35th Annual Western Dakota SHEEP DAY

February 9, 1994

Hettinger Armory

Hettinger Research Extension Center
Department of Animal and Range Sciences
North Dakota State University

February 9, 1994

Dear Sheep Producer:

On behalf of the Department of Animal and Range Sciences and the Hettinger Research Extension Center, let us welcome you to "Sheepday". This report collectively represents North Dakota State University's efforts at both locations to provide information for the support of the sheep industry. We welcome your comments as grassroots users of the efforts of both Extension and Experiment Station resources. Your constructive comments serve to allow us to participate meaningfully in the future of your industry.

A collective, positive and participatory attitude by producers and caretakers of their land grant resources will go far to solve problems confronting the sheep industry.

Best wishes for a day of sharing and learning.

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PROGRAM

9:45 AM (MST)	Sheep Equipment Display and Coffee at the Hettinger Armory
10:00 AM	Early Bird Door Prize Drawing
10:10 AM	HETTINGER & FARGO STATION REPORTS Mr. Dan Nudell Mr. Rob Zelinsky Dr. Kris Ringwall Dr. Paul Berg Mr. Timothy Faller
12:00 NOON	LUNCH: AMERICAN LAMB DINNER
1:00 PM	WELCOME Dr. Brendan Donnelly Vice President for Agriculture and University Outreach North Dakota State University
1:15 PM	"SHEEP PRODUCTION - POST WOOL INCENTIVE" Moderator: Randy Grueneich, Adams County Extension Agent Participants: Gerhardt Reichenback, Sidney, MT Myron Grueneich, Turtle Lake, ND Doug Nenow, Alexander, ND Peter Orwick, Legislative Assistant for A.S.I. American Sheep Industry Association Englewood, Colorado
2:30 PM	"HOW TO MEET YOUR FLOCK HEALTH CARE NEEDS WITH REDUCED FINANCIAL INPUTS" Dr. Jay Bobb, DVM Pipestone Veterinary Clinic Pipestone, Minnesota
3:20 PM	"CLOSING REMARKS" Mike Thompson, President North Dakota Lamb & Wool Producers Assoc. Bowman, North Dakota

*There will be a spouse program in the afternoon beginning at 1:15 PM. Presentations at this program will focus on cooking with lamb and issues of the home.

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 AND EXTENSION CENTER
AND MAIN STATION

DR. BERT MOORE
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AT THE
35TH ANNUAL SHEEP DAY
HETTINGER RESEARCH AND EXTENSION CENTER
HETTINGER, NORTH DAKOTA
FEBRUARY 9, 1994

Effects of Different Dietary Protein Sources in Beet Pulp Based Diets on Lamb Growth and Milk Production

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Summary

Twenty-four 220 lb purebred black faced ewes suckling twins were utilized in a randomized complete block design with four replicates to test the effects of three protein sources on milk production and lamb growth. Each replicate consisted of two ewes/pen. Ewes and their lambs were housed at the NDSU Nutrition Research Center and were allotted according to age of the ewe, age of lambs, sex of the lambs, and breed. The pairs were placed on test at 14d of age (± 5d). Diets were limit fed two times daily at 700h and 1700h and formulated to meet NRC requirements. Diets were analyzed for nutrient composition and were formulated to be isonitrogenous and isocaloric. All diets were beet pulp based with corn being the concentrate source and alfalfa hay (ground) serving as the roughage source. The protein supplements were soybean meal (control), sunflower meal, and crambe meal. Trace mineral salt was fed ad libitum throughout the experiment. The beginning and ending weight and body condition score for the ewes were similar among treatments (P>.05). Lamb gains were similar across all treatments (P>.05). Milk protein, fat,total solids, and production were consistent within weeks and among treatments (P>.05). Protein sources did not alter rumen pH (P>.05). These data indicate that the producers can select the most economical protein source to feed in corn/alfalfa diets to ewes.

Introduction and Justification

The protein requirement for ewes suckling twins during the first six weeks of lactation is 3.43 times that of the same ewe during maintenance (NRC, 1985). In many cases, protein is relatively expensive. A knowledge of the nutrient contributions of these specific protein sources toward meeting lactation requirements could result in producers making more economical feed management decisions.

Newborn lambs diet consist entirely of milk, therefore, the quantity and quality of milk are essential to maximize lamb growth (Brown and Hogue, 1985). The genetics and the plane of nutrition of a lactating ewe are key traits in determining the amount of milk she can produce. Boylan et al. (1984) showed that during a 130d lactation period an average Suffolk ewe will produce 1.47 lb of milk per day. Another study concluded that an average lamb needs to consume 5 lb of milk per every 1 lb it gains (Robinson et al., 1969). The ewes in this experiment are genetically superior to the average ewe. It is expected that they would produce more milk and subsequently their lambs should gain faster. Secondly, the quality of milk is important to lamb growth. A study done at NDSU in which lactating ewes were fed at 100, 115, and 130 percent of the NRC crude protein requirements showed no significant changes in milk composition levels (Murphy et al., 1990). Gaining a better understanding of these nutritional quality factors should give rise to advancements in ewe and lamb production.

Furthermore, feedstuffs produced in North Dakota will be utilized in this study and are readily available to producers. North Dakota leads the nation in sunflower production and is 20th in soybean production (N.A.S.S., 1993).

In 1992, U.S. sheep numbers were 10.8 million head and the estimated lamb crop was 7.25 million (N.A.S.S., 1993). Coupling these figures with the fact that sheep producers on the average obtain 80-85 percent of their yearly revenue from lamb sales, further strengthens the claim that gain and feed efficiency needs to be maximized to make production more cost effective.

Objective

The purpose of this study will be to determine the effects of dietary protein sources in beet pulp based diets and how these protein sources affect lamb growth and milk quantity and quality of lactating ewes.

Procedure

Twenty-four lactating, purebred black faced ewes (Suffolk and Hampshire) suckling twins were utilized in a randomized complete block design with four replicates, three treatments, and two samples per replicate. Diets were formulated to be isonitrogenous and isocaloric and analyzed for nutrient composition prior to the initiation of the study. Molasses was added to the diets at a rate of 50 lb/t to improve the palatability of the crambe ration. Palatability was a problem in this ration due to the bitter taste caused by the glucosinolates contained in crambe meal. After the acclimation period, crambe consumption equaled that of the other treatments. Lambs were allowed ad libitum access to creep feed after day 28 of the study to allow for accurate evaluation of milk production.

After allotment, ewes were condition scored as to the standards set by Russell and co-workers in 1969. Milk production was measured at 7d intervals using a modified weigh-suckle-weigh technique (Neidig and Iddings 1919, Owen 1957, and Coombe et al., 1960). Milk samples were also taken at 7d intervals and were analyzed for protein (AOAC, 1984), fats and total solids (Mojonnier, 1925). Feed and fecal samples were collected for 5d at 14d intervals and analyzed for Acid Insoluble Ash to determine diet digestibility (Van Keulen and Young, 1977). Rumen samples were obtained at 14d intervals via suction strainer to determine pH, volatile fatty acid, and ammonia concentrations. Volatile Fatty Acids were analyzed by gas chromatography (Supelco, 1975). Ammonia was determined using the Berthelot Reaction (Sigma, 1980).

Results and Discussion

The nutritional profile of the feedstuffs incorporated in the three diets are shown in Table 1. The percent composition of each feedstuff to each diet are shown in Table 2. Lamb gains were similar among treatments and followed corresponding growth curves of other NDSU experiments. Ewe milk production (Table 3) peaked during weeks 4-6 of lactation, corresponding to previous work done on ewe lactation. Milk protein level stayed at a similar level during the trial after climbing to the level during week 5 of lactation. Once milk production decreased, the milk protein level peaked and stabilized because there was less milk produced. Milk fat and total solid levels were directly proportional. Milk fat levels declined as the trial proceeded and milk protein and total solids increased. These results are explained by the fact that the ewe has less stored fat and as a result milk protein and total solids must increase. Ewe body weights and body condition scores (Table 4) were not variable ($P>.05$) among treatments. Creep feed intake was different among treatments ($P<.05$). Lamb variation within rep, between rep within treatment and among ewes accounts for this difference. These data concludes that the choice of these three protein sources depends on the economics of each supplement.

TABLE 1. FEEDSTUFF COMPOSITION USED FOR THE DIET FORMULATION

	%				
Feedstuff	DM	Protein	TDN[a]	Ca	P
Alfalfa	84.4	18.4	53.3	1.49	.22
Beet Pulp	90.8	10.1	67.2	.19	.44
Corn	84.9	11.3	82.3	.01	.36
Crambe meal	95.1	34.4	85.0	1.12	.95
Sunflower meal	92.2	41.5	74.6	.41	1.14
Soybean meal	90.0	50.1	78.8	.34	.70

All nutritional data is on an analyzed DM basis
[a]TDN's are book values on an as fed basis

TABLE 2. PERCENT FEEDSTUFF COMPOSITION AND NUTRITIONAL ANALYSIS OF EACH DIET

	%		
Feedstuff	Crambe	Sunflower	Soybean
Beet Pulp	50	50	50
Alfalfa	25	25	25
Corn	13.25	16.00	17.75
Crambe	11.75	----	----
Sunflower	----	9.00	----
Soybean	----	----	7.25
[a]TDN	67.8	66.8	67.2
DM	88.3	88.1	87.7
Protein	14.9	14.9	14.9
Ca	.58	.56	.52
P	.39	.33	.28

[a]TDN's are calculated from book values on an as fed basis

TABLE 3. MILK PRODUCTION AND MILK COMPOSITION

Treatment	Milk Production lbs./d	% Protein	% Fat	% Total Solids
Crambe	6.36	5.66	4.70	16.60
Sunflower	6.78	5.94	5.16	17.02
Soybean	6.60	5.69	4.78	16.99
SE	.70	.44	.40	.64

No Differences (P>.05)

TABLE 4. LAMB AND EWE WEIGHTS AND EWE BODY CONDITION SCORES

TREATMENT	Beg. Ewe Weight (lbs.)	End Ewe Weight (lbs.)	Beg.Body Score	End Body Score	Lamb Gain (lbs./d/pr)
Crambe	225.5	209.6	2.94	2.81	1.85
Sunflower	224.4	199.4	3.13	2.94	1.76
Soybean	221.8	206.8	3.38	3.25	1.67
SE	.96	.82	.17	.42	.52

No Differences (P>.05)

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Transcervical Artificial Insemination in Sheep

J.D. Kirsch, R.D. Zelinsky and W. Limesand

NDSU Experiment Station, Fargo 1993

INTRODUCTION

Profitability of the sheep industry is enhanced by technological advancements. The use of artificial insemination (AI) has produced many gains in the livestock industry. A problem that has reduced the amount of artificial insemination in the ewe has been the configuration of the cervix. Six different cervical types have been identified in the ewe. Until recently, AI has not been possible in sheep because of the species' long and anatomically complex cervix. The ewes' cervix contains six rings on the average, and the openings to the rings are small and are off center to one another. This is an initial report on that technique.

PROCEDURE

In study 1, 15 Suffolk and Hampshire ewes were utilized in a study during the first week of August. Ewes were in condition scores 2.5 to 4. Condition scores were on a 1-5 scale with one being emaciated and five being obese. Progesterone sponges were vaginally inserted and remained in ewes for 13 days. Upon pessary removal, 5 mls of PG 600 (Intervet Inc., Millsboro, DE) was administered intramuscularly to each ewe.

Vasectomized rams were placed with ewes for 30 minutes twice daily to monitor estrus activity. Ewes in heat were recorded and artificially inseminated 10-12 hours later. A Commodore foot trimming cradle was used as a part of the insemination system. It positions the ewe on her back with the hind legs pointed forward. The belly muscles are relaxed and no tension is placed on the reproductive organs. This makes it much easier to manipulate and penetrate the cervix. Ewes accept this system quite well and are effectively restrained by it. A 40 second thaw at 96° F was used on 0.5 cc french straws. After artificial insemination, ewes were removed from the remaining ewes to be bred so repeated handling was avoided. The insemination procedure itself must be as stress free as possible. Therefore, adequate handling facilities to avoid chasing sheep is a must.

The insemination technique is quite simple. First, insert the speculum into the vagina and light source into the speculum. Locate the cervix and determine the position of cervical opening and grasp the cervix with the forceps. Find the entrance to the cervical canal and guide the tip of the insemination gun through the rings of the cervix while rotating the tip. Finally, expel the semen over a 10-second interval and clean equipment between ewes.

Study 2 consisted of 15 Columbia ewes during the second week of August that received CIDR's for 13 days. CIDR's are a fork type of synchronization product that contains natural progesterone. Upon removal of CIDR's, 500 IU of FSH was injected into the muscle of each ewe. The same procedure was followed for heat detection and artificial insemination as in study 1.

RESULTS AND DISCUSSION

Preliminary results are presented in Table 1. During the period of artificial insemination, the ambient temperature became very hot. No ultrasound or return to estrus data was available. Ewes will be lambing the first weeks of January and pregnancy rates and conception rates from transcervical artificial insemination will be determined.

Reasons for using AI in sheep include establishment of new breeds, health maintenance, international export/import and the improvement of production from superior sires.

Transcervical artificial insemination offers a humane and easy method of insemination in sheep. Lambing results may be affected by factors such as semen quality, ewe management and body condition.

Table 1. Ewes artificially inseminated by the transcervical technique.

	Suffolk	Hampshire	Columbia
Total Ewes	15	15	15
No of Ewes AI	11	8	9

COMPARING STANDARD CREEP FEEDS TO A HIGH FIBER BABY LAMB CREEP PROGRESS REPORT N.D. - 6261

T.C. Faller and K.A. Ringwall
Hettinger Research Extension Center

INTRODUCTION

Baby lamb survival and growth are major factors influencing profitability of the sheep enterprise. There are many questions about the use of creep feeds as a component of profitable sheep production. North Dakota produces the necessary ingredients for formulating acceptable baby lamb creep feeds. Most baby lamb creeps are formulated on the basis of high energy and low fiber recipes. This trial represents two years of effort investigating the use of high fiber lamb creeps.

PROCEDURE

A flock of 360 western whitefaced ewes lambing in January were utilized to about 180 ewes and lambs to 12 pens consisting of three treatments with four replications. A typical pen would have 15 ewes with either 20 to 24 baby lambs. The lambs were sired by Rambouillet rams. The three treatments were a standard pelleted 16 percent protein high energy - low fiber creep, which will serve as the control (C), a rolled high grain textured creep that was treated with liquid molasses and 16 percent protein (TEX), and a high fiber 16 percent protein pelleted lamb creep (H.F.). Lambs were weighed initially, at 30, and 50 days from the onset of the experiment when they were weaned at approximately 66 days of age. Ewes were weighed on condition scored at the onset of the trial. Condition scores were on a 1-5 basis with 1 being emaciated and 5 being obese. All lambs were subjected to a standard grower-finisher program at the conclusion of the initial trial until the attained slaughter weigh. Carcass data was collected at slaughter time.

OBJECTIVE

The objective was to determine comparable baby lamb survivability and performance using a natural high fiber creep feed (HF), a texturized creep feed (TEK) to a standard high energy low fiber lamb creep (C).

RESULTS AND DISCUSSION

The results of the trial are shown in tables 1-6. Creep feed consumption was measured from the onset of the trial thru day 30, and for day 30-51, and then for the total duration of the trial.

The (HF) creep had the highest level of consumption and the (C) lamb creep had the lowest, as shown in Table 1. Gain for pounds of feed fed is shown in Table 2.

TABLE 1
CREEP FEED CONSUMPTION

Daily Feed Consumption/hd	Custom High Fiber(HF)	Texturized(T)	Standard Lamb Creep(C)
Initial wt to Mid st	0.45		
Mid wt to Wean wt	1.47		

TABLE 2
LAMB WEIGHT GAIN PER FEED CONSUMED (POUNDS)

Daily Feed Consuption/hd	Custom High Fiber (HF)	Texturized (T)	Standard Lamb Creep(C)
Intial wt to mid wt	1.25	1.20	1.18
Mid wt to Wean wt	0.51	0.58	0.58

Average daily gains of lambs in the trial differed as shown in Table 3. Lambs subjected to the (HF) gained best during the creeping period and slower in the feedlot phase when compared to (C).

TABLE 3
LAMB AVERAGE DAILY GAIN (POUNDS)

Average Daily Gain	Custom High Fiber(HF)	Texturized(TEX)	Standard Lamb Creep(C)
Initial wt to Mid wt	0.47	0.39	0.40
Mid wt to Wean st	0.73	0.78	0.74
Initial wt to Wean wt	0.58	0.55	0.53
Wean wt to Feedlot wt	0.71	0.72	0.69

Adjusted for lamb sex(male) rearing type(twin) and dam age(3 year old)
[ab] Means in the same row with different superscripts differ (P<.05)

Lamb survivability was measured at four junctions from the onset of the creep feeding trial till slaughter time. While significant differences did not surface statistically, the differences that did occur in this trial would be significant to the producer;

especially if they were considering using a (TEX) lamb creep. Death losses are displayed in Table 4. Differences of this magnitude certainly warrant further investigation.

TABLE 4
LAMB DEATH FOR JANUARY BORN RAMBOULLET LAMBS FED THREE CREEP RATIONS DURING 1992 AND 1993[a]

Interval (days)	Custom High Fiber(HF)	Texturized(TEX)	Standard Lamb Creep(C)
Initial inventory to mid inventory	2.4 %	4.3 %	5.0 %
MId inventory to weaning inventory	0.6 %	3.1 %	1.9 %
Total attrition to weaning	3.0 %	7.4 %	6.9 %

a Initial inventory was 1-28-92 and 1-26-93, Mid inventory was 2-29-92 and 2-25-93, and Weaning inventory was 3-19-92 and 3-19-93. Death loss equals number of dead lambs, within an interval divided by the total inital number.

Lamb weights displayed in Table 5 represent 3 weigh days from the onset of the trial until slaughter time.

TABLE 5
ADJUSTED 46,66,131 DAY WEIGHT[a]
with adjustments

Adjusted Weight	Custom High Fiber(HF)	Texturized(TEX)	Standard Lamb Creep(C)
46 day weight	32.9	30.4	30.4
66 day weight	47.2	45.7	44.7
131 day weight	92.4	92.6	90.6

[a] Weight adjusted for age only.

Table 6 summarizes carcass information of those lambs that went to slaughter. There were significant differences (P<.05) in leg conformation score and loin eye area when comparing those lambs that received the (HF) diet as a baby lamb to those that received the (C) diet.

TABLE 6
PERCENTAGE KIDNEY FAT, LEG CONFORMATION SCORE, USDA QUALITY GRADE, 12TH RIB FAT THICKNESS, LOIN EYE AREA AND USDA YIELD GRADE.

	Custom High Fiber (HF)	Texturized(TEX)	Standard Lamb Creep(C)
Percent Kidney Fat(%)	3.18	3.00	2.66
Leg Conformation Score	12.6[a]	11.6	11.8[b]
USDA Quality Grade	11.6	11.6	11.4
12th Rib Fat Thickness	0.17	0.21	0.17
Loin Eye Area	2.34[a]	2.19	2.14[b]
USDA Yield Grade	2.96	3.20	2.88

[ab] Means in the same row with different superscripts differ ($P<.05$)

CONCLUSIONS

Differences in baby lambs survivability, consumption, and growth rate for lambs feed HF during days 10-66 of life indicate no reasons why feed manufactures should not consider formulation of High Fiber baby lamb rations. There were very few statistical differences in this trail, however the actual data favors HF in all important income areas.

SHEEP RESEARCH FOR THE NEXT CENTURY

P.T. Berg and T.F. Faller

Sheep research at NDSU involves many people and several scientific disciplines. The task of an effective research program is to balance immediate, practical questions with a basic scientific effort focused on perceived future direction of the industry. Often these basic studies seem to have little application at the time, but as the implementation of science and technology develop, the knowledge gained in these studies becomes both valuable and commonplace. The long-term sheep research program centers within a regionally coordinated group of studies known as the "Hatch" projects. The objectives of these efforts are listed below:

<u>OBJECTIVES</u>

1. To evaluate genetic and physiological control of prolificacy, seasonal fertility and lamb survival.
2. To evaluate genetic and environmental strategies to improve the efficiency of lean tissue accretion in lambs.
3. To evaluate genetic and nutritional effects on milk production.

The NDSU projects involve aspects from all of these objectives. We have been involved in warm confinement vs cold dry-lot for some time and the current study will deal with documentation of death losses in lambs under three management regimens and two laming seasons. January lambing in a warm barn will be compared to a more traditional cold dry-lot. Reasons for lamb loss will center around respiratory losses within the warm barn compared to exposure (hypothermia) losses in the conventional setup. This same comparison will be repeated with a May lambing comparison. Added to the May lambing will be a low labor input, semi-range flock. Each lambing group will consist of 32 Rambouillet and 32 Rambouillet-Montadale crossbred ewes. Data from previous studies indicated that lambs of Border Leicester, Cheviot or crosses from these breeds exhibited high survival rates under a variety of conditions.

We will continue the study on seasonal lambing. We have a sizeable fall lambing flock and will continue to monitor the persistence of out-of-season estrus and fertility.

The Fargo sheep unit has been supplying retail grocery stores in the Fargo-Moorhead area with fresh lamb for over two years. Basically these lambs are intact males, quite large at slaughter. A research project has evolved from this outlet. These stores allow us to completely peel the fat off the four major wholesale cuts, (shoulder, rack, loin and leg). This give the opportunity to evaluate individual lambs for "trimmed wholesale cut" production. In July of 1992 the yield grade formula in lambs was reduced to a single fat measure directly over the eye between the 12^{th} and 13^{th} rib. Many producers and industry people are not convinced this was a good move. It was done to simplify the procedure as yield grading is now mandatory on all carcasses which are quality graded. We process the lamb carcasses into standard wholesale cuts at the meat lab and are thus able to obtain weights on the individual pieces, both with the fat on and fat peeled, we measure fat at the interfaces of the cuts and because these are from purebred flocks, we can trace pedigrees. We expect to be able to determine the degree of genetic involvement in differences of lean growth potential within breed and between sire groups. We process approximately 300 lambs per year. This study should lead to the identification of factors affecting lean tissue production and how to measure lean proportion in live animals and in carcasses.

As part of this lean lamb study the Columbia flocks at both Hettinger and Fargo will be used to evaluate Bioelectrical Impedance (BEI) as a tool for selection of live replacement rams and ewes and as a device for evaluation of carcasses for proportion of fat-free mass. BEI measures a bodies resistance to a low level electrical current. Lean tissue is a good electrical conductor, fat is not. Based on this principle, and previous work with pigs, sheep and humans, BEI holds promise as a means for identifying individuals with the potential to produce lean tissue at a rapid rate. The proposed research is a divergent selection study where the Columbia flock will be divided into three groups. A High Lean Flock, a Low Lean Flock and a Control. The High Lean ewes will be mated to ram lambs selected for high lean tissue growth potential estimate based on BEI analysis at 2, 4 and 6 months of age. The Low Lean ewes will be mated to ram lambs selected for low lean production. The control flock will serve as an unselected base for comparison. The lambs produced will be part of the lean lamb marketing effort to the retail stores.

We have just completed the first year of a study to evaluate protein sources relating to milk production of ewes. The preliminary results of this study are presented elsewhere in this booklet.

MID-GESTATION AND LATE GESTATION PROTEIN SUPPLEMENTATION OF ANGORA NANNIES AND RAMBOUILLET EWES FED LOW QUALITY ROUGHAGE DIETS

K.A. Ringwall, P.M. Berg, J.S. Caton and T.C. Faller

INTRODUCTION

Livestock are important economic contributors to agriculture and to the national and international economy. Livestock contributes from 20-25 percent of North Dakota's agricultural cash receipts exceeding cash receipts from crops in 32 percent of the states' counties. For many rural people, additional income opportunities may exist when livestock are added to present farm enterprises. Livestock would not only utilize current waste forage in present crop production systems, but would also provide enhanced utilization of medium to low quality forage produced under current CRP acreage. The addition of small ruminants such as sheep and goats to the livestock enterprise would also enhance the utilization of harvested forage and grasslands, plus help control leafy spurge and other invading weed species.

Utilization of medium to low quality forage diets (standing crop, CRP hay or crop residue) by sheep and goats are hindered by low intakes and digestibilities. Intake of forage in sheep and goats is critical. Research with traditional protein supplements has shown increases in low quality forage intake and digestibility resulting in enhanced livestock production. Why natural protein supplementation enhances forage utilization remains unclear. Protein supplements have two areas of impact, ruminal and intestinal and the requirements for ruminal protein (rumen degraded) and intestinal protein (escape or non-degraded) are unclear.

The objective of this trial is to help determine if level of escape protein versus rumen degraded protein alters forage intake and utilization, alters reproductive performance or enhances fiber production in sheep and goats.

PROCEDURE

Low quality forage was fed to Angora nannies in 1992 and 1993, and to Rambouillet ewes in 1993 and will be in 1994. The basal forage fed included mature grass hay (7.3% crude protein) in 1992, mature CRP hay in 1993 (7.5% crude protein), and 60% straw/corn stover (3.5% crude protein) blended with 40% alfalfa hay (15.4% crude protein) in 1994. All diets were formulated to meet the Nutritional Research Councils (NRC) requirements for gestation and late gestation in 1992 and 1993. In 1994, the sheep diets were calculated at 115% of NRC requirements due to excessive death loss in 1993.

Protein requirements were met utilizing the following supplements. Three protein supplements were formulated based on NRC requirements for Angora goats or sheep to provide increasing levels of escape (UDP) protein. All supplements were formulated to provide 1.76 Mcal/Kg net energy for maintenance, 20.0% rumen degradable protein, 1.08% Calcium and 1.06% Phosphorus. The control supplement was formulated to provide 5.0% escape protein for a total of 25% crude protein, step one supplement was formulated to provide 20.0% escape protein for a total of 40% crude protein, and step two supplement was formulated to provide 35% escape protein for a total of 55% crude protein. Late gestation angora nanny energy requirements were met by top dressing corn and sheep and goat mineral requirements were met by including limestone, trace mineral salt and dicalcium phosphate in the total mixed ration. Throughout the trial, the low quality forage was fed ad libitum. Supplementation was started mid gestation, following the acclimation to low quality grass hay. Mid gestation supplement levels were 99 and 112 grams of each supplement for the goats in 1992 and 1993, and 100 and 140 grams of each supplement for the sheep in 1993 and 1994, respectively. Late gestation supplement levels were 301 and 301 grams for the goats in 1992 and 1993, and 190 and 311 grams for the sheep in 1993 and 1994.

Eighty shorn yearling Angora nannies were purchased and acclimated to the Hettinger Research Center facilities the fall of 1991 and provided ad libitum grass/alfalfa mix hay. All nannies were synchronized with 0.125 mg Fenprostalene on December 10 and 16 and handmated to Angora billies. The forty eight nannies that mated were allocated to six pens and acclimated to grass hay and shorn February 18. Nannies were weighed twice prior to breeding and once prior to side sampling mohair, shearing and kidding. Supplementation was started on March 2, following the 30 day acclimation to low quality grass hay. The late gestation ration was started on March 31.

Following May kidding, the nannies and their kids were pastured through out the summer. Nannies and kids were removed from grazing pastures on September 28, weaned and placed in confinement and fed ad libitum grass/alfalfa hay until breeding. All kids and excess nannies were sold and the same 48 nannies utilized the first year were synchronized with 0.125 mg Fenprostalene on December 10 and 21, 1992 and artificially inseminated on December 24. Those nannies that returned to heat were handmated to Angora billies January 11-15, 1993. The forty eight nannies that mated were allocated to six pens the week of January 18 and supplementation started February 8. The late gestation ration was started on April 22. Following May kidding, the nannies and kids were drylotted until the end to the trial in September, 1993. Data were analyzed using general linear procedures.

In 1992, 131 mature Rambouillet ewes were synchronized with 0.5 mg fenprostalene on November 7. Ninety ewes expressed estrus (based on mating data), mated to Columbia rams and 89 ewes were diagnosed pregnant. Ewes were sheared November 24. Seventy two pregnant ewes were allotted to six pens based on condition score and fetal numbers and acclimated to the low quality forage. Mid gestation supplementation was started on February 1 and the late gestation ration was started on March 8. Ewes were induced (to lamb) on April 4 with two mg of flumethasone. Ewes were weighed periodically through out the trial and condition score monitored. Eight ewes within each pen were side sampled when the supplementation started, prior to lambing and the following fall prior to shearing on September 24, 1993.

The trial is being repeated in 1994 and 136 mature Rambouillet ewes were synchronized with 0.5 mg fenprostalene on November 8. Eighty one ewes expressed estrus (based on ovulation data) and were mated to Suffolk rams. Eight ewes were removed from the ninety two ewes because of triplet ovulations and three ewes were removed because of ovulation failure. Of the seventy ewes that ovulated, ten ewes were open. Ewes were sheared November 18. Sixty ewes were allotted, based on condition score and fetal numbers, to six pens and acclimated to the low quality forage. Mid gestation ration was started January 10, 1994 and the eight ewes in each pen were side sampled January 13. The trial is on going and will finish in September, 1994.

RESULTS

Angora goat results are presented in tables 1-8. Table 1 indicates the consumption of low quality hay. There was no significant difference between treatments during mid gestation, however the control nannies intake was greater than step 2 nannies. There was no significant differences in body weight (table 2) between the treated groups, although all the nannies increased in body weight throughout the duration of the protein supplementation period. This increase in body weight would be normal weight gain for a pregnant nanny. All groups lost weight following kidding and then maintained weight while grazing.

All nannies were purchased freshly shorn, and there was no difference between treatment groups at the start of the trial as shown in table 3 for mohair production. The mid and late gestation step one and step two supplementation increased mohair production and there was a significant response to the supplement (step 2) in which the greatest portion of the protein was escape protein within 48 days. Similar results were obtained the next 38 day period when mohair production increased as the percentage of escape protein increased. The protein supplements were stopped when the nannies kidded and returned to pasture. The treatment effects stopped when the supplement was ended, and there was no significant carry over effects. Total six month clip (table 3) was not significantly different between treatments.

Table 4 indicates there was no influence of supplements fed during pregnancy on kid growth performance or kid mohair production. Table 5 presents the reproductive performance of those nannies that cycled during the breeding season. Those nannies that did not cycle (32 nannies) were removed from the trial and sold. The only trait that could have been influenced by the treatments was pregnancy loss. There was no significant difference between nannies assigned to each treatment. Only pregnant nannies were utilized in the project analysis.

Tables 6 and 7 evaluate both the 1991 and 1992 breeding season. Nannies were synchronized both years of the project and table 6 indicates that 0.125 mg Fenprostalene is effective in synchronizing nannies that are actively cycling. Sixty and 83 percent of the nannies expressed estrus in 1991 and 1992, respectively, however no nannies expressed estrus following synchronization in early October. The nannies were artificially bred in 1992 and table 7 documents some observations regarding mucus type and the ability to penetrate the cervix with an inseminating pipette. The most desirable mucus for insemination was sixty to sixty three hours after the second injection of fenprostalene. This was also the time that the cervix was most successfully penetrated. Table 8 suggests that even though 40 nannies expressed estrous, only 29 nannies ovulated based on kidding date and mucus score. Twelve of these 29 nannies were successfully bred by artificial insemination.

Please keep in mind that the ewe data, which are presented in tables 9-14, are based on only the first year of the trial. The project has one more year of data collection to go and at that time the project will be summarized. Table 9 indicates the amount of roughage the ewes are consuming. Currently, all treatments are consuming approximately the same amount. Table ten indicates the problems that were occurring within this trial. All ewes, regardless of treatment started to loss condition shortly after the start of feeding the CRP hay. By the end of supplementation, the ewes had lost over one full condition score, while increasing in weight due to pregnancy.

Table 11 indicates that a trend was evident in wool production, increased wool production as escape protein increased. Total wool production was low, and table 12 indicates that additional problems developed. Of the lambs that survived (table 13), very few lambs gained weight the first week of life (table 12). The ewes did not milk well after lambing, even though the ration was changed to meet the NRC requirement for lactation with no low quality forage. The majority of lambs that died following birth were under nourished, resulting in predisposition to many post natal problems. Although two ewes did not lamb in step two, the treatments did not substantially influence pregnancy loss (table 14).

This trial has one more year to go and the requirements will be increased to 115% of NRC requirements because of the unacceptable production levels obtained last year. The poor performance levels and tremendous mortality obtained from feeding the CRP hay could only be called a disaster.

Table 1

MEAN DAILY LOW QUALITY FORAGE AD LIBITUM INTAKE (lb) OF ANGORA NANNIES FED THREE LEVELS OF SUPPLEMENTAL ESCAPE PROTEIN DURING 1992 AND 1993

Date	Control	Step 1	Step 2
Mid gestation[a]	2.36	2.34	2.33
Late gestation[b]	2.60[c]	2.45	2.35[d]
Mid to Late gestation	2.48	2.39	2.34

[a] Nannies were acclimated to forage and supplements. Eight nannies per pen were fed supplement for 32 and 53 days in 1992 and 1993, respectively. Total supplement fed per nanny was 9.3 and 13.1 pounds in 1992 and 1993, respectively.

[b] Eight nannies per pen were fed supplement for 32 and 41 days in 1992 and 1993, respectively. Total supplement fed per nanny was 22.6 and 18.9 pounds in 1992 and 1993 respectively, and 8.8 and 6.6 pounds of corn per nanny was added to the ration in 1992 and 1993, respectively.

[cd] Means in the same row with different superscripts differ ($P<.05$).

Table 2

MEAN BODY WEIGHT (lbs) OF PREGNANT ANGORA NANNIES FED THREE LEVELS OF SUPPLEMENTAL ESCAPE PROTEIN DURING 1992 AND 1993

Month Weighed	Control	Step 1	Step 2
April[a]	74	70	73
May[b]	82	75	81
September[c]	72	70	72

[a] April weights were taken April 3, 1992 and April 1, 1993.

[b] May weights were taken May 5, 1992 and May 15, 1993.

[c] September weights were taken September 28, 1992 and September 28, 1993.

Table 3

MEAN SIDE SAMPLE MOHAIR WEIGHT AND ADJUSTED SIX MONTH MOHAIR WEIGHT OF PREGNANT AND LACTATING ANGORA NANNIES DURING 1992 AND 1993

Date	Control	Step 1	Step 2
CLIP[a] (lbs)			
Spring	5.8	5.7	5.8
SIDE SAMPLES[b] (grams)			
Mid gestation (48 days)	1.7[c]	1.9	2.3[d]
Late gestation (38 days)	1.4[c]	1.7	2.3[d]
Lactation (141 days)	14.0	14.3	14.5
Mid gestation through lactation (229 days)	17.3[c]	18.0	19.1[d]
CLIP[a] (lbs)			
Fall	4.4	4.8	4.9

[a] Mohair fleece weight adjusted to 183 days growth.

[b] Mohair side sample taken 4 inches ventral from the last thoracic veribra (4x3 inches^2). The side sample collection period began on February 18, 1992 and February 8, 1993 and were adjusted for the first 48 days, the next 38 days, the last 141 days and the total period. Supplement was fed during mid and late gestation.

[cd] Means in the same row with different superscripts differ (P<.05).

Table 4

MEAN ADJUSTED 63 AND 128 DAY BODY WEIGHT AND ADJUSTED SIX MONTH MOHAIR WEIGHT FROM ANGORA KIDS PRODUCED FROM NANNIES FED THREE LEVELS OF ESCAPE PROTEIN DURING 1992 AND 1993

Weight	Control	Step 1	Step 2
Adjusted 63 day (lbs)	25	24	24
Adjusted 128 day (lbs)	32	33	33
Kid mohair[a] (lbs)	1.9	2.0	1.9

[a] Mohair fleece weight adjusted to 183 day growth.

Table 5

MEAN REPRODUCTIVE PERFORMANCE OF ANGORA NANNIES FED THREE LEVELS OF ESCAPE PROTEIN INCLUDING NUMBER EXPOSED, NUMBER DIAGNOSED PREGNANT, NUMBER CARRIED FULL TERM, NUMBER FAILING TO CONCEIVE AND PREGNANCY LOSS DURING 1992 AND 1993

Treatment	Initial number	Diagnosed pregnant[a]	Full term pregnancy	Number non-preg	Pregnancy Loss[b]
Control	32	30	28	4	2
Step 1	32	27	25	7	2
Step 2	32	30	28	4	2[c]

[a] Realtime ultrasound evaluation February 18, 1992.

[b] Pregnancy loss equal nannies diagnosed pregnant minus number nannies with full term pregnancy and indicates the pregnancy loss during the feeding of the treatments and is the only trait in this table that could have been influenced by treatment.

[c] Accidental dexamethasone induced premature parturition (one nanny) March 11, 1992.

Table 6

ESTROUS EXPRESSION OF ANGORA NANNIES FOLLOWING SYNCHRONIZATION WITH FENPROSTALENE

Year	Total Nannies	Total Nannies Injected	Estrous Expression Post Injection Time[a] <36	36	48	60	72	>72	Number Anestrus	Number Mated
1991[b]	80	80	3	7	18	6	3	11	32	48
1992[c]	48	48	0	0	0	0	0	0	48	0
1992[d]	48	48	0	12	22	4	2	0	8	48[e]

[a] Number of hours from injection time, all nannies were observed for estrus up to 72 hours post injection. In 1991 nannies were observed for estrus following the initial injection of fenprostalene for six days.

[b] December 10, 1991, 0.125 mg fenprostalene injected, followed by observation of estrus. Nannies were hand mated at initial observation of estrus and 12 hours later. All nannies not expressing estrus within 6 days were reinjected on December 16 with 0.125 mg fenprostalene and observed for estrus and mated as previously described.

[c] October 12, 1992, 0.125 mg fenprostalene injected, October 19, 0.125 mg fenprostalene injected, with estrous detection following the second injection. All nannies were anestrus.

[d] December 10, 1992, 0.125 mg fenprostalene injected, December 21, 0.125 mg fenprostalene injected, with estrous detection following the second injection.

[e] All nannies were artificially bred regardless of estrus.

Table 7

CERVICAL PENETRATION OF ARTIFICIAL INSEMINATION SHEATH AND CERVICAL MUCUS OBSERVATIONS DURING ARTIFICIAL INSEMINATION OF MATURE ANGORA NANNIES

Insemination Time[c]	Cervical Penetration[a] N	0	1	2	3	Cervical Mucus Consistency[b] 0	1	2	3
60 hours	48	10	17	15	6	5	40	0	3
72 hours	48	3	36	5	4	8	23	13	4

[a] Zero=no penetration, 1=1 ring, 2= two to four rings, 3= uterus
[b] Zero=no observed mucus, 1=stretchy, 2=semi-stretchy, 3=non-stretchy
[c] Hours after second injection with fenprostalene.

Table 8

CERVICAL PENETRATION OF ARTIFICIAL INSEMINATION SHEATH AND NUMBER OF ARTIFICIAL INSEMINATION PREGNANT MATURE ANGORA NANNIES DURING 1993

	Cervical Penetration[a] 0	1	2	3
Number[b]	1	14	12	2
Number pregnant	0	3	8	1

[a] Zero=no penetration, 1=1 ring, 2= two to four rings, 3= uterus
[b] Twenty nine nannies responded to fenprostalene based on kidding date and a mucus consistency score of 1 (stretchy).

Table 9

MEAN DAILY LOW QUALITY FORAGE AD LIBITUM INTAKE (lb) OF MATURE RAMBOUILLET EWES FED THREE LEVELS OF SUPPLEMENTAL ESCAPE PROTEIN DURING 1993

Date	Control	Step 1	Step 2
1-18-93 to 1-31-93[a]	5.80	5.85	5.91
2-01-93 to 3-07-93[b]	4.96	4.93	4.89
3-08-93 to 4-04-93[c]	4.67	4.74	4.73

[a] Ewes were acclimated to forage (14 days).

[b] Twelve ewes per pen were fed supplement for 35 days 1993. Total supplement fed per ewe was 7.7 pounds in 1993.

[c] Twelve ewes per pen were fed supplement for 28 days in 1993. Total supplement fed per ewe was 11.8 pounds in 1993.

Table 10

LEAST SQUARE MEAN BODY WEIGHT (lbs) AND CONDITION SCORE OF PREGNANT MATURE RAMBOUILLET EWES FED THREE LEVELS OF SUPPLEMENTAL ESCAPE PROTEIN DURING 1993

	Control		Step 1		Step 2	
Date	weight	condition	weight	condition	weight	condition
12-09-92	146	2.8	145	2.9	148	2.8
1-06-93	150	2.9	151	2.8	153	2.8
1-29-93	155	2.3	158	2.2	158	2.5
3-08-93	157	2.0	159	2.1	166	2.2
4-04-93	164	1.8	176	1.7	180	1.9
4-15-93	155	2.0	157	2.1	166	2.1
4-22-93	151	2.1	156	2.1	159	2.1
6-22-93[b]	131	-.-	129	-.-	137	-.-

[a] Condition score scale: 1=extremely thin, 2=thin, 3=moderate, 4=fat, 5=extremely fat.

[b] No condition score was taken on June 22, 1993.

Table 11

LEAST SQUARE MEAN SIDE SAMPLE WOOL WEIGHT AND ADJUSTED 365 DAY WOOL WEIGHT OF PREGNANT AND LACTATING MATURE RAMBOUILLET EWES FED THREE LEVELS OF SUPPLEMENTAL ESCAPE PROTEIN DURING 1993

Date	Control	Step 1	Step 2
SIDE SAMPLES[a] (grams)			
1-29-93	5.1	5.2	5.1
4-01-93	1.2	1.6	1.7
9-23-93	8.8	8.6	9.1
Total side sample	15.3	15.3	15.9
Adjusted[b] (lbs)			
Fleece weight	7.3	7.7	8.3

[a] Mohair side sample taken 4 inches ventral from the last thoracic veribra (4x3 inches^2). Ewes were sheared November 24, 1992.
[b] Wool fleece weight adjusted to 365 days growth.

Table 12

LEAST SQUARE MEAN BIRTH WEIGHT ADJUSTED[a] 9, 16, 30, 48 AND 60 DAY WEIGHT FROM LAMBS PRODUCED FROM MATURE RAMBOUILLET EWES FED THREE LEVELS OF ESCAPE PROTEIN DURING 1993

Weight	Control	Step 1	Step 2
Individual lamb weight			
Birth Weight (lbs)	11.3	11.8	11.1
Adjusted 9 day (lbs)	11.3	12.9	12.7
Adjusted 16 day (lbs)	13.9	15.1	15.4
Adjusted 30 day (lbs)	19.6	20.1	22.0
Adjusted 48 day (lbs)	27.6	27.5	28.9
Adjusted 60 day (lbs)	33.5	31.7	32.4
Lamb weight per pregnant ewe			
Adjusted 60 day (lbs)	28.4	27.1	32.3

[a] Weight adjusted for age of lamb.

Table 13

REPRODUCTIVE PERFORMANCE AND LAMB SURVIVAL[a] OF MATURE RAMBOUILLET EWES FED THREE LEVELS OF ESCAPE PROTEIN DURING 1993

	Control	Step 1	Step 2
Birth Type (%)	1.67	1.75	1.58
Born Dead (%)	0.00	0.09	0.00
Birth day inventory (%)	1.67	1.66	1.58
Dead (%)	0.42	0.49	0.20
Grafted[b] (%)	0.25	0.17	0.25
Nine day inventory (%)	1.00	1.00	1.13
Dead (%)	0.00	0.04	0.00
Sixteen day inventory (%)	1.00	0.96	1.13
Dead (%)	0.08	0.00	0.13
Thirty day inventory (%)	0.92	0.96	1.00
Dead (%)	0.00	0.04	0.00
Forty eight day inventory (%)	0.92	0.92	1.00
Dead (%)	0.04	0.04	0.00
Sixty day inventory (%)	0.88	0.88	1.00

[a] Reproductive performance and lamb survival based on the number of ewes lambing.
[b] Lambs were grafted based on ewes ability to raise. Ewes were evaluated at birth. All grafted lambs were removed from the inventory for analysis.

Table 14

REPRODUCTIVE PERFORMANCE AND EWE ATTRITION OF MATURE RAMBOUILLET EWES[a] FED THREE LEVELS OF ESCAPE PROTEIN DURING 1993

	Control	Step 1	Step 2
Diagnosed pregnant[b]	24	24	24
Full term pregnancy	24	24	22
Pregnancy loss[c]	0	0	2
Ewe attrition[d]	1	6	1

[a] Initial ewes selected from 131 mature ewes synchronized with 0.5 mg fenprostalene. Ninety ewes which expressed estrus based on breeding marks. Eleven of the ninety ewes were open.

[b] Realtime ultrasound evaluation December 9, 1992 and January 6, 1993.

[c] Pregnancy loss equal ewes diagnosed pregnant minus full term pregnancy and indicates the pregnancy loss during the feeding of the treatments.

[d] Pen 1: ewe 86-609, dead 3-29-93, pregnancy toxemia, ewe 89-1404, dead 4-25-93, parturition mortality, ewe 89-1475, dead 4-7-93, parturition mortality; Pen 2: ewe 89-1374, dead 6-8-93, blue bag; Pen 3: ewe 88-415, dead 5-6-93, unknown; Pen 4: ewe 87-468, dead 5-13-93, unknown, ewe 88-354, dead, unknown, ewe 88-494, dead 5-13-93, pneumonia.

REPRODUCTIVE CHARACTERISTICS OF MATURE AND YEARLING RAMBOUILLET EWES WHEN EXPOSED DURING APRIL AND JULY TO PRODUCE SEPTEMBER AND JANUARY LAMBS

K.A. Ringwall, T.C. Faller, and P.M. Berg

INTRODUCTION

Seasonal infertility continues to be a biological puzzle. Previous studies have helped to isolate some of the components of seasonal infertility, but sheep as a whole continue to be very seasonal in their reproduction. The interactions of management with various types of sheep make predictable solutions difficult. Hopefully a long term genetic solution would be found that would aid sheep producers in obtaining a predictable lamb crop at different times of the year. The purpose of this project is to provide additional information regarding the potential of maintaining a closed fall lambing system with a December/January cleanup lambing through the selection of fall born rams.

PROCEDURE

Starting in 1986, Rambouillet ewes were randomly mated to Rambouillet rams and evaluated in a lambing system that expected the ewes to lamb three times in a two year period. Starting the spring of 1992 the flock was closed and these ewes are being evaluated in an April breeding season, with only an July clean up. Ewes will be group mated to fall born Rambouillet rams during April (April 1 plus 36 days) and re-exposed in July (July 15 plus 36 days) to Suffolk/Columbia rams for a cleanup breeding season. Ewes and rams are mixed several times on the first day of breeding to assure good ram exposure. A random set of November bred ewes will be maintained as a control for future comparison.

The top 80% of the fall born ewe lambs and top 10% of the fall born ram lambs for growth will be available as replacements. Mature ewes will be classified as either only lambing in the fall, lambing both fall and winter, lambing only in the winter, or failing to lamb as a 3 year old or older ewe. Any ewe that fails to lamb as a 3 year old ewe or older or is unsound will be culled.

RESULTS AND DISCUSSION

Although the influence of fall born ewe lambs is not known yet, early observations (table 1) would suggest that a fall lambing system with a January clean-up lambing will work in North Dakota. A continual concern is reduced body condition of the ewes following winter feeding or lactation. However, table 1 indicates that at least half the ewes are conceiving to spring mating and the remainder conceiving to a July clean up breeding season. Currently, 89% (table 1) of the ewes are lambing on an annual basis when expected. Those ewes that aren't, are culled from the fall lambing system and exposed for traditional April/May lambing and sold. This trial will be continued to obtain production information on at least three more generations of fall born ewes.

Table 1

REPRODUCTIVE PROLIFICACY AND PRE-BREEDING WEIGHTS AND CONDITION SCORE FOR RAMBOUILLET EWES DURING APRIL AND JULY WHEN EXPOSED AT MATURE, OR YEARLING AGES FOR THREE ESTROUS CYCLES AS LACTATING OR NON-LACTATING EWES[a]

Breeding Period		N	Pre-breeding WT	Pre-breeding Cond[b]	Percentage Diagnosed pregnant[c]	Lambing Percentage[d]	Weaning Percentage[e]
Mature[f]							
April	Dry	198	133	2.6	58	1.37	1.12
April	Wet	265	126	2.6	49	1.11	0.96
July	Dry	333	145	3.0	84	1.52	1.22
Yearling[g]							
April	Dry	265	111	2.7	15	1.18	0.97
July	Dry	37	115	2.5	84	1.29	0.97

[a] July 1993 lambing information only entered through January 7, 1993.

[b] Ewe body condition score scale: 1=extremely thin, 2=thin, 3=moderate, 4=fat, 5=extremely fat.

[c] Eighty-nine percent of the initial ewes were diagnosed pregnant twice within two years. Fifty-one ewes were diagnosed pregnant to lamb twice in the fall, twenty-nine ewes were diagnosed pregnant to lamb twice in the winter, and fifty-four ewes were diagnosed pregnant to lamb once in the fall and once in the winter.

[d] Lambing percentage equals the number of lambs born divided by the number of ewes lambing.

[e] Weaning percentage equals the number of lambs weaned divided by the number of ewes lambing

[f] Mature ewe exposed to ram at approximately 2 years of age or older.

[g] Yearling ewe exposed to ram at approximately 15 months of age.

Understanding the Components of Sheep Reproduction.

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Introduction

The sheep has been and continues to be reported as an efficient ruminant that offers potential economic rewards for those that produce lamb and wool for market. Generally speaking, the number of market lambs produced will have the largest impact on the profitability of the sheep enterprise. There in lies the reason for this trial and article. If you pick up any sheep publication, a producer will see tremendous variation in reproductive rates of sheep. For instance in the most recent Western Dakota Sheep Day publication (Hettinger, ND, February 10, 1993), reproductive rates range from a low of 1.65 lambs born per ewe lambing with .84 lambs weaned per ewe exposed to 2.03 lambs born per ewe lambing with 1.67 lambs weaned per ewe exposed. The purpose of this trial and article is to help illustrate and explain those factors that influence sheep reproduction.

Review of the components of reproduction

If the sheep industry is going to improve sheep reproduction, all biological events that influence reproduction must be understood and a common set of terms must be defined so that all participants within the industry can understand the information that is presented. Figure one presents a flow chart of information required to calculate reproductive efficiencies. Those traits that are in bold print are biological traits that need to be documented in order to calculate the composite traits.

Overall flock reproductive rate (figure 1) is composed of lambing percentage, lambing rate and postnatal survival. Lambing percentage is influenced by the number of ewes that express estrus (Estrous rate), the number of ewes that express estrus that conceive (Conception rate), and the number of ewes that conceive and maintain pregnancy to full term (Prenatal survival). Lambing rate is a trait unique to species, like sheep, that have multiple ovulations. Lambing rate is determined by the number of eggs that are released by the ovaries (Ovulation rate) and the ability of each of these eggs to survive (Embryo survival rate). The last component is postnatal survival, which is the number of lambs born that actually survive to weaning.

Figure two illustrates when the events of figure one occur. Following exposure to the ram or artificial synchronization, several reproductive events unfold. Obviously, reproductive success or loss can occur with each event. A ewe may simply not express estrus or express estrus and fail to ovulate or conceive. If a ewe does conceive, the conceptus may fail to implant or die during embryonic and fetal development. The ewe's system may fail during pregnancy, especially the last month or week resulting in maternal death and subsequent fetal death. Lambs and ewes are lost during parturition and many lambs fail to adapt to life outside the womb. The last negative influence on flock reproductive rate occurs at weaning, for those lambs that fail to adapt to the loss of maternal influence. To help put some numbers to the various components of reproduction, a trial was conducted involving three types of sheep.

Procedure

A flock of 10 F1 Finnish Landrace x Rambouillet (FR), 10 F1 Booroola Merino x Rambouillet (BR) and 10 Rambouillet (R) ewes were selected randomly from 60 ewes of each breed type. These ewes were five and six years of age and the breeds utilized were selected to allow for a full range of variation in the biological reproductive traits. These ewes were synchronized with one mg of fenprostalene to lamb May 15 and each ewe was bred to two rams of different breeds at the onset of estrus. Columbia or Rambouillet rams were used for the first mating, followed by Suffolk rams for the second mating. Pregnancy was determined by laparoscopy. All ewes were fed alfalfa/grass hay from mating to the last four weeks of gestation. The late gestation ration was 80% alfalfa haylage and 20% barley ad libitum (ADF=27.8%, NDF=43.7%, Protein=14.7% and Ash=12.1%). Starting April 23, daily urine samples were collected and the amount of ketones present in the urine sample was quantified using the Ames keto stixs for all ewes. All ewes that had urine ketone concentrations 15 mg/dl or greater were drenched with 25 ounces of a high energy supplement (Weak Ewe Solution) containing beet molasses, concentrated steffen filtrate, propylene glycol, phosphoric acid, urea plus added vitamins and minerals. All ewes were randomly selected for blood sampling on May 9 or 10. Ewe reproductive data included percentage ewes pregnant, ovulation rate, lambing date, lambing percentage, and percentage lambs weaned. Lamb survival data included fetal survival 30 days post conception, percentage mummified fetuses, percentage stillborn lambs, percentage bummed lambs, seven day live lamb inventory, fourteen day live lamb inventory as well as ewe attrition rate and date. Lamb growth data included birth weight and weaning weight. Ewe body condition and body weight was evaluated pre-breeding, three times pre-lambing and at weaning. Data were analyzed using general linear models and logistic regression.

Results

The results are presented in tables 1 through 6. Prelambing weights and body condition scores are similar between breeds (table 1), however the FR ewes tend to be heavier. All FR and BR ewes and 9 R ewes responded to synchronization (table 1). Figure 3 depicts the average time for each breed type as well as the individual ewe response to synchronization. A greater ($P<.05$) percentage of FR and BR ewes conceived than R ewes (table 1).

Ketotic episodes were more frequent within the FR ewes than BR or R ewes (table 1). The average number of ketotic days for FR, BR and R ewes, respectively, during the last 21 days of gestation were 1.3, 1.5 and 2.2 and only during the last 7 days of gestation were 1.3, .6 and 1.2. Figure 4 depicts the overall daily incidence of ewes producing urine ketones during the last 21 days of gestation and the increase in ewes producing ketones during the last week of gestation. The energy supplement terminated 90% of the ketotic episodes for 24 hours and was not dependent on breed type since all breed groups responded to treatment (table 1). The average number of treatments per ewe is given in table one and ranged from zero to a maximum of nine.

A summary of live lambing rates are presented (table 2) for the FR, BR and R ewes. All prelambing reproductive rates were greater (P<.05) for FR and BR ewes versus R ewes. Within the prolific lines of sheep, Booroola Merino crossbred ewes have the greatest (P<.05) conception failure and embryonic loss, while the Finnish Landrace crossbred has increased late term fetal loss. The very high ovulating BR ewes lost 57 lambs per 100 ewes lambing due to conception or implantation loss and 156 lambs per 100 ewes lambing due to embryonic mortality versus zero and 22, respectively, for the FR ewes. The FR ewes in turn, lost 23 lambs per 100 ewes lambing due to late term fetal death and 22 lambs per 100 ewes lambing during parturition versus 12 and 25, respectively, for the BR ewes. The lower ovulating R ewes lost a total of 67 lambs in early pregnancy, but none late in gestation or during parturition.

Total pre-parturition and parturition losses are of the magnitude of .67 (0+22+23+22), 1.62 (57+156+12+25) and .50 (17+50+0+0) lambs for FR, BR and R ewes, respectively (table 2). Both prolific ewe types tend to have increased lamb death rates associated with parturition versus the Rambouillet (table 3). All of the Rambouillet lambs survived, while both the FR and BR ewes lost lambs during parturition. Overall, 90% of the lambs that did not require assistance survived, while only 76% of those lambs requiring assistance survived. Total parturition time is presented in table 4 and individual ewe variation is depicted in figure 5. The BR ewes took the longest time to deliver, followed by the FR ewes and the R ewes took the shortest time.

Table 5 presents information regarding observation of the placenta following parturition and figure 6 illustrates individual ewe variation within breed type. No trends are evident in the number or area of cotyledon development at birth. Figure 7 illustrates that when expressed per pound of lamb, the mean cotyledon area does not differ significantly by birth type. Cotyledon area could not be associated with differences in lamb survival in this trial.

During the first two weeks of life (table 2), despite extra ordinary managerial attempts to maintain lambs with the ewes in this study, decreases in reproductive percentages through lamb loss were of the magnitude of .33, .50 and .33 lambs for Finnish Landrace, Booroola Merino and Rambouillet sheep. After 14 days of age, with intense managerial input, no lamb loss occurred. However, figure 8 depicts the incidence of unknown disease factors that were present in this set of confined lambs. If an increase of body temperature over 104 degrees F is used as a gauge of infection, at least one lamb was treated daily with antibiotics while these lambs were maintained with their mothers (figure 8). Almost 80% of the lambs spiked a fever following docking and castration. The week previous to weaning, over 20% of the lambs were spiking fevers to unknown infective agents. Each breed group lost lambs post weaning up to 78 days of age (table 2). Although some lambs did eventually die in the feedlot, no trial data was collected past 78 days of age.

Tables 6 and 7 combine the observations of ketotic days, blood serum glucose, body condition change, body weight change and subsequent reproductive success. Serum glucose levels decrease as fetal number increase and mean ketotic days increase as serum glucose levels decrease and fetal numbers increase (table 6). The extra demands placed on the ewe is obvious as external body condition decreases more rapidly as gestation progresses and more fetal numbers are present (table 6). However, these ewes may not look tough since total weight gain will off set appearance change due to decreased body condition (table 6). Table 7 associates changes in body condition and ketotic days to subsequent ability to give birth and raise all the offspring. The number of lambs a ewe could lactate for and wean (figure 9) decreased from 243% for those ewes that indicated no urine ketones to 187% for those ewes that indicated urine ketones one day during gestation to a low of 100% for those ewes that had greater than one ketotic day during gestation. Four of the ewes that had greater than one day of elevated urine ketones raised no lambs (figure 9).

Discussion and Conclusion

The original purpose of conducting this trial was to provide an illustration and documentation of those biological processes that influence sheep reproductive rate. Figure 2 revisited would indicate that there are several critical time periods that must be observed in order to maximize sheep reproduction. In summary, just over 3% of these ewes failed to express estrus, 17.2% of the ewes that expressed estrus failed to conceive or implant any lambs. Of those ewes that were pregnant, all ewe types started with a greater than 200% lamb crop. Additional conception failure, implantation failure and early embryonic mortality lowered the high ovulating FR and BR ewes to a mid gestation fetal count of 2.67 and 2.75, respectively and the R ewes to 1.67. This would indicate that considerable loss of lamb production occurs following breeding and that more attention needs to made to post-breeding management and nutrition. Using these data as an estimate, a typical Rambouillet flock of 100 ewes has lost 67 lambs before mid gestation.

Late gestation losses did not seem to be a factor for the Rambouillet ewes, however high ovulating sheep like the FR and BR ewes continue to lose lambs. Figure 9 must be emphasized. Those ewes that are not fed adequately to meet daily nutritional requirements will not successfully raise to weaning those lambs resulting from the increased ovulation rate. In fact, table eight shows typical lamb survival for different types of birth in North Dakota. Typically 13 to 15 percent of the single and twin lambs do not survive until weaning and these numbers are greatly increased for triplets (23%) and quad\quint (33%) births. The ketone data and glucose data strongly indicate that late term (day 126 plus) ewes should not under go nutritional stress for any 24 hour period.

These data question any feeding system for prolific ewes that does not deliver fresh, energy rich feed every 24 hour period.

Parturition loss is frustrating and can account for 20 plus lambs per 100 ewes lambing. Unfortunately, those lambs that perished during parturition were all dead prior to the birth of the first lamb. Increased attendance at the birth of these lambs would not have increased the number of lambs that survived. Neonatal mortality following birth also resulted in a similar number of lost lambs compared to actual parturition loss. Increased practical neonatal care would not of saved any lambs born to this set of ewes, since all possible care was given to these lambs at birth. The greatest neonatal loss occurred with the FR ewes, and these were lambs that were born with a heart rate but never attained life sustaining respiration. Speculation would suggest that these lambs were the result of prelambing problems.

Once the lambs survived the neonatal period, all lambs survived until weaning. These data strongly suggest that if a ewe is provided a good lactation diet and was not ketotic prior to parturition, the ewe will raise any offspring produced. Those lambs that are bummed are a managerial judgement call and would certainly very from producer to producer. In this trial, only those lambs that failed to gain weight during the first week of life were bummed. Figure 10 illustrates that at the Hettinger Research Center, almost all lamb mortality occurs during the first week of life. Additional data from Iowa would also conclude (table 9) that once a lamb survives the neonatal period, additional combinations of supplements do not increase the lambs chances of survival to weaning. Figure 8 indicates that a lamb will be exposed to numerous infectious agents, yet quick timely antibiotic therapy will result in increased lamb survival.

In conclusion, all points in Figure 2 must constantly be monitored. Those sheep operations that fail to recognize that lamb mortality occurs continuously from conception to weaning will fail to correct substantial lamb losses within the operation.

TABLE 1

INITIAL EWE NUMBERS, EWE WEIGHT, EWE CONDITION, ATTRITION RATE, REPRODUCTIVE ANALYSIS, DAYS KETOTIC[a], AND TREATMENTS OF SUPPLEMENTAL ENERGY OF FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET, AND RAMBOUILLET EWES

	Finnish Landrace	Booroola Merino	Rambouillet
Number of ewes	10	10	10
Body weight			
Breeding weight	149	141	144
Day 33 gestation	158	147	152
Day 126 gestation	181	161	163
Day 142 gestation	184	162	165
Weaning weight	144	127	139
Pre-lambing condition			
Breeding condition	2.7	2.4	2.2
Day 33 gestation	2.4	2.1	2.3
Day 126 gestation	2.2	2.1	2.2
Day 142 gestation	1.8	1.8	1.8
Weaning condition	1.6	1.5	1.8
Ewe attrition[b]	1	1	0
Reproductive analysis			
Ewes synchronized[e]	10[c]	10[c]	9[d]
Preg. Ewes (01-17-91)	9	9	6
Induced response[f]	9[c]	8[c]	5[d]
Ewes lambing	9	8	6
Number of ewes ketotic			
Last 21 days gest.	6	2	3
Last 7 days gest.	6	2	3
Ketotic days per ewe			
Last 21 days gest.	1.3	1.5	2.2
Last 7 days gest.	1.3	.6	1.2
Supplemental energy treatments per ewe lambing	1.3	1.5	2.2

[a] Urine samples were analyzed daily for ketones using *Ames* "Ketostix."
[b] Finnish Landrace ewe 6-395 died 05-16-91 with parturition complications, 2 treatments of supplemental energy were given, and Booroola Merino ewe 6-331 died 06-18-91 reason unknown, 0 treatments of supplemental energy were given.
[cd] Means in the same row with different superscripts differ(P<.05).
[e] Ewes were synchronized with .5 mg of *Fenprostalene*.
[f] Induced all ewes May 11, 1991, with 2 mg of *Flumethasone* (*Flucort*).

TABLE 2

PREDICTED REPRODUCTIVE PERFORMANCE, LAMB SURVIVAL, AND LAMB GROWTH OF FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET, AND RAMBOUILLET EWES EXPRESSED PER 100 EWES

	Finnish Landrace	Booroola[a] Merino	Rambouillet
Lambing date[b]	May 12[c]	May 13[cd]	May 14[d]
Day -147 ovulation rate[e]	289[c]	400[d]	217[c]
Conception/Implantation failure[f]	0	57	17
Day -117 uterus count[g]	289[c]	314[c]	200[d]
Total embryonic mortality	22[c]	156[d]	50[d]
Late gestation fetal percentage	267[c]	275[c]	167[d]
Fetal mortality[i]	23	12	0
Day -1 inventory[h]	244[c]	263[c]	167[d]
Parturition mortality[i]	22	25	0
Day 0 inventory	222	238	167
Percentage dead[j]	22	0	0
Percentage bummed[k]	0	0	33
Day 7 inventory	200	238	134
Percentage dead	0	0	0
Percentage bummed	11	50	0
Day 14 inventory	189	188	134
Percentage dead	0	0	0
Weaning day inventory			
Day 56 inventory	189	188	134
Post weaning inventory			
Day 60	189	188	134
Day 70	178	188	134
Day 78	178	175	117
Birth weight	9.7[cd]	8.6[c]	11.5[d]
Adjusted 56 day wt.[l]	42.4	38.5	38.5

[a] Three means include less than 8 Booroola ewes which lambed.
[b] Parturition is day 0. All other evaluations deviate from that date.
[cd] Means in the same row with different superscripts differ(P<.05).
[e] *Corpora lutea* count 31 days after mating, laparoscopic observation.
[f] Difference between *corpora lutea* count and uterus count on 01-17-91.
[g] Visual evaluation of uterus (laparoscopic observation).
[h] Realtime ultrasound evaluation of fetus one day prior to lambing.
[i] Fetal mortality is a fetus with no heart rate one day prior to lambing. Parturition mortality is a fetus/lamb with no heart rate from one day prior to lambing to the completion of parturition. All parturition mortality in this trial occurred prior to the delivery of the first lamb.
[j] Lambs born alive, but died prior to 7 day inventory.
[k] Lambs were bummed based on ewes ability to raise lambs. Ewes were evaluated at birth and 7 days inventory.
[l] Lamb weaning weight adjusted for age, sex, and rearing type.

TABLE 3

PERCENTAGE OF LAMBS IN NORMAL DELIVERY POSITION, ABNORMAL DELIVERY POSITION, AND ASSOCIATED PROBLEMS FOR FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET, AND RAMBOUILLET EWES[a]

	Finnish Landrace	Booroola Merino	Rambouillet	Overall	
	Born	Born	Born	Born	Survived[b]
Number	24	22	10	56	47
Percentage with normal positioning	62	82	60	70	87
Percentage requiring repositioning	38	18	40	30	76
Percentage of repositioning[a]					
Two lambs at once	9			4	
Ewe exhaustion[c]		4	20	6	
Abnormal presentation[d]	29	14	20	20	

[a] All deliveries were allowed to be completed with limited technician assistance, once the lamb was in the birth canal, lambs in abnormal delivery position were repositioned and allowed to complete delivery.
[b] Lambs survival to weaning.
[c] If the ewe lacked the physical stamina to deliver the lamb once the lamb was in the birth canal, the birth was assisted.
[d] One or two legs back, breech, or head back.

TABLE 4

ELAPSED TIME, IN HOURS, TO PRESENTATION OF FETAL PLACENTA, AND ELAPSED TIME BETWEEN LAMBS FOR FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET, AND RAMBOUILLET X RAMBOUILLET EWES

	Finnish Landrace	Booroola Merino	Rambouillet	Mean
Average time from induction to presentation of fetal placenta[a]	45.40 (n=9)	56.88 (n=8)	61.48 (n=5)	53.20 (n=22)
Average time from presentation of fetal placenta to first delivery	3.15 (n=9)	3.54 (n=8)	2.96 (n=5)	3.25 (n=22)
Average time from first delivery to second delivery	.62 (n=9)	.90 (n=7)	.54 (n=3)	.71 (n=19)
Average time from second delivery to third delivery	.20 (n=6)	.54 (n=5)	---	.36 (n=11)
Average time from third delivery to fourth delivery	---	.83 (n=2)	---	.83 (n=2)
Total delivery time	3.89	4.87	3.29	4.11

[a] Common terminology bag of waters.

TABLE 5

NUMBER OF EWES, NUMBER OF COTYLEDONS, MEAN INDIVIDUAL COTYLEDON AREA, TOTAL COTYLEDON AREA PER FETUS, TOTAL COTYLEDON AREA PER EWE AND MEAN COTYLEDON AREA PER POUND OF LAMB AT BIRTH BY DIFFERENT BIRTH TYPES FOR FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET AND RAMBOUILLET EWES[a]

	Finnish Landrace	Booroola Merino	Rambouillet
Number of ewes			
Single	--	1	2
Twin	3	2	3
Triplet	6	3	--
Quadruplet	--	2	--
Mean cotyledon number			
Single	--	63	71
Twin	84	46	81
Triplet	78	88	--
Quadruplet	--	73	--
Mean individual cotyledon area			
Single	--	5.0	7.2
Twin	8.7	12.2	7.8
Triplet	13.1	6.3	--
Quadruplet	--	12.6	--
Total cotyledon area per fetus			
Single	---	315	415
Twin	369	283	320
Triplet	308	185	---
Quadruplet	---	225	---
Total cotyledon area per ewe[a]			
Single	---	315	415
Twin	738	566	640
Triplet	925	554	---
Quadruplet	---	899	---
Mean cotyledon area per pound of lamb at birth			
Single	---	31.5	28.2
Twin	33.1	30.3	31.2
Triplet	34.1	20.7	---
Quadruplet	---	32.1	---

[a] The diameter of each cotyledon was used to calculate the cotyledon area in square centimeters.

TABLE 6

INDIVIDUAL LATE GESTATION BLOOD SERUM GLUCOSE, MEAN KETOTIC DAYS, BODY CONDITION LOSS, AND BODY WEIGHT GAIN FOR SINGLE, TWIN, TRIPLET, QUADRUPLET, AND QUINTUPLET PREGNANCIES FOR FINNISH LANDRACE X RAMBOUILLET, BOOROOLA MERINO X RAMBOUILLET, AND RAMBOUILLET EWES[a]

	Single	Twin	Triplet	Quadruplet	Quintuplet
Blood serum					
Glucose(mg/dl)	65.75	58.08	53.82	51.75	45.00
Mean ketotic days[b]	0.00	0.53	1.03	1.13	2.25
Body condition[c]					
loss breeding to					
Day 33	+.3	0.0	-.4	-.5	---
Day 126	0.0	0.0	-.5	-1.0	---
Day 142	-.3	-.3	-1.0	-1.0	---
Body weight gain					
Breeding to					
Day 33	+10	+8	+8	+3	---
Day 126	+14	+26	+26	+21	---
Day 142	+19	+29	+27	+22	---

[a] Additional 60 Booroola Merino X Rambouillet ewes were sampled for urine ketones and blood serum glucose to increase number of samples for the triplet, quadruplet and quintuplet pregnancies.

[b] Urine samples were analyzed daily for ketones using *Ames* "Ketostix." Mean ketotic days equal the total number of ewe days with urine ketones 15 mg/dl or greater, divided by total ewe numbers. A ewe day is one when an individual ewe's urine ketones are 15 mg/dl or greater.

[c] Condition score scale: 0=extremely thin and unthrifty, 1=extremely thin, 2=thin, 3=moderate, 4=fat, 5=extremely fat.

TABLE 7

MEAN BODY CONDITION LOSS, LAMBS BORN ALIVE, BORN DEAD, BUMMED AND WEANED FOR EWES WITH NO URINE KETONES OR ONE KETOTIC DAY, AND TWO OR MORE KETOTIC DAYS DURING THE LAST 21 DAYS OF GESTATION

	No or one ketotic[a] days	Two or more ketotic[a] days
Number of ewes	16	7
Body condition loss[b]		
Breeding to		
Day 33	-.2	0.0
Day 126	-.1	-.7
Day 142	-.4	-1.3
Lambs born	231	271
Lambs born dead	6	114
Lambs bummed	6	86
Lambs weaned	219	71

[a] Urine samples were analyzed daily for ketones using *Ames* "Ketostix." No ewes had clinical signs of pregnancy toxemia.

[b] Mean body condition score at breeding was 2.4, condition score scale is as follows: 0=extremely thin and unthrifty, 1=extremely thin, 2=thin, 3=moderate, 4=fat, and 5=extremely fat.

TABLE 8

PERCENTAGE OF LAMB SURVIVAL TO WEANING BY BIRTH TYPE[a]

Type of birth	Percentage survival to weaning
Single	87%
Twin	85%
Triplet	77%
Quad\Quint	67%
Overall	85%

[a] Haugen, Roger G. 1992. North Dakota Sheep Production Testing Program, NDSU.

TABLE 9

PERCENTAGE OF LAMB SURVIVAL UNTIL WEANING FOR DIFFERENT COMMERCIALLY AVAILABLE PRODUCTS

	Percentage lamb survival
Trial one[a]	
Vitamin ADE injection	90
Control	90
Trial two[b]	
Strong lamb	96
Control	98
Trial three[b]	
Lamb and Kid Kare	97
Fastrack probiotics	97
Control	97
Trial four[c]	
Vitamin B injection	87
Control	92

[a] Youngs, Curtis R. and Don K. Hummel. 1992. Beef and Sheep Research Report, Iowa State University.
[b] Morrical, Dan. 1993 Personal correspondence.
[c] McClain, Arnold and Dan Morrical. 1992. Beef and Sheep Research Report, Iowa State University.

Flock reproductive rate: Is a composite reproductive trait which is lambing percentage times lambing rate times postnatal survival.

- >> Lambing percentage: Is a composite reproductive trait which is Pregnancy rate times prenatal survival. If ewes are not pregnancy checked, than lambing percentage is the number of ewes that lamb divided by the number of ewes exposed.

  - >> Pregnancy rate (pregnancy percentage): Is a composite reproductive trait which is estrous rate times conception rate. If mating or estrous data are not obtained, pregnancy rate can be the number of ewes diagnosed as pregnant divided by the number exposed to the ram. The inverse of pregnancy rate is the percent open. Open percentage is the number of ewes which failed to express estrus plus the number of ewes which failed to conceive divided by the number of ewes exposed.

    - >> **Estrous rate** (mating percentage): Is the number of ewes expressing estrus divided by the number of ewes exposed to the ram.

    - >> **Conception rate:** Is the number of ewes diagnosed pregnant divided by the number of ewes expressing estrus.

  - >> **Prenatal survival:** Is the number of pregnant ewes that complete the pregnancy with at least one full term lamb divided by the number of females diagnosed pregnant. All term lambs are included, even if the lamb died at birth. The inverse of prenatal survival is mortality. Prenatal mortality (pregnancy loss percentage or abortion rate) is the number of pregnant ewes that terminate pregnancy before term (abort) divided by the number of females diagnosed pregnant.

- >> Lambing rate: Is a composite reproductive trait which is ovulation rate times embryo survival rate. If the component traits are not known, than divided the number of lambs born by the number of pregnant ewes.

  - >> **Ovulation rate:** Is the number of corpora lutea per ewe divided by the number of ewes observed.

  - >> **Embryo Survival rate:** Is the total number of lambs born and aborted divided by the number of corpora lutea observed.

- >> **Postnatal survival:** Is the number of lambs weaned divided by the number of full term lambs bummed. The inverse of postnatal survival is postnatal mortality. Postnatal mortality (lamb death loss) is the number of term lambs which died divided by the number of lambs born.

Figure 1. Required information to improve reproductive efficiency of sheep

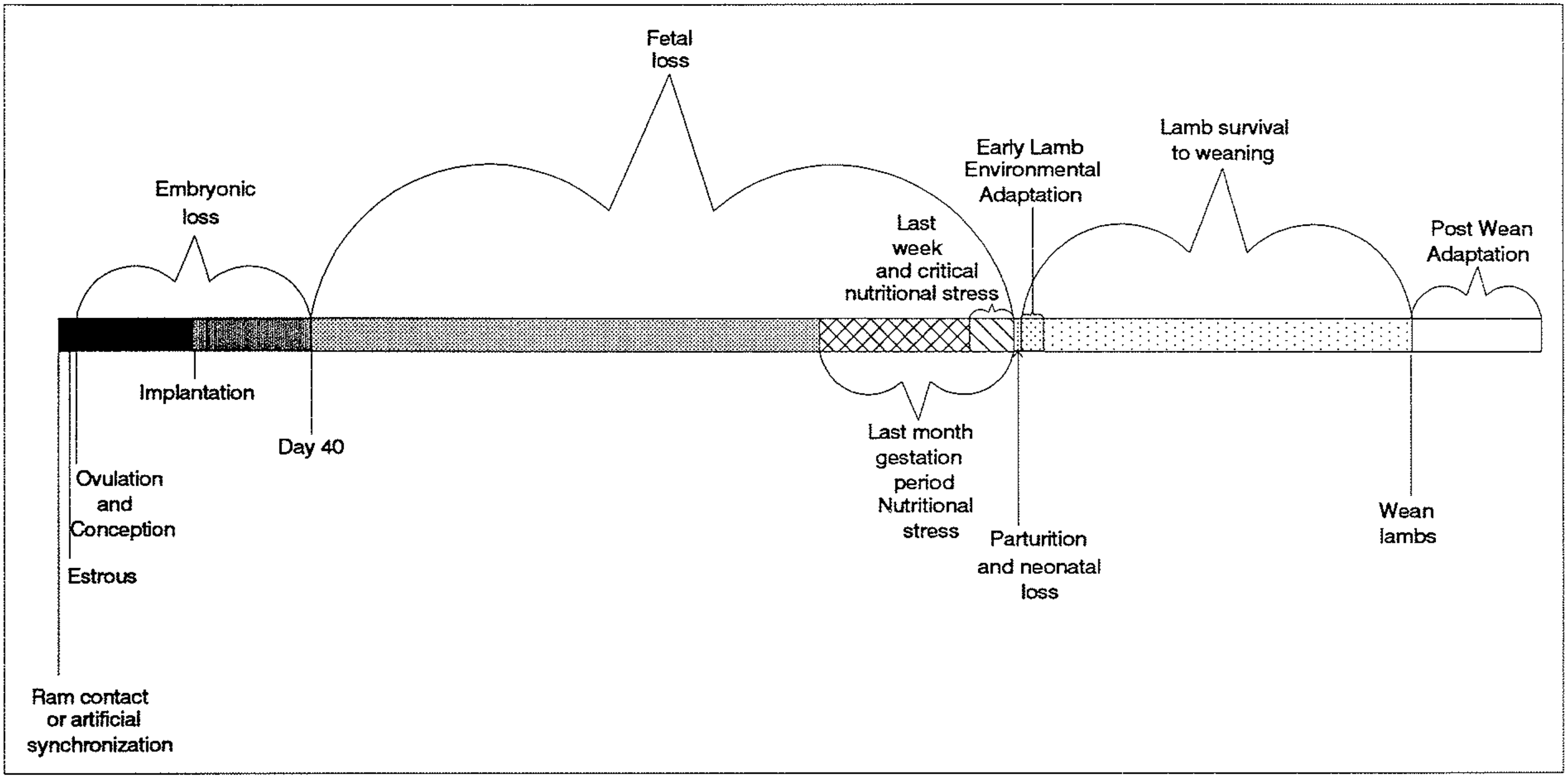


Figure 2. Schematic reproductive timeline for sheep

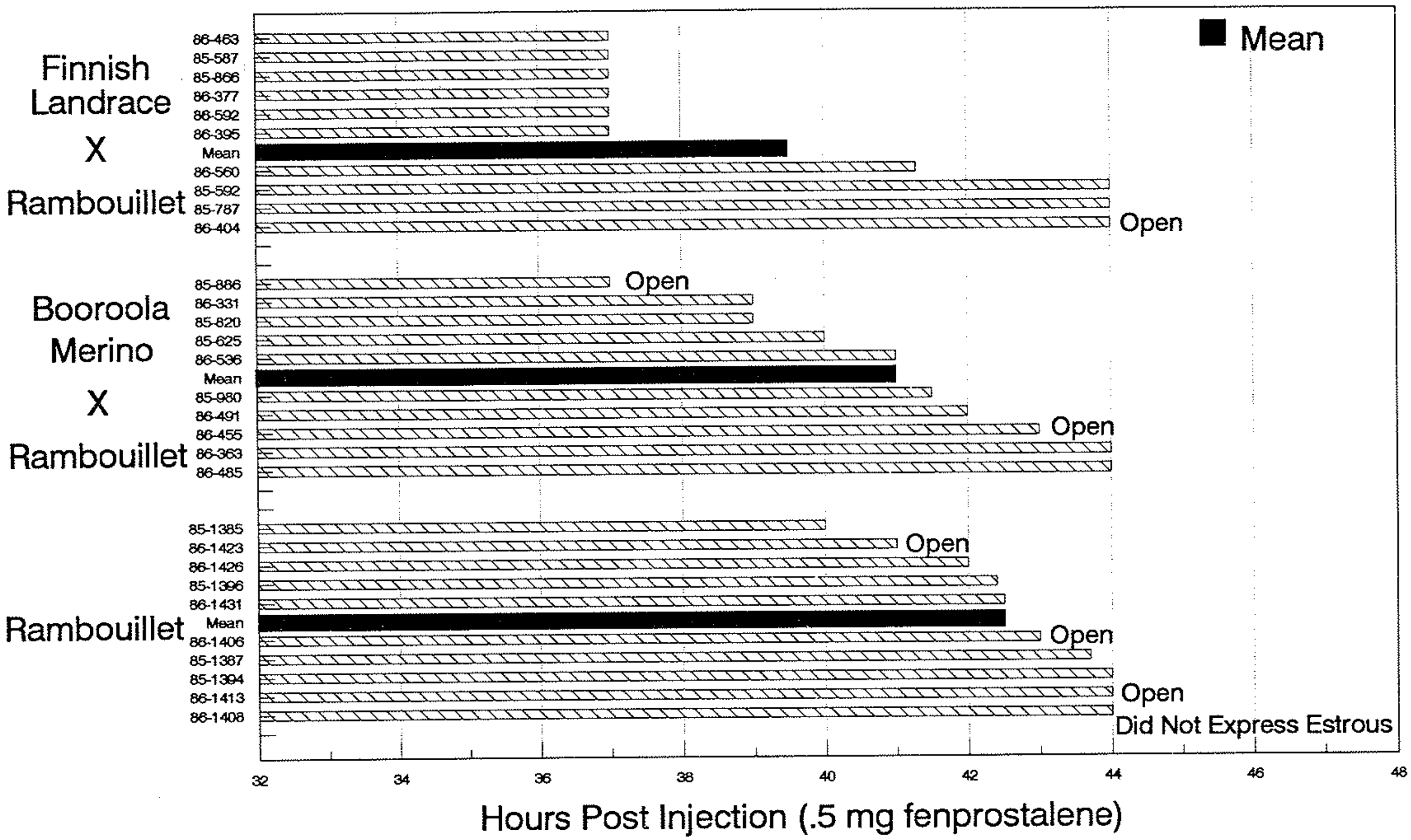


Figure 3. Individual ewe and mean estrous response to synchronization of two injections of .5 mg fenprostalene on Dec 3 and Dec 15 for Finnish Landrace X Rambouillet, Booroola Merino X Rambouillet, and Rambouillet X Rambouillet Ewes.

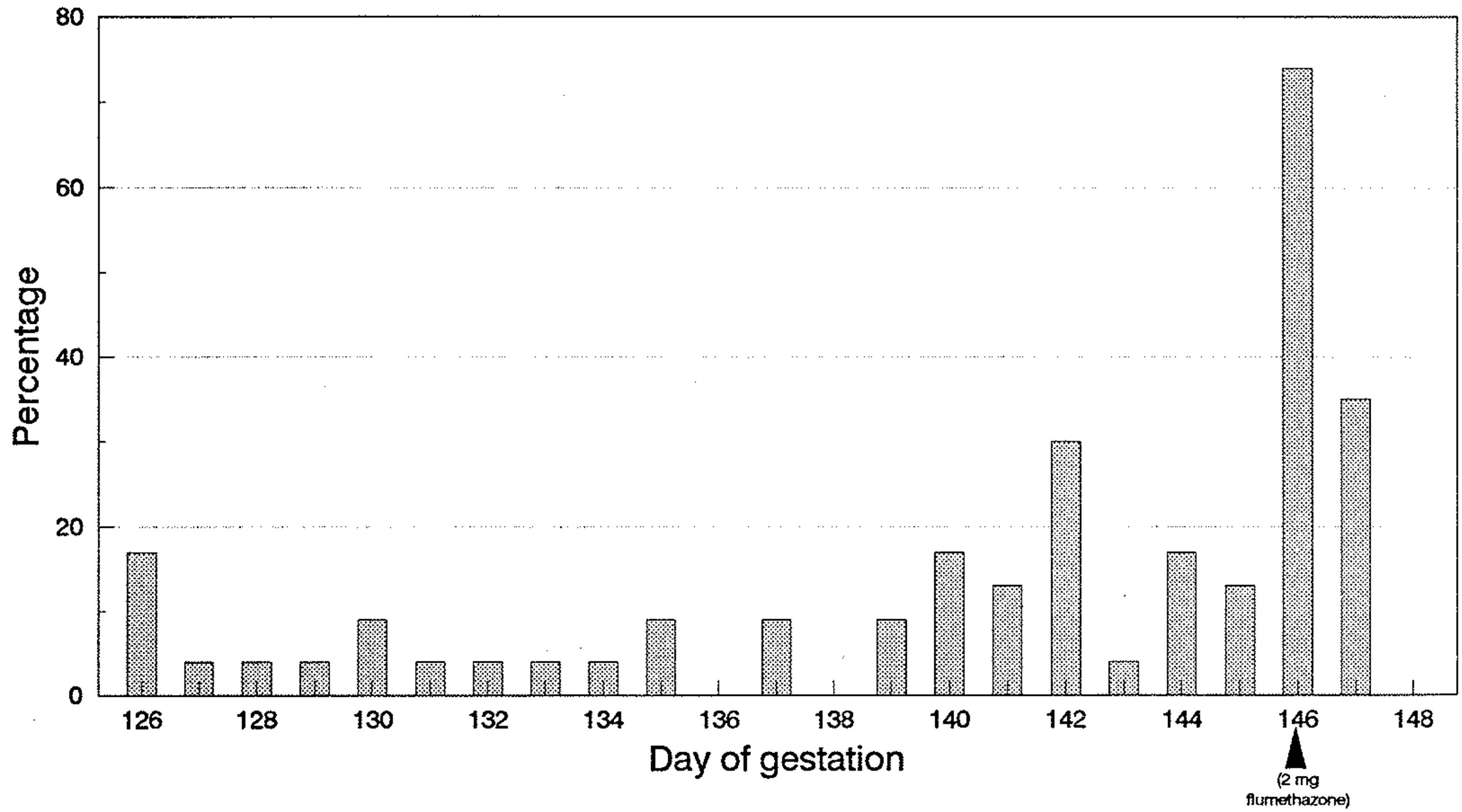


Figure 4. Number of ewes with 15 mg/dl or greater urine ketones the last 21 days of gestation for Finnish Landrace X Rambouillet, Booroola Merino X Rambouillet, and Rambouillet X Rambouillet ewes.

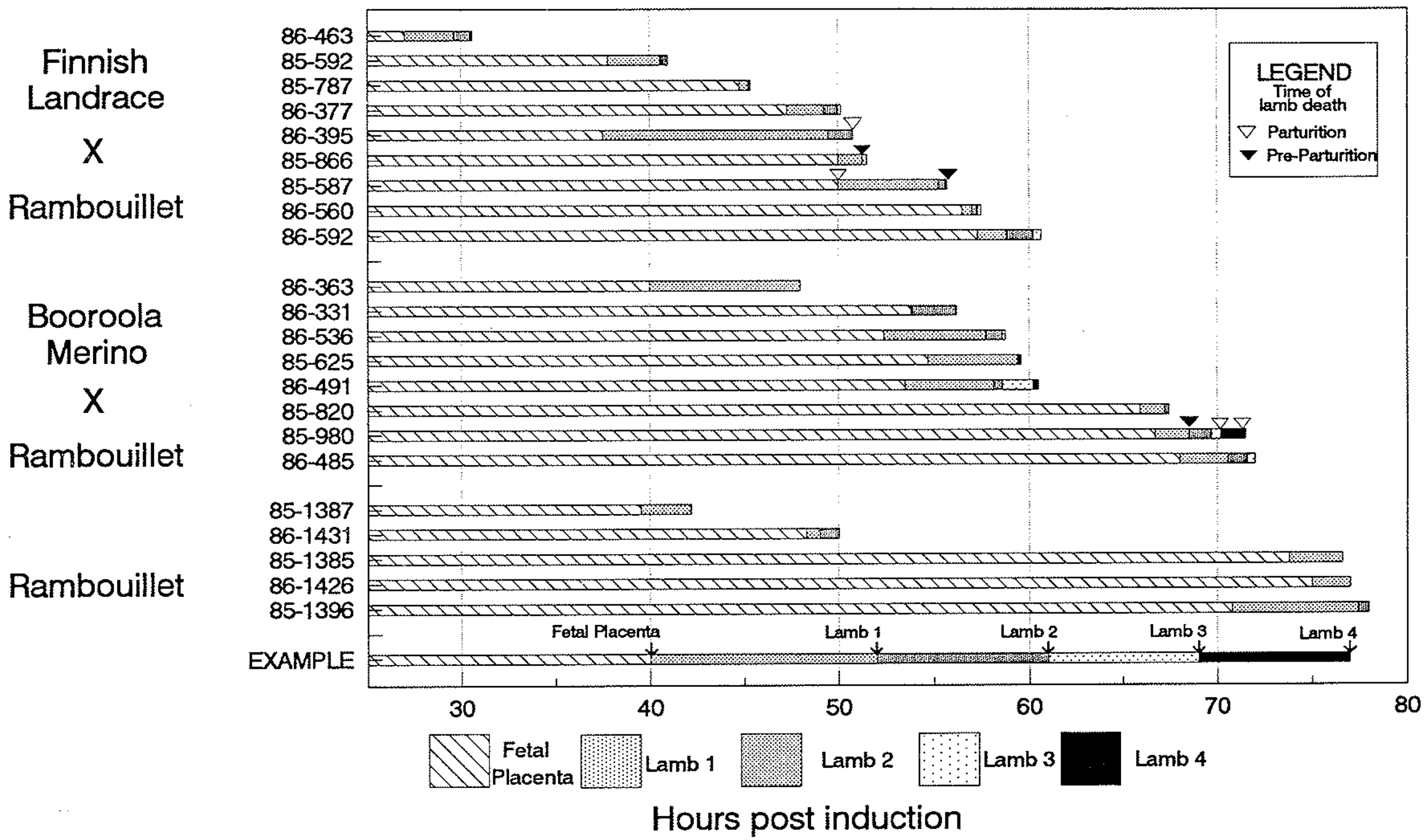


Figure 5. Hours post induction (.5 mg flumethazone) to presentation of fetal placenta, first lamb, second lamb, third lamb, and fourth lamb for Finnish Landrace X Rambouillet, Booroola Merino X Rambouillet, and Rambouillet X Rambouillet ewes.

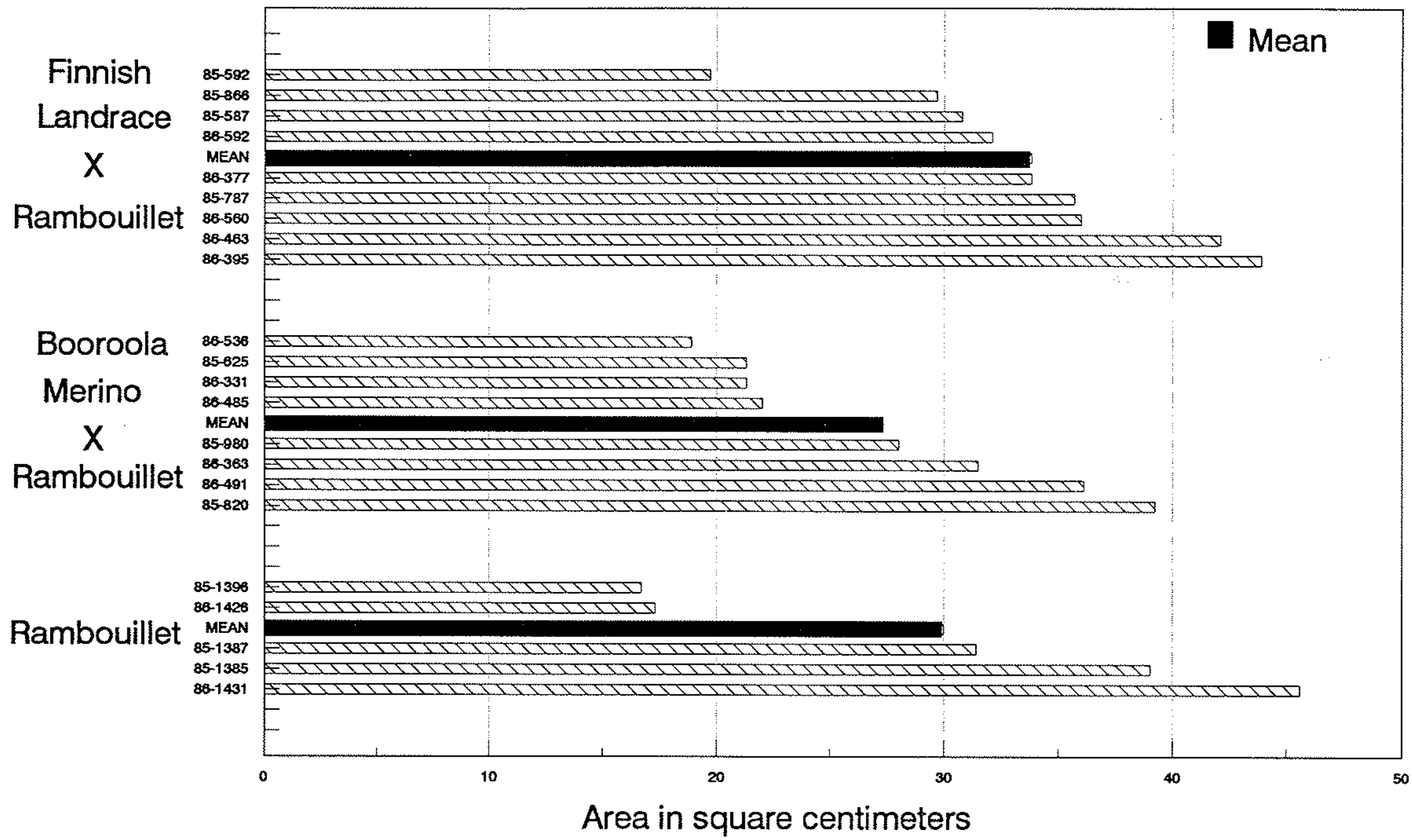


Figure 6. Individual ewe and mean cotyledon area per pound of lamb at birth for Finnish Landrace X Rambouillet, Booroola Merino X Rambouillet, and Rambouillet X Rambouillet ewes.

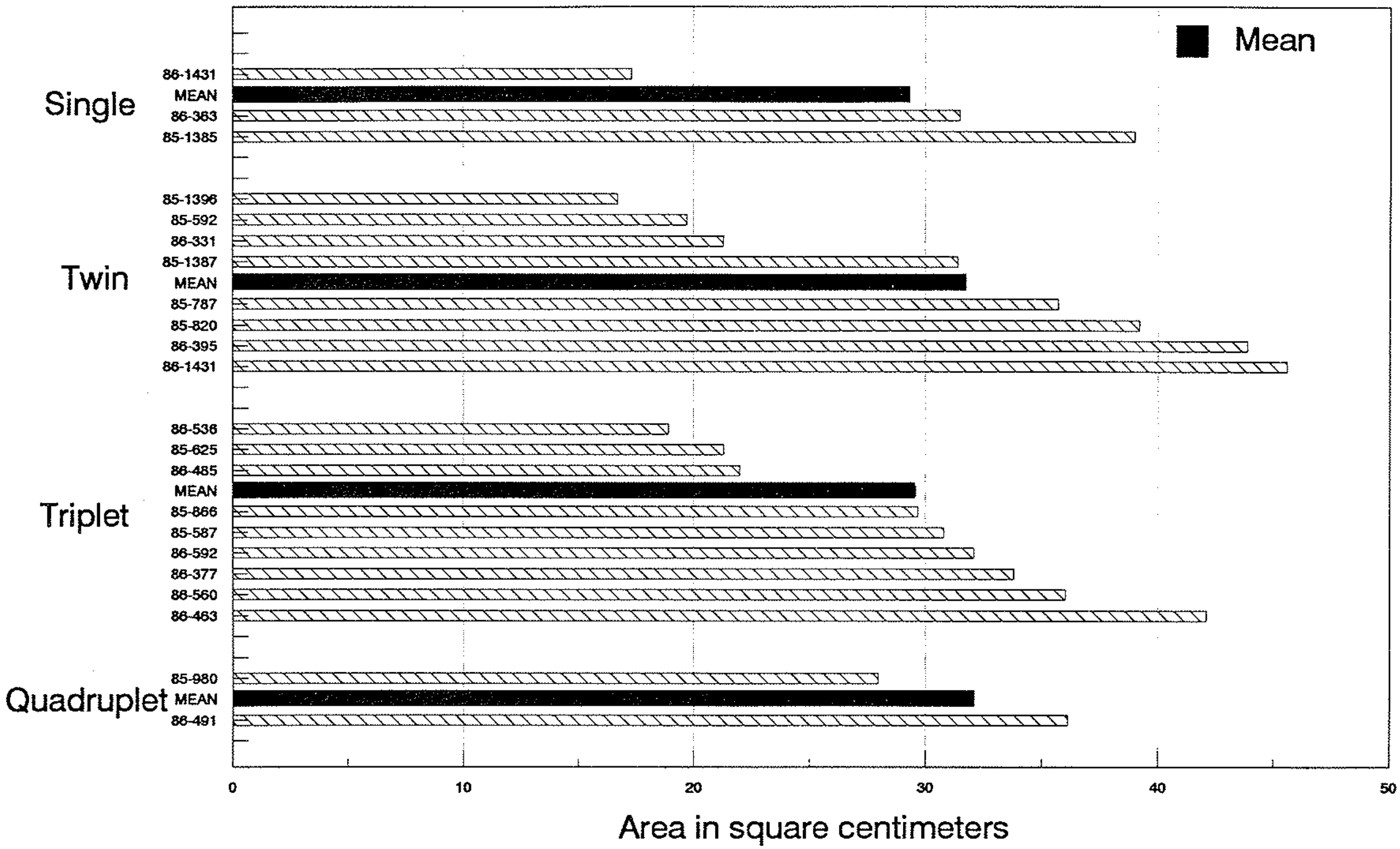


Figure 7. Individual ewe and mean cotyledon area per pound of lamb at birth for single, twin, triplet, and quadruplet birth types.

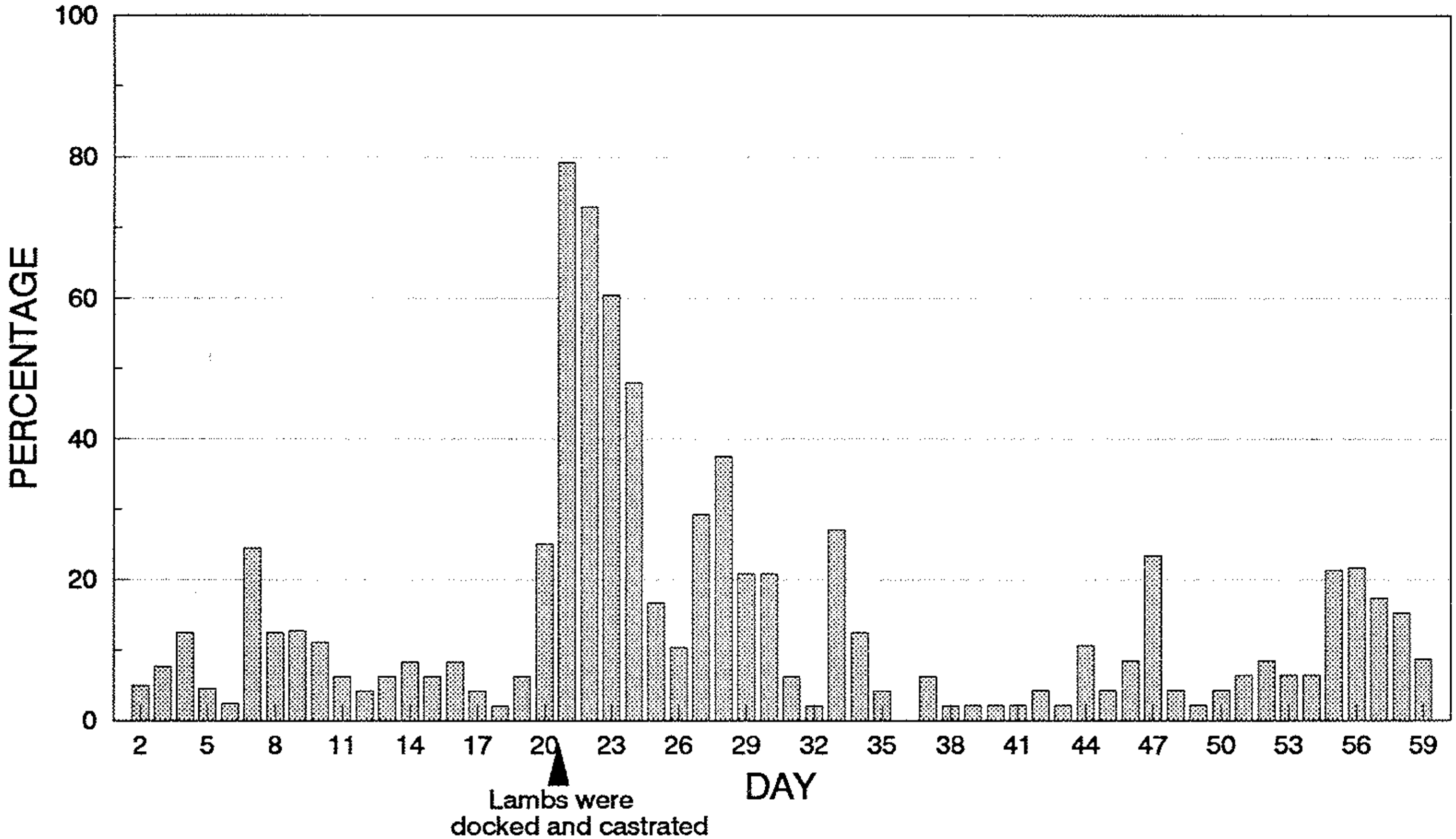


Figure 8. Daily percentage of lambs with temperatures elevated beyond 104 degrees F for Finnish Landrace X Rambouillet, Booroola Merino X Rambouillet and Rambouillet X Rambouillet ewes.

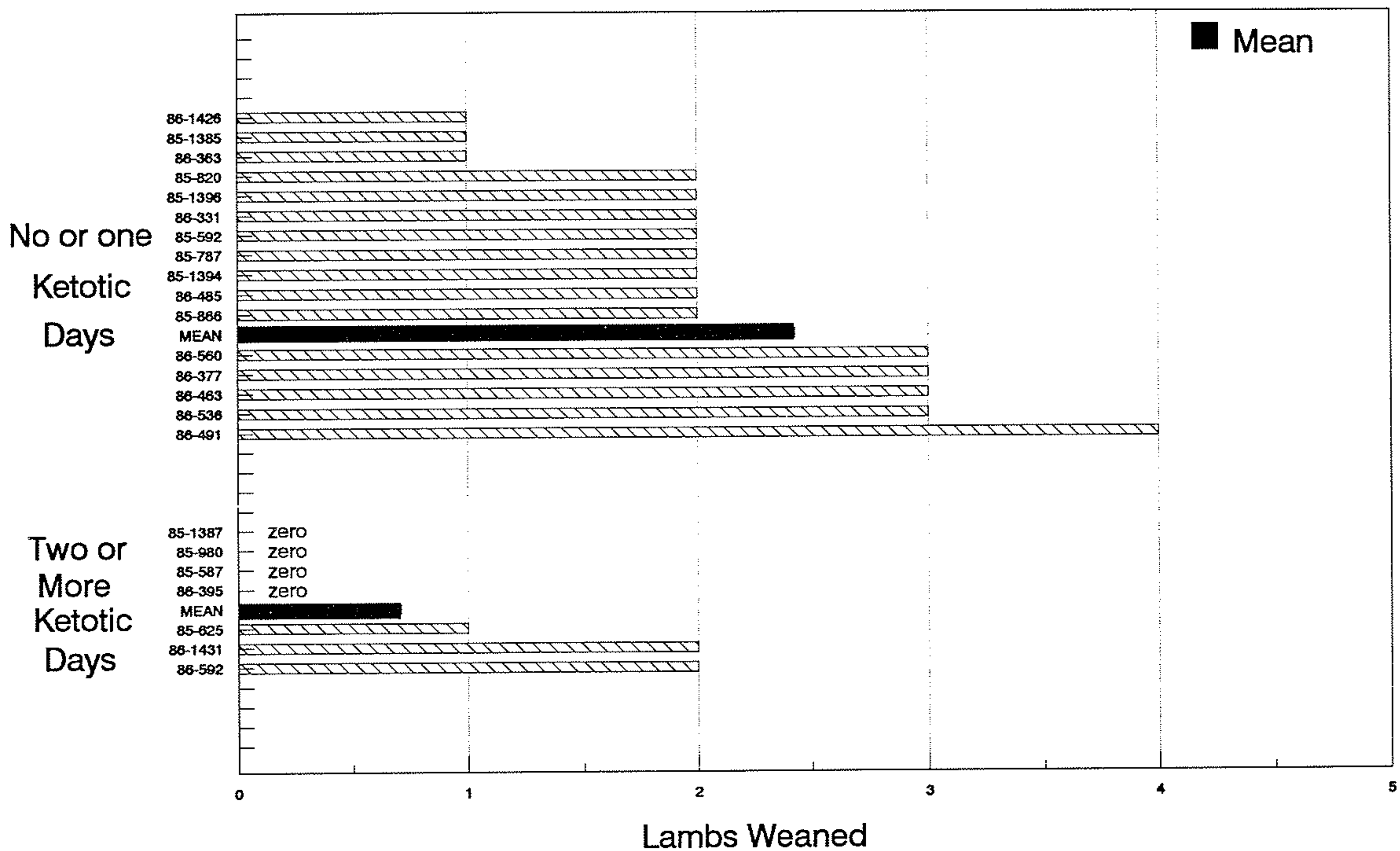


Figure 9. Mean and individual lambs weaned per ewe lambing for ewes with no or one day urine Ketones greater than 15 mg/dl and for ewes with two or more days with greater than 15 mg/dl urine Ketones.

Figure 10. Percentage of dead lambs by age of lamb for 228 dead lambs produced at the Hettinger Research Center in the spring of 1992.

WHERE WILL MY BUSINESS RECORDS TAKE ME?

DAN NUDELL

What are financial business records? What is the reason for keeping these records? Keeping financial records is a commitment of time and labor. Why go to the effort? For most of us it is not a favorite job. As sheep producers, we want to be in the barn producing, not at the kitchen table with papers. There are two compelling reasons to make this effort.

The first reason is that resources are limited and need to be used in the most efficient way possible. In any farm venture, three resources contribute to commodity production. They are labor, management skill, and equity capital. The common thread is that they are limited. There are only so many hours we can work, we can only learn so many management techniques and certainly equity capital is limited. We need to insure that we receive the most return for those resources(profit). Financial performance testing is the tool used for this job.

The second reason is the concept of profitability and feasibility. Feasibility is easy to grasp; it is a cash flow look at finances that quickly tells us if there is money in the checkbook at the end of the year. If a commodity generates enough cash to cover its variable expenses, it is feasible to produce that commodity, at least for a time. Most producers probably intuitively know their cash position.

The second part of this concept is more difficult to measure. Profitability measures a venture's sustainability. Can the venture or commodity generate profits over all expenses (cash and non-cash) and do so at a level equal to alternative uses for the resources consumed?

Profitability looks at resource use over a long term and against alternate uses of these resources. Profitability analysis of an enterprise forces one to determine if the enterprise is paying full market value for the inputs it consumes. Agricultural enterprises can be feasible but not profitable. Cash flow can be generated at the expense of equity. By the same token, an enterprise can be profitable but not feasible. For example, one that relies on asset appreciation for profit may not generate cash flow. Remembering that resources are limited, it it important to use them in both a profitable and feasible manner.

When looking at finances only on the cash flow side, we risk having cash in the checkbook at the expense of equity reduction without truly receiving profit from our activities. Another danger is making a profit that is not as large as could be made from other activities. Dr. Harlan Hughes, NDSU Livestock Economist says that the successful producer today makes profit from asset productivity not asset appreciation. This important concept requires more sophisticated tools to measure.

Two tools are available for the shepherd to use in measuring financial performance. The first is called "SHEEPBUD". Sheepbud is a computer software program that assists in completing an analysis of the sheep enterprise on your farm or ranch. The program helps you assess both the profitability and feasibility of sheep production specific to your farm. It measures inputs and returns in the sheep enterprise on a cash out of pocket basis, and measures resource use against competing uses.

The second tool is called the SHEPHERD IMS database. The shepherd database is a collection of all the Sheepbud data from many farms and years compiled to give average results for several critical financial and production measurements. The results allow producers to graphically look at the results of their efforts and the resources used compared to other producers. The database also maintains a historical record of individual producers results to allow each producer to measure trends and chart progress. SHEPHERD IMS provides a fast and easily understood look at several measurements of financial health.

Examples of Sheepbud output pages and Shepherd IMS graphs are printed in the last pages of this report.

Do these tools provide tangible benefits to producers? Lets compare the average results from clients enrolled in the North Dakota Sheep Development Project with average results from the state as a whole. Keep in mind that the producers in the Sheep Project are new producers. Most started raising sheep at the same time that record keeping started.

Group ONE is Sheep Development Project Participants
Group TWO is all North Dakota Sheep Producers

Below is production and financial data from 1990.

GROUP	FLOCK SIZE	LAMBING RATE	PER EWE PRODUCTION	LAMB SELL PRICE	WOOL SELL PRICE	GROSS PER EWE
ONE	77	136%	132	$50	$0.63	$65
TWO	75	119%	79	$51	$0.59	$52

h:\records\sheday.wk1
N.D. AG STATISTICS 1991

Now lets look at the same information in 1992.

GROUP	FLOCK SIZE	LAMBING RATE	PER EWE PRODUCTION	LAMB SELL PRICE	WOOL SELL PRICE	GROSS PER EWE
ONE	110	161%	156	$61	$0.60	$94
TWO	94	100%	85	$57	$0.58	$59

h:\records\2shday94.wk1
N.D. AG STATISTICS 1993

Combining the data from both years is a real eye opener.

	SHEEP PROJECT PARTICIPANTS			STATE AVERAGE ALL PRODUCERS		
	1990	1992	CHANGE	1990	1992	CHANGE
FLOCK SIZE IN HD.	77	110	43%	75	94	25%
CWT PRODUCTION/EWE	132	156	19%	79	85	8%
LAMB SELL PRICE	$50	$61	23%	$51	$57	11%
WOOL SELL PRICE	$63	$60	-6%	$59	$58	-2%
GROSS $/EWE	$65	$94	44%	$52	$59	13%
LAMBING BIRTH RATE	136%	161%	18%	119%	100%	-16%

H:\records\2shday94.wk1

Compare the change from 1990 to 1992 in production and financial indicators between the two groups. Operating in the same business climate, same markets and equal input prices the business record group achieved more dramatic change in their flock performance. The changes as a total allowed them to increase their gross return per ewe to a 44 percent higher level than two years previously. While it is true that market prices rose during this two year period, the gains in gross dollars returned to the flock is over three times the improvement made by the rest of the producers in the state.

Those gains were not because they kept financial business records, but because they used the information only financial records could provide to make profitable use of their resources. The use of these tools does not guarantee success in the sheep business; however it does provide the astute producer with information needed to make profitable business decisions in todays rapidly changing agricultural environment.

THIS IS A SAMPLE SHEEPBUD OUTPUT PAGE

FEED COST

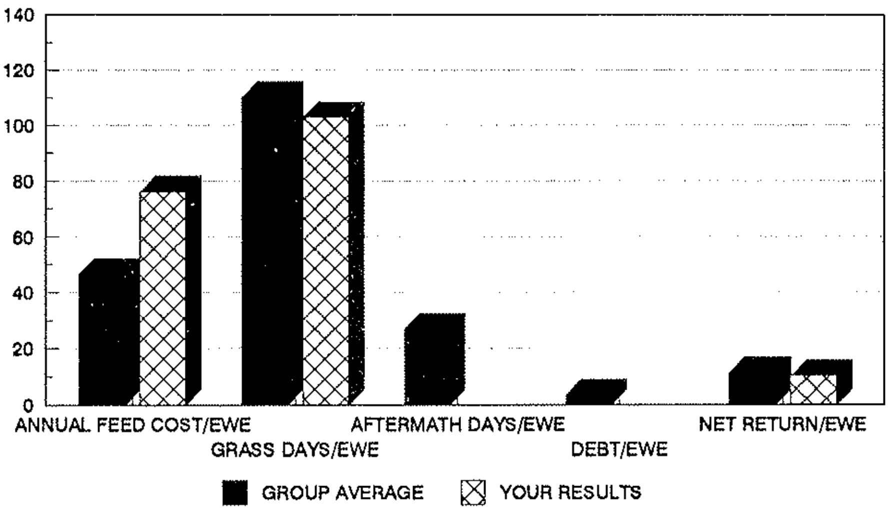
CASH FLOW	PRICE	FEED	PER EWE		ECONOMIC COST		OPPORTUNITY COST
$1,545	$30	HAY	0.51	TON @	$40	/TON	$2,060
$536	$6.50	PASTURE	0.82	AUMS @	$12.00	/AUM	$989
$1,282	$1.50	GRAIN	8.51	BU @	$2.00	/BU	$1,710
$0	$0	PROTEIN SUPPL.	0.00	LBS @	$0	/TON	$0
$0	$1	STUBBLE	0.40	AUMS	$7	/CWT	$3
$300	$3	COMM. FEED	100.00	UNITS	$3	UNIT	$300
$3,663		TOTAL FEED COST FOR ENTERPRISE					$5,061
$37		ANNUAL FEED COST PER EWE					$51
$21		FEED COST PER CWT OF LAMB EQUIVALENT PRODUCED					$28
$319		RETURNS PER $100 FEED FED					$235

LIVESTOCK COSTS

CASH FLOW	PRICE	ITEM			ECONOMIC COST		OPPORTUNITY COST
$30	$10	BEDDING	3	TONS @	$15	/TON	$45
$727	$5.91	MARKETING	123	HEAD @	$5.91	/HEAD	$727
$400	$4.00	VET & MEDICINE		@	$4.00	/EWE	$400
$150	$1.50	POWER & FUEL/ EWE		@	$1.50	/EWE	$150
$150	$1.50	UTILITIES & GEN FARM		EXP @	$1.50	/EWE	$150
$400	$4.00	SUPPLIES		@	$4.00	/EWE	$400
$250	$2.50	SHEARING		@	$2.50	/EWE	$250
$2,107		ANNUAL LIVESTOCK COSTS PER HERD					$2,122
$21		ANNUAL LIVESTOCK COSTS PER EWE					$21
$12		L.S. COST PER CWT OF LAMB EQUIVALTENT PRODUCED					$12

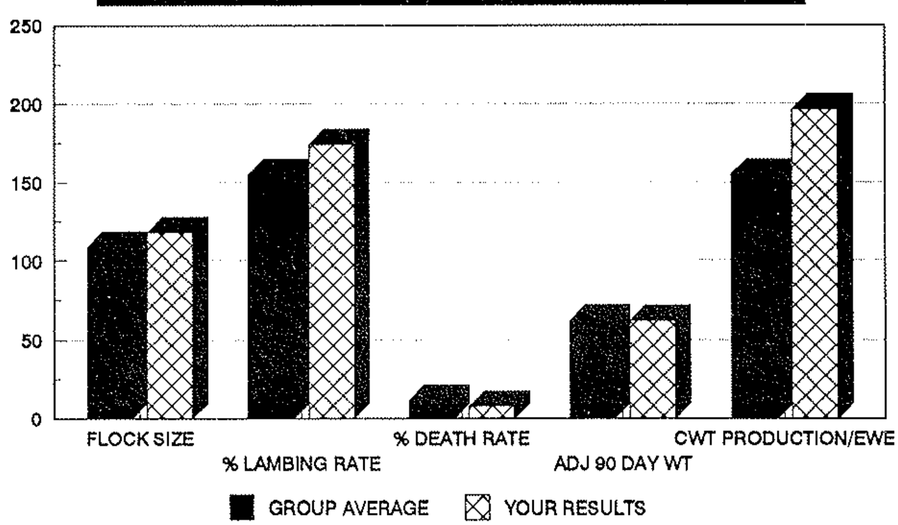
SAMPLE SHEPHERD IMS OUTPUT

1992 FINANCIAL INFORMATION



02-250GR3

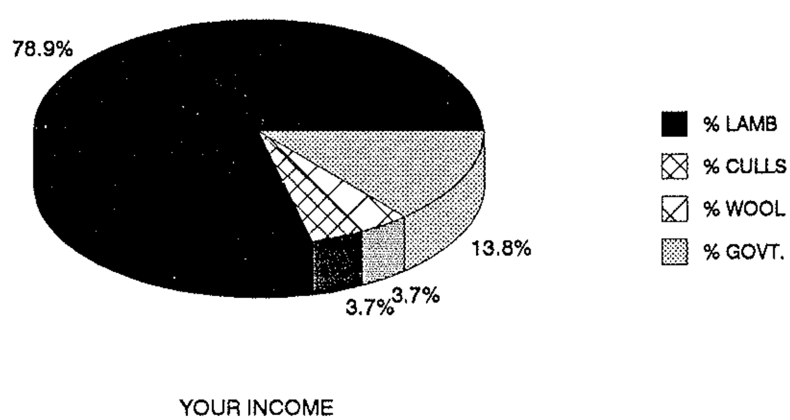
1992 PRODUCTION TEST RESULTS



02-250GR1

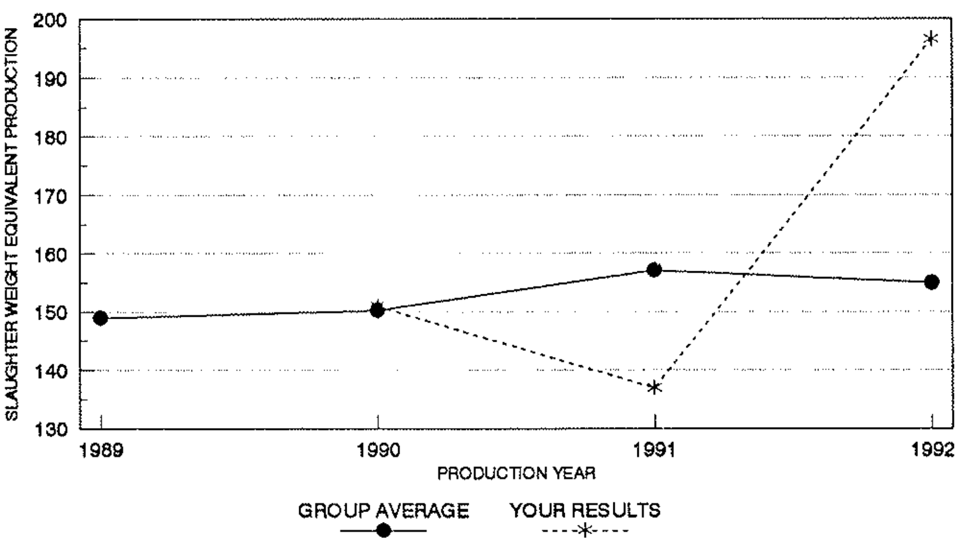
SAMPLE SHEPHERD IMS OUTPUT

1992 INCOME BY PRODUCT CATAGORY



02-250GR10

TREND IN TOTAL PER EWE PRODUCTION



02-250GR5

PROGRESS REPORT

Conservation Reserve Program (CRP) Grazing and Haying Study, 1992-1993

By

William T. Barker, Paul Nyren, Don Stecher, Dennis Whitted, Tim Faller, Kevin Sedivec and Jim Nelson

Introduction

This study was initiated in 1992 and carried out again in 1993. This study is designed to continue for three more growing seasons.

The objectives of this study are to determine:

1. The floristic composition and structure of CRP lands and to note changes in floristic composition and structure due to grazing and haying over 5 years.

2. The production and utilization of CRP land vegetation under seasonlong and twice-over grazing.

3. The production and quality of hay from CRP lands.

4. The success of game and non-game wildlife species on CRP lands.

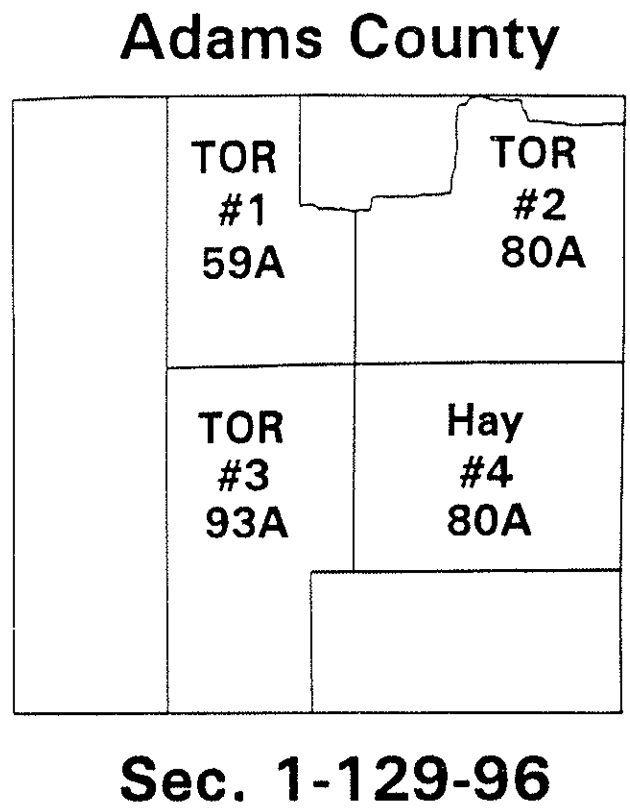
5. The erosion from CRP lands that have been variously grazed and hayed and to compare this with similar cropland.

6. The economic returns from grazing and haying CRP lands.

There will be an effort by the ND Extension Service and all the personnel involved with this study to disseminate information resulting from this effort to help landowners and policy makers make decisions regarding CRP lands when present CRP contracts end.

Methods and Materials

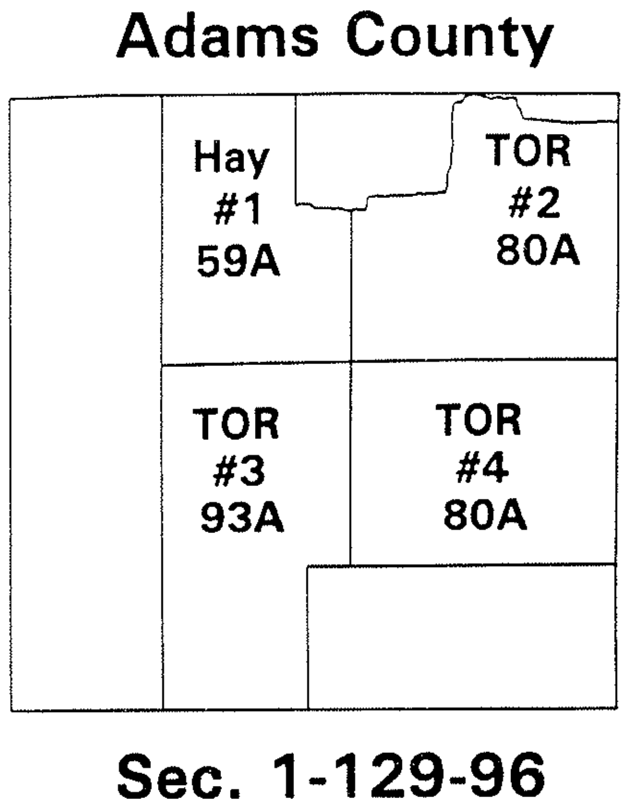
Figures 1-4 show the study sites in Adams and Bowman counties. The Adams County study site consists of four pastures. Three pastures are part of a twice-over rotation grazing system grazed by 60 yearling heifers and 119 (121 in 1993) yearling ewes. One pasture is hayed each year. Pastures are rotated each year so that grazing does not begin in the same pasture in successive years and so that haying does not occur in the same area in successive years. This will allow for better growth of the plants and for better vigor of the plants. The rotations and stocking rates are given in Figures 1 and 2 for 1992 and 1993.



Twice-over Rotation: Grazed 60 yearling heifers
and 119 yearling ewes

Rotation dates:
Pasture 1 5-19-92 to 6-3-92
Pasture 2 6-4-92 to 6-24-92
Pasture 3 6-25-92 to 7-16-92
Pasture 1 7-17-92 to 8-5-92
Pasture 2 8-6-92 to 8-27-92
Pasture 3 8-28-92 to 9-18-92

Figure 1. Adams County Study Site 1992.

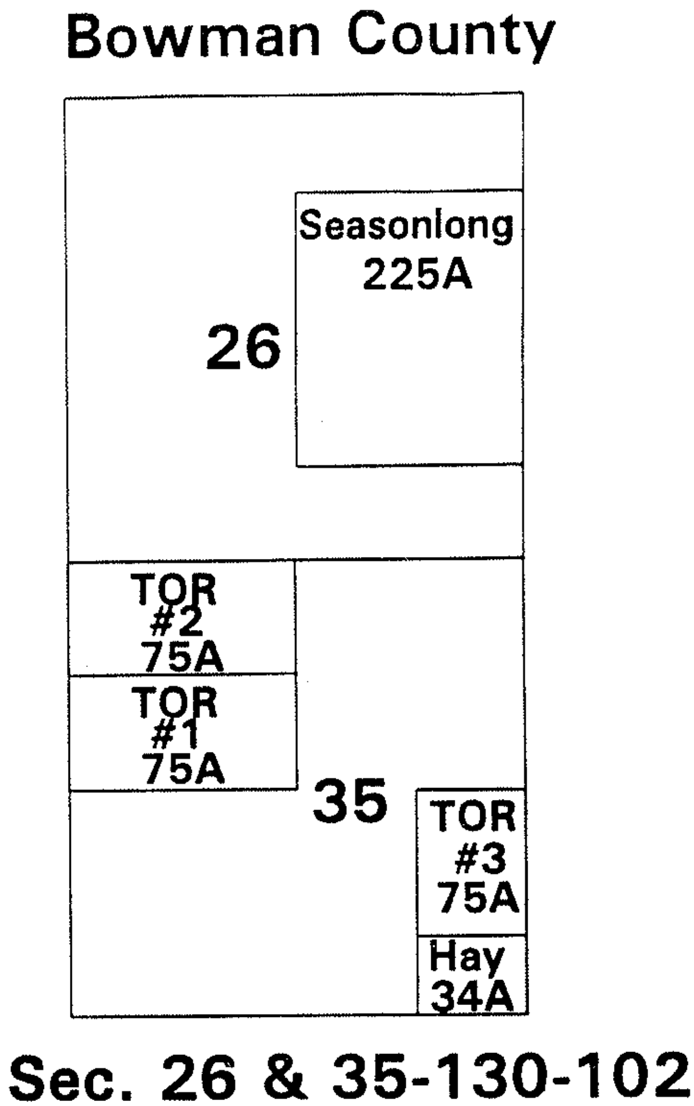


Twice-over Rotation: Grazed 60 yearling heifers and 121 yearling ewes.

Rotation dates:

Pasture 2 5-18-93 to 6-7-93
Pasture 3 6-8-93 to 6-28-93
Pasture 4 6-29-93 to 7-19-93
Pasture 2 7-20-93 to 8-9-93
Pasture 3 8-10-93 to 8-30-93
Pasture 4 8-31-93 to 9-21-93

Figure 2. Adams County Study Site 1993.

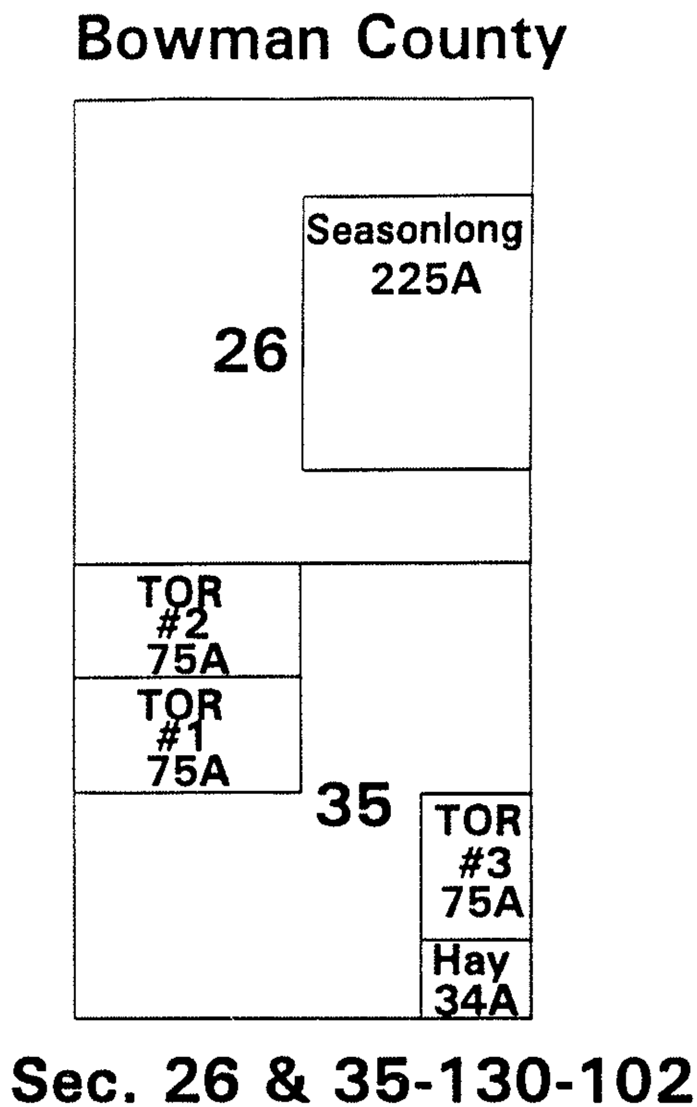


Seasonlong: Grazed 24 yearling heifers

Twice-over Rotation: Grazed 52 yearling heifers

Rotation dates:
- Pasture 1 5-14-92 to 6-3-92
- Pasture 2 6-4-92 to 6-24-92
- Pasture 3 6-25-92 to 7-16-92
- Pasture 1 7-17-92 to 8-5-92
- Pasture 2 8-6-92 to 8-27-92
- Pasture 3 8-28-92 to 9-18-92

Figure 3. Bowman County Study Site 1992.



Seasonlong: Grazed 17 cow/calf pairs

Twice-over Rotation: Grazed 35 cow/calf pairs

Rotation dates:
Pasture 2 5-18-93 to 6-7-93
Pasture 3 6-8-93 to 6-28-93
Pasture 1 6-29-93 to 7-19-93
Pasture 2 7-20-93 to 8-9-93
Pasture 3 8-10-93 to 8-30-93
Pasture 1 8-31-93 to 9-21-93

Figure 4. Bowman County Study Site 1993.

The Bowman County study site consists of a hayed area, three pastures used in a twice-over rotation grazing system and a seasonlong grazing pasture. In 1992 the seasonlong pasture was grazed with 24 yearling heifers and the twice-over grazing system was grazed with 52 yearling heifers. In 1993 the seasonlong pasture was grazed with 17 cows/calf pairs and the twice-over grazing system was grazed with 35 cow/calf pairs. The rotations and stocking rates are given in Figures 3 and 4 for 1992 and 1993.

The forage production and utilization was determined using exclosure cages and a paired plot clipping technique on overflow, silty and clayey (Adams Co.) sites in each grazing treatment pasture.

Floristic composition and structure data were determined using points analysis and frequency quadrats. Frequency, basal cover and density are determined by these methods.

The livestock were weighed at the start of grazing and at the end of grazing and the average daily gain and the gain per acre were calculated for the grazing treatments.

Results

Tables 1 and 2 give the total forage production on the Bowman and Adams Counties Study Sites for 1992 and 1993, respectively.

Total production ranged from 2870 lbs/acre to 4667 lbs/acre in 1992 and from 3477 lbs/acre to 6717 lbs/acre in 1993. Utilization from 36 % to 68 % in 1992 and from 27 % to 61 % in 1993. These results compare favorably with what one would expect from rangeland in western North Dakota.

Table 3 shows the grazing treatment, the number of acres grazed, the type and number of animals used and the length of grazing season at the Bowman and Adams Counties study sites in 1992 and 1993. This table also gives the average daily gain (ADG) and gains/acre for both cows and calves, as well as for sheep in Adams County.

Table 4 gives the yields and nutritional qualities of the hay taken from the Bowman and Adams Counties CRP study sites.

The floristic composition and structure data will be included in a later CRP report.

Table 1. Total Forage Production on Bowman and Adams Counties Study Sites in 1992.

	Twice-over Rotation Grazing System (TOR)												Average Seasonlong Grazing System (SL)		
	Pasture 1			Pasture 2			Pasture 3			Average TOR					
	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization
Bowman County															
Legumes	836	537	64	1532	1118	73	1311	873	67	1227	843	69	385	105	27
Forbs	193	179	93	0	0	0	219	219	100	138	133	96	3	2	67
Grasses	3404	1015	30	3135	1755	56	1340	614	46	2626	1128	43	3212	1171	36
Total	4433	1731	39	4667	2873	62	2870	1706	59	3991	2104	53	3600	1278	36
Adams County															
Alfalfa	875	495	57	1190	681	57	1356	1047	77	1140	741	65			
Other Forbs	89	68	76	130	110	85	39	38	97	86	72	84			
Intermediate Wheatgrass	2698	1687	63	2344	876	37	1666	984	59	2236	1182	53			
Other Grasses	70	46	66	0	0	0	0	0	0	23	15	65			
Total	3732	2296	62	3664	1667	45	3061	2069	68	3486	2011	58			

Table 2. Total Forage Production on Bowman and Adams Counties Study Sites in 1993.

	Twice-over Rotation Grazing System (TOR)												Average Seasonlong Grazing System (SL)		
	Pasture 1			Pasture 2			Pasture 3			Average TOR					
	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization	Production lbs/A	Utilization lbs/A	% Utilization
Bowman County															
Legumes	859	551	64	1619	973	60	2281	1303	57	1587	942	59	1971	523	27
Forbs	63	37	59	4	1	25	6	3	50	24	13	54	34	24	71
Grasses	2805	1510	54	2186	785	36	2596	1075	41	2529	1123	44	4712	1277	27
Total	3727	2098	56	3809	1759	46	4883	2381	49	4140	2078	50	6717	1824	27
Adams County															
Alfalfa	1336	1088	81	1087	571	53	1346	704	52	1256	788	63			
Other Forbs	158	134	85	41	22	54	43	29	67	81	62	77			
Intermediate Wheatgrass	2490	1238	50	2255	896	40	2732	1369	50	2492	1168	47			
Other Grasses	68	26	38	94	20	21	377	326	86	180	124	69			
Total	4052	2486	61	3477	1509	43	4498	2428	54	4009	2141	53			

Table 3. Livestock Production on Bowman and Adams Counties CRP in 1992 and 1993.

Location	Grazing Treatment	Number of Acres	Number and Type of Animals	Grazing Season Length	ADG (lb)	Gains/A (lb)	ADG (lb)	Gains/A (lb)	ADG (lb)	Gains/A (lb)
Bowman Co. 1992	TOR[1]	225	52 Yearling Heifers	125	1.59	45.93	-	-	-	-
	SL[2]	131	24 Yearling Heifers	125	1.81	41.45	-	-	-	-
Bowman Co. 1993	TOR	225	35 Cow-Calf Pairs	128	0.87	17.32	2.63	52.37	-	-
	SL	131	17 Cow-Calf Pairs	128	0.88	14.62	2.52	41.86	-	-
Adams Co. 1992	TOR	232	60 Yearling Heifers + 119 Yearling Ewes	123	1.43	45.49	-	-	0.37	23.34
Adams Co. 1993	TOR	232	60 Yearling Heifers + 121 Yearling Ewes	127	1,61	52.88	-	-	0.42	27.82

[1]TOR = Twice-over rotation grazing system.
[2]SL = Seasonlong grazing.

Table 4. Yield and Nutritional Quality of Hay at Bowman and Adams Counties CRP Study Sites in 1992 and 1993.

Cutting	Location	Total Acres	Total Yield (Tons/Ac)	Percent Dry Matter (DM)	Ash	Percent Crude Protein (CP)	Percent Acid Detergent Fiber (ADF)	Percent Neutral Detergent Fiber (NDF)
1st	Bowman Co. 1992	34	2.00	96.40	5.75	8.40	52.50	74.90
2nd	Bowman Co. 1992	34	0.87	95.96	10.08	18.70	36.08	53.96
1st	Bowman Co. 1993	34	0.80	98.70	8.5*	12.13	19.2	45.00*
2nd	Bowman Co. 1993	34	0.63	92.5	8.9*	18.55	32.8	41.00*
1st	Adams Co. 1992	80	1.33	96.30	7.30	9.15	52.84	75.48
1st	Adams Co. 1993	59	.75	NA	NA	NA	NA	NA

NA = Not available (analysis not complete).
*Estimated.

SECTION II
MANAGEMENT SECTION

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HETTINGER RESEARCH AND EXTENSION CENTER

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NORTH DAKOTA STATE UNIVERSITY

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EXTENSION LIVESTOCK SPECIALIST
NORTH DAKOTA STATE UNIVERSITY

35TH ANNUAL SHEEP DAY

HETTINGER RESEARCH AND EXTENSION CENTER
HETTINGER, NORTH DAKOTA

FEBRUARY 9, 1994

SHEARING MANAGEMENT

Timothy C. Faller

Hettinger Research Extension Center

Animal production systems are in a constant state of flux. Producers are always making decisions that eventually effect their profitability. Some decisions such as breed selection and sire selection are of a long term nature. Normal management decisions may have long term effects but in general are thought of as only effecting profitability on an annual basis. Time of shearing is one of those management choices that is made on an annual basis and really only effects profitability in one given year. Producers have already made a decision when they wish to lamb and this decision may effect if they decide to shear prior to or after parturition. The potential hazard of environmental and climatic change are essential in determining time of shearing.

The following is a list of considerations for producers when deciding which shearing date might fit them best.

ADVANTAGES

1. Reduced space requirements based on removing the annual wool clip or the provision of needed space for the baby lambs which are soon to arrive. If you shear after lambing you must provide space for the ewe, the wool and the lambs.

2. Warmer and drier lambing facilities are very positive advantages to consider when making shearing time decisions. Wool has a very absorbent characteristic which tends to keep more moisture in the lambing facility when the ewes are in full fleece. Wool is also an excellent insulator which reduces the effect of body heat when the ewes are housed inside in full fleece.

3. It is a well known fact that newborn lambs will find the teat more easily when the udder is bare. If your system requires shearing after lambing then you should shear away all wool from the udder to assist the newborn lamb in finding the teat. You may do this individually as the ewes lamb providing that you are usually present at lambing. If not you should crutch the whole brood ewe flock just prior to the first lamb being born. Crutching does increase variable costs.

4. More ewes will tend to lamb indoors when you allow them to go outside during the day for feeding purposes if they are shorn as opposed to not. Producers may experience a reduced problem with chilled udders when the ewes are shorn and fed outside than when they are crutched and fed outside.

5. A much cleaner wool clip is a major advantage to shearing prior to the onset of lambing. Most wool contamination from the lambing process comes from bedding techniques, lambing fluids, and normal body fluids associated with parturition.

6. Many times a wool break occurs because of the lambing process. It occurs because of normal fevers and stress associated with lambing. If it does occur it is better to have the break on the outside of the fleece than on the inside.

7. Paint brands will remain more legible when the ewe is branded and in short fleece as opposed to the long staple. Shearing after lambing may set up the incidence of having to re-brand the ewes and again increasing variable costs.

8. A major advantage of shearing prior to lambing is that the producer has an opportunity to evaluate and pick up body condition if the ewes are found to be too thin. The producer may find that only certain individuals are too thin possibly because of age differences or the presence of internal parasites. To use this management tool effectively it would suggest that shearing should occur about thirty days prior to the onset of lambing.

9. The most effective time to treat for external parasites is when the ewe is freshly shorn. The elimination of both internal and external parasites prior to lambing is just one less stress the ewe must contend with at this very important time.

After considering the advantages of shearing prior to lambing producers should not fail to equally weigh the disadvantages which may not be as numerous but may be the limiting factors for his operation.

DISADVANTAGES

1. If the sheep producer has selected a very severe or variable climatic time as his best time to lamb and availability of quality housing is limited the sheep producer may chose to shear after lambing. In a future year the producer might adjust his lambing time to better mesh lambing time with the desire to shear in advance of lambing.

2. Taking the wool off the ewes body when it is cold or inclement increases her energy requirement. This clearly says that a shorn ewe requires more feed during bad weather than a ewe with her wool coat on.

After you weigh the pros and cons of shearing time it would appear that most but not all sheep operations would profit by selecting a shearing date prior to the onset of lambing. The producer that does select to shear prior to lambing is faced with some additional management considerations.

Many producers perform a wide array of management tasks approximately 25-35 days prior to the start of lambing. Shearing, treating for internal and external parasites, vaccinating for enterotoxemia, and trimming hooves are all routine management tasks that fit well together. Actual shearing date selection, lining up quality shearers, providing dry, clean housing, and climatic conditions of the date selected are all factors that will influence success of accomplishing actual shearing on the date selected.

Management associated with harvesting of the sheep producers second crop is a very important factor in determining ultimate profitability of the total sheep enterprise.

HETTINGER BRANCH EXPERIMENT STATION

FLOCK CALENDAR - OUTLINE

The following guidelines are neither inclusive nor intended to fit every sheep operation. Each operation is different, therefore each "calendar of events" should be tailored to each flock's needs.

PRIOR TO BREEDING

1. Bag and mouth ewes and cull those that are not sound.
2. Replace culled ewes with top-end yearlings or ewe lambs.
3. Keep replacement ewe lambs on growing ration.
4. Evaluate sires: use production records.
    a. Be sure they are vigorous, healthy and in good breeding condition.
    b. Rams should be conditioned at least a month before the breeding season. Flush rams in poor condition.
    c. Allow at least two mature rams or four buck lambs per 100 ewes.
5. Flush ewes:
    a. 1 pound grain/day two weeks to five weeks before breeding (usually 17 days).
    b. If ewes are over-conditioned, the effect of flushing will be lessened.
6. Vaccinate all ewes for vibriosis and enzootic abortion (EAE) 50 days prior to breeding and booster 21 days later all ewe lambs and new ewes in the flock.
7. Identify all ewes and rams with ear tags, paint brands or tattoos.

BREEDING

1. The ovulation rate of a ewe tends to be lowered at the first part of the breeding season. Vasectomized or teaser rams run with the ewes through the first heat period tend to stimulate them and increase the ovulation rate at the second heat period.
2. Use a ram marking harness or painted brisket to monitor breeding. Soft gun grease with paint pigment mixed in works well for painting the brisket. A color sequence of orange, red and black is recommended with colors being changed every 17 days.

3. Leave rams in NO LONGER than 51 days (35 days is more desirable).

   a. An exception may be with ewe lambs. Allowing them four heat cycles or 68 days may be beneficial.

4. Remove rams from ewes after the season (don't winter rams with ewes).

PRIOR TO LAMBING - EARLY PREGNANCY (First 15 Weeks)

1. Watch general health of ewes. If possible sort off thin ewes and give them 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.

3. An exception to the above is feeding pregnant ewe lambs. They should receive good quality roughage and grain (about 20 percent of the ration) during this period.

LAST SIX WEEKS BEFORE LAMBING

1. Trim hooves and treat for internal parasites.

2. Six to four weeks before lambing feed 1/4 to 1/3 pound grain/ewe/day.

3. Shear ewes before lambing (even up to one to two weeks prior is satisfactory). Keep feeding schedule regular and watch weather conditions immediately after shearing (cold).

4. Vaccinate ewes for enterotoxemia.

5. Control ticks and lice immediately after shearing.

6. Four weeks before lambing increase grain to 1/2 to 3/4 pound/ewe/day (usually done immediately after shearing).

7. Give A-D-E preparations to ewes if pastures and/or roughage are or have been poor quality.

8. Feed selenium-vitamin E or use an injectable product if white muscle is a problem. **Caution** Don't do both.

9. Check facilities and equipment to be sure everything is ready for lambing.

10. Two weeks before lambing increase grain to 1 pound per ewe per day.

LAMBING

1. Be prepared for the first lambs 142 days after turning the rams in with the ewes, even though the average pregnancy period is 148 days.

2. Watch ewes closely. Extra effort will be repaid with more lambs at weaning time. Saving lambs involves a 24-hour surveillance. Additional help at this time is money well spent.

3. Put ewe and lambs in lambing pen (jug) after lambing (not before).

4. Grain feeding the ewes during the first three days after lambing is **not** necessary!

5. Be available to provide assistance if ewe has troubles.

6. Disinfect lamb's navel with iodine as soon after birth as possible.

7. Be sure both teats are functioning and lambs nurse as soon as possible.

8. Use additional heat sources (heat lamps, etc.) in cold weather.

9. Brand ewe and lambs with identical number on same sides. Identify lambs with ear tags, tattoos or both.

10. Turn ewe and lambs out of jug as soon as all are doing well (one to three days).

11. Bunch up ewes and lambs in small groups of four to eight ewes and then combine groups until they are a workable size unit.

12. Castrate and dock lambs as soon as they are strong and have a good start (two days to two weeks of age). Use a tetanus toxoid if tetanus has been a problem on the farm (toxoids are not immediate protection. It takes at least 10 days for immunity to build).

13. Vaccinate lambs for soremouth at one to two weeks of age if it has been a problem in the flock.

14. Provide a place for orphaned lambs. Make decision on what lambs to orphan as soon after birth as possible for the best success. Few ewes can successfully nurse more than two lambs.

END OF LAMBING TO WEANING

1. Feed ewes according to number of lambs suckling. Ewes with twins and triplets should receive a higher plane of nutrition.

2. Provide creep feed for lambs (especially those born during the winter and early spring).

3. Vaccinate lambs for overeating at five weeks and seven weeks of age.

WEANING

1. Wean ewes from lambs, not lambs from the ewes. If possible, remove ewes from pen out of sight and sound of lambs. If lambs have to be moved to new quarters, leave a couple of ewes with them for a few days to lead the lambs to feed and water locations.

2. Lambs should be weaned between 50 and 60 days of age or when they weigh at least 40 pounds and are eating creep and drinking water. The advantage of early weaning is that the ewe's milk production drops off to almost nothing after eight weeks of lactation.

3. Grain should be removed from the ewe's diet at least one week prior to weaning and low quality roughage should be fed. Restriction of hay and water to the ewe following weaning lessens the chance of mastitis to occur. Poorer quality roughage should be fed to the ewes for at least 10 to 14 days following weaning.

4. Handle the ewes as little as possible for about 10 days following weaning. Tight udders bruise easily. If possible, bed the area where the ewes will rest heavily with straw to form a soft bed for the ewes to lay on.

WEANING TO PRE-BREEDING

1. If ewes go to pasture, treat for internal parasites.

2. Feed a maintenance ration to the ewes. Put ewe lambs that lambed back on a growing ration once they have quit milking.

3. Adjust ewe's conditions so they can be effectively flushed for next breeding season. Don't get ewes too fat prior to breeding.

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

2. Use good equipment. Self priming nipple and tube assemblies have been found to be excellent for starting orphans. Many types of feeding systems can be homemade.

3. Start on nurser quickly. Young lambs start easier. Check ewe's 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 Formaldehyde solution commercially available that retards bacterial growth in milk (1 cc/gallon milk).

6. Vaccinate to protect against overeating. For immediate short term (two weeks) protection use antitoxin. For long term protection use bacterial toxoids (cl. perfringens 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 ounce 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'x72', Feeder Lamb Barn	3.00
MW 72506	240 Ewe and Lambing Barn, 40'x104'	3.00
MW 72507	500 Ewe and Lamb Feeding Barn, 74'x256'	3.00
MW 72508	12' x 16' Portable Lamb Feeding Shed	2.00
MW 72509	40 Ewe and Lambing Barn, 24x32'	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, 15000, 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