WESTERN EXTENSION, RESEARCH, AND ACADEMIC COORDINATING COMMITTEE (WERA 039)

2011

ANNUAL REPORTS

JUNE 5 – 8

SPEARFISH, SOUTH DAKOTA

2011 JOINT ANNUAL MEETING OF THE
WESTERN EXTENSION, RESEARCH AND ACADEMICS COMMITTEE 039
AND NORTH CENTRAL EXTENSION, RESEARCH AND ACADEMICS COMMITTEE 214

SPEARFISH, SOUTH DAKOTA

JUNE 5 — 8, 2011

TENTATIVE AGENDA

Sunday, June 5	Arrive in Spearfish – Social gathering that evening – time & location TBA	
Monday, June 6	7:00 – 8:00 am	Breakfast (provided with registration)
	8:00 – 8:15 am	Welcome & Introductions
	8:15 – 8:30 am	Administrative Advisors Reports
	8:30 – 10:00 am	WERA-039/NCERA-214 Reports
	10:00 – 10:30 am	Break
	10:30 – Noon	WERA-039/NCERA-214 Reports
	Noon – 1:00 pm	Lunch (provided with registration)
	1:00 – 3:00 pm	WERA-039/NCERA-214 Reports
	3:00 – 3:30 pm	Break
	3:30 – 5:00 pm	WERA-039/NCERA-214 Reports
	6:00 pm	Dinner (provided with registration) – Location TBA
Tuesday, June 7	8:00 – 9:00 am	Business Meetings
	9:00 – 10:00 am	WERA-039/NCERA-214 Reports
	10:00 – 10:30 am	Break
	10:30 – Noon	WERA-039/NCERA-214 Reports
	Noon – 1:00 pm	Lunch (provided with registration)
	1:00 – 3:00 pm	WERA-039/NCERA-214 Reports
	3:00 – 3:30 pm	Break
	3:30 – 5:00 pm	WERA-039/NCERA-214 Reports
	5:00 pm	Adjourn
Wednesday, June 8	Sheep/Ag Tour – 8:00 am – 5:00 pm	

Table of Contents

WERA 039 Current and WCC 39 Historical Records of Dates, Location, and Officers 1987-2011

Date	Location	Chair	Secretary
6/5-6/8/11	Spearfish, SD	J.A. Walker	T.R. Whitney
6/7-6/9/10	Dubois, ID	C.S. Schauer	J.A. Walker
5/31-6/2/09	Reno, NV	R.H. Stobart	C.S. Schauer
6/1-6/3/08	Chico Hot Springs, MT	C.K. Chapman	R.H. Stobart
6/3-6/6/07 (NCERA 190)	Corvallis, OR	M. Salisbury	C.K. Chapman
5/22-5/23/06	San Angelo, TX	C. Lupton	M. Salisbury
5/17-5/18/05	Houston, TX	J. Taylor	C. Lupton
5/17-5/18/04	Reno, NV	H. Meyer	J. Taylor
6/04-6/07/03	Hettinger, ND	R. Kott	H. Meyer
5/30-6/01/02	Bozeman, MT	T. Faller	R. Kott
5/17-5/20/01	Kerrville, TX	S. Ramsey	T. Faller
6/28-6/30/00(NC 111)	Idaho Falls, ID	D. Holcombe	S. Ramsey
5/20-5/22/99	Reno, NV	P. Hatfield	D. Holcombe
5/27-5/30/98	Ruidoso, NM	J. Huston	P. Hatfield
6/25-6/28/97 (NC 111)	Ames, IA	M. Dally	J. Huston
5/16-5/18/96	Laramie, WY	R. Kott	M. Dally
5/18-5/20/95	Hopeland, CA	M. Riley	R. Kott
5/19-5/21/94	San Angelo, TX	T. Ross	M. Riley
5/20-5/22/93	Bozeman, MT	G. Snowder	T. Ross
5/28-5/30/92	Reno, NV	V. Thomas	G. Snowder
1/17-1/18/91 (ASI)	Long Beach, CA	----------	V. Thomas
1990 (ASI)	Phoenix, AZ	----------	----------
1989 (NC 111)	Corvallis, OR	C. Lupton	----------
1988	Reno, NV	H. Meyer	C. Lupton
1987	Reno, NV	----------	H. Meyer

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Minutes of the 2010 Meeting of the WERA-039 Coordinating Committee

Minutes of the 2009 Meeting of the WERA-039 Coordinating Committee Dubois, ID June 7 – June 9, 2010

The WERA-039 business meeting was called to order by Chair Chris Schauer. Greg Lewis extended a welcome from the USDA Sheep Station to the WERA 039 committee. The chair extended his thanks to Bret Taylor for hosting this year's meeting.

Members of the WERA-039 committee attending the business meeting were Chair – Chris Schauer (North Dakota State University), Julie Walker (South Dakota State University), Bret Taylor (USDA Sheep Station), Greg Lewis (USDA Sheep Station), Christopher Lupton (Texas A&M University), Rodney Kott (Montana State University), Pat Hatfield (Montana State University), Travis Whitney (Angelo State University), Richard Battaglia (University of Idaho), Reid Redden (Montana State University), Brian Neville (North Dakota State University), and Jim Thompson (Oregon State University).

Last year's minutes were reviewed. Bret Taylor moved to accept the minutes as written. Rodney Kott seconded the motion and it passed unanimously.

Dick Battaglia, WERA-039 administrative officer, gave his report to the committee. Dick also thanked Bret Taylor and Greg Lewis for hosting the meeting and tours, and thanked Chris Schauer and Julie Walker for their efforts in organizing the meeting. Dick passed out the submitted rewrite for the WERA 039. Dick indicated that the rewrite was submitted on time and final ruling will be made by October 1st. He indicated that within the rewrite that each state should have a representative for the state that is listed as participating states. He handed out the list of Participants for the WERA Temp3021 committee and reminded individuals that they needed to apply. Rodney Kott indicated that he was approved. Bret Taylor has not logged on yet. Tumen Wuliji and Jim Thompson have not submitted. Dick asked if Bret Taylor representative the state of Idaho. Greg Lewis commented that Bret Taylor be noted on representative for Idaho; Karen Launchbaugh is conducting some sheep research especially some of her grazing research. Steve LeValley should be removed from the list of participant. Patricia Fuerst at Washington State University Department of Crop and Cereal Sciences had contacted Dick and might be interested in joining the WERA committee. Joe Harrison name should be removed from the list. Rodney Kott made the motion to approve the rewrite and Bret Taylor second the motion. Motion passed unanimously.

Chris Schauer nominated that Travis Whitney for Secretary. Motion to cease nominations and cast unanimous ballot by Julie Walker. Bret Taylor seconded and the motion passed unanimously. Julie Walker will be Chair next year..

Discussion was held regarding the location of next year's meetings. Julie Walker and Chris Schauer indicated that South Dakota State University will host the 2011 in Rapid City. Greg Lewis and Jim Thompson will extend a invitation to the NCERA 190 committee to have a join committee meeting in 2011. Potential dates are between June 1st and June 10th. Bret Taylor made the motion to extend the invitation to NCERA 190, seconded by Chris Lupton and passed unanimously

Rodney Kott made a motion to have the chair write a letter of support for the AFRI grant evaluating residual intake. Seconded by Julie Walker, motion passed unanimously.

As there was no further business the business meeting with adjourned at 9:20 am.

Presentations started at 9:30 am on June 8, 2010.

Members of the WERA-039 committee attending the presentations were Chair – Chris Schauer and graduate student Brian Neville (North Dakota State University), Julie Walker (South Dakota State University), Christopher Lupton (Texas A&M University), Travis Whitney (Angelo State University), Richard Battaglia (University of Idaho), Bret Taylor and Greg Lewis (USDA Sheep Experiment Station. Dubois, Idaho), Jim Thompson (Oregon State University), Patrick Hatfield, Rodney Kott and graduate student Reid Redden (Montana State University)..

WERA Objective 1: "Develop ecologically and economically sound land management practices that use the unique harvesting abilities of sheep and goats for: a) managing and sustaining native plant communities; b) controlling invasive, exotic plant species; and c) improving nutrient cycling and pest management in range and cropping systems."

Reports given by Travis Whitney.

WERA Objective 2: "Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products by: a) improving biological efficiency through better understanding of environmental and genetic events that influence meat and fiber production; b) identifying unique feedstuffs that enhance the nutritional value of meat; c) utilizing state-of-the-art instrumentation both in the field and in the lab to accurately and rapidly measure important characteristics of wool, mohair, and cashmere; and d) develop animal identification systems that ensure the accurate real-time linking of animals to lifetime genetic, performance, health, and origin databases."

Reports given by Chris Lupton, Julie Walker, Chris Schauer, Travis Whitney, Brian Neville and Reid Redden

WERA Objective 3: "Rapidly and accurately disseminate new information to the producer through: a) development of novel technology transfer platforms; b) hosting field days at research centers; and, c) organizing on farm demonstration projects."

No reports were represented for objective 3.

Dr. Steve Smith, visited with the WERA 039 committee about the changes in National Institute of Food and Agriculture (NIFA) via teleconference.

Michelle Mousel provided a report on the Terminal Sire Evaluation research project being conducted at USDA Sheep Station, Dubios, ID.

The meeting was adjourned at 2:45 pm, with a walking tour of the USDA Sheep Research Station, Dubois, ID.

June 9th, Greg Lewis provided an update of the status of USDA Sheep Station and interactions with various outside agencies. Cody Moffet presented on using imaging to measure recovery from fire. Cody Moffet provides a rangeland tour of the postfire shrub cover dynamics.

Respectfully submitted by Julie Walker – June 9, 2010

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WERA039: Coordination of Sheep and Goat Research and Education Programs for the Western States

Duration:

October 01, 2010 to September 30, 2015

Administrative Advisor(s):

Nancy Irlbeck (COL) - Research

Statement of Issue(s) and Justification:

The American sheep and goat industries are undergoing a new awareness of their role in food and fiber production within an ecologically and economically sustainable production setting. Sheep and goats in modern management systems provide more than meat, milk, pelts, and fiber. They may also lend themselves as tools to improve ecological systems. Where small ruminant numbers have declined, many ecological problems have increased. For example, encroachment of noxious and exotic plants, although present for over 100 years, have dramatically increased with the decline of small ruminant grazing. Sheep and goats are the most economically and environmentally sound means of controlling many of these invaders and, additionally, can be used to control small grain insect pests and add value to crop residue. Although the role of small ruminants in stabilizing native ecosystems is an evolving frontier for scientists and producers, improving the ability of the American sheep and goat industries to compete favorably in a rapidly developing world market requires new and refined information and communication for enhancing the biological efficiency of meat and fiber production and marketing of these products.

Currently, sheep infrastructure is undergoing major changes and hair sheep and meat goats are becoming increasingly important contributors to the income of small ruminant producers. These industry changes provide opportunities to implement innovations to complement other agricultural production systems as well as increase the production efficiency of sheep and goats in the presence of aggressive international competition. To best serve the sheep and goat industries, our ultimate goal is to facilitate the successful development and integration of sustainable, ecologically sound, and economically viable, and energetically efficient systems that use available resources to produce unique, high quality, and safe meat and fiber products from sheep and goats.

Objectives

1. 1. Develop ecologically and economically sound land management practices that use the unique foraging abilities of sheep and goats for: a) managing and sustaining functional and productive native plant communities; b) controlling invasive, exotic plant species; and c) improving nutrient cycling and pest management in range and cropping systems.
2. 2. Develop sheep and goat management strategies that enhance efficiency for production of high quality, marketable end products by: a) improving biological efficiency through better understanding of environmental and genetic events that influence meat and fiber production; b) identifying unique feedstuffs that enhance the nutritional value of meat; c) utilizing state-of-the-art instrumentation both in the field and in the lab to accurately and rapidly measure important characteristics of fiber; and d) develop animal identification systems that ensure the accurate real-time linking of animals to lifetime genetic, performance, health, and origin databases; and e) increase reproductive efficiency in ewes.

3. 3. Rapidly and accurately disseminate new information to producers through: a) development of novel technology transfer platforms; b) hosting field days at research centers; c) organizing on-farm demonstration projects; and d) incorporating research findings into high school and university classrooms.

Procedures and Activities

Redefine the role of sheep and goats for enhancing ecological systems via integrated small ruminant management systems. The WERA-039 has contributed greatly to defining the numerous advantages of sheep and goat grazing to recover and sustain rangeland ecosystems and enhance cropping systems. Continued and new research utilizing sheep and goats includes: a) control of invasive plant species by grazing or mechanically harvesting not just for biomass, but the beneficial nutrients and properties of these species; b) riparian management, fire suppression, and weed control in forest, range, and cropping systems; and c) replacement of traditional chemical and mechanical fallow methods in cropping systems. Participating institutions (9) are Montana, North Dakota, Idaho, Texas, Nevada, Oregon, New Mexico, and Utah. Participating institutions (9) are from Montana, North Dakota, Idaho, Texas, Nevada, Oregon, New Mexico, and Utah.

Continued development and validation of better methods of quantifying wool quality. In the past, this has included development of ASTM measurement standards for Laserscan and OFDA for measuring fiber diameter and evaluation of skirting and classing wool prior to sale. These technologies are the basis for the national wool quality improvement program. Many results have been incorporated along with basic wool-handling skills into numerous American Sheep Industry Association-sponsored outreach programs. Modern technologies such as Near-Infrared Reflectance Spectroscopy and Staplebreaker Model 2, are being used to quantify important fleece characteristics in breeding programs focused on improving overall productivity and quality of the wool breeds. Participating institutions (5) are from Texas, Montana, Wyoming, Idaho, and Colorado.

Develop strategic feeding/supplementing practices to enhance sheep productivity. The evolving theme of current and published supplementation research by the WERA-039 is focused on timely and profitable uses of supplemental feeds targeting increased growth and profitability in the feedlot as well as improved reproductive efficiency. Continued and current projects are underway to enhance neonatal lamb survival, short- and long-term ewe health, and nutritive quality and healthy attributes of meat through the use of underutilized feed resources. Participating institutions (7) are New Mexico, Colorado, North Dakota, Idaho, Texas, South Dakota, and Utah.

Develop a decision support system for goat production based on the genetic potential, biological efficiency, and nutrient and management requirements of goats. Using large, medium, and small-framed breeds, continued and current research is underway to define and subsequently improve carcass merit, milk composition, and lactation curves of goats. Additionally, conduct a revision of Langston University├ s Meat Goat Handbook to include relevant materials for the Northern Great Plains. Participating institutions (4) are Texas, Montana, North Dakota, and South Dakota.

Enhance the management capabilities of producers through testing, development, and system integration of accurate and real-time animal identification programs. Current and continued research is underway to use retinal imaging for accurate sheep identification, and test the efficacy of radio frequency identification systems based on accuracy, economic feasibility, user-

friendliness, and longevity of different ear tag types and readers. The participating institution is Wyoming.
Evaluate potential benefits of introducing sheep and goat breeds that are either not currently in the U.S. or have only recently been introduced. Past research focused on Australian Merino breeding into certain lines of U.S. fine-wool sheep to increase both quality and quantity of wool produced. Cooperative evaluation of Australian genetic sources is possible only because of the pooling of resources from several WERA-039 stations. That breeding project resulted in a series of cooperative publications. In addition, flocks developed during this project are currently suppliers of breeding stock to the commercial industry. Additionally, the South African Meat Merino is being introduced into western white faced sheep in New Mexico. Participating institutions (6) are Texas, Montana, Wyoming, New Mexico, Nevada, and Idaho.
Provide new information on developing a safer meat product for human consumption. Current and continuing research is being conducted to identify potential routes of pathogen contamination and what pre- and post-slaughter protocols could be implemented to alleviate these routes. Participating institutions are TX, Colorado, North Dakota, Idaho, and New Mexico.

Expected Outcomes and Impacts:

- 1) Integrating natural resource and crop management systems with sheep and goat production to improve crop and rangeland ecological health and productivity, decrease fossil fuel and pesticide use, and provide science based information of the mutually profitable incorporation of sheep into natural resource and crop management systems.
- 2) Enhancing overall flock health and the nutritive value of meat through the strategic use of unique feedstuffs.
- 3) Enhancing value-based marketing systems to reward quality production of meat and fiber.
- 4) Increasing collaborative research across disciplines and communication among regional institutions.
- 5) Defining the accurate and efficient use of real-time rapid animal identification technologies.
- 6)Effective outreach and communication through peer-reviewed publications, bulletins, and effective interactions among sheep producers, researchers and extension personnel.

Project Participation:
Include a completed Appendix E form

Educational Plan:
The WERA-039 participants will continue to identify and investigate critical research issues that relate to sheep and goat production in the Western region with ramifications nationwide. This will be achieved by coordinating specific research projects among several stations to allow for better use of resources and a more focused effort toward project objectives. Cooperating stations in various forms will publish results of coordinated, multi-location projects; i.e., research progress reports, extension bulletins, popular articles, symposia proceedings, and refereed journal articles. Thus, research information will be presented in usable forms for all segments of the sheep and goat industries.
Each WERA-039 participant is committed to reporting individual achievements and contributing data and time to cooperative publications. Exchange of information among participants will be in

the same format as that used in past years; i.e., an annual brief summary/progress report on each contributing project from each participant, submitted in advance, bound, and presented and discussed at the annual WERA-039 meeting.
The WERA-039 objectives encompass the major research priorities formulated by the research and education task force of the American Sheep Industry Association and by WERA-039 participants. Because of the challenges being faced by the sheep and goat industry at the current time, it is important to quickly share our findings with the industry. Results will be presented in popular press articles, regional publications, extension bulletins, and regional educational seminars. The WERA-039 will continue to encourage publishing in the Sheep and Goat Research Journal, and development of new (and refinement of traditional) means of technology transfer.

Governance:
A Chairperson and Secretary will be elected each year at the Annual Meeting. A Nominating Committee, appointed by the current Chair, will select and submit nominees to the membership. Nominations from the floor will also be accepted. In the past, the current Secretary has typically been elevated to Chairperson and a new Secretary elected. Communications from the Administrative Advisor and Chairperson will be e-mailed directly to the active WERA-039 participants. The Secretary will record and e-mail the minutes from the Annual Meeting, and will also be responsible for binding into one volume and distributing the Station Reports at the Annual Meeting.

Signatures:
s:/Richard A. Battaglia
Last Modified: 12-May-2010

WERA039: Coordination of Sheep and Goat Research and Education Programs for the Western States

Appendix E: Format for Reporting Projected Participation

Part 1: Participant List

Station/Institution and Department	Participant	Objective No.	Research						Extension	
			KA	SOI	FOS	SY	PY	TY	FTE	Program
Colorado - Colorado State University	Steve Levalley	1	307 307 307	3610 3820 3620	1010 1010 1010	0.10	0.10	0.00	0.50	• Agricultural competitiveness and profitability • 4-H and youth development
Montana - Montana State University	Patrick Hatfield	1,2,3	0	0	0	1.00	0.00	0.00	0.00	
Montana - Montana State University	Patrick Hatfield	1,2,3	302	3310	1010	0.10	0.00	0.00	0.00	• not specified
Montana - Montana State University	R. W. Kott	1,2,3	302	3310	1010	0.10	0.00	0.00	0.00	• not specified
Nevada - University of Nevada	T Wuliji	2	307 308 303	3699 3630 3699	1080 1080 1080	0.44	0.50	0.00	0.00	• not specified
Nevada Cooperative Extension	Tumen Wuliji	2	301 303	3699 3820	1080 1010	0.50	0.25	0.25	0.25	• Agricultural competitiveness and profitability
New Mexico - New Mexico State University	T. ROSS	1,2,3	301 303	3610 3610	1020 1010	0.10	0.00	0.00	0.00	• not specified
North Dakota - North Dakota State University	Timothy Faller	unknown	121 121	3610 3010	1060 1060	0.10	0.00	0.00	0.00	• not specified
North Dakota - North Dakota State University	Christopher Schauer	1,2,3	121 121	3610 3010	1060 1060	0.10	0.00	0.00	0.00	• not specified
OTHER-Angelo State University	B. May	unknown	0	0	0	0.00	0.00	0.00	0.00	• not specified
OTHER-Angelo	Micheal W	2,3	301	3820	1060	0.10	0.00	0.00	0.00	• not specified

State University	Salisbury		302 302 301	3820 3610 3610	1060 1060 1060					
Ohio - Ohio State University	Paul S Kuber	2	303 511 501 502	3610 3699 3620 3699	1010 3090 1060 1080	0.10	0.00	0.00	0.10	• 4-H and youth development
Oregon - Oregon State University	James M. Thompson	2,3	302 307 313	3610 3610 3610	1060 1060 1060	0.20	0.00	0.00	0.30	• Agricultural competitiveness and profitability
South Dakota State University	Julie A Walker	1,2	307 302	3610 3610	1010 1010	0.10	0.00	0.00	0.10	
Texas AgriLife Research	Christopher Lupton	1,2	511 511 303 303 303 303 302	3820 3699 3820 3820 3699 3699 3820	1060 1060 1080 1060 1080 1060 1060	1.00	1.00	2.50	0.00	• not specified
Texas AgriLife Research	Christopher Lupton	2	308	3699	1060	0.10	0.00	0.00	0.00	• not specified
Texas AgriLife Research	Shawn Ramsey	2	301 307 302 308	3699 3699 3610 3699	1010 1010 1020 1020	0.10	0.10	0.00	0.00	• not specified
Texas AgriLife Research	Travis R Whitney	1,2	302 302	3020 3610	1010 1010	0.10	0.00	0.00	0.00	• not specified
USDA, ARS, U.S. Sheep Experiment Station	Joshua B Taylor	1,2	302 121	3610 799	1010 1070	1.00	0.00	0.00	0.00	• not specified
Utah Cooperative Extension	Kim Chapman	3	0	0	0	0.00	0.00	0.00	0.15	• Agricultural competitiveness and profitability
Wyoming - University of Wyoming	Robert H. Stobart	2,3	302 302	3699 3699	1080 1060	0.10	0.00	0.00	0.00	• not specified

Part 2: Research Summary

Combination of KA, SOI, and FOS	Total SY	Total PY	Total TY
0-0-0	1.000	0.000	0.000
121-3010-1060	0.100	0.000	0.000
121-3610-1060	0.100	0.000	0.000
121-799-1070	0.500	0.000	0.000
301-3610-1020	0.050	0.000	0.000
301-3610-1060	0.025	0.000	0.000
301-3699-1010	0.025	0.025	0.000
301-3699-1080	0.250	0.125	0.125
301-3820-1060	0.025	0.000	0.000
302-3020-1010	0.050	0.000	0.000
302-3310-1010	0.200	0.000	0.000
302-3610-1010	0.600	0.000	0.000
302-3610-1020	0.025	0.025	0.000
302-3610-1060	0.092	0.000	0.000
302-3699-1060	0.050	0.000	0.000
302-3699-1080	0.050	0.000	0.000
302-3820-1060	0.168	0.143	0.357
303-3610-1010	0.075	0.000	0.000
303-3699-1060	0.143	0.143	0.357
303-3699-1080	0.290	0.310	0.357
303-3820-1010	0.250	0.125	0.125
303-3820-1060	0.143	0.143	0.357
303-3820-1080	0.143	0.143	0.357
307-3610-1010	0.083	0.033	0.000
307-3610-1060	0.067	0.000	0.000
307-3620-1010	0.033	0.033	0.000
307-3699-1010	0.025	0.025	0.000
307-3699-1080	0.147	0.167	0.000
307-3820-1010	0.033	0.033	0.000
308-3630-1080	0.147	0.167	0.000
308-3699-1020	0.025	0.025	0.000
308-3699-1060	0.100	0.000	0.000
313-3610-1060	0.067	0.000	0.000
501-3620-1060	0.025	0.000	0.000
502-3699-1080	0.025	0.000	0.000

511-3699-1060	0.143	0.143	0.357
511-3699-3090	0.025	0.000	0.000
511-3820-1060	0.143	0.143	0.357
Grand Total:	5.440	1.950	2.750

Part 3: Extension Summary

Program	Total FTE
Agricultural competitiveness and profitability	0.95
4-H and youth development	0.35
Grand FTE Total:	1.40

Last Modified: 17-May-2010

REPORTS

OBJECTIVE 1

Develop ecologically and economically sound land management practices that use the unique harvesting abilities of sheep and goats for: a) managing and sustaining native plant communities; b) controlling invasive, exotic plant species; and c) improving nutrient cycling and pest management in range and cropping systems.

MONTANA STATE UNVIERSITY, BOZEMAN, BOZMAN, MT 59717
USDA-ARS, SIDNEY, MT 59270

SHEEP GRAZING EFFECT ON GREENHOUSE GAS EMISSIONS

J. L. Barsotti, U. M. Sainju, A. W. Lenssen, H. Goosey, and P. G. Hatfield

RESEARCH OBJECTIVE

We evaluated the effect of two fallow management practices (sheep grazing [Grazing] and no-tilled herbicide application [Chemical] for weed control) and three cropping sequences (continuous spring wheat [CSW], spring wheat-Austrian winter pea/hay barley-fallow (SW-P/HB-F), and continuous alfalfa (CA) on soil surface greenhouse gas.

RESULTS

Soil temperature increased from May to August and then declined while water content responded to substantial precipitation events in May, June, and September. Greenhouse gas fluxes peaked following substantial precipitation during increased temperature. The CO2 flux was greater in the chemical than in the grazing treatment in May and June and greater in CA than in other cropping sequences at most measurement dates. The N2O flux was greater in CSW than in other cropping sequences in May and June. The CH4 flux varied with fallow management at various measurement dates. Total CO2 flux from May to October was greater in CA than in other cropping sequences, regardless of fallow management. Total N2O flux followed the order: CSW>SW-P/HB-F>CA. Total CH4 flux was not influenced by treatments. While enhanced microbial activity due to increased soil temperature and water content probably increased greenhouse gas fluxes, greater root respiration likely increased CO2 flux in CA than in other cropping sequences. Increased N fertilization probably increased N2O flux in CSW than in other cropping sequences. Sheep grazing has minimum effect on greenhouse gas emissions compared with no-tilled herbicide application for weed control.

APPLICATION

Sheep grazing is an inexpensive method of weed and pest control but little is known about its effect on greenhouse gas emissions under dryland cropping systems. (CO2, N2O, and CH4) fluxes and temperature and water content to a depth of 15 cm. These preliminary results indicate that greenhouse gas production is similar when comparing grazing to no till fallow management systems.

MONTANA STATE UNVIERSITY, BOZEMAN, BOZMAN, MT 59717

IMPACT OF SHEEP GRAZING ON DEMOGRAPHIC PARAMETERS OF CHEATGRASS (*BROMUS TECTORUM*) AND WILD OAT (*AVENA FATUA*) IN THREE COMMON MONTANA AGRICULTURAL SYSTEMS

M. Graves, J. Mangold, H. Goosey, P. Hatfield, and F. Menalled

RESEARCH OBJECTIVE

Compare the impact of targeted sheep grazing vs. chemical fallow on weed population dynamics.

RESULTS

Cheatgrass plant densities averaged 43 plants/m2 in the chemical fallow plots compared to 2 plants/m2 in the graze fallow plots by August 10, 2010. Wildoat densities in the graze fallow plots averaged 3 plants/m2 compared to 19 plants/m2 in the chemical fallow plots.

APPLICATION

Targeted sheep grazing provided an effective alternative weed control method for cheatgrass and wild oat in summer fallow of rotational cropping.

MONTANA STATE UNVIERSITY, BOZEMAN, BOZMAN, MT 59717

HYMENOPTERAN PARASITOID RESPONSE TO SHEEP GRAZING, TILLAGE, AND HERBICIDES IN WHEAT-FALLOW ROTATIONS

H. B. Goosey, J. Hatfield, M. G. Rolston, K. M. O'Neill, G. D. Johnson, and P. G. Hatfield

RESEARCH OBJECTIVE

The influence of sheep grazing on beneficial parasitoid insect abundance in a wheat-fallow system has not been investigated. We conducted a preliminary survey of parasitoid abundance in two wheat-fallow cropping systems where weed growth on fallowed land was managed either with conventional tillage, herbicides, or sheep grazing. The objective was to determine if fallow management practice influenced the abundance of Hymenopteran parasitoid located in wheat cropped plots.

RESULTS

Analysis of treatment effect indicates that, during both sampling years, more adult Hymenopteran parasitoids were captured from the Grazed than the Chem fallow system and that, with the exception of 2008 SW-F, captures were also greater in the Grazed over the Mech system. Furthermore, adult parasitoid captures from either WW-F and SW-F systems did not differ between Chem and Mech fallow in either study year.

APPLICATION

Previous research suggests that moderate levels of disturbance produced the greatest insect diversity because disturbances open up new resources for colonists and prevent competitively dominant species from monopolizing resources. Therefore, it is logical to suggest that sheep grazing, as demonstrated in this wheat-fallow system, could be view as a moderately disturbing event with potentially beneficial influences on Hymenopteran parasitoids.

MONTANA STATE UNVIERSITY, BOZEMAN, BOZMAN, MT 59717

SHEEP GRAZING WHEAT SUMMER FALLOW AND THE IMPACT ON SOIL NITROGEN, COMPACTION, MOISTURE, AND CROP YIELD IN A FOUR YEAR STUDY

P. G. Hatfield, H. B. Goosey, and A. W. Lenssen

RESEARCH OBJECTIVE

Compare three methods of summer fallow (sheep grazing, chemical application, and mechanical tillage) and two cropping systems (spring wheat – summer fallow and winter wheat – summer fallow) on soil nitrogen, soil moisture, soil bulk density, and crop yields.

RESULTS

Interactions were not detected for cropping system by summer fallow method. During years in which plots were left fallow, soil moisture and soil nitrogen at 0 to 6, 6 to 12, and 12 to 24 inches was greatest ($P < 0.05$) in chemical fallow plots lowest ($P < 0.05$) in grazed fallow plots and intermediate or not different in mechanical fallow plots. However, during cropped years soil moisture and soil nitrogen did not differ among summer fallow methods at any of the measured depths. The same relationship was noted for soil bulk density with grazed plots having greater ($P < 0.05$) bulk density than either the chemical or mechanical tilled summer fallow plots in fallow years, but no difference among summer fallow methods in cropped years. Grain yield, test weight and grain protein did not differ among fallow treatments. However nitrogen fertilizer application was greater in the grazed than other fallow treatment plots.

APPLICATION

Although summer fallow grazing resulted in increased soil bulk density, differences were mitigated by the over winter freeze and thaw cycle resulting in no impact during the cropped years. Higher levels of nitrogen fertilization were required in the plots that had been previous summer fallow with grazing sheep, because unlike tilled or sprayed plants, grazed plants were still capable of growth. However, yields were maintained with higher levels of fertilization.

TEXAS AGRILIFE RESEARCH, TEXAS A&M SYSTEM, SAN ANGELO, TEXAS 76901

DIVERGENT SELECTION OF GOATS FOR HIGH AND LOW JUNIPER CONSUMPTION - YEAR 9

J. W. Walker, Erika S. Campbell, Charles A. Taylor, Jr., C. J. Lupton and D. F. Waldron

RESEARCH OBJECTIVE

The objective of this research is to selectively breed two different goat breeds, i.e., Angora and meat to create divergent lines in each breed to increase or decrease their genetic potential for consuming juniper. These different lines of goats are involved in experiments to, as my old mentor Hudson Glimp would say, determine "What hath God wrought?" Of course some would contend that Moses should be credited with this saying (Numbers 23:23), I am sure that Hudson would claim to have said it first, but then I digress. Genetic progress requires accurate measurement of the trait that is being selected. The objective of this report is to show short- and long-term variation of percentage juniper in the diet.

RESULTS

Twelve multiparous female Angora goats, average age 3.7 yr (range = 2 to 7) and weight 31.5 kg (SD = 4.2 kg) at the beginning of the study, were used. Goats were selected from a flock of 279 nannies that was in a genetic selection study to create high and low juniper-consuming lines of goats. Based on 4 previous determinations of percentage juniper in their diets that were made between December 2003 and May 2004, half of the goats were selected from the first quartile and half were selected from the fourth quartile. Once selected, these nannies grazed the same 16-ha pasture for the next 24 mo beginning in September 2004, except for periods when they were moved to the drylot for a 21-d period in February 2005 and March 2006 for shearing and a subsequent period to allow regrowth of mohair in a protected environment prior to returning to pasture. Nannies were supplemented with approximately 0.11 kg•d-1 of whole cottonseed for 90 d during both winters. Nannies were not bred throughout the study.

Sampling Procedures. Fecal samples were collected to determine percentage juniper in the diet using near-infrared reflectance spectroscopy (NIRS). Goats were sampled twice weekly on Monday and Thursday when they were on pasture except in February 2005 when they were sampled every other day for a total of 14 collections. To collect fecal samples, nannies were penned in individual 46 x 91 cm pens with expanded metal floors for about 1 h beginning at 0800 h. Fecal samples, about 10 g, were collected from screen bottomed trays located beneath the floor. A potential maximum of 196 samples were collected from each goat during the 24-mo study. Percentage juniper in the diet was determined using fecal NIRS.

The data were divided into 4 sets of contiguous time series that represented 2 paired sets of time series that were paired for the same season and duration in different years. A dormant season time series consisted of observations from October 2004 to January 2005 and a similar set for the 2005 to 2006 season; the two data sets are referred to as Period 1 and 2, respectively. There were 31 observations per animal in each of the Period 1 and 2 time series. A growing season time series consisted of observations from late March through mid September 2005 and a similar set for 2006; the two data sets are referred to as Period 3 and 4, respectively. There were 53 observations per animal in each of the Period 3 and 4 time series. In February 2006, samples were collected every other day for a total of 14 observations/animal. This time series was analyzed to determine if a shorter sampling frequency changed periodicity of detectable frequencies.

Spectral analysis was used to determine the presence and length of cyclic variation in juniper consumption during growing and dormant season periods. An empirical approach was used to determine the best time of year to sample goats to determine the percentage juniper in their diet. An animal's true propensity to consume juniper was considered to be the mean of all observations on an individual animal for the 2-yr study (JCALL). At each sample date, the percentage juniper in the diets of the 12 goats was used to calculate the simple coefficient of determination (r^2) between a 2-date moving average of percentage juniper in the diet of an individual goat at that date and JCALL for the same animal. Thus, each r^2 consisted of 12 data pairs corresponding to the 12 goats in this study.

The average periodograms and spectral ratios for each period in Figure 1 include only goats with significant periodicities. The periodogram for the dormant season (Figure 1a) showed similar patterns for both years and the peak at 9 d indicates that the average cycle length was about 9 d (Figure 1a). There were some differences between the periodograms for 2004 and 2005 (Figure 1b) but these differences occurred after the peaks that represented the important cyclic patterns of variation. Furthermore, the differences between the spectra as indicated by the spectral ratios were primarily due to greater overall variation in 2004 compared to 2005 rather than differences in location of spectral peaks. The periodograms for the growing season (Figure 1c) had a peak between 8 and 7 d for 2005 and 2006, respectively. Similar to the dormant season spectral ratios, differences between the growing season periodograms occurred after the peaks that represented important cyclic patterns (Figure 1d). In February 2006, fecal samples were collected every other day for a total of 14 collections. Spectral analysis of these samples found no animals with significant ($P > 0.13$) cyclic patterns.

The coefficients of determination between 2-sample moving averages and the mean of all samples for an individual animal varied over time (Figure 2). The r^2 was highest for a 3-mo period in the spring both years but began about 2 mo earlier in 2005 (i.e., March) than in 2006 (i.e., May). Coefficients of determination were lower in the fall and winter months as well as July and August of 2005. The correlation of the r^2 and the mean percentage juniper in the goat diets was positive, but low ($r = 0.169$; $P = 0.011$; Figure 2). Figure 2 indicates that the seasonal juniper consumption is most closely related to overall juniper consumption in the spring during the transition between high winter and low spring and summer consumption of juniper. The relationship between juniper consumption during a single month and overall juniper consumption declined once the animals were at the lower level of juniper consumption and when juniper consumption was increasing.

Spectral analysis indicated significant ($P < 0.10$) periodicities for 5, 4, 7 and 9 of the 12 goats in Periods 1, 2, 3, and 4, respectively. Based on the results of the spectral analysis and an estimate of amplitude, the idealized cyclic variation for each period is shown in Figure 3. Variation from peak to trough during a 7- to 9-d cycle was about 50% of the range of the 95% confidence interval for mean juniper consumption across all observations. This indicates that intermediate length cycles are important sources of variation affecting goat diets and their impact on plant communities.

APPLICATION

Consumption of juniper by free-grazing goats had a 7- to 9-d cycle. This indicates that regulation of plant secondary metabolites may occur over a longer time frame than typically has been studied. Sampling schemes must consider this variation to accurately estimate the percentage of a chemically defended plant in a herbivores diet and the optimal sampling scheme in this case was determined to be 2 samples separated by one-half the cycle length. Proper sampling is particularly important when individual animal variation is important as in studies to estimate heritability of dietary preferences. The best season to collect samples to estimate yearlong consumption of juniper was in the spring, even though consumption was highest in the winter.

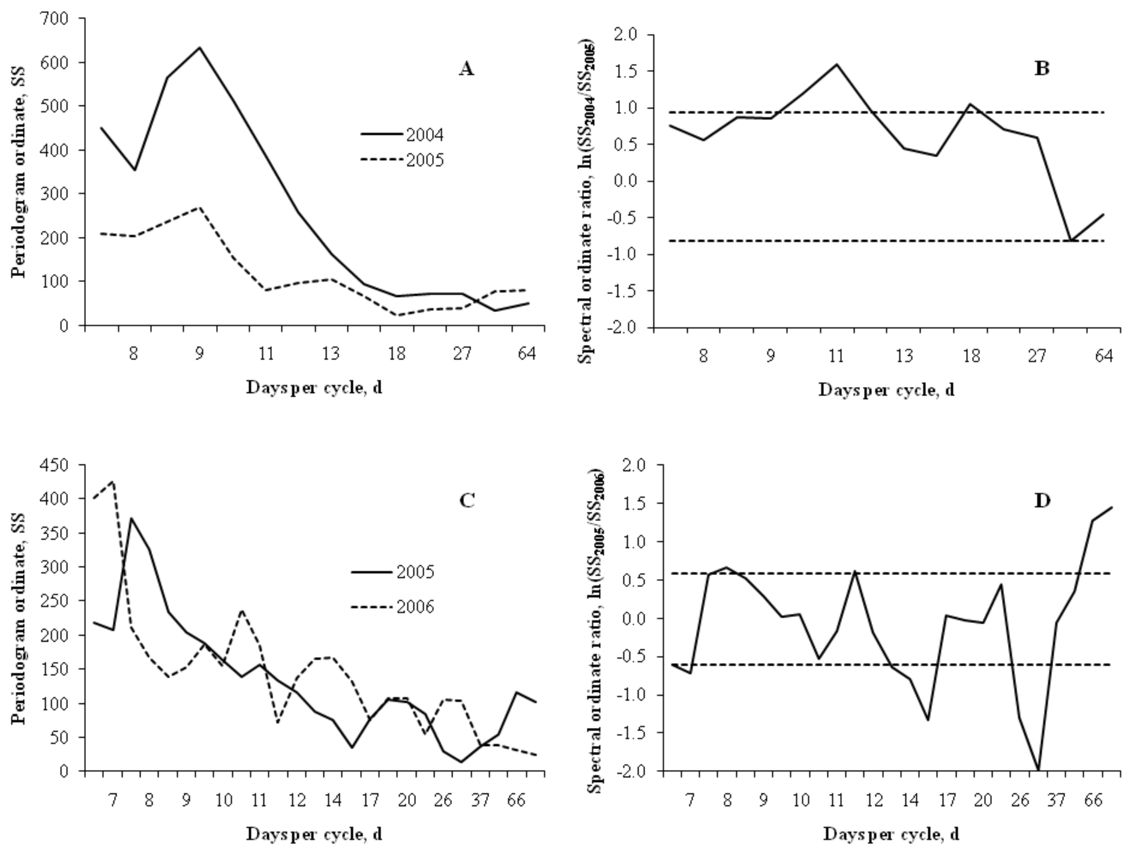

Figure 1. Periodogram ordinates, i.e. sums of squares (SS) in A and C and spectral ratios in B and D for first difference juniper consumption by goats on juniper woodlands for two different periods and years. Dormant season (Oct. – Jan.) periodogram and spectral ratio are shown in A and B, respectively. Growing season (mid Mar. – mid Sept.) periodogram and spectral ratio are shown in C and D, respectively. Dashed lines (-) on B and D represent 95% pointwise tolerance intervals assuming that the spectral ratios for the 2 yr are equal.

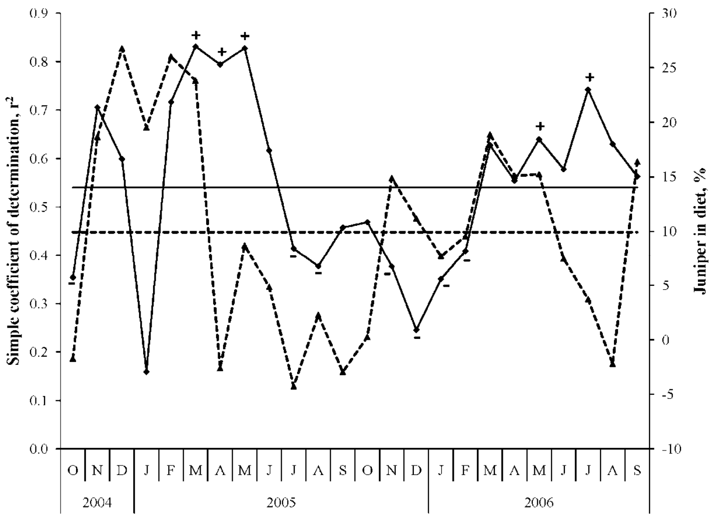

Figure 2. Solid line (——) is the average coefficient of determination (r^2) for each month between the 2-sample moving average value for individual goats and the mean for all of their observations. The solid horizontal line is the average r^2 for all moving averages and + indicates above-average months ($P < 0.05$) and – indicates below average months ($P < 0.05$) . The dashed lines (-) are the monthly average percentage juniper in the diet and the dashed horizontal line is the average percentage juniper in the diet for all months.

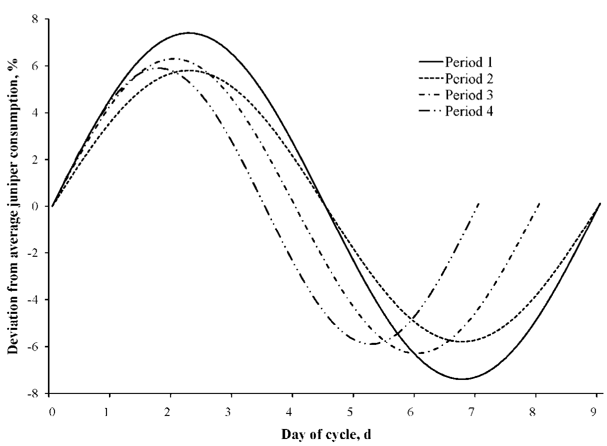

Figure 3. Idealized cyclic variation in juniper consumption by free-grazing goats that had significant ($P < 0.10$) periodograms. Sine curves are based on the major cycle length as determined by spectral analysis and the amplitude of the change between adjacent samples. Periods 1 and 2 were during the dormant season in 2004 and 2005, respectively. Periods 3 and 4 were during the growing season in 2005 and 2006, respectively.

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CHEMICAL COMPOSITION DIFFERS BETWEEN BROWSED AND NON-BROWSED ASHE JUNIPER TREES

R. P. Adams,[1] J. P. Muir,[2] C. A. Taylor, Jr.,[3] and T. R. Whitney[4]

RESEARCH OBJECTIVE

Leaf secondary compound concentrations were examined in browsed and non-browsed *Juniperus ashei* to identify selective browsing patterns by goats and deer.

RESULTS

Analysis of volatile leaf oils (terpenoids) revealed that the browsed trees were lower in total oil than non-browsed trees (2.18 vs. 3.46%, dw basis; Table 1). Extractable and fiber-bound condensed tannins (CT) were not different but protein-bound CT concentrations were greater in browsed trees. Among digestibility measures (NDF, ADF, IVDMD), IVDMD was greater in non-browsed leaves (Table 1). Terpene components analyzed on a percent total oil basis had 3 differences versus 6 highly significant differences on a mg/g dw basis. Clearly the terpenoid components profile differed little between browsed and non-browsed trees (Fig. 2). Total CT are negatively associated with oil yields (Fig. 1). No association was found between crude protein and oil yields or between digestibility (IVDMD, NDF, ADF) and oil yields. The question of whether individual plants or populations may invest less in CT when greater amounts of terpenes are produced (or vice-versa) may have management implications since individual browsers or populations may adapt to consuming or avoiding either CT or terpenes. Browsed tree leaves being less digestible than non-browsed tree leaves may be a result of complex interactions between CT, terpenes, fiber, and nutrients, and warrants further investigation.

APPLICATION

The examination of correlation between CT and oils in Ashe juniper merits further study. The question of whether individual plants or populations may invest less in CT when terpenes are produced (or vice-versa) may have management implications since individual browsers or populations may adapt to consuming or avoiding either CT or terpenes. If this occurs, it begs the question whether plants then reverse their investment in CT or terpenes to adjust to the additional browsing pressure. Browsed tree leaves being less digestible than non-browsed tree leaves may be a result of complex interactions between CT, terpenes, fiber, and nutrients, and warrants further investigation.

Table 1. Comparison leaf oils, condensed tannins (CT) and crude protein (CP) from browsed- and non-browsed *Juniperus ashei*. Terpenoid data were analyzed on both a mg/g DM-basis and on a percentage of total oil basis.

KI[3]	Item[1]	Browsed	Non-browsed	F signif.[2]	Browsed	Non-browsed	F signif.
	% yield (g/100-g DM-basis)	2.18	3.47	19.4***			
	% extractable CT	6.31	6.18	0.69ns			
	% protein-bound CT	2.54	2.20	6.20*			
	% fiber-bound CT	0.21	0.22	0.88ns			
	% total CT	9.06	8.61	0.65ns			
	% CP	6.49	6.25	0.42ns			
	% NDF	34.30	33.65	1.52ns			
	% ADF	23.99	23.50	1.22ns			
	% IVDMD	71.56	74.32	12.62**			
KI[3]	compound	DM-basis, mg/g			Percentage of total oil basis		
926	tricyclene	.76	1.33	10.8**	3.47	3.76	0.7ns
939	α-pinene	.32	.59	7.4*	1.46	1.66	0.9ns
954	camphene	.69	1.24	14.7**	3.21	3.53	1.3ns
979	β-pinene	.02	.04	1.3ns	0.09	0.12	0.8ns
991	myrcene	.42	.93	7.9*	1.87	2.60	3.1ns
1006	δ-3-carene	.10	.04	1.4ns	0.64	0.12	3.4ns
1024	p-cymene	.57	.75	7.7*	2.66	2.18	7.1*
1029	limonene	1.84	3.59	11.2**	8.31	10.41	5.8*
1060	γ-terpinene	.14	.30	5.4*	0.59	0.84	2.4ns
1088	terpinolene	.13	.21	4.7*	0.59	0.60	0.02ns
1102	isopentyl-isovalerate	.08	.12	1.4ns	0.34	0.32	0.04ns
1145	camphor	10.0	15.8	15.3**	46.79	45.49	0.2ns
1149	camphene hydrate	.24	.43	11.1**	1.30	1.26	0.6ns
1169	borneol	.39	.51	1.6ns	1.72	1.52	0.5ns
1217	trans-carveol	.10	.11	0.5ns	0.51	0.43	0.2ns
1242	carvone	.12	.15	1.5ns	0.65	0.52	1.0ns
1289	bornyl acetate	2.7	4.19	3.9ns	11.87	12.33	0.4ns
1550	elemol	.16	.36	12.9**	0.73	1.03	3.3ns
1631	γ-eudesmol	.07	.12	3.7ns	0.33	0.34	0.01ns
1650	β -eudesmol	.06	.09	1.2ns	0.28	0.24	0.3ns
1978	manoyl oxide	.27	.28	0.01ns	1.34	0.83	3.3ns
2242	diterpene,<u>43</u>,91,135,286[4]	.09	.16	6.6*	0.47	0.46	0.01s
2272	diterpene,<u>227</u>,269,43,284	.09	.0.9	0.01ns	0.46	0.28	2.6ns
2282	sempervirol	.34	.32	0.7ns	1.66	1.03	7.8*
2312	abieta-7,13-dien-3-one	.90	1.33	3.0ns	3.91	3.82	0.02ns
2331	trans-ferruginol	.06	.06	0.02ns	0.30	0.19	3.8ns
2343	4-epi-abietol	.10	.12	0.3ns	0.41	0.36	0.2ns
2383	diterpene,<u>135</u>,148,91,286	.06	.09	2.7ns	0.26	0.27	0.01ns

[1] CT assay per Terrill et al. (1992); IVDMD = 48-hr *in vitro* dry matter digestibility; NDF, neutral detergent fiber; ADF, acid detergent fiber.
[2] F test: ns = not significant, > 0.05; * = 0.05; ** = 0.01, *** = 0.001.
[3] KI = Kovats index on DB-5 column. Compositional values < 0.1% were denoted as traces (t).
[4.] major ions listed with base (100%) ion underlined, plus two major ions and the molecular ion.
Trace compounds (< 0.05% total oil) and unidentified components < 0.5% were not reported.

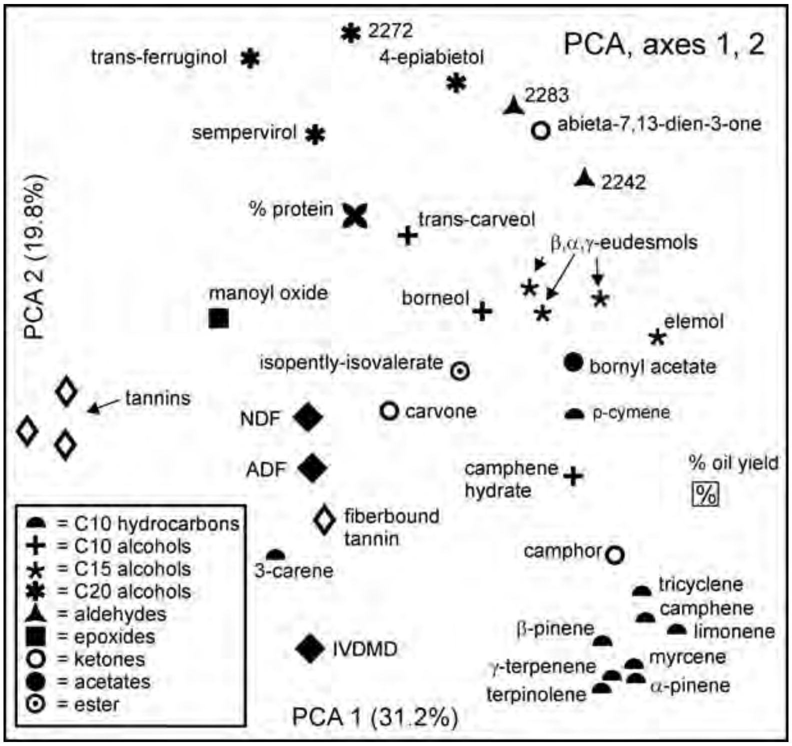

Figure 1. Principal components analysis (PCA) of terpenoids, condensed tannins, and crude protein concentrations. Variance explained by a component is indicated in parenthesis.

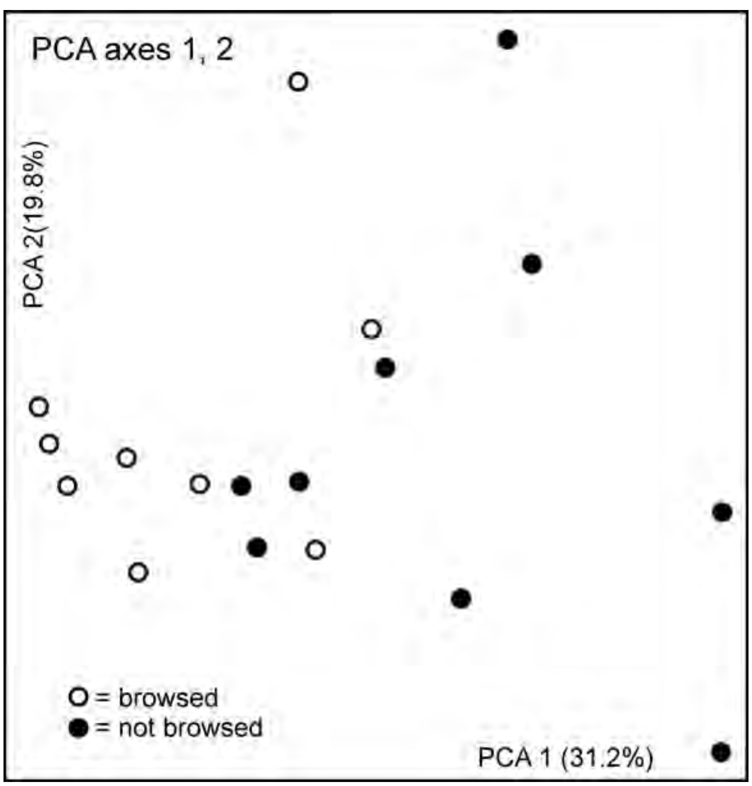

Figure 2. Principal components analysis (PCA) ordination of browsed and not-browsed *J. ashei* trees.

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SAN ANGELO, TEXAS 76901

USE OF THE PENN STATE PARTICLE SEPARATOR TO DETERMINE IF MOLASSES CAN REDUCE SORTING OF GROUND JUNIPER WHEN JUNIPER IS USED AS A FEED INTAKE LIMITER FOR LAMBS

T. R. Whitney, A. E. Lee, M. G. Williamson, C. D. Swening, and R. L. Noland

RESEARCH OBJECTIVE

The Penn State particle separator (PSPS) was used to determine if molasses can reduce sorting of ground juniper when juniper is used as a feed intake limiter for lambs

RESULTS

Rambouillet wether lambs (n = 21) were fed *ad libitum* treatments in the morning that consisted of coarse-ground juniper material, dried distillers grains with solubles (DDGS), and either no water or molasses (CNTL; 50:50:0), water (WAT; 45:45:10), or a 50:50 water:cane molasses solution (MOL; 45:45:10); lambs were fed an *ad libitum* basal pelleted diet in the afternoon (Table 1). Lamb body weight, average daily gain, basal diet and total dry matter intake (DMI), and gain to feed efficiency were similar ($P > 0.17$) among treatments, but DMI of MOL was greater than CNTL ($P < 0.09$, Table 2). Particle size distributions of each treatment and feed refusals were determined by the PSPS, which contains a series of 3 sieves and a solid bottom pan. Treatment × sieve interactions ($P < 0.001$) were observed for g/kg of dry matter (DM) under and retained on sieves and for neutral detergent fiber (aNDF). The WAT and MOL had less ($P < 0.001$) DM under and greater ($P < 0.001$) DM retained on the 8.0- and 1.18-mm sieves than CNTL, suggesting that molasses adhered to small and large juniper particles and DDGS (Table 3). When material > 19.0 mm was excluded from calculations, geometric mean length and standard deviation decreased for all treatments, but MOL had less material in the bottom pan (< 1.18 mm; $P <0.001$) than WAT (Table 4). For treatment refusals, treatment × sieve interactions ($P < 0.04$) were observed for g/kg of DM under and retained on sieves, but g/kg of DM under and retained on the 19.0- and 8.0-mm sieves were similar ($P > 0.10$, Table 5) among treatments. The CNTL and MOL had greater ($P < 0.001$) DM under the 1.18-mm sieve (bottom pan) as compared to WAT, suggesting that lambs sorted WAT more than CNTL or MOL. However, chemical composition of treatment refusals suggested that lambs sorted the treatments at similar extents. The PSPS was effective in determining particle size distribution of diets (Fig. 1) and feed refusals containing coarse-ground woody forage material. Removing coarse-ground juniper material greater than 19-mm from the treatments does not currently seem warranted, but should be considered if it is going to be ground finer and included in non-agglomerated or pelleted diets that reduce or eliminate sorting, respectively.

APPLICATION

The PSPS was effective in determining particle size distribution of diets and feed refusals containing coarse-ground woody forage material. Results indicated that coarse-ground juniper can restrict feed intake and that the level of restriction depends on addition of water or a water:molasses solution to the feed. Both water and water:molasses solution increased adherence of fine particles and DDGS to the juniper material. Removing the top sieve material (> 19.0 mm) from the calculations reduced geometric mean length and standard deviation of all treatments.

Particle separation results of feed refusals also suggested that lambs sorted WAT more than CNTL or MOL. However, chemical composition of treatment refusals suggested that a limited amount of sorting occurred. Removing coarse-ground juniper material that is greater than 19.0-mm does not seem warranted unless this material is going to be ground finer and included in non-agglomerated or pelleted diets that reduce or eliminate sorting, respectively; in this case, removing large stem material would likely increase the beneficial nutrient characteristics of juniper, e.g. greater CP and less NDF and ADF concentrations. Further research is warranted to evaluate these treatments in a rangeland production system and to determine level of supplement intake using DDGS and coarse- or fine-ground juniper at various concentrations.

Table 1. Ingredients of treatments and chemical composition (g/kg dry matter; DM) of basal diet, dried distillers grains with solubles (DDGS), juniper forage, treatments, and various particle sizes.

				Treatment[a]		
Item[b]	Basal	DDGS	Juniper	CNTL	WAT	MOL
Ingredient						
Juniper forage				500	450	450
DDGS				500	450	450
Water				-	100	-
Molasses and water (50:50)				-	-	100
DM	921	948	940	924	890	909
CP	179	268	48	139	146	143
ADF	187	127	459	305	269	283
aNDF	303	373	540	478	449	439
Crude fat		86	34	72	73	66
Ash	68	43	48	47	43	50
NFC		273	378	311	332	352
Particle size distribution						
$DM_{>19.0\ mm}$			903	932	943	926
$DM_{19.0\ to\ 8.0\ mm}$			907	923	904	900
$DM_{8.0\ to\ 1.18\ mm}$			914	936	913	909
$DM_{<1.18\ mm}$			899	950	912	898
$DM_{>1.18\ mm}$			937			
$DM_{19\ to\ 1.18\ mm}$			936			
$CP_{>19.0\ mm}$			33	27	38	40
$CP_{19.0\ to\ 8.0\ mm}$			35	41	77	82
$CP_{8.0\ to\ 1.18\ mm}$			63	110	129	130
$CP_{<1.18\ mm}$			94	255	254	249
$CP_{>1.18\ mm}$			54			
$CP_{19.0\ to\ 1.18\ mm}$			55			
$ADF_{>19.0\ mm}$			619	629	572	588
$ADF_{19.0\ to\ 8.0\ mm}$			559	512	435	398
$ADF_{8.0\ to\ 1.18\ mm}$			362	323	262	256
$ADF_{<1.18\ mm}$			366	174	154	166
$ADF_{>1.18\ mm}$			489			
$ADF_{19.0\ to\ 1.18\ mm}$			418			
$aNDF_{>19.0\ mm}$			739	743	706	696
$aNDF_{19.0\ to\ 8.0\ mm}$			684	612	542	519
$aNDF_{8.0\ to\ 1.18\ mm}$			443	424	389	359
$aNDF_{<1.18\ mm}$			455	370	387	361

aNDF$_{>1.18\text{ mm}}$	522			
aNDF$_{19.0\text{ to }1.18\text{ mm}}$	496			
Crude fat$_{>19.0\text{ mm}}$	16			
Crude fat$_{19.0\text{ to }8.0\text{ mm}}$	21			
Crude fat$_{8.0\text{ to }1.18\text{ mm}}$	53			
Crude fat$_{<1.18\text{ mm}}$	39			
Crude fat$_{>1.18\text{ mm}}$	42			
Crude fat$_{19.0\text{ to }1.18\text{ mm}}$	42			
Ash$_{>19.0\text{ mm}}$	35	18	27	18
Ash$_{19.0\text{ to }8.0\text{ mm}}$	39	42	48	43
Ash$_{8.0\text{ to }1.18\text{ mm}}$	57	48	46	55
Ash$_{<1.18\text{ mm}}$	47	43	49	49
Ash$_{>1.18\text{ mm}}$	45			
Ash$_{19.0\text{ to }1.18\text{ mm}}$	48			

[a] Treatments consisted of coarse-ground juniper leaves and stems and DDGS containing either no water or molasses (CNTL), water (WAT), or a 50:50 solution of cane molasses and water (MOL).
[b] Juniper forage consisted of ground juniper leaves and stems (pre-harvest stem diameter <3.6 cm) dried to approximately 920 g/kg DM. CP=crude protein; ADF=acid detergent fiber; aNDF=neutral detergent fiber assayed with a heat stable amylase and expressed inclusive of residual ash; NFC=Nonfibrous carbohydrates=DM–CP–crude fat–ash–aNDFom) according to Mertens (2002). Particle size distribution determined by using the Penn State Particle Separator sieving technique.

Table 2. Effects of adding water or molasses to ground juniper forage and dried distillers grains with solubles (DDGS) on lamb performance[a].

	Treatment[b]				*P*-value[c]		
Item[d]	CNTL	WAT	MOL	SEM[e]	t	d	t × d
Initial BW, kg	43.8	43.8	42.9	1.7	0.97	<0.001	0.09
Final BW, kg	50.6	50.8	52.0	1.8	0.97	<0.001	0.09
ADG, kg	0.24	0.26	0.32	0.03	0.21	0.003	0.20
Treatment DMI, kg	0.094[b]	0.107[ab]	0.197[a]	0.038	0.09	0.02	0.81
Basal diet DMI, kg	1.466	1.502	1.479	0.079	0.95	<0.001	0.91
Total DMI, kg	1.559	1.609	1.676	0.097	0.70	<0.001	0.86
G:F, kg/kg	0.16	0.16	0.20	0.02	0.18	<0.001	0.13

[a] Means within a row without a common superscript differ ($P<0.10$).
[b] Treatments consisted of coarse-ground juniper leaves and stems and DDGS containing either no water or molasses (CNTL; 50:50), water (WAT; 45:45:10), or a 50:50 solution of cane molasses and water (MOL; 45:45:10). Water (68 mL) or water-molasses solution (56 mL) was sprayed onto the juniper and DDGS mixture using a hand-pump sprayer and then mixed by hand.
[c] t =treatment; d=day
[d] BW=body weight; ADG=average daily gain; DMI=dry matter intake; G:F=gain to feed ratio
[e] Standard error of the means.

Table 3. Particle size distribution, physical effectiveness factor (pef), and physically effective aNDF (peNDF) of treatments[a].

Item[d]	CNTL	WAT	MOL	SEM[e]	t	s	t × s
	Treatment[b]				P-value[c]		
DM under sieve, g/kg DM					<0.001	<0.001	<0.001
19.0 mm	944[1]	940[1]	935[1]	4.2	0.33		
8.0 mm	841[a,2]	810[b,2]	798[b,2]	6.8	<0.001		
1.18 mm	491[a,3]	418[b,3]	400[b,3]	7.3	<0.001		
SEM[e]	4.1	6.8	7.3				
DM retained, g/kg DM					0.09	<0.001	<0.001
>19.0 mm	55.8[4]	60.5[3]	64.8[3]	4.2	0.41		
19.0 to 8.0 mm	103.0[a,3]	129.3[b,2]	137.0[b,2]	3.6	<0.001		
8.0 to 1.18 mm	350.2[a,2]	392.2[b,1]	398.5[b,1]	5.0	<0.001		
<1.18 mm	491.0[a,1]	418.0[b,1]	399.8[b,1]	7.3	<0.001		
SEM[e]	4.1	5.7	5.6				
$X_{gm\ tot}$, mm	2.4[b]	2.8[a]	2.9[a]	0.1	<0.001		
$S_{gm\ tot}$, mm	3.4	3.5	3.6	0.1	0.07		
$aNDF_{tot}$, g/kg of total DM					<0.001	<0.001	<0.001
>19.0 mm,	42.0[4]	43.0[3]	45.0[3]	3.0	0.68		
19.0 to 8.0 mm	63.0[b,3]	70.0[a,2]	71.0[a,2]	2.0	0.008		
8.0 to 1.18 mm	149.0[a,b,2]	153.0[a,1]	143.0[b,1]	2.0	0.005		
<1.18 mm	182.0[a,1]	162.0[b,1]	144.0[c,1]	3.0	<0.001		
SEM[e]	2.0	3.0	3.0				
$pef_{>1.18\ mm}$	0.51[b]	0.58[a]	0.60[a]	0.01	<0.001		
$peNDF_{>1.18\ mm}$, g/kg DM	253.0	265.0	259.0	4.0	0.12		

[a] Means within a row (a,b,c) or column (1,2,3,4) without a common superscript differ ($P<0.05$).
[b] Treatments consisted of coarse-ground juniper leaves and stems and DDGS containing either no water or molasses (CNTL; 50:50), water (WAT; 45:45:10), or a 50:50 solution of cane molasses and water (MOL; 45:45:10). Water (68 mL) or water-molasses solution (56 mL) was sprayed onto the juniper and DDGS mixture using a hand-pump sprayer and then mixed by hand.
[c] Main effects. t =treatment; s=sieve
[d] DM=dry matter; $X_{gm\ tot}$, mm and $S_{gm\ tot}$, mm=geometric mean length and standard deviation, respectively, as calculated by the ASAE standard (2001); $aNDF_{tot}$ = (aNDF of each sieve and bottom pan, g)/(DM of all material, g)*100; $pef_{>1.18}$ measured as the proportion of DM retained above the 1.18 mm-sieve; $peNDF_{>1.18\ mm}$=estimated by summing the pef aNDF content of each fraction of particles retained on the relative sieve. Particle size distribution determined by using the Penn State Particle Separator sieving technique.
[e] Standard error of the means.

Table 4. Particle size distribution, physical effectiveness factor (pef), and physically effective aNDF (peNDF) of treatment material less than 19.0 mm[a].

	Treatment[b]				P-value[c]		
Item[d]	CNTL	WAT	MOL	SEM[e]	t	s	t × s
DM under sieve, g/kg DM					<0.001	<0.001	<0.001
8.0 mm	891[a,1]	862[b,1]	853[b,1]	4.2	<0.001		
1.18 mm	520[a,2]	445[b,2]	427[b,2]	6.7	<0.001		
SEM[e]	4	7	6				
DM retained, g/kg DM					0.06	<0.001	<0.001
19.0 to 8.0 mm	109.1[b,3]	137.8[a,3]	146.8[a,2]	4.2	<0.001		
8.0 to 1.18 mm	370.9[b,2]	417.6[a,2]	425.9[a,1]	4.9	<0.001		
<1.18 mm	520.1[a,1]	444.6[b,1]	427.3[b,1]	6.7	<0.001		
SEM[e]	4.4	6.2	5.3				
$X_{gm\ <19.0\ mm}$, mm	1.93[b]	2.24[a]	2.33[a]	0.03	<0.001		
$S_{gm\ <19.0\ mm}$, mm	2.58[b]	2.63[a]	2.64[a]	0.01	<0.001		
aNDF $_{<19.0\ mm}$, , g/kg of total DM					<0.001	<0.001	<0.001
19.0 to 8.0 mm	67[b,3]	75[a,2]	76[a,2]	2	0.008		
8.0 to 1.18 mm	157[a,b,2]	163[a,1]	153[b,1]	2	0.004		
<1.18 mm	192[a,1]	172[b,1]	154[c,]1	3	<0.001		
SEM[e]	2	3	3				
pef $_{19.0\ to\ 1.18\ mm}$	0.50[b]	0.56[a]	0.57[a]	0.01	<0.001		
peNDF $_{19.0\ to\ 1.18\ mm}$, g/kg DM	224[b]	237[a]	229[a,b]	3	0.01		

[a] Means within a row (a,b,c) or column (1,2,3) without a common superscript differ (P<0.05).
[b] Treatments consisted of coarse-ground juniper leaves and stems and DDGS containing either no water or molasses (CNTL; 50:50), water (WAT; 45:45:10), or a 50:50 solution of cane molasses and water (MOL; 45:45:10). Water (68 mL) or water-molasses solution (56 mL) was sprayed onto the juniper and DDGS mixture using a hand-pump sprayer and then mixed by hand.
[c] Main effects. t =treatment; s=sieve
[d] DM=dry matter; $X_{gm\ <19.0\ mm}$, mm and $S_{gm\ <19.0\ mm}$, mm=geometric mean length and standard deviation, respectively, as calculated by the ASAE standard (2001); aNDF $_{<19\ mm}$=(aNDF 19.0 to 8.0 and 8.0 to 1.18 sieves and bottom pan, g)/(DM of all material, g)*100; pef $_{19.0\ to\ 1.18}$ measured as the proportion of DM retained above the 1.18 mm-sieve, but excluding the 19.0-mm sieve material; peNDF $_{19.0\ to\ 1.18\ mm}$=estimated by summing the pef aNDF content of each fraction of particles retained on the relative sieve. Particle size distribution determined by using the Penn State Particle Separator sieving technique.
[e] Standard error of the means.

Table 5. Particle size distribution of treatment refusals[a]

	Treatment[b]				*P*-value[c]		
Item[d]	CNTL	WAT	MOL	SEM[e]	t	s	t × s
DM under sieve, g/kg							
DM					<0.001	<0.001	0.03
19.0 mm	937[1]	928[1]	934[1]	6	0.47		
8.0 mm	826[2]	802[2]	815[2]	10	0.22		
1.18 mm	492[a,3]	440[b,3]	468[a,3]	8	<0.001		
SEM[e]	8	10	6				
DM retained, g/kg							
DM					0.5	<0.001	<0.001
> 19.0 mm	63[4]	73[4]	66[4]	6	0.32		
19.0 to 8.0 mm	111[3]	126[3]	119[3]	5	0.09		
8.0 to 1.18 mm	335[b,2]	362[a,2]	348[a,b,2]	6	0.008		
< 1.18 mm	492[a,1]	440[b,1]	468[a,1]	8	<0.001		
SEM[e]	6	7	6				
X_{gm}, mm	2.5	2.8	2.6	0.1	0.13		
S_{gm}, mm	3.4[b]	3.6[a]	3.6[a]	0.1	0.02		

[a] Means within a row (a,b) or column (1,2,3,4) without a common superscript differ (P<0.05).
[b] Treatments consisted of coarse-ground juniper leaves and stems and DDGS containing either no water or molasses (CNTL; 50:50), water (WAT; 45:45:10), or a 50:50 solution of cane molasses and water (MOL; 45:45:10). Water (68 mL) or water-molasses solution (56 mL) was sprayed onto the juniper and DDGS mixture using a hand-pump sprayer and then mixed by hand.
[c] Main effects. t =treatment; s=sieve
[d] DM=dry matter; X_{gm}, mm and S_{gm}, mm=geometric mean length and standard deviation, respectively, as calculated by the ASAE standard (2001). Particle size distribution determined by using the Penn State Particle Separator sieving technique.
[e] Standard error of the means.

Fig. 1. Particle distribution of material separated by the Penn State particle separator. From left to right: material remaining on 19.0-, 8.0-, and 1.18-mm sieves, and in the bottom pan (<1.18 mm). Average particle length of material remaining on the top sieve (>19.0 mm) were measured manually and used as the geometric mean length because stem material on the top sieve was greater than 10 g/kg of total sample mass (ASAE #S424; 2007).

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SUPPLEMENTS CONTAINING ESCAPE PROTEIN IMPROVE REDBERRY JUNIPER INTAKE BY GOATS

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RESEARCH OBJECTIVE

To determine if: (1) protein sources high in escape protein (cottonseed meal and dried distillers grains) would improve juniper consumption over protein sources that are highly degradable in the rumen and (2) protein sources high in sulfur-containing amino acids (SBM) aid in detoxification of monoterpenoids and improve juniper consumption.

RESULTS

Redberry juniper (Juniperus pinchotii Sudw.) is a common invasive plant species in west central Texas. Goats will consume redberry juniper, but intake is limited by monoterpenoids found in the plant. Previous research has shown that goats will increase juniper intake through (1) conditioning and (2) protein supplementation. This study compared intake of juniper when goats received different protein supplements, either with or without protein sources that are high in amino acids that escape digestion in the rumen. Recently weaned Boer-cross goats (n = 47) were randomly placed into 5 treatments. Treatments 1, 2, 3 and 4 received a protein supplement and juniper for 1 hour daily for 14 days, along with a basal diet of alfalfa pellets (2% BW). Treatment 5 received only a basal diet of alfalfa pellets and juniper. All supplements were formulated to be isonitrogenous (37% CP; Table 1). Treatment 1 contained cottonseed meal (high CP escape value); Treatment 2 contained cottonseed meal and dried distillers grains (DDG, higher CP escape value); Treatment 3 contained soybean meal (low CP escape value), and Treatment 4 contained soybean meal and DDG (moderate CP escape value; Table 2). Refusals of juniper, supplements, and alfalfa were weighed daily to determine intake. Supplementation with (1) cottonseed meal, (2) soybean meal, or (3) soybean meal and DDG did not influence ($P > 0.05$; Table 3) juniper intake. Conversely, goats supplemented with cottonseed meal and DDG ate more ($P < 0.05$) juniper than goats only receiving alfalfa, possibly due to increased escape of glucogenic amino acids. We contend that supplementation with feeds high in protein escape values should increase juniper intake on rangelands.

APPLICATION

Winter protein supplementation is often implemented by landowners throughout the southwestern U.S. Supplementation costs continue to rise as feed ingredients (e.g. corn and soybean meal) are used for biofuel production. For livestock enterprises to remain viable, alternative supplements must be identified. Distiller’s dried grains are a readily available byproduct of ethanol production. When incorporated in protein supplements, they seem to provide a source of amino acids that apparently escape rumen digestion and improve juniper consumption. Based on the results of this study, we recommend including DDG in traditional CSM-based supplements for winter supplementation of goats foraging on juniper dominated rangelands.

Table 1. Ingredients (%) and nutritional value (%) of protein supplements.

Ingredients	Supplement (Treatment) 1	2	3	4
CSM	88.7	77.5	--	--
SBM	--	--	78.7	63.1
DDG	--	16.2	--	26.7
Molasses, cane	3.4	3.4	3.4	3.4
Rice bran	7.5	2.5	17.5	6.5
Trace mineral	0.02	0.02	0.02	0.02
Vitamin ADE	0.3	0.3	0.3	0.3
TDN	70.2	72.3	73.8	76.6
Protein	37.3	36	39.6	37.3
DE (Mcal kg^{-1})	5.68	5.54	8.15	7.43

[a]All percentages based on 909.1 kg

Table 2. True *in vitro* dry matter digestibility, potential undegradable intake protein(UIP), and acid detergent insoluble crude protein[a](ADICP).

Item[b]	Treatment ALF	CSM	CSM/DDG	SBM	SBM/DDG
24-hr					
tIVDMD	61.44	80.60	79.22	90.38	87.52
UIP, % initial DM	**4.45**	**2.76**	**3.65**	**1.44**	**2.22**
dCP, % initial DM	16.35	36.68	35.95	39.16	37.54
ADICP, % initial DM	2.57	3.69	6.58	1.87	2.57
ADICP, % initial CP	12.36	9.29	16.61	4.61	6.36
48-hr					
tIVDMD	69.07	83.72	84.60	94.20	92.20
UIP, % initial DM	**3.33**	**2.48**	**2.87**	**0.67**	**1.43**
dCP, % initial DM	17.47	37.22	36.73	39.93	38.98
ADICP, % initial DM	2.18	3.89	4.09	1.66	3.07
ADICP, % initial CP	10.48	9.79	10.33	4.09	7.59

[a]True *in vitro* dry matter digestibility (tIVDMD), potential undegradable intake protein (UIP), and acid detergent insoluble crude protein (ACDICP).

[b] 24- and 48-hr = digested for 24 or 48 hr, washed, and rinsed with neutral detergent solution.

Table 3. Average intake of alfalfa, protein, and juniper for treatments receiving different protein supplements[a].

Supplement	Intake: Alfalfa (g kg^{-1} BW)	Protein (g^{-1} hd^{-1}day)	Juniper (g kg^{-1} BW)
CSM	17.8$\pm$1.3	4.4$\pm$0.3	1.5$\pm$0.5
CSM/DDG	20.5$\pm$1.3	4.7$\pm$0.3	2.6$\pm$0.5
SBM	18.1$\pm$1.3	4.3$\pm$0.3	1.5$\pm$0.5
SBM/DDG	19.7$\pm$1.3	4.5$\pm$0.2	1.4$\pm$0.5
Alfalfa	22.9$\pm$1.3	4.0$\pm$0.2	0.9$\pm$0.5

[a]All supplements were isonitrogenious (37%)

OBJECTIVE 2

Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products by: a) improving biological efficiency through better understanding of environmental and genetic events that influence meat and fiber production; b) identifying unique feedstuffs that enhance the nutritional value of meat; c) utilizing state-of-the-art instrumentation both in the field and in the lab to accurately and rapidly measure important characteristics of wool, mohair, and cashmere; and d) developing animal identification systems that ensure the accurate real-time linking of animals to lifetime genetic, performance, health, and origin databases.

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THERMOGENESIS, BLOOD METABOLITES AND HORMONES, AND GROWTH OF LAMBS BORN TO EWES SUPPLEMENTED WITH DOCOSAHEXAENOIC ACID

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RESEARCH OBJECTIVE

Our objective was to determine the effects of feeding algae derived docosahexaenoic acid (DHA) to ewes during late gestation and early lactation on lamb thermogenesis, serum metabolites and hormones, and post-natal growth.

RESULTS

Lamb rectal temperature, glucose, NEFA, cortisol, leptin, and birth weights did not differ between treatments. Body weight at 38 d was greater ($P = 0.03$) for lambs born to Control ewes than for lambs born to Algae-supplemented ewes; however, the colostrum of Algae-supplemented ewes had a greater specific gravity ($P = 0.05$) than for Control ewes indicating a potential higher IgG concentration.

APPLICATION

Despite a potentially positive effect on ewe colostral IgG concentrations, supplementation of DHA during late gestation and early lactation had a negative effect on lamb BW and did not affect indices of lamb thermogenesis.

Objective 2. Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products by: a) ***improving biological efficiency through better understanding of environmental and genetic events that influence meat and fiber production; c) utilizing state-of-the-art instrumentation both in the field and in the lab to accurately and rapidly measure important characteristics of wool, mohair, and cashmere.***

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A COMPARISON BETWEEN TEXAS RAMBOUILLET SHEEP AND MERINO F1 CROSSES - YEAR 4

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RESEARCH OBJECTIVE

The objective of this research is to increase income from fine-wool ewes maintained on rangeland by increasing wool production and improving wool quality without causing a reduction in lamb production and without incurring increased inputs in the form of labor or nutrition. To this end, we are evaluating a crossbreeding strategy using imported Merino sires and local Rambouillet ewes to produce smooth-bodied offspring that are well adapted to western ranges.

RESULTS

For 3 yr, commercial Rambouillet (R) ewes (2-7 yr of age, average fiber diameter [AFD] = 21.3 ± 2.1 μm) were bred to selected Australian and U.S. Merino (M) rams either via laparoscopic artificial insemination (LAI) or naturally (yr 3 only). Contemporary Rambouillet lambs were produced by exposing R ewes to highly productive, performance-tested R rams for 3 wk prior to and 3 wk after the LAI date. In years 3 and 4, ewes born into the program in 2007 and 2009 were exposed to Rambouillet rams only. The number of ewes bred and sires used are summarized in Table 1. The BW, number, and genotype of lambs weaned are listed in Table 2 and reflect the relatively low numbers of lambs we have been able to raise so far in this program. In year 1, lambs were born and raised under range conditions and paternity was confirmed by DNA analysis of blood. To avoid predation losses and the necessity of DNA testing, ewes were shed-lambed in subsequent years. Lambs were weighed at weaning and as yearlings and ewes were weighed at breeding. Shorn fleeces were weighed and the weights adjusted to 365 days. Whole fleeces were measured for clean yield, average fiber diameter (AFD), average fiber curvature (AFC), and comfort factor (CF) using the OFDA 100, and manually for average staple length (ASL). Fiber characteristics (AFD, CVFD, ASL, and AFC) were also determined on mid-side samples using an OFDA2000 instrument. In addition, weaned lamb and fleece monetary values were calculated using the appropriate USDA and AWEX data. To date, data have been analyzed each year using PROC MIXED of SAS. The model included fixed effects of genotype and sex and a random effect of sire within genotype. Partial data obtained from ewes that were bred to lamb and were shorn in the spring of 2011 are summarized in Tables 3 and 4. These means were obtained using the GLM procedure of SAS to determine the effects of genotype and year of birth on the reported traits. These mean values and particularly trends are similar to those observed in earlier years. However, it is already apparent that year is a major factor influencing most of the variables measured or calculated.

APPLICATION

This evaluation is likely of most interest to range producers of fine-wool sheep. We are continuing to evaluate the strategy that was designed to produce crossbred sheep capable of growing significantly more and finer wool than their dams without additional inputs or decreased lamb production. The M X R sheep have consistently produced finer wool than their R counterparts and in a range (less than 18.6 microns) that has had a very significant effect on fleece value. However, the expected increase in fiber production due to the infusion of Merino genetics has not been observed. To date, differences in pounds of lamb weaned and ewe and ram BW have been similar. However, the R appears to have the edge at this time. No doubt lamb and wool production have been negatively influenced by prevailing conditions (including predation, drought, excessive cold, and problems with ram preference and libido) during the study. But most of these effects were experienced equally by the 2 genotypes. It would be interesting to see how the sheep would perform in a "good" year.

Table 1. Breeding time, and number of ewes and sires used by year

	No. ewes bred to Merino sires		No. ewes bred to Rambouillet sires	No. Merino sires		No. Rambouillet sires
Date bred	LAI	Natural	Natural	LAI	Natural	
June 2007	187	0	115	5	0	4
October 2008	220	0	120	3	0	4
October 2009	68	120	120	5	4	4
October 2010	0	0	99	0	0	8

Table 2. Weight, kg (and number) of lambs weaned by sex, genotype, and year

	Female		Male	
Lambing date	MXR	R	MXR	R
October, 2007	26.0 (25)	27.5 (20)	29.3 (22)	30.7 (24)
March, 2009	29.3 (32)	30.5 (30)	36.6 (48)	35.6 (47)
March, 2010	25.0[b] (53)	28.1[a] (64)	27.0 (46)	28.3 (48)

Table 3. 2011 Bodyweight, lamb, fleece, and fiber data for ewes born into the program

Dependant variable	Genotype: M X R (n = 109)	Genotype: R (n = 109)	Year born: 2007 (n = 39)	Year born: 2009 (n = 61)	Year born: 2010 (n=118)
BW, kg (at breeding)	47.3	50.0	53.4a	45.4b	32.8c (not bred)
NLB	.61	.45	.69	.44	-
NLW	.54	.41	.67	.36	-
12 mo, whole fleece					
ADJGFW, kg	3.55[a]	3.35b	4.03a	4.00a	2.97b
OFDA2000 data					
AFD, µm	18.3[b]	19.1a	19.2a	19.0a	18.4b
CVFD, %	15.3	15.4	14.7b	15.6 a	15.4a
CF, %	99.8[a]	99.6b	99.6ab	99.5b	99.8a
ASL, mm	81.3	77.9	83.1a	83.6a	76.6b
AFC, deg/mm	73.4[b]	85.2a	82.2	81.9	77.3

[a, b, c] For genotype and year born, means within a row having different superscripts differ ($P < 0.05$).
Key to abbreviations:
BW = body weight at breeding (October, 2010); NLB = number of lambs born per ewe exposed; NLW = number of lambs per ewe at 6 wk of age; ADJGFW = grease fleece weight adjusted to 365 d; AFD = average fiber diameter; CVFD = coefficient of variation of fiber diameter; CF = comfort factor (% fibers < or = to 30 :m); ASL = average staple length; AFC = average fiber curvature.

Table 4. Current ewe wool market value

Dependant variable	Genotype: M X R (n = 109)	Genotype: R (n = 109)
ADJGFW, kg	3.55	3.35
ADJGFW, lb	7.83	7.39
$/lb greasy (May 10, 2011)	4.93	3.96
Fleece value, US$	38.60	29.26

Objective 2. Develop sheep and goat management strategies that enhance the efficiency for production of high quality marketable end products.

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NATIONAL SHEEP QUALITY AUDIT

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RESEARCH OBJECTIVE

1. Investigate, document and summarize the quality defects as they relate to meat, wool and the dairy industry.
2. Educate producers, feeders, packers and processors on quality defects and progress made since the 1992 audit.
3. Provide information to the Sheep Safety and Quality Assurