have been purchased and evaluated monthly at the Research Extension Center. Nonseasonal rams are much harder to find within the Brown flock than seasonal rams. Blood sampling for later analysis for luteinizing hormone was started in October 1987 and done monthly. The rams are bled at -30, 0, 15, 60 and 75 minute intervals with 1 Ug GnRH administered at 1 and 61 minute time periods.

Currently, 25 to 30 Rambouillet ewes per ram are mated yearly to four seasonal and four nonseasonal rams. Purchased ewes are gradually being replaced with their daughters and granddaughters. An upgrading breeding program will be practiced by continually breeding seasonal sired ewes to seasonal rams and nonseasonal sired ewes to nonseasonal rams. Those ewe lambs born in 1986 (n=47) and 211 purchased aged Rambouillet ewes were mated from August 7, 1987 to September 10, 1987. The purchased ewes are maintained under semi-range and stubble grazing systems except for breeding and lambing. Starting in 1988, 110 daughters of seasonal or nonseasonal rams born during 1986 and 1987 will be exposed initially for two cycles in April. Those that do not breed, will be mated in August. These ewes will only have the opportunity to breed during April or August. Those ewes that do not breed during April will have estrus monitored with teaser wethers from June until August breeding.

TRIAL FIVE RESULTS AND DISCUSSION. Four Rambouillet rams were purchased in August of 1985, 1986 and 1987 after initial evaluation of Brown's Rambouillet rams. In 1985 two rams were selected each from two different age groups of rams, while in 1986 and 1987 all four rams were from the same age group. These rams have had scrotal circumference measurements taken on a monthly bases since arriving at the station. Based on the March to pre-breeding measurements (the scrotal circumferences used to select the rams) living rams 4066, 6014 and 6559 were classified as nonseasonal and rams 4162, 5303, 5367, T311, 7242 and 6579 were classified as seasonal.

The accuracy of classification based on two measurements appears to be repeatable (Table 3). The first eight rams that were purchased have had the March through pre-breeding measurements retaken and the scrotal circumference changes the following year were similar with the exception of 5367. Those rams purchased in 1987 do not have one full years measurements available.

The mating and lambing performance of ewes exposed to each ram is presented in Table 4. The ability of seasonal or nonseasonal rams to mate and conceive lambs during the fall appears to be similar, however there is a slight advantage for the seasonal rams. The difference between the number of ewes mated during the first cycle from 1985 versus 1986 and 1987 is accounted for by the change in breeding times. Ram 2532 had a lower conception rate (ewes lambed of those mated) in 1985 due to unexplained reasons. This ram died after the 1986 breeding season. The specific cause of death is unknown, however, congestion and edema of the lung indicated congestive heart failure. The ram showed little evidence of orderly spermatogenesis at the time of death due to orchitis and epididymitis. The ram did mate 12 ewes prior to death and 10 ewes subsequently lambed. Ram 6135 appears to have a similar situation in that he settled very few ewes in 1987, based on preliminary evaluation of pregnant ewes (low conception rate). Seasonal daughters had greater reproductive performance in terms of pregnant ewes than did nonseasonal daughters during August breeding, although ram 6135 was exposed to nonseasonal daughters.

Ewe lambs sired by seasonal and nonseasonal rams purchased in 1985 and 1986 were evaluated for puberty and ovualtion rate during the fall of 1987. In Table 7, 15 of 24 (62.5%) seasonal ewe lambs were cycling by December 12, 1987 and 15 of 28 (53.6%) nonseasonal ewe lambs were cycling. These results are similar to those in 1986, (seasonal = 72.2% versus nonseasonal = 69.2% cycling). Updated ovulation rates are presented Table 10, and were 1.22 CL for ewe lambs sired by seasonal rams and 1.25 CL for ewe lambs sired by nonseasonal rams. Daughters of ram 5367 were omitted from these numbers because of his mixed classification. The number of daughters of each seasonal or nonseasonal ram that mated during June, July or August as long yearlings is indicated in Table 4. There are no obvious differences between daughters of seasonal rams or nonseasonal daughters in the ability to express estrus during the summer at this point in the trial.

TRIAL SEVEN EXPERIMENTAL PROCEDURE. Reproductive performance is currently being evaluated on 85 ewes sired by Dorset rams and out of 1/2 Rambouillet x 1/4 Finnish Landrace x 1/4 Border Leicester ewes. These ewes were born during 1983 and 1984 and were randomly sorted into two groups, one lambing during January and the other during April. The ewes are managed under a pasture system with the exception of lambing in complete confinement. Ewe were bred to Suffolk rams.

TRIAL SEVEN RESULTS AND DISCUSSION. Table 7 illustrates no obvious differences between the reproductive performance between those ewes lambing in January versus those lambing in April.

OBJECTIVE THREE

GENETIC ENGINEERING

DEVELOPMENT OF THE DAKOTA MERINO

TRIAL EIGHT EXPERIMENTAL PROCEDURE. A flock of 81 Dakota Merino ewes (various levels of Booroola Merino x Rambouillet combinations) and 11 Dakota Merino rams of the same breeding are maintained under semi-range conditions at the NDSU Research Extension Center - Hettinger. Initial crosses to obtain these ewes and rams were made in 1984 and 1985 utilizing a group of Wyoming Rambouillet range ewes and nine Booroola Merino rams leased from USDA-Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebraska. The ewes were back crossed to Booroola Merino rams during 1986 and 1987 breeding periods. The Booroola Merinos were leased from USDA-MARC, Clay Center. One group of Dakota Merino ewes were mated to a Dakota Merino ram because one of the Booroola Merino rams went lame prior to breeding during 1987. The Dakota Merino rams were exposed to Rambouillet ewes to produce 3/4 Rambouillet ewes. Selection efforts are for homozygousity of the Booroola fertility gene. All ewes and rams must have fleeces that grade 60's or greater and ewes and rams must be classified as homozygous or heterozygous for the Booroola fertility gene based on either production or ovulation rate. Rams selected must have a minimum of .6 lbs weight per day of age up to 150 days of age. A control flock of a minimum of 100 Rambouillet ewes (from the same source as the original Rambouillet ewes used to produce the Dakota Merinos) is being maintained and bred to Rambouillet rams.

Puberty is monitored as ewe lambs for two estrous cycles prior to December laparoscopic procedures. 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 end with adhesive (Endocrinology 78:208-211 1966). Four wethers are used and implanted at different times to assure continued coverage of estrus ewes. In an effort to monitor estrus activity, mating marks were recorded as light if no more than 2 marks were evident on the ewes rump, medium if three or more marks were evident and heavy if individual marks could not be counted because of excessive mounting by the teaser wether. Ovulation rates are determined during December by laparoscopic techniques. Those ewe lambs with ovulation rates of one or less will be culled from the flock.

TRIAL EIGHT RESULTS AND DISCUSSION. Table 11 indicates the production characteristics of Rambouillet ewes bred to Dakota Merino rams, Dakota Merino ewes bred to Booroola Merino rams and Rambouillet ewes bred to Rambouillet rams. Reproductive performance is greater for the Dakota Merino ewe than the Rambouillet ewe, however the Rambouillet ewe appears to wean a heavier lamb. Growth rate is a trait that needs to be improved in the Dakota Merino. The Rambouillet ewes in Table 11 are all aged ewes. Although not presented in the table, the Dakota Merino ewes averaged 12.1 lbs of wool which yielded 55.26%, contained 2.03% vegetable matter and had a fiber diameter of 24.03 microns (60's) with a standard deviation of 5.95 microns. The Rambouillet ewes sheared 13.0 lbs of wool which yielded 58.44%, contained 1.21% vegetable matter and had a fiber diameter of 23.28 microns (62's) with a standard deviation of 4.56 microns. These Rambouillet ewes were born in 1986 and represent the second generation of control ewes, but will not lamb until winter 1988.

Average birth weight and percentage survival rate through 56 days of age for various combinations of Booroola Merino and Rambouillet breeding are presented in Table 5. As Birth weight decreases with increased prolificacy, lamb survival also decreases. However the trend is the same between the breed types or combinations, suggesting that even though those lambs involving the Booroola Merino may be smaller at birth, their chance for survival under reasonalbe management is the same as the larger lamb.

The results of the laparoscopies have been presented in Tables 9 and 10 in terms of ovulation rates detected from ewe lambs of each sire. After three years data, not all the purebred Booroola rams leased from MARC at Clay Center, Nebraska would appear to be homozygous for the Booroola fertility gene. The data presented in Table 9 would suggest that ram 1 was a non-carrier of the gene, ram 2 was heterozygous, and rams 3 - 11 were homozygous Additional colaborative research between federal and state research stations will help confirm these observations.

Nine groups of progeny test ewes were mated to Dakota Merino rams during the fall of 1986. The progeny from these matings were evaluated during December of 1987 (Table 9). With the exception of ram 5, all the Dakota Merino rams progeny had greater ovulation rates than did the control Rambouillet ewelambs (Table 10).

TRIAL NINE. After a long term single trait selection project was completed in 1983, the three lines of Columbia sheep were reduced to two. The visually selected and those selected for wool production were combined to form one visually selected line and the line selected for lamb production was kept separate. The objective for maintaining the two lines was to help understand the large number of multiple births (triplets and quadruplets) occuring in the line selected for lamb production. Selection will be continued for prolificacy within the lamb production line and for Columbia type standards within the visually selected line.

TRIAL NINE RESULTS AND DISCUSSION. Since the project revision, Table 11 gives the overall performance of the Columbis ewes. Currently no obvious differences exist between the two groups of sheep. Ewe lambs were evaluated for ovulation rate during December (Table 10), the individual sires used within the Columbia flock varied considerably in ovulation rate however the two groups of ewes did not.

TABLE 1

BODY WEIGHT (LBS) OF F1 BOOROOLA X RAMBOUILLET, F1 FINN X RAMBOUILLET AND RAMBOUILLET EWES LAMBS BORN DURING 1985 AND 1986

	INITIAL EWE LAMB NUMBERS	SEVEN MONTH WEIGHT	YEARLING WEIGHT	PRE-BREEDING WEIGHT
	(1985)			
RAMBOUILLET	35		103	125
BOOROOLA X	36	91	121	119
FINN X	36	109	141	137
	(1986)			
RAMBOUILLET	40		100	132
BOOROOLA X	57	80	106	124
FINN X	36	102	132	147

TABLE 2

APRIL REPRODUCTIVE PERFORMANCE AND SUBSEQUENT LAMB GROWTH OF BOOROOLA MERINO X RAMBOUILLET, FINNISH LANDRACE X RAMBOUILLET AND RAMBOUILLET X RAMBOUILLET EWES BORN DURING 1985

	EWE TYPE		
	BOOROOLA MERINO	FINNISH LANDRACE	RAMBOUILLET
NUMBER OF EWES EXPOSED	39	36	37
NUMBER OF EWES LAMBING	34 (87%)	32 (89%)	29 (78%)
NUMBER OF LAMBS BORN	71 (209%)	75 (234%)	34 (117%)
NUMBER OF LAMBS WEANED	50 (147%)	49 (153%)	26 (90%)
AVERAGE 56 DAY WEIGHT	30 lbs	36 lbs	37 lbs
SEPTEMBER 6 WEIGHT	63 lbs	81 lbs	82 lbs
DECEMBER 8 WEIGHT	91 lbs	112 lbs	108 lbs
1987 PRE-BREEDING WEIGHT	127 lbs	151 lbs	140 lbs
1987 FLEECE WEIGHT (19% moisture)	18.0 lbs	14.4 lbs	15.4 lbs

TABLE 3

SCROTAL CIRCUMFERENCE CHANGE FROM MARCH TO PRE-BREEDING FOR SEASONAL AND NONSEASONAL RAMS DURING THE FIRST AND SECOND YEAR OF EVALUATION

RAM NUMBER	CLASSIFICATION 1ST YEAR	/2ND YEAR	AVERAGE CHANGE (CM) 1985	1986	1987	ACROSS YEARS
2532	nonseasonal	/nonseasonal	2.9	2.1	dead	2.5
4066	nonseasonal	/nonseasonal	2.5	3.9	2.1	2.8
6014	nonseasonal	/nonseasonal		1.3	dead	1.3
6135	nonseasonal	/nonseasonal		0.6	3.7	2.2
6559	nonseasonal	/pending			2.5	2.5
5367	seasonal	/nonseasonal		8.2	2.7	5.4
3289	seasonal	/seasonal	8.7	8.7	dead	8.7
4162	seasonal	/seasonal	5.5	6.5	3.5	5.2
5303	seasonal	/seasonal		8.4	7.1	7.7
T311	seasonal	/pending			6.3	6.3
6579	seasonal	/pending			7.8	7.8
7242	seasonal	/pending			9.2	9.2

TABLE 4

NUMBER OF EWES MATED, EWES LAMBING AND SUBSEQUENT REPRODUCTIVE PERFORMANCE OF FEMALE OFFSPRING FOR NONSEASONAL AND SEASONAL RAMBOUILLET RAMS DURING FALL BREEDING WHEN EXPOSED FOR TWO ESTRUS CYCLES.

Ram	Class	Year	Ewes	Number Mated 1st Cycle	2nd Cycle	Total Mated	Ewes Lambing	Daughters Performance Total Ewes	Total Mated June	July	Aug	Total Preg.
2532	N/N	1985	27	20	6	26	14	10	0	2	6	5
		1986	12	0	12	12	10					
4066	N/N	1985	27	24	3	27	22	8	1	4	7	0
		1986	12	0	12	12	10					
		1987	28	0	24	24	?					
6014	N/?	1986	12	1	11	12	11					
6135	N/N	1986	12	2	10	12	11					
		1987	28	12	15	27	?					
6559	N/?	1987	25	6	16	22	?					
5367	S/N	1986	12	1	11	12	11					
		1987	28	12	16	28	?					
3289	S/S	1985	26	23	3	26	22	14	1	3	12	12
		1986	12	1	11	12	10					
4162	S/S	1985	27	24	3	27	22	15	2	9	15	11
		1986	12	3	9	12	11					
5303	S/S	1986	12	4	8	12	10					
		1987	28	13	13	26	?					
6579	S/?	1987	25	12	11	23	?					
7242	S/?	1987	25	4	19	23	?					
T311	S/?	1987	24	19	5	24	?					

TABLE 5

AVERAGE BIRTH WEIGHT AND PERCENTAGE SURVIVAL RATE THROUGH 56 DAYS OF AGE FOR COLUMBIA, BOOROOLA MERINO, DAKOTA MERINO, RAMBOUILLET AND VARIOUS CROSSES DURING JANUARY-FEBRUARY LAMBING

	SINGLE BIRTHS		TWIN BIRTHS		TRIPLET BIRTHS		QUAD. BIRTHS	
EWE TYPE X RAM TYPE	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL
COLUMBIA X COLUMBIA	12.9 (11)	82% (9/11)	12.4 (75)	79% (59/75)	10.3 (9)	67% (4/6)	--	---
BOOROOLA X RAMBOUILLET	12.1 (10)	80% (8/10)	9.6 (16)	75% (12/16)	6.7 (3)	0% (0/2)	--	---
DAKOTA MERINO X BOOROOLA	10.1 (9)	89% (8/9)	7.3 (32)	84% (27/32)	6.1 (36)	71% (17/24)	4.8 (4)	50% (1/2)
RAMBOUILLET X RAMBOUILLET	14.0 (20)	65% (13/20)	11.9 (116)	73% (85/116)	9.8 (9)	17% (1/6)	--	---
RAMBOUILLET X DAKOTA MERINO	13.9 (35)	86% (30/35)	11.7 (82)	71% (58/82)	8.9 (21)	79% (11/14)	--	---

TABLE 6

AVERAGE BIRTH WEIGHT AND PERCENTAGE SURVIVAL RATE THROUGH 56 DAYS OF AGE FOR BOOROOLA MERINO, DAKOTA MERINO, FINNISH LANDRACE, RAMBOUILLET AND VARIOUS CROSSES DURING APRIL LAMBING

	SINGLE BIRTHS		TWIN BIRTHS		TRIPLET BIRTHS		QUAD. BIRTHS	
EWE TYPE X RAM TYPE	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL	AVG B/WT.	% SURVIVAL
BOOROOLA X RAMBOUILLET	11.7 (11)	91% (10/11)	9 (32)	91% (29/32)	7.1 (27)	67% (12/18)	6.6 (8)	100% (4/4)
FINNISH X RAMBOUILLET	12 (1)	100% (1/1)	10.6 (36)	81% (29/36)	7.5 (32)	73% (16/22)	6.6 (4)	100% (2/2)
RAMBOUILLET X DAKOTA MERINO	13.9 (35)	89% (31/35)	11.1 (124)	77% (95/124	9.3 (6)	100% (4/4)	--	---
RAMBOUILLET X RAMBOUILLET	13.4 (24)	67% (16/24)	10.7 (10)	100% (10/10)	--	---	--	---

TABLE 7

JANURARY AND APRIL REPRODUCTIVE PERFORMANCE AND SUBSEQUENT LAMB GROWTH OF 1/2 DORSET CROSSBRED EWES

	JANUARY LAMBING	APRIL LAMBING
NUMBER OF EWES EXPOSED	42	43
NUMBER OF EWES LAMBING	40 (95%)	39 (91%)
NUMBER OF LAMBS BORN	79 (198%)	78 (200%)
NUMBER OF LAMBS WEANED	62 (155%)	60 (154%)
AVERAGE 56 DAY WEIGHT	44 lbs	37 lbs

TABLE 8

NUMBER OF EWE LAMBS EXPRESSING ESTRUS FOR DAKOTA MERINO AND RAMBOUILLET LAMBS DURING FALL 1987

EWE LAMB TYPE	SIRE NUMBER	TOTAL EWE LAMBS	11-5 11-21	11-21 12-7
DAKOTA MERINO	r356-569	14	0(0%)	2(14%)
DAKOTA MERINO	r449-425	12	0(0%)	2(16%)
DAKOTA MERINO	r663-722	14	0(0%)	3(21%)
DAKOTA MERINO	83-1501	23	6(26%)	10(44%)
DAKOTA MERINO	85-1500	6	2(33%)	3(50%)
DAKOTA MERINO	85-1026	4	1(25%)	3(75%)
DAKOTA MERINO	85-898	6	2(33%)	3(50%)
DAKOTA MERINO	85-870	7	1(14%)	3(43%)
DAKOTA MERINO	85-817	8	3(38%)	5(63%)
DAKOTA MERINO	85-755	8	3(38%)	5(63%)
DAKOTA MERINO	85-739	13	8(62%)	11(85%)
DAKOTA MERINO	83-696	16	9(56%)	7(44%)
DAKOTA MERINO	86-531	8	7(88%)	6(75%)
DAKOTA MERINO	86-198	15	11(73%)	7(47%)
RAMBOUILLET	2532	7	1(14%)	3(43%)
RAMBOUILLET	3289	7	2(29%)	4(57%)
RAMBOUILLET	4066	7	1(14%)	3(43%)
RAMBOUILLET	4162	5	2(40%)	2(40%)
RAMBOUILLET	5303	12	7(58%)	9(75%)
RAMBOUILLET	5367	11	1(9%)	5(45%)
RAMBOUILLET	6014	8	4(50%)	7(88%)
RAMBOUILLET	6135	6	1(16%)	2(33%)

TABLE 9

NUMBER OF EWE LAMBS WITH NONE, SINGLE, TWIN, TRIPLET, QUADRUPLET OR QUINTRUPLET OVUATION RATES FOR DAKOTA MERINO AND BOOROOLA MERINO SIRES

OVULATION RATE	DAKOTA MERINO SIRES								
	1	2	3	4	5	6	7	8	9
NONE	7	2	7	0	0	2	2	0	4
SINGLE	2	6	0	1	6	1	1	4	3
TWIN	2	2	5	3	0	3	3	2	5
TRIPLET	2	2	0	0	0	1	2	1	1
QUADRUPLET	0	0	0	0	0	0	0	1	0
QUINTRUPLET	0	0	0	0	0	0	0	0	0
TOTAL EWE LAMBS	13	12	12	4	6	7	8	8	13
AVERAGE CORPUS LUTEUM	2.00	1.60	2.00	1.75	1.00	2.00	2.16	1.88	1.77

SIRE 1: r356-569, SIRE 2: r449-425, SIRE 3: r663-722, SIRE 4: 85-1026, SIRE 5: 85-898, SIRE 6: 85-870, SIRE 7: 85-817, SIRE 8: 85-755, SIRE 9: 85-739

OVULATION RATE	BOOROOLA MERINO SIRES										
	1	2	3	4	5	6	7	8	9	10	11
NONE	3	1	2	0	2	2	0	5	3	2	2
SINGLE	10	6	2	4	2	3	1	3	1	2	1
TWIN	1	1	5	10	3	3	4	6	11	10	1
TRIPLET	0	0	0	0	1	1	1	3	3	4	1
QUADRUPLET	0	0	0	1	0	0	0	1	0	3	1
QUINTRUPLET	0	0	0	0	0	1	0	0	0	0	0
TOTAL EWE LAMBS	14	8	9	15	8	10	6	17	18	21	6
AVERAGE CORPUS LUTEUM	1.09	1.14	1.71	1.87	1.83	2.13	2.00	2.00	2.13	2.42	2.50
LAMBS BORN/ EWE LAMBING	1.33	1.96	2.25	2.11	2.50						

SIRE 1: 115-001, SIRE 2: 215-2002, SIRE 3: 015-001, SIRE 4: 215-001 SIRE 5: 015-002, SIRE 6: 315-013, SIRE 7: 315-002, SIRE 8: 315-016, SIRE 9: 315-025, SIRE 10: 83-1501, SIRE 11: 85-1500

TABLE 10

NUMBER OF EWE LAMBS WITH NONE, SINGLE, TWIN, TRIPLET, QUADRUPLET OR QUINTRUPLET OVUATION RATES FOR COLUMBIA AND RAMBOUILLET SIRES

OVULATION RATE	COLUMBIA SIRES 1	2	3
NONE	3	1	2
SINGLE	9	2	9
TWIN	2	5	3
TRIPLET	0	0	1
QUADRUPLET	0	0	0
QUINTRUPLET	0	0	0
TOTAL EWE LAMBS	14	8	15
AVERAGE CORPUS LUTEUM	1.18	1.71	1.38

SIRE 1: 83-696, SIRE 2: 86-531
SIRE 3: 86-198

OVULATION RATE	RAMBOUILLET SIRES 1	2	3	4	5	6	7	8
NONE	5	2	4	9	4	2	1	1
SINGLE	10	12	9	5	8	5	4	3
TWIN	4	5	2	1	0	3	3	2
TRIPLET	0	0	0	0	0	0	0	0
QUADRUPLET	0	0	0	0	0	0	0	0
QUINTRUPLET	0	0	0	0	0	0	0	0
TOTAL EWE LAMBS	19	19	15	15	12	10	8	6
AVERAGE CORPUS LUTEUM	1.29	1.29	1.18	1.17	1.00	1.38	1.43	1.40

SIRE 1: 4162, SIRE 2: 3289, SIRE 3: 4066, SIRE 4: 2532, SIRE 5: 5303, SIRE 6: 5367, SIRE 7: 6014, SIRE 8: 6135,

TABLE 11

JANUARY REPRODUCTIVE PERFORMANCE AND SUBSEQUENT LAMB GROWTH OF BOOROOLA MERINO X DAKOTA MERINO, DAKOTA MERINO X RAMBOUILLET, RAMBOUILLET AND COLUMBIA EWES

	EWE TYPE			
	RAMBOUILLET	DAKOTA MERINO	COLUMBIA	RAMBOUILLET
RAM TYPE MATED TO	DAKOTA MERINO	BOOROOLA MERINO	COLUMBIA	RAMBOUILLET
NUMBER OF EWES EXPOSED	107	39	57	96
NUMBER OF EWES LAMBING	83 (78%)	38 (97%)	52 (91%)	81 (84%)
NUMBER OF LAMBS BORN	138 (166%)	81 (213%)	96 (185%)	145 (179%)
NUMBER OF LAMBS WEANED	99 (119%)	53 (139%)	72 (138%)	98 (121%)
AVERAGE 56 DAY WEIGHT	38 lbs	27 lbs	54 lbs	39 lbs
SEPTEMBER 6 WEIGHT	102 lbs	81 lbs	139 lbs	107 lbs
DECEMBER 8 WEIGHT	117 lbs	93 lbs	157 lbs	123 lbs
1987 PRE-BREEDING WEIGHT		127 lbs	208 lbs	149 lbs

TABLE 12

COMPARSION OF 1/4 BOOROOLA MERINO x 3/4 RAMBOUILLET LAMBS AND RAMBOUILLET LAMBS FOR GROWTH (LBS) AND CARCASS TRAITS.

TRAITS	3/4 RAMBOUILLET 1/4 BOOROOLA	RAMBOUILLET
NUMBER OF LAMBS	28	26
CARCASS WEIGHT	45.1	45.5
LEG SCORE	11.1	11.0
QUALITY GRADE	10.7	10.6
KIDNEY PERCENT	2.62	2.48
12TH RIB BACK FAT	0.16	0.16
RIB EYE AREA	2.40	2.26
YIELD GRADE	2.84	2.78

PURCHASING AND BREEDING EWE LAMBS
PROJECT ND6261
(1988 PROGRESS REPORT)

The most important factor to a profitable sheep enterprise is more income than expense. Many factors influence the long term profit potential for a sheep enterprise. Of these, percent lamb crop marketed on an annual basis is of primary importance. Other factors that have great importance are: market values, management expertise, initial purchase price, interest rates. In view of the high prices of older breeding ewes many producers have considered quality ewe lambs for replacement stock or as a base flock for establishing a new enterprise. The most predominant ewe lamb available is the western white face with a high level of Rambouillet ancestry.

PROCEDURE

The Hettinger Research Extension Center initiated a three year project to study the value of ewe lambs purchased as breeding stock. Two hundred ewe lambs of predominant Rambouillet ancestry will be purchased in the fall of years 1987-1989. Each year the ewe lambs will be subjected to either of two nutritional regimes. The (high level HL) ration will be based on 60% grain and 40% alfalfa. The (low level LL) ration will be grazing crop aftermath with 1# grain as a supplement daily. When grazing is not available 4# of alfalfa will be added to the grain supplement. Lambs were weighed initially and allotted randomly to (HL) or (LL) rations based on a 10# weight break. The (HL) and (LL) rations will be fed from purchase through the end of breeding. After completion of breeding the ewe lambs will be submitted to similar diets for the duration of the trial. The ewe lambs will be exposed to fertile Columbia ram lambs for a 30 day period, December 15 through January 15 each year. Data will be collected on livability, weight gain, breeding performance, market value of wool and lamb produced and subsequent year's performance of the 600 ewe lambs involved.

RESULTS

The major objective of this investigation was to evaluate performance of western ewe lambs as breeding stock and to assist producers in establishing a reasonable value for purchase of breeding ewe lambs. A second objective was to evaluate the effect of the (HL) and (LL) nutritional regimes on ewe lamb performance and ewe performance in subsequent years. Two hundred ewe lambs were purchased October 12, 1987 at an average weight of 85#. They were weight tagged (initial weight) and allotted October 26, 1987. A breeding weight was taken December 2, 1987 and a post breeding weight was taken January 15, 1988. Table I represents weights of the ewe lambs at various weigh periods. Four lambs were removed from the data for various reasons: one died, two lost their identification and one was a castrated male instead of a female.

WEIGHT RANGE	INITIAL NO. (LL)	INITIAL NO. (HL)	INITIAL WT. 10-26-87 (LL)	INITIAL WT. 10-26-87 (HL)	BREEDING WT. 12-2-87 (LL)	BREEDING WT. 12-2-87 (HL)	POST BREEDING WT. 1-15-87 (LL)	POST BREEDING WT. 1-15-87 (HL)
60-70#	3	2	65.0	68.0	76.0	80.0	84.3	83.0
70-80#	18	17	75.8	75.8	95.3	90.1	95.7	103.9
80-90#	28	27	83.7	84.5	100.0	100.3	102.4	117.48
90-100#	28	27	94.4	94.0	111.6	109.0	112.5	127.2
100-110#	15	16	103.3	103.9	121.3	118.1	120.6	139.31
110-120#	5	5	113.0	111.4	127.0	123.0	126.8	144.6
120-130#	2	3	122.0	123.0	140.0	140.0	139.5	155.7
TOTAL	99	97	-	-	-	-	-	-
AVERAGE	-	-	90.9	91.1	108.2	105.8	109.3	123.3

Lambs grew at similar rates in the (LL) group while an abundance of crop aftermath was available as compared to the confined (HL) group. When the (LL) group was subjected to a limited diet the (HL) group excelled as would be expected. Total feed costs for the (LL) group were $7.70 for the 82 day feeding period involved, for the (HL) group feed costs were $17.14. Data collected in 1988 relative to reproductive performance of the two groups will indicate if the additional feed investment will be repaid. After breeding both groups will be grown on a similar diet based on 20% grain and 80% roughage fed at 5# per head daily.

COMPARISONS OF LAMBS FED BARLEY OR CORN DIETS FED IN WHOLE OR GROUND FORM

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Hettinger Experiment Station - 1987
and
Animal and Range Sciences - NDSU

Summary

Two experiments, utilizing 640 early weaned lambs, were conducted to determine the comparable feeding values of barley to corn each fed in whole and ground form. Complete mixed diets containing 16% protein and 26% alfalfa were self fed. Soybean meal was the protein supplement. Lambs averaged about 60 pounds across lots at the start of the experiment and were taken off near 100 pounds. Final weights were similar (P>.05) across dietary treatments. Lambs consumed more (P<.01) of the corn diets (3.10 lb/d) compared to those on the barley diets (2.86 lb/d). Gains and feed efficiencies were similar (P>.05) between grains and physical forms. Quality grade was slightly higher, 11.4 vs 11.1 for corn and barley respectively (P<.06). The % kidney was higher (P<.01) for the lambs on corn, indicating more mesentery fat. However, backfat was similar (P>.05) between corn and barley but was higher (P<.002) (.20 vs .18) for whole grains and ground grains respectively. The corn diets required 15% soybean meal and the barley diets 10% which represents a considerable savings in protein supplementation of the barley diets. The feed needed per unit of gain was the same for both diets. These data support that of previously reported experiments comparing barley to corn for lambs. It also supports the 1987 experiments conducted at the main station in Fargo.

Introduction and Justification

Sheep producers in North Dakota have several cereal grains available to them for finishing lambs. Decisions concerning the optimum grain to produce depends on several factors such as, potential energy and protein yield/acre, constraints of farm programs, performance of lambs on a particular grain and carcass merit of the lambs. The producers that purchase grains should have information available to them concerning the comparable feeding value of the various grains. The Hettinger Station and the Department of Animal and Range Sciences have conducted several experiments in the recent past few years that provides information to answer the questions of comparable feed value among the common grains (corn, barley, oats, wheat and combinations of these). Most comparisons have been made on an equal grain replacement basis not on an equal energy basis. The diets have contained the same level of protein and vitamin and mineral supplementation. Complete diets have been self-fed in the coarse ground form at the Hettinger Station. Work reported at the 1987 Western Dakota Sheep Day which was conducted at the Station in Fargo, indicates that lambs gained about 11% faster on 8% less feed when it was pelleted compared to ground. There were no differences in dressing percent. Pelleting of light bushel weight barley or corn improves feed lot performance of lambs more than pelleting heavy bushel weight grains. Pelleting of complete lamb diets is increasing in the larger feed lots nationally but the use of pelleted diets by North Dakota producers is minimal. Most whole grains are masticated quite thoroughly by sheep with the exceptions of the grains with very hard kernels. There is a need to determine the comparative feeding value of good quality corn or barley fed in complete mixed diets in whole or ground forms to early weaned feeder lambs. These experiments will provide more information concerning barley/corn comparisons in terms of lamb performance and carcass characteristics in addition to the effect of physical form on these criterion.

Objectives

To determine the comparable feeding values of barley and corn fed in complete mixed alfalfa/SBM diets either in ground or whole form to early weaned feeder lambs. Diet comparisons will be based on lamb performance and carcass characteristics.

Procedure

Six hundred and forty early weaned lambs (56 d) were allotted by weight, sex and breed. The four dietary treatments were assigned at random to the eight lots in each of two trials. Lamb weight and feed intakes were recorded on a two week basis. The trials were terminated when average weight of the lambs is about 100 pounds. Some of the lambs were followed to market with the following criterion being recorded: % shrink, quality, grade, yield grade, % kidney, loin area and loin fat.

Samples of feedstuffs were taken and analyzed (Table 1) prior to the formulation of diets (Table 2). Feed samples were taken on a biweekly basis throughout the experiments with the nutritional composition shown in Table 3. The protein levels of the barley diets were slightly higher than the corn diets but the fiber (ADF) and digestibilities (IVDMD) were similar across diets (Table 3). Statistical analysis were applied to assist in the interpretation of the results.

Results and Discussion

The results of both experiments have been combined as presented in the tables. There was some variation in the average initial weight by treatment in experiment 1 and this is reflected in the initial weights in Table 4. The nutritional composition of the diets based on samples taken throughout both experiments are shown in Table 3. All dietary treatments were similar in nutritional value. The digestible dry matters (IVDMD) were also similar even though the barley diets were formulated to be slightly lower in TDN (Table 2). The performance of the lambs comparing barley to corn diets with each in whole and ground forms are shown in Table 4 and the statistical summaries in Table 6. Lambs on whole barley were the most efficient ($P<.05$) in the conversion of feed to gain and the feed intake per day was the lowest for that diet. There were no differences ($P>.05$) between barley and corn fed lambs in gain/day or feed/gain when comparing across whole and ground (Table 6). The carcass criterion by dietary treatment are shown in

Table 5 and the statistical summaries comparing grains and forms in Table 6. The carcass weights of the lambs slaughtered were similar (P>.05) across diets as were the leg scores. Quality grade was 11.6 for the lambs on ground corn and 11.0 for the lambs on ground barley (P<.05). There were no other differences in quality grade. Yield grade was higher (P<.05) for lambs on whole barley compared to ground barley (3.31 vs 2.84). Whole grains resulted in higher (P<.001) yield grades than ground grains (3.22 vs 2.95) (Table 6). The reason for these differences are not understood at this time and further research may be required to determine if these differences can be repeated and explained. Backfat was thicker (P<.002) on lambs fed whole grains (Table 6) than those fed ground grains. The % kidney was higher (P<.01) in the lambs fed corn compared to barley (Table 6).

These experiments comparing barley to corn indicate that either grain can be used very effectively for finishing lambs. This supports the research reported in previous years and from the main station this year. Less protein supplement is required when barley is the major grain compared to corn which should result in a more economical diet. Carcass criterion and lamb performance are all very acceptable and really not appreciably different between corn or barley.

Acknowledgement

The North Dakota Agricultural Experiment Station and the Animal and Range Sciences Department appreciate the grant from the North Dakota Barley Council of all the grains used in these experiments.

Table 1. Composition of feedstuffs used in the lamb feeding trials at Hettinger (1987)

		% (90% DM)				
Feedstuff	Bushel wt.	Protein	TDN	ADF	Ca	P
Alfalfa	-	16.0	52	34	1.25	.173
Barley	49	12.0	77	6.2	.046	.290
Corn	52	9.0	84	2.0	.012	.285
SBM	-	44.0	78	10	.250	.600
Limestone	-	-	-	-	36	-
Dical. Phos.	-	-	-	-	22	18

Composition common to all diets:
TM salt .5%, limestone .5%, dical phos. .5%, ammonium chloride .5%, super pellets 1.25%
Vitamins ADE .05% or according to recommendations
Terramycin 2.5 g/100# of diet.

Table 2. Diets for finishing lamb trials Hettinger 1987

		%				
Feedstuff	% of diet	Protein	TDN	ADG	Ca[a]	P[a]
Corn Control (1)						
Alfalfa	26	4.16	13.5	8.84	.325	.045
Corn	57	5.13	47.9	1.14	.007	.162
SBM	15	6.6	11.7	1.50	.038	.090
Totals	98	15.9	73	11.48	.660	.387
Barley (2)						
Alfalfa	26	4.14	13.5	8.84	.325	.045
Barley	62	7.44	47.7	3.84	.028	.180
SBM	10	4.40	7.8	1.00	.025	.060
Totals	98	16.0	69.0	13.68	.668	.325

[a]Ca & P calculated with .5% each of limestone and dicalcium phosphate.

Table 3. Nutritional composition[a] of diets based on laboratory analysis Fargo 1987

	Whole barley	Whole corn	Ground barley	Ground corn
Protein	16.9 ± .86	15.9 ± .80	17.4 ± .47	16.9 ±.54
ADF	11.0 ± .77	10.9 ± .10	11.7 ± .79	11.0 ±.88
ADL	2.49± .91	2.39± .53	2.44± .29	1.97±.30
Ash	5.04± .49	4.99± .58	5.58± .37	5.38±.26
Ca	.66± .10	.72± .177	.80± .10	.81±.101
P	.43± .036	.40± .039	.43± .022	.45±.026
Mg	.20± .013	.20± .016	.23± .019	.21±.020
IVDMD	72±1.57	72±2.00	71±	73±.69

[a]As fed basis except Ca and P on dry basis.

Table 4. Lamb performance comparing barley to corn fed in whole and ground forms. Hettinger 1987

	Whole barley	Whole corn	Ground barley	Ground corn
Initial wt.	57.6[b]	61.6[a]	58.6[b]	54.4[c]
Final wt.	96.5	98.6	94.6	94.9
Gain/day	.503[ab]	.487[a]	.476[a]	.536[b]
Feed/gain	5.60[a]	6.71[b]	6.26[b]	6.43[b]
Feed/day	2.79[a]	3.06[ab]	2.92[ab]	3.14[b]

[a,b,c]Differences greater than $P<.05$.

Table 5. Carcass criterion of lambs fed barley or corn in whole or ground form

	Whole barley	Whole corn	Ground barley	Ground corn
Carc. wt.	51.8 ±.99	51.9 ±.89	49.7 ±.91	52.2 ±1.07
Quality grade	11.1 ±.17[ab]	11.2 ±.15[ab]	11.0 ±.15[a]	11.6 ± .18[b]
Yield grade	3.31±.03[a]	3.14±.08[ab]	2.84±.08[b]	3.07± .08[ab]
Leg score	11.0 ±.14	11.3 ±.13	11.2 ±.13	11.2 ± .15
Back fat (in.)	.22±.01[a]	.19±.01[b]	.17±.01[c]	.19± .01[b]
% kidney	2.79±.12[ab]	3.04±.11[a]	2.54±.11[b]	2.91± .13[a]

[a,b,c]Differences greater than $P<.05$.

Table 6. Statistical summary of the two way comparisons of barley to corn and whole to ground. Fargo 1987

	Barley		Corn	Whole		Ground
Gain/day		ns[a]			ns	
Feed/gain		ns			ns	
Feed/day	2.86		3.10 (P<.01)		ns	
Carc. wt.		ns			ns	
Quality grade	11.1		11.4 (P<.06)		ns	
Yield grade		ns		3.22		2.95 (P<.001)
Leg score		ns			ns	
Back fat		ns		.20		.18 (P<.002)
% kidney	2.66		2.98 (P<.01)		ns	

[a]Not different at P<.05.

PERFORMANCE AND CARCASS CHARACTERISTICS OF LAMBS FED CORN OR BARLEY SUPPLEMENTED WITH SOYBEAN MEAL OR DISTILLERS DRIED GRAINS

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Animal and Range Sciences
NDSU, 1987

Summary

Barley was compared to corn supplemented with either soybean meal (SBM) or distillers dried grains (DG) in complete ground mixed lamb diets. Three experiments were conducted utilizing early weaned lambs. The diets were iso-nitrogenou (14% protein) and iso-caloric (72% TDN). Lambs on the barley diets consumed an average of 3.57 pounds a day compared to 4.07 on the corn diets (P<.0003) which resulted in lower (P<.0003) daily gains (.76 and .87 respectively). The lambs on the barley diets were equally (P>.05) as efficient to corn in feed utilization. Lambs on the corn diets required more (P<.05) feed/gain when supplemented with DG and there was no difference in efficiency due to protein source when barley was fed. The average final weight for the corn fed lambs was 107 pounds compared to 101 pounds (P<.009) for those on barley. This may have contributed to the slightly higher (P<.003) dressing % 54 and 52% respectively for corn and barley and a slightly higher (P<.03) loin weights of 2.88 and 2.57 kg respectively for corn and barley. There were no significant differences due to diet (either grains, protein sources or interactions) among all the other carcass criterion (back fat, kidney %, loin area, conformation grade, leg score and yield grade).

Introduction and Justification

Information concerning the comparable feeding value of the common feed grains available to livestock producers is very important in making economical feed-management decisions. Several research trials with feeder lambs in the past few years have provided very useful data in the utilization and comparable worth of the various feed grains such as; corn, barley, oats, wheat, mixtures of those, varying quality of the feed grains, physical form in which they are fed and compared with several protein sources. This information has been discussed at the Western Dakota Sheep Days and published in the proceedings of these meetings as well as in the North Dakota Farm Research and papers given on the regional and national meetings. When grains relatively higher in protein, such as barley, oats and wheat, are fed considerable less protein supplementation is required. In many feeding situations diets containing these feed stuffs results in diets that improve the profitability of the feedlot operation. The effect on profitability is largely dependent on the prices of the feedstuffs (grain, protein supplement and the roughage) in the diet. Previous research has compared barley with corn on a one to one replacement basis with equal protein but not with equal energy and protein. In order to more accurately interpret comparable feeding value of barley to corn (lamb performance and carcass criterion) three experiments were conducted with diets containing equal energy and protein and fed to early weaned lambs.

Objectives

The major objectives of this research are to compare the relative feeding value of barley to corn fed with either soybean meal or distillers dried grains with alfalfa as the roughage when fed in finishing diets of equal energy and protein to early weaned lambs. Criterion to measure feed value will be lamb performance (gain, feed intake and feed efficiency), digestibility of dry matter and selected nutrients and several carcass characteristics.

Procedures

Early weaned (56 day) lambs (168) were assigned by weight, breed and sex to one of 4 diets (corn/SBM, corn/DG, barley/SBM and barley/DG) in three (2 replicates x 4 diets) experiments. The feedstuffs used in the diets were analyzed for nutritional content and the diets were formulated on the analyzed values except table values were used for TDN. The values used for diet formulation are shown in Table 1. The diets and nutritional composition are shown in Table 2. Diet samples were taken biweekly through the experimental periods and were analyzed for nutritional composition and are recorded in Table 3. Protein was slightly higher, at an average of 15%, than the formulated diet at 14% (Tables 2 and 3). The estimated digestibilities (IVDMD) averaged about 69% (Table 3) which was similar to the formulated diets of 72% TDN (Table 2). The diets containing distillers grains as the protein source were slightly higher than those with soybean meal (Table 3). Lamb weights and feed consumption was recorded on a biweekly basis. Lambs were taken off the experiments when all the lambs in the experiment averaged between 100 and 110 pounds. Eight representative lambs (both sexes) from each dietary treatment were slaughtered in the Animal and Range Science meat laboratories for carcass characteristics. Samples of loin chops were frozen for in depth nutritional analysis both in the ram and cooked forms. This work is currently in progress and the results will be reported when available.

Results and Discussion

The 4 dietary treatments were relatively equal in protein, digestible energy, calcium, phosphorous and other added vitamins and minerals (Table 3). This criterion was necessary to meet the major objective of the experiment. Lamb performance and digestibility data are shown in Table 4. The initial weight of the lambs averaged 58 pounds but the final lambs on the corn diets were heavier ($P<.009$) than those on the barley diets (107 and 101 pounds respectively) (Table 6). Final weights were similar within a grain for the SBM or DG as the protein sources. The daily gains followed the same pattern as final weights (Table 4) since the average initial weights were similar among diets. Lambs consumed more ($P<.0003$) of the corn diets (4.07 lb/day) than of the barley diets 3.57 lb/day (Table 6). This supports data previously reported. The feed per gain was similar ($P>.05$) between corn and the barley diets but more ($P<.05$) feed was required per gain with distillers dried grains when fed with corn (Table 4). Digestibilities, as determined by feed and feces internal indicator, were generally lower (P<.05) for the barley diets. Digestible dry matter, protein and fiber were similar (P>.05) with either SBM or DG when fed with barley (Table 4). The fiber digestibilities were lower than expected in the barley diets and is not understood at this time.

The carcass characteristics are shown in Tables 5 and 6. Live weights of the lambs selected for slaughter were slightly heavier for the corn than the barley diets. The differences were not significant but might explain in part the slightly higher (P<.003) dressing % and loin weights (P<.03) for the corn fed lambs (Table 6). The difference in loin weights between grains may have been due to heavier final weight of the lambs on the corn/DG compared to barley/DG (Table 5). Carcass grade was also the highest (P<.05) for the lambs on corn/DG compared to the barley/DG. Again the heaviest live weights of the lambs selected for slaughter in the corn DG grains compared to the lightest live weights of the barley/DG grains might contribute to these differences in dressing %, loin weights and carcass grade. There were no differences between grains, protein sources and interactions in the other carcass characteristics measured (Table 5).

The information generated from these experiments will be useful to producers in making feed-management decisions which could result in improved profitability. Feed required per unit of gain is similar between barley and corn when fed on an equal energy and protein basis. Considerably less protein supplement is needed in the barley diets. Most carcass characteristics were similar between the two grains and maybe all would be similar if adjusted to an equal live weight basis. Distillers dried grains was equal to soybean meal when fed with barley in all measures of lamb performance but resulted in more feed required for gain when fed with corn.

Acknowledgement

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Table 1. Composition[a] of feedstuffs used in diets for finishing lamb trials. Fargo 1987

	%						
Feedstuff	bu. wt.	Protein	TDN	DE/#	ADF	CA	P
Barley	49	11.4	74	1540	6.2	.05	.34
Corn	53	8.5	83	1660	2.0	.02	.28
DDG[b]	-	26	78	1560	26.0	.08	.73
SBM	-	44	78	1560	10.0	.25	.60
Alfalfa	-	16	52	1040	34.0	1.25	.17
Limestone	-	-	-	-	-	36	-
Dicalcium	-	-	-	-	-	22	18

[a]90% dry or as fed basis.

[b]65% barley and 35% corn distillers grains plus solubles.

Table 2. Dietary treatments and nutritional composition[a] for finishing lamb trials. Fargo 1987

		%					
Feedstuff	% of diet[b]	Protein	TDN	DE	ADF	Ca[c]	P[c]
Corn/SBM (1)							
Alfalfa	28	4.48	14.5	291	9.52	.350	.048
Corn	60	5.10	49.8	996	1.20	.012	.168
SBM	10	4.40	7.8	156	1.00	.025	.060
Totals	98	13.98	72.1	1443	11.72	.677	.366
Corn/DDG (2)							
Alfalfa	28	4.48	14.56	291	9.52	.350	.048
Corn	50	4.25	41.50	830	1.00	.010	.140
DDG	20	5.20	15.60	312	5.20	.016	.146
Totals	98	13.93	71.7	1433	15.72	.666	.424
Barley/SBM (3)							
Alfalfa	14	2.24	7.28	146	4.76	.175	.024
Barley	77	8.78	59.29	1185	4.77	.038	.262
SBM	7	3.08	5.46	109	.70	.017	.042
Totals	98	14.10	72.0	1440	10.23	.700	.418
Barley/DDG (4)							
Alfalfa	14	2.24	7.28	146	4.76	.175	.024
Barley	69	7.87	53.13	1063	4.28	.034	.235
DDG	15	3.90	11.70	234	3.90	.012	.111
Totals	98	14.01	72.1	1443	12.94	.691	.460

[a]90% dry or as fed basis.

[b]Composition common to all diets: .5% each of TM salt and ammonium chloride, 1.25% vitamins ADE, antibiotics and special supplement.

[c]Diets 1 and 2 had .5% each of limestone and dicalcium phosphate.

[c]Diets 3 and 4 had 1.0% of limestone and .5% dicalcium phosphate.

Table 3. Nutritional composition[a] of diets fed to lambs based on laboratory analysis. Fargo 1987

	Corn/SB	Corn/DG	Barley/SB	Barley/DG
		%		
Protein	14.5 ± .86	14.8 ±1.22	15.0 ±1.42	15.1 ± .54
ADF	11.6 ±1.64	16.9 ±5.64	10.5 ±1.58	12.7 ±2.36
ADL	2.48± .38	4.16±1.53	1.88± .44	2.79± .60
Ash	5.42± .47	5.96± .51	5.65±1.07	5.88± .29
Ca	.91± .17	.96± .21	.92± .30	.93± .13
P	.40± .05	.42± .07	.44± .06	.48± .05
IVDMD	70±4.1	68±2.9	69±4.5	68±3.5

[a]As fed basis except Ca and P.

Table 4. Lamb performance and digestion coefficients. Fargo 1987. Comparing barley to corn

	Corn/SB	Corn/DG	Barley/SB	Barley/DG
Initial wt.	58.5	58.6	58.7	58.2
Final wt.	109[a]	106[ab]	101[b]	101[b]
Gain/day	.90[a]	.84[ab]	.75[bc]	.76[bc]
Feed/day	3.98[a]	4.17[a]	3.52[b]	3.63[b]
Feed/gain	4.44[a]	4.96[b]	4.67[ab]	4.78[ab]
Dig. dry matter	81.7[a]	77.6[ab]	73.4[b]	73.4[b]
Dig. protein	77.4[a]	73.1[b]	71.4[b]	71.6[b]
Dig. ADF	58.0[a]	60.5[a]	26.2[b]	30.0[b]

[a,b,c]Differences greater than P<.05.

Table 5. Carcass criterion of lambs fed corn or barley with either soybean meal or distillers dried grains

	Corn/SB	Corn/DG	Barley/SB	Barley/DG
Live wt. (kg)	48.2 ±4.17	49.6 ±5.87	46.9 ±4.74	46.1 ±2.66
Loin wt. (kg)	2.76± .37^{ab}	2.99± .43^{a}	2.64± .41^{ab}	2.49± .32^{b}
Dressing %	53.7 ±2.71^{a}	54.4 ±1.49^{ac}	51.9 ±2.29^{b}	51.4 ±1.88^{b}
Carcass grade	10.6 ±1.06^{ab}	11.0 ± .93^{a}	10.4 ± .74^{ab}	10.1 ± .35^{b}
Backfat (cm)	.292± .097	.267± .099	.257± .137	.251± .072
Kidney %	2.16± .74	2.31± .26	2.18± .48	2.05± .53
Loin area (cm^2)	16.3 ±1.54	16.4 ±2.48	15.1 ±2.63	14.9 ±1.55
Conf. grade	11.1 ± .64	11.6 ± .92	11.1 ± .64	11.0 ±1.07
Leg score	11.9 ±1.13	12.1 ±1.36	12.1 ±1.25	11.5 ±1.07
Yield grade	2.37± .39	2.33± .25	2.27± .34	2.25± .19

[a,b,c]Differences greater than ($P<.05$).

Table 6. Statistical summary comparing corn to barley, soybean meal to distillers grains and the interactions of only those that are different[a]

Loin wt. (kg)	corn (2.88) and barley (2.57) $P<.03$
Dressing %	corn (54.1) and barley (51.7) $P<.003$
Final live wt. (#)	corn (107) and barley (101) $P<.009$
Daily gain (#)	corn (.87) and barley (.76) $P<.0003$
Daily feed intake (#)	corn (4.07) and barley (3.57) $P<.0003$
Feed/gain	Soybean meal (4.56) and distillers grain (4.87) $P<.05$

[a]All other comparisons of corn to barley or soybeal meal to distillers grains or interactions of grains to protein sources were similar.

VARIOUS ENERGY LEVELS FOR EWES FED ALFALFA:STRAW DIETS

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

SUMMARY

The general objective of this experiment was to determine the effects of feeding varying levels of straw [0 (0S), 20 (20S), 40 (40S) and 60% (60S) straw] with alfalfa on ewe reproductive performance. Twenty five second or third parity Suffolk ewes were randomly assigned to five treatments and the experiment was conducted for two reproductive cycles. The ewes were penned individually in adjacent pens. Four dietary treatments were alfalfa replaced with 0 (0S), 20 (20S), 40 (40S), and 60% (60S) straw. Ten ewes were placed on the 40S diet with five ewes designated as a negative control (NC) group. Each diet was supplemented with .23 kg SBM daily and 20% phosphorous mineral and TM salt were offered free choice. The diets were chopped and fed ad libitum from post weaning (April) to flushing (August) (120 d) and from post breeding (October) to midgestation (December) (45 d). During flushing and breeding (August to October) (60 d) all ewes except the NC group were fed alfalfa ad libitum and .45 kg grain (barley or corn). The NC ewes were fed the 40S diet from post-weaning to midgestation. All ewes were returned to previous treatment diets from October to November. All ewes were fed a common late gestation and lactation diet of alfalfa and corn.

Digestibilities and intake of the diets decreased as the percent straw in the diets increased. The positive relationship between digestibility and intake resulted in greater weights at flushing for the 0S ewes compared to the other treatments. Ewes fed the 60S diet did not consume enough nutrients to maintain body weight and had the lowest weight following the maintenance period.

Conception rates were variable among treatments. The 40S treatment had the highest (90%) and the 60S treatment the lowest (50%) conception rates. Lambing rate and weight of lamb born/ewe exposed were higher (170% and 10.16 kg, respectively) for ewes fed the 40S diet compared to ewes fed the 60S (60% and 3.75 kg, respectively) or 0S (90% and 5.91 kg, respectively) diets. Reproductive performance was similar for ewes on a high (0S) or low (60S) plane of nutrition. Results were similar when lambing data was expressed as ewes lambing. It is believed that the reproductive response to the treatment diets was due to the condition of the ewes at breeding time. Ewes in moderate condition outperformed ewes in high and low condition. These results were interpreted to indicate that a moderate plane of nutrition during maintenance is more desirable than a high or low plain of nutrition. In this experiment the most effective diet was 40% straw and 60% alfalfa supplemented with protein and minerals.

Ewes that were flushed had a higher lambing rate and a greater weight of lamb born/ewe exposed compared to ewes that were not flushed.

INTRODUCTION

Self feeding chopped straw/alfalfa diets can reduce feed costs and save labor. North Dakota produces about 8.4 million Mg of straw/year (USDA, 1984). Feed costs are about 60% of the annual cost/ewe/year. Straw could replace a substantial portion of the feed energy required for ewes during periods of low energy requirements (maintenance and early gestation). It has been shown (Barry and Johnstone, 1976; Brown and Johnson, 1985) that dry matter intake and digestible energy rapidly decrease below recomended levels (NRC. 1975) as percent straw increases. During the maintenance and(or) flushing periods the ewe must be able to recover from her previous lactation and prepare herself for the following gestation and lactation. Otherwise a subsequent decrease in reproductive performance can be expected.

Cereal straws limit intake so they could be used in a self feeding program, thereby saving labor. Many factors have been proposed to affect roughage intake. Physical form, digestibility, palatability, rate of passage, and nutrient content of the diet have been suggested as some of the dietary factors related to intake. Mertens (1987) reviewed factors affecting intake and concluded that when high fiber, low energy diets are fed, intake is limited by the physical capacity of the animal and becomes a function primarily of the diet. Weston (1967) suggested that the primary factor limiting intake of wheaten hay was nitrogen deficiency and that the second limiting factor was rate of passage. Blaxter et al. (1961), Petchey and MBatya (1977) and many others have demonstrated that voluntary intake of digestible energy decreased as the quality of roughage in the diet decreased.

Past experiments (Light et al, 1984; Faller et al, 1986; Thonney and Hillers (1977) involving alfalfa diets with 0, 20, 40, and 60% straw have indicated that ewes can perform satisfactorily on high straw diets. Other work (Laytimi et.al 1984) indicated that high levels of wheat straw do not affect conception rates, but limit the number of multiple births. Many authors have reported on the effects of nutrition during maintenance, prebreeding and(or) early gestation on conception rate, ovulation rate and(or) embryonic loss. The ewe is most susceptible (Edey, 1969) to embryonic loss through the period of implantation (12 to 24 d) and normally 20-30% (Edey (1969) of fertilized ova are lost during pregnancy. Ewes in higher body condition have been shown to have a higher ovulation rate (Edey, 1969; El-Sheikh et al., 1955; Guerra et al., 1972; Gunn et al., 1972; Rind et al., 1984 and others) and subsequent higher embryonic losses (Edey, 1966; Edey, 1969; El-Sheikh et al., 1955; Gunn et al., 1972; Rind et al., 1984) than ewes in poorer condition. However Gunn and Doney (1975) and Edey (1966) reported that low levels of body condition and(or) prebreeding nutritional state increases the proportion of single ovulations and increases embryonic loss. A high clearance rate of progesterone for ewes on a high plane of nutrition (Parr et al.. 1987) and a poor uterine environment (Edey, 1969) have been suggested as reasons for decreased conception rate and embryo survival. Testosterone appears to have a negative impact on ovulation rate (Rhind et al., 1987). Apparently, ewes in moderate condition are likely to have a greater lamb production than ewes in obese or thin condition.

The general objective of this experiment was to determine the nutritional parameters of chopped alfalfa:straw diets and to relate the effect of these diets to subsequent ewe reproductive performance. The specific objectives were as follows:

1. To determine the digestibilities of alfalfa diets replaced with 0, 20, 40 and 60% straw fed with and without SBM.
2. To compare digestion coeficients determined using acid insoluble ash (AIA) and acid detergent lignin (ADL).

3. To determine the dry matter and nutrient intakes of alfalfa diets replaced with 0, 20, 40, and 60% straw.
4. To assess the effect of these diets on ewe weight gain(loss) during maintenance and early gestation.
5. To relate effects of these diets to conception rate, lambing rate, and weight of lamb born.
6. To relate the within treatment effect of weight gain(loss) on conception rate, lambing rate, and weight of lamb born.
7. To investigate the flushing response of ewes fed. 40% straw:60% alfalfa supplemented with SBM. during maintenance.

EXPERIMENTAL PROCEDURE

Experimental Units

Twenty-five second or third parity commercial Suffolk ewes were randomly assigned to five treatments. These ewes weighed an average of 70 kg and were penned individually (indoors) in adjacent screened pens. Dry matter intake, dietary composition, diet digestibilities and lambing performance were determined. One ewe developed chronic acidosis and was eliminated from the experiment.

Treatments

The dietary treatments were as follows:

Treatment	Diet
0S	100% alfalfa
20S	80% alfalfa:20% wheat straw
40S	60% alfalfa:40% wheat straw
NC	60% alfalfa:40% wheat straw (negative control to be fed treatment diet from April 20 to November 25)
60S	40% alfalfa:60% wheat straw

Soybean meal was supplemented at .23 Kg·ewe^{-1}·d^{-1} and 20% phosphorous mineral and trace mineral salt were offered free choice to all ewes.

Protocol

Dietary intakes were recorded and refusals (< 10% of offerings) were weighed and discarded weekly. The treatment diets were self fed from April to August (maintenance, 120 d) and continued from October to December (early gestation, 45 d) for a total of about 165 d. Oat straw replaced wheat straw for about 2 wk during maintenance for yr one. During flushing (August to September, 15 d) and breeding (September to October, 45 d) all ewes except the negative control treatment were fed a common diet (alfalfa:barley). The negative control ewes were fed the treatment diet from April to December. The ewes were taken off the flushing diet after two estrous cycles (October 8) and returned to the treatment diets. During yr two the soybean meal supplementation was discontinued postbreeding to assess digestibilities of the alfalfa:straw diets. After November 25 all ewes were fed a gestation diet (alfalfa). After the lambs were weaned (March 31 to April 15) the ewes were again randomized and placed back on the dietary treatments for year two. No ewe was fed the same treatment diet for both years. Fecal samples were collected rectally from the twentyfive ewes in experiment one three times during maintenance, two times during early gestation and once during flushing and breeding. Representative diet samples were collected throughout the experiment and ewe weights were recorded at weaning, midmaintenance, preflushing, postbreeding and mid-gestation. Ewe condition score was determined at weighing by methods outlined by Russel et. al (1969).

RESULTS AND DISCUSSION

Diets Diet and feedstuff composition is presented in table 1. The percent of SBM in the diet increased as the percent straw in the diet increased because intake of roughage decreased. Diets supplemented with SBM were adequate (NRC, 1985) for all nutrients expressed on the concentration basis. Protein was slightly deficient for the 60S diet and protein and DE were deficient for the 40S and 60S diets when SBM was not supplemented.

TABLE 1. CHEMICAL COMPOSITION FOR FEEDSTUFFS[a]

	Alfalfa	Straw	SBM[b]
	IFN 1-00-063	IFN 1-05-175	IFN 1-04-604
Dry matter, %	86.3 ±4.4	87.5 ±4.6	90
DE, kcal/kg	2.79±14	1.72±.18	3.87
Protein, %	16.7 ±2.3	3.6 ±1.0	49.9
ADF, %	47.9 ±6.4	63.3 ±5.2	8.2
ADL, %	9.3 ±1.0	9.3 ±.8	-----
AIA, %	1.31±45	7.7 ±1.9	.24.042[c]
Ca, %	1.59±46	.36±.14	.34
P, %	.28±07	.10±.04	.7
Mg, %	.42±09	.17±.1	.3

[a]Dry basis. [b]NRC, 1985. [c]From lab analysis.

Intake Dry matter intake was averaged over the entire experiment because intake was the same within treatments during maintenance and early gestation. Dry matter, DE, protein, Ca, P and Mg intake decreased as the percent straw in the diet increased with ($P<.04$) and without ($P<.06$) SBM supplement (Tables 2 and 3). When SBM was fed there were no nutritional deficiencies in any of the diets. When SBM was not fed intake of energy, protein and phosphorous were deficient in the 40S and 60S treatments. Dry matter intake was lower than recommended (NRC, 1985) when SBM was not fed in the 60S diet. A slow rate of passage and low digestibility are likely factors limiting intake of diets with and without SBM. Mertens (1987) reviewed factors affecting intake and concluded that when high fiber, low energy diets were fed, intake was limited by the physical capacity of the animal. Van Soest (1965) determined that a high level of cell wall constituents decreases digestion. Blaxter et al. (1961) noted an inverse relationship between rate of passage and digestibility. This supporting evidence clearly explains the low intake of the diets with high levels of high fiber, poorly digested, straw. Mertens and Ely (1979) demonstrated that intake of dry matter is influenced more

TABLE 2. DRY MATTER AND NUTRIENT INTAKE/Kg BODY WEIGHT LEAST-SQUARE MEANS (LSM) AND STANDARD ERRORS (SE) FOR ALFALFA:STRAW:SBM DIETS

		Treatment diet[a]				
	Req.[b]	0S	20S	40S	60S	SE
Dry matter, g/kg	17.1	26.5[c]	24.0[d]	21.3[e] 1	18.8[f]	.88
DE, kcal/kg	41.4	84.2[g]	63.0[h]	55.1[i]	45.4[j]	2.8
Protein, g/kg	1.61	5.26[k]	4.35[l]	3.41[m]	2.95[n]	.127
Phosphorous, g/kg	.0342	.0818[o]	.0663[o]	.0558[p]	.0466[q]	.0023
Calcium, g/kg	.0357	3716[r]	.2719[s]	.2056[t]	.1378[u]	.0107
Magnesium, g/kg	.0257	.1346[v]	.0782[w]	.0651[x]	.0501[y]	.0032

[a]0, 20, 40, and 60% straw, respectively.
[b]NRC, 1985. Requirements for 70 kg ewe during maintenance.
[c-y]Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P values of <.03, <.02, <.005, <.006, <.0001, and <.04; respectively.

TABLE 3. DRY MATTER AND NUTRIENT INTAKES/Kg BODY WEIGHT LEAST-SQUARE MEANS (LSM) AND STANDARD ERRORS (SE) FOR ALFALFA:STRAW DIETS.

		Treatment diet[a]				
	Req.[b]	0S	20S	40S	60S	SE
Dry matter, g/kg	20.0	24.6[c]	21.9[c,d]	20.5[e]	17.5[f]	1.09
DE, kcal/kg	48.6	69.4[g]	53.4[h]	44.4[i]	35.5[j]	3.3
Protein, g/kg	1.86	3.07[k]	2.10[l]	1.42[m]	0.86[n]	.09
Phosphorous, g/kg	.0414	.0638[o]	.0481[p]	.039[q]	.028[r]	.002
Calcium, g/kg	.05	.3732[s]	.2713[t]	.2135[u]	.1418[v]	.0119
Magnesium, g/kg	.0257	.1301[w]	.0722[x]	.0616[y]	.0455[z]	.0035

[a]0, 20, 40, and 60% straw, respectively.
[b]NRC, 1985. Requirement for a 70 kg ewe during early gestation.
[c-z]Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P values of <.06, <.06, <.0004, <.005, <.002, and <.04; respectively.

by indigestible fiber and rate of passage than by rate of fiber digestion. Straw is high in indigestible fiber so additional increments of straw will rapidly decrease the digestibility of the whole diet. Previous reports indicate that DE and protein deficiency will decrease dry matter intake (Weston, 1967; Campling et al., 1962; Lyons et al., 1970; McCollum and Galyean, 1985). These factors could also have limited intake when straw was fed at 40 and 60% and SBM was not supplemented. Krysl et al. (1987) has indicated that cottonseed meal will increase intake and estimated gastrointestinal fill. Church and Santos (1981) found voluntary dry matter and digestible energy intake of wheat straw was increased by the addition of SBM. Soybean meal supplement may have increased dry matter intake of the high straw diets. However, differences in dry matter intake of supplemented and unsupplemented roughage were not tested because the roughage quality and sources were not constant. Further processing (grinding and(or) pelleting) would be expected to increase the dry matter intake and decrease the digestibility of roughage due to a faster rate of passage.

Apparent digestion coefficients Digestion coefficients (table 4) for dry matter, energy, protein and ADF of the alfalfa:straw:SBM diets decreased ($P<.04$) as the percent straw in the diet increased. A sharp decrease in digestibilities of DM, energy, protein and ADF was noted when as little as 20% straw was added to the diet. Digestibility of ADF was decreased more by the addition of straw than were DE or protein. The digestibility and intake of the roughage in the 60S diet was higher when SBM was fed. This may have been due to the low protein content in the diet without SBM. Others have reported an increase in digestibility of low quality forages by supplementing with nitrogen (Church and Santos, 1981; Coombe and Christion, 1969; Campling et al., 1962; Lyons et al., 1970; McCollum and Galyean, 1985).

Apparent digestion doefficients were determined for diets fed without SBM with AIA used as an internal indicator. Apparent digestion coefficients for DM, energy, protein, ADF and ADL decreased as the percent straw in the diet increased ($P<.06$).

TABLE 4. APPARENT DIGESTION COEFFICIENT (DETERMINED USING AIA) LEAST-SQUARE MEANS (LSM) AND STANDARD ERRORS (SE) FOR ALFALFA:STRAW:SBM DIETS.

	Treatment diet[a]				
	0S	20S	40S	60S	SE
Dry matter	72.1[b]	60.5[c]	59.0[c]	54.2[d]	1.4
Energy	73.1[e]	62.2[f]	61.1[f]	57.2[g]	1.5
Protein	82.5[h]	75.9[i]	74.9[i]	71.7[j]	.8
ADF	62.7[k]	42.7[l]	48.8[l]	49.0[l]	2.8

[a] 0, 20, 40, and 60% straw, respectively.
[b-l] Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P values of <.01, <.04, <.004, and <.001, respectively.

Weight and condition score. Ewes weights are presented in table 5. Average initial weight and condition score across treatments were 70 kg and 2.74, respectively.

The ewes on the 0S diet gained 4.5 kg while all other treatment groups lost weight during the maintenance period. Ewes on the 20S and 40S treatment lost less weight ($P<.002$) than ewes on the 60S diet. The ewes on the 0S treatment gained more condition ($P<.03$) than the ewes on

TABLE 5. WEIGHT AND WEIGHT CHANGE LEAST-SQUARE MEANS (LSM) AND STANDARD ERRORS (SE) FOR EWES.

	Treatment diet[a]				
	0S	20S	40S	60S	SE
	kg				
Weight					
April[b]	66.8	71.0	70.9	71.0	2.2
August	71.3[c]	70.6[c]	68.8[c]	63.4[d]	2.0
October[b]	75.3	74.2	72.6	68.5	2.4
December	76.1[e]	73.9[e]	71.8[e]	65.0[f]	2.4
Weight changes					
maintenance	4.5[g]	-.4[h]	-2.0[h]	-7.7[i]	.9
flushing:-breeding[b]	4.0	3.5	4.6	5.1	1.1
early gest.	.6[j]	-.3[j]	-.8[j]	-3.5[k]	1.0
April-Dec.	8.7[l]	2.8[m]	2.9[m]	-6.0[n]	1.6

[a]0, 20, 40, and 60% straw, respectively.
[b]P>.05 for overall F-test.
[c-n]Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P values of <.05, <.05, <.002, <.08, and <.02; respectively.

the 40S and 60S treatments and 20S ewes gained more condition (P<.03) than the 60S ewes. Weight (kg) and condition score changes during maintenance resulted in prebreeding weights and condition scores of 71.3, 3.2; 70.6, 3.2; 68.8, 2.6 and 63.4, 2.6 for the 0S, 20S, 40S and 60S treatments, respectively. These weights and condition scores range from very good to poor condition and reflect the decrease in dry matter intake, nutrient density and digestibility of the diets as the percent straw in the diet increased.

All ewes gained weight during the flushing and breeding period. Weight gains were similar (P>.05) across all treatments and varied from 5.1 kg (60S) to 3.5 kg (20S). Weight change during flushing and breeding was negatively correlated with weight change during maintenance for the 0S (r=-.63, p<.07) 20S (r=-.62, p<.07) and 60S (r=-62, p<.06) treatments. Other reports also indicate a compensatory response to prior undernutrition (Arnold and Birrell, 1977; Allden and Young, 1964; Gunn et al., 1983; Langlands, 1968). Ewes in the NC treatment gained weight (P>.05) comparable to the 40S ewes during the flushing and breeding period (table 6). This may have been due to an increase in opportunity to sort feed, an increase in activity and competition for feed in the group breeding pens during flushing:breeding. Sorting of feed was not a factor during the maintenance and early gestation periods because feed was offered based on appetite and wastage was minimized. Ewes on the 0S treatment lost condition during this period while the ewes on the 60S and 40S treatments gained condition. This appears to be a compensatory response to the loss of weight during maintenance. These differences were not significant.

TABLE 6. REPRODUCTIVE PERFORMANCE AND WEIGHT LEAST-SQUARE MEANS (LSM) AND STANDARD ERRORS (SE) FOR EWES FLUSHED (40S) AND NOT FLUSHED (NC).

	Treatments		
	40S	NC	SE
Flushing:breeding weight change, kg[a]	4.64	4.34	1
October weight, kg[a]	72.6	73.9	1.93
Lambing data/ewe exposed			
Conception rate, %[b]			
open	10	30	--
concieved	90	70	--
Lamb born, kg	10.2[c]	5.8[d]	1.4
Lambing rate, %	170	100	23
Distribution of lambs, %[e]			
ewe open	10	30	--
single	10	40	--
twin	80	30	--
Lambing data/ewe lambing			
Julian lambing date[a]	38.9	37.3	1.93
Ave. lamb weight, kg[a]	5.99	6.02	.3
Lamb born, kg	11.39[f]	8.73[g]	.93
Lambing rate, %	190	146	15
Distribution of lambs, %[h]			
single	11	57	--
twin	89	43	--

[a]P>.05 for overall F-test. [b]P>.05 for X^2.
[c,d]Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P <.04.
[e]P<.08 for X^2.
[f,g]Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at P <.07.
[h]P<.05 for X^2.

Weight changes during early gestation followed the same pattern as during maintenance, however the differences were not as great, possibly because the duration was shorter. At the end of the experiment (midgestation) the 60S ewes were lighter (P<.05), had lost more weight (P<.02) and had a lower condition score (P<.03) than the other treatments. The 0S treatment gained the most weight (P<.02) during the entire experiment.

Lambing results. Reproductive data are shown in tables 7 and 8. Conception rate was higher (P<.05) for ewe fed the 40S diet compared to

TABLE 7. LAMBING DATA LEAST-SQUARE MEANS (LSM), STANDARD ERRORS (SE) AND CHI-SQUARE (X^2) TABLES FOR EWES EXPOSED.

	Treatment diet[a]				
	0S	20S	40S	60S	SE
Lamb born, kg[b]	5.91[d]	6.39[d]	10.16[c]	3.75[d]	1.43
Conception rate, %[e]					
open	22	33	10	50	--
concieved	78	67	90	50	--
Lambing rate, %[f]	90	112	170	60	24
Distribution of lambs, %[g]					
ewe open	22	33	10	50	--
single	67	22	10	40	--
twin	11	44	80	10	--

[a] 0, 20, 40, and 60% straw, respectively.
[b] Quadratic response ($P<.02$). Cubic response ($P<.04$).
[c,d] Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at $P <.07$.
[e] 40S vs 60S $P<.05$ for X^2.
[f] Quadratic response ($P<.01$). Cubic response ($P<.07$).
[g] 0S vs 40S and 40S vs 60S $P<.01$ for X^2.

TABLE 8. LAMBING DATA LEAST-SQUARE MEANS (LSM), STANDARD ERRORS (SE) AND CHI-SQUARE TABLES (X^2) FOR EWES LAMBING.

	Treatment diet[a]				
	0S	20S	40S	60S	SE
Julian lambing date[b]	39.3	43.5	38.8	35.6	3.1
Ave. lamb wt.,kg[b]	6.77	5.89	6.0	6.37	.3
Lamb born, kg[c]	7.64[e]	9.55[d,e]	11.35[d]	7.39[e]	.87
Lambing rate, %[f]	115	167	189	119	16
Distribution of lambs, %[g]					
single	86	33	11	80	--
twin	14	67	89	20	--

[a] 0, 20, 40, and 60% straw, respectively.
[b] $P>.05$ for overall F-test.
[c] Quadratic response ($P<.003$).
[d,e] Row LSM with different superscripts differ according to pairwise independent t-tests among the LSM at $P <.005$.
[f] Quadratic response ($P<.001$).
[g] 0S vs 40S and 40S vs 60S $P<.01$ for X^2.

ewes fed the 60S diet. Conception rates were 78, 67, 90 and 50% for 0S, 20S, 40S and 60S treatments, respectively. Conception rates were poor in the second year among all treatments for unknown reasons. Ewes in the 40S treatment had a higher lambing rate/ewe exposed (P<.01) compared to ewes in the 0S and 60S treatments. Gunn et al. (1983) also reported higher lambing rates for ewes in intermediate condition, compared to ewes in high or low condition, due to a greater response to flushing. The moderate condition of the 40S ewes is expected to have contributed to a greater response to flushing than ewes in excess (0S) or poor (60S) condition. Others have demonstrated a higher ovulation rate and higher embryo losses for ewes in excess condition compared to ewes in poorer condition (Edey, 1969; El-Sheikh et al., 1955; Guerra et al., 1972; Gunn et al., 1972; Rhind et al., 1984; Edey, 1966). The high body condition of the ewes in the 0S treatment was expected to have contributed to a higher ovulation rate and higher embryo loss than ewes in poorer condition. Previous research has indicated that ewes in poor condition have a lower ovulation rate and higher embryo loss than ewes in higher condition (Gunn and Doney, 1975; and Edey 1966). Ewes in the 60S treatment were in poor condition at breeding and may have had a lower ovulation rate and also a greater embryo loss than ewes in moderate condition. Weight of lamb born/ewe exposed was directly related to lambing rate. Ewes in the 40S treatment had more weight of lamb born/ewe exposed (P<.07) compared to all other treatments. Kilograms of lamb born/ewe exposed (P<.04) and lambing rate/ewe exposed (P<.07) showed a cubic response to percent straw in the diet. Ewes offered a moderate plane of nutrition (40S) were in a more optimal condition at breeding than ewes on a high (0s) or low (60S) plane of nutrition. Average lamb weight did not differ (P>.05) among treatments, but appeared to be inversely related to lambing rate. Results were similar when expressed as ewes lambing. There were no stillborn lambs in any treatment. Lambing dates based on a Julian calendar were not different (P>.05) among treatments.

Flushing improved the reproductive performance of the ewes fed the 40S diet (table 6). Ewes in the 40S treatment had a higher lambing rate/ewe exposed (P<.08) and a greater weight of lamb born/ewe exposed (P<.04) compared with the NC ewes. Allen and Lamming (1961) demonstrated an increase in ovulation rate for flushed moderately conditioned ewes compared to ewes that were not flushed. Ewes fed the 40S treatment tended to have a higher conception rate. Results were similar when expressed as ewes lambing. There were no effects of flushing observed for ewe weights.

The North Dakota Sheep Ked and Louse Control Program

"1988 PROGRESS REPORT"

Roger G. Haugen
Extension Sheep Specialist
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The North Dakota Sheep Ked and Louse Control Program was implemented in the fall of 1986. It's a voluntary program to make North Dakota a ked and louse free state. The program's success depends entirely on its acceptance by sheep producers and their cooperation. The initial plan of action is listed below.

<u>The North Dakota Ked and Louse Free Sheep Program</u>

1986-87
* Education/Demonstration Programs.
* Identify participating producers.

1988
* Continue education efforts; document economic gains.
* Identify non-participating producers
* Designation of ked and louse free status to flocks.
* Inform marketing outlets of ND ked free skins.

1989
* Encourage non-participating producers to treat.
* Ask the North Dakota Livestock Sanitary Board to required that imported sheep be treated or come from a designated ked and louse free state.

1990
* Declare North Dakota a ked and louse free state.

What has happen since the fall of 1986?

Educational programs were held in four locations during the fall-winter of 1986-87 (Page, Lisbon, Stanley and Hettinger). Producers were presented information on the program and management practices on how to control both keds and lice. Educational programs were continued during the fall-winter of 1987-88 at Carrington, Oakes, Steele, Rolette, and Devils Lake.

Individual Flock Status

Details for designation of ked and louse free status to flocks were set by the ked and louse control committee to begin in 1988. For a producer to have his or her flock declared ked and louse free, they must first have used a product to control keds and lice prior to the time they are being inspected. Their flock must be inspected and found free of both keds and lice.

Inspection should be done at shearing time or as soon as possible after the flock has been sheared. Inspection can be done by anyone who knows what keds and lice are and can recognize them. Preferrably, shearers would be the ideal inspectors but others such as vets, fellow sheepman, etc. could also inspect. A form needs to be filled out by the producer and signed by the inspector declaring the flock ked and louse free. The ked and louse free status is done on a yearly basis.

Display signs to designate a producer whose flock has been declared free have been made and will be given to the producer to hang on the barn or whatever facility he or she prefers. Business cards are also available for producers to carry declaring their flock free status. Both the signs and the business cards are also on a yearly basis.

Plans are to require all sheep being entered in ram and ewe sales in North Dakota by the year 1989 be from ked and louse free flocks.

North Dakota being Declared a Ked and Louse Free State

Plans are in motion to define what requirements need to be met in order for North Dakota to be declared ked and louse free. The State Livestock and Sanitary Board is working on this aspect. In 1989, all sheep and lambs that go through markets in North Dakota and originated from North Dakota flocks will be inspected for keds and lice. Statistics will be gathered on the infestations of North Dakota sheep and lambs with keds and lice. Concentrated attempts will be made to clean up any trouble spots in the state so that by the year 1991, North Dakota could possibly be declared ked and louse free.

A voluntary control program has no restrictions, regulations, quarantines or fines: but it does provide an opportunity for the sheep producers of North Dakota to take action and make the North Dakota sheep industry a better industry. If you have questions concerning the program, contact one of the committee members below.

Committee Members for the North Dakota Sheep Ked and Lice Control Program

Chairman: Roger Haugen,NDSU Extension Sheep Specialist
Dr. Robert Velure,State Livestock Sanitary Board
Tim Faller,Hettinger Experiment Station
James Robertson,NE producer,Hope
James Goettle,NW producer,Donnybrook
Ronald Wanner,SW producer,Golden Valley
Joel Hamar,SE producer,Ellendale
Fred Eagleson,Past President of NDLWPA,Buchanan

Advisors: Dr.Dennis Kopp,NDSU Extension Entomologist
Dr.Kurt Wohlgemuth,NDSU Extension Veterinarian

BONDING TO FACILITATE MULTISPECIES GRAZING

C. V. Hulet, D. M. Anderson, W. L. Shupe, and J. Smith
USDA, Agriculture Research Service
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Cattle, sheep and goat diets have been shown to be complementary for efficient range forage utilization. Multispecies grazing has therefore been recommended, but has generally remained unimplemented because of unacceptably high predation losses of sheep and goats. An account of the social attachment of a ram to horses the temporary attachment of individual wether sheep to steers and of guard dogs to sheep suggested that social bonding of sheep and goats to cattle might be possible. Cattle protect their calves from predators. If bonding would occur then the close association of sheep and goats to cattle might provide protection from predation by coyotes and dogs.

Rambouillet x Polypay lambs averaging 45, 62, and 90d of age were confined in small pens (1200 sq. ft. 7 lambs per pen) with 8-9 mo-old heifers (3 per pen) for 60d. Control lambs were kept isolated from cattle. Following 30 and 60 days of pen confinement the treated and control lamb-heifer groups were observed in 300 acre range pastures for evidence of interspecific bonding. During the first tests following 30 days confinement the 45 and 90-day-old groups consistently followed and stayed with the heifers over an 8-hr. test period. The 90-day group became separated twice during the observation period and the control group had no tendency to stay with the heifers. Observation and a specially designed study established that two abusive heifers (abusive to lambs) in the 62-day -old group delayed, but did not prevent bonding. The 60-day test demonstrated that all of the lambs kept in close confinement with heifers consistently stayed with the heifers throughout the test and the control lambs remained entirely independent of the heifers.

Protection from Predation

To evaluate the effectiveness of social bonding as a method of protecting lambs from coyote predation a field study was conducted in 1986. Seven heifers and 9 bonded lambs were rotated between 2 pastures (av. 700 acre) frequented by coyotes, between 13 March and 1 May with no death loss. On 2 May a group of 8 unbonded lambs were placed in a nearby pasture. Four of the 8 lambs were killed by coyotes over a 19d-period, the surviving lambs were then removed from the area and the trial was terminated 6 days later. Again no bonded lambs were lost. During the following 23d interval the bonded group was maintained on a 1000-acre pasture without any loss. On 18 June the remaining 4 lambs and 11 mature ewes were placed in a 1200-acre pasture while the original bonded group was placed in a nearby 600-acre pasture. The two groups of animals were rotated between the two pastures. Nine of the 15 control sheep were lost over a 43-day period compared with zero loss in the heifer-bonded group. The surviving control sheep were then removed from the study area leaving the bonded lambs as the only sheep available to the coyotes. However, no bonded lambs were lost during a 3-week test. None of the bonded lambs were lost during the entire 163-day exposure to predation. These results indicate that bonding to cattle can be an effective method of controlling coyote predation on free-ranging sheep.

The next study was conducted to determine the mechanism in the bonded multispecies herd that provides protection to the sheep:

Response of Bonded and Unbonded Sheep to the Approach of a Trained Border Collie

Intra-and interspecific association of young cattle and yearling ewes bonded or non-bonded to cattle was observed under free-ranging conditions preceding, during and following the approach of a trained border collie dog. The dog treatment provided insight into the response of livestock to an aggressive, threatening canine. As the dog approached, the cattle and sheep would come together. The sheep would run in among the cattle leaving the cattle on the periphery to face the dog. The confrontation of the cattle and dog usually would discourage the dog unless he was urged on by his trainer. The dog became more aggressive following urgent commands and the cattle and sheep herd would turn and move away, always with the sheep in the middle and the cattle on the perimeter. If the dog got too close the cattle would kick at the dog and occasionally turn and threaten to bunt the dog. As long as the dog was present the sheep would stay in among the cattle whether stopped or moving. In contrast the unbonded yearling ewes, even when moved next to a herd of cattle would move completely independent of the cattle when chased by the dog.

Bonding of Goats to Sheep and Cattle

Cattle on the range prefer grass, sheep prefer forbs (weedy plants) and goats prefer brouse (shrubs and trees). Since much of our western range includes brush and trees it would be still more efficient to include all three species in the flock and herd (flerd). Therefore, the next step was to determine if goats would also bond to cattle and would be protected from predators. Mohair goats when tested following a study similar to the lamb-heifer study did develop a cross-specific attachment or bond when tested on pasture but this bond did not endure over a extended period of time on the range. However, when mohair goats which had been bonded to cattle were placed with both cattle and sheep for two weeks and then tested over extend periods of time on the range they did consistently stay with the flerd and both sheep and goats were protected from coyotes, while control (unbonded) goats were badly decimated.

Although much progress has been made there remains much to be learned. We need to know how large numbers of cattle and bonded sheep behave and if the character of subgroups that form is such that predation protection is still effective. We need to devise methods for bonding sheep to cattle on the range without the cost of confinement and feed. We need to study the complimentarily of cattle and guard dogs on maximizing predator control for sheep and goats. We need to develop efficient methods of separating bonded sheep from cattle for management activities such as cutting lambs out for market, sheering, etc. We need to know if bonding will facilitate the management of Spanish goats which can be extremely difficult to gather and work by themselves.

In Conclusion:

We know that in small flocks, bonding to cattle can be a valuable tool in not only protecting sheep from canine predators but can also greatly facilitate finding sheep in large brushy pastures and can minimize the need for sheep-tight partition fences. We need to reduce the cost of bonding, extend our knowledge to the management of large commercial flocks and study methods of combining the attributes of dogs and cattle for protecting sheep and goats from predation.

SECTION II

MANAGEMENT SECTION

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29TH ANNUAL SHEEP DAY

HETTINGER RESEARCH & EXTENSION CENTER
HETTINGER, NORTH DAKOTA

FEBRUARY 10, 1988

Sheep Economics

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Basic sheep management is the key to any successful sheep enterprise. Profitability hinges on it. There are many parts to sound sheep management such as genetics, nutrition, health care, etc., but this paper will deal with the economic component. A realistic look at costs and returns in a sheep enterprise will be examined.

The following are some BASIC ECONOMIC ASSUMPTIONS that will be used:

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* **Value of Breeding Ewes** - $100 **Value of Replacement Ewe Lambs** - $85

  Percent Replacement Rate - 15% **Annual Interest Rate** - 13%

  Average Ram Investment - $300 (Salvage Value - $50; Useful Life - 3 yrs)

* **Annual Feed Requirements/Ewe** - 0.85 TON of Hay ($40/Ton)
  130 LB Grain ($.03/lb)
  65 LB/Ram Feed ($0.03/lb)

  Annual Ewe Feed Costs = $39.85

  Feed Required/Lamb to Market (110 lbs) - 350 LB Concentrate ($0.045/lb)
  110 LB Hay ($0.02/lb)

  Lamb Feed Costs = $17.95

* **Other Variable Costs** - Vet, Medical, Fuel, Marketing, Shearing, etc.
  Annual Per Ewe Cost = $10 when selling market lambs
  Annual Per Ewe Cost = $ 8 when selling feeder lambs

  Interest on Variable Costs - Feed, Supplies, etc.
  Annual Per Ewe Cost = $4.80 when selling market lambs (Range $4.45-$5.15)
  Annual Per Ewe Cost = $2.95 when selling feeder lambs

* **Fixed Costs** - Interest on Breeding Stock ($13.39),
  Ram Depreciation ($2.50), and Taxes ($1.09)
  Annual Per Ewe Cost = $16.98
  Existing Buildings and Equipment Used - No Cost

* **Breeding Ewes Death Rate** - 4% **Salvage Value of Cull Ewe** - $28
  Average Fleece Weight/Ewe/Year - 9.50 Lbs **Price Received/LB** - $1.83
  Annual Return/Ewe for Cull Ewe Sales and Wool Sales = $20.47

* **Average Market Wt of Lambs** - 110 lbs **Average Feeder Wt of Lambs** - 70 lbs
  Feed Conversion Factor for Lambs - 4.5 lbs feed per pound of gain

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The following two tables give profit and return figures associated with different lamb weaned percents as well as different selling prices. One table deals with operatons which feed their own lambs out and the other where lambs are sold as feeders. All the above assumptions are used in the calculations.

In the middle of Table 1 we see that at a 150% lamb crop and $70 dollar lambs, $25.86 per ewe is available to a producer to pay back on his initial investment in breeding stock as well as his own labor.[5]

Table 1. Profit and Return to Management Per Ewe Unit at Alternative Lamb Crop Percentages and Market Prices

Per Cent Lamb Crop Weaned	Market Price ($/CWT)														
	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
110	-12.04	-9.95	-7.86	-5.77	-3.68	-1.59	.50	2.59	4.68	6.77	8.86	10.95	13.04	15.13	17.22
120	-7.67	-5.36	-3.05	-.74	1.57	3.88	6.19	8.50	10.81	13.12	15.43	17.74	20.05	22.36	24.67
130	-3.31	-.78	1.75	4.28	6.81	9.34	11.87	14.40	16.93	19.46	21.99	24.52	27.05	29.58	32.11
140	.71	3.46	6.21	8.96	11.71	14.46	17.21	19.96	22.71	25.46	28.21	30.96	33.71	36.46	39.21
150	5.07	8.04	11.01	13.98	16.95	19.92	22.89	25.86	28.83	31.80	34.77	37.74	40.71	43.68	46.65
160	9.44	12.63	15.82	19.01	22.20	25.39	28.58	31.77	34.96	38.15	41.34	44.53	47.72	50.91	54.10
170	13.45	16.86	20.27	23.68	27.09	30.50	33.91	37.32	40.73	44.14	47.55	50.96	54.37	57.78	61.19
180	17.82	21.45	25.08	28.71	32.34	35.97	39.60	43.23	46.86	50.49	54.12	57.75	61.38	65.01	68.64
190	22.18	26.03	29.88	33.73	37.58	41.43	45.28	49.13	52.98	56.83	60.68	64.53	68.38	72.23	76.08

A closer look at the table reveals that for every increase of 1 percent lamb crop weaned, an additional 48 to 70 cents profit per ewe is realized depending on the market price. For example at $80 dollar lambs, every 10% increase in number of lambs weaned equals an additional $7 more profit per ewe. At $60, that figure is $4.80.

Looking at it from the price side, every $1 increase per hundredweight in the market price results in a minimum $1.04 additional income per ewe (110% lamb crop) with an eleven cents add on per 10% increase in lamb crop weaned. For example at a 140% lamb crop, a jump in market price from $66 to $76 results in $13.70 more income per ewe.

Operations that lamb early (January thru March) normally have to have some buildings for lambing purposes. The above figures are based on using existing facilities at no costs. If a producer was to build a new facility with equipment to house his flock, an additional $20.82 worth of expenses per ewe would be incurred.

The building is depreciated over 20 years and equipment over 10 years. An interest rate of 13% is used for both. Space requirements for a ewe and her lamb/lambs is about 20 square feet. Building cost was estimated at $4.50 per square foot.

To figure the estimated profit and return to management from Table 1 when new buildings and equipment are involved, subtract $20.82 from every value in the table.

Producing feeder lambs involves less capital outlay. Feed for the lambs is the obvious difference. Facilities are the other. Most producers that produce and sell feeder lambs lamb later in the year (April and May) when less labor is required. The figures in Table 2 indicate at $70 dollar feeder prices and 150% weaned crop, profit is $18.34 or $7.52 less then the same figures for market lambs. However less time is spent by the producer.

Table 2. Profit and Return to Management Per Ewe Unit at Alternative Lamb Crop Percentages and Feeder Prices

Per Cent Lamb Crop Weaned	Feeder Price ($/CWT) 56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
110	-10.57	-9.24	-7.91	-6.58	-5.25	-3.92	-2.59	-1.26	.07	1.40	2.73	4.06	5.39	6.72	8.05
120	-6.65	-5.18	-3.71	-2.24	-.77	.70	2.17	3.64	5.11	6.58	8.05	9.52	10.99	12.46	13.93
130	-2.73	-1.12	.49	2.10	3.71	5.32	6.93	8.54	10.15	11.76	13.37	14.98	16.59	18.20	19.81
140	1.19	2.94	4.69	6.44	8.19	9.94	11.69	13.44	15.19	16.94	18.69	20.44	22.19	23.94	25.69
150	5.11	7.00	8.89	10.78	12.67	14.56	16.45	18.34	20.23	22.12	24.01	25.90	27.79	29.68	31.57
160	9.03	11.06	13.09	15.12	17.15	19.18	21.21	23.24	25.27	27.30	29.33	31.36	33.39	35.42	37.45
170	12.95	15.12	17.29	19.46	21.63	23.80	25.97	28.14	30.31	32.48	34.65	36.82	38.99	41.16	43.33
180	16.87	19.18	21.49	23.80	26.11	28.42	30.73	33.04	35.35	37.66	39.97	42.28	44.59	46.90	49.21
190	20.79	23.24	25.69	28.14	30.59	33.04	35.49	37.94	40.39	42.84	45.29	47.74	50.19	52.64	55.09

Changes in lamb crop percent affect profit at the level of 42 to 56 cents additional income (depending on the feeder price) per ewe for each 1% increased in lambs weaned . Increasing lambs weaned from 110% to 130% adds $9.70 additional income per ewe at $70 dollar feeder lambs. At $80, that figure is $11.20.

Price increases at $1 increments per cwt for feeder lambs result in a minimum 66 cents additional income per ewe (110% lamb crop) with a seven cents add on per 10% increase in lamb crop weaned. For example at a 130% lamb crop, a jump in feeder price from $66 to $76 results in $8.05 more income per ewe.

HETTINGER BRANCH EXPERIMENT STATION

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 weeds 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 first 17 days).

2. Leave rams in NO LONGER than 57 days (38-40 days more desirable).

3. Remove rams (do not sinter 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.

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

6. Iodine for disinfecting navels.

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).

3. Rotate pastures if possible, this also is helpful in internal parasite control.

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.

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: Enterotoxemia, 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 a 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.

ORPHAN LAMBS - MANAGEMENT IDEAS

1. To buy a good milk replacer it should be 30% fat and at least 24% protein. Good replacers are available from:
   a. Land O'Lakes
   b. G T A

   It will cost approximately $1.00 per pound and each lamb will require from 15 to 20 pounds.

2. Use good equipment. NDSU has had good success with the LAMB Bar, K & K Mfg. They sell a self priming nipple and tube assembly that we have found to be excellent for starting orphans. Many types of feeding systems can be home made.

3. Start on nurser quickly. Young lambs start easier. Check ewes udder right after she lambs and make the 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 results and then cooled down. Lambs fed cold milk grow well with less problems from scours and other digestive disturbance. Cold milk keeps better too.

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 cc of 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 antibody 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, 2 ounces are ideal.

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

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

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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

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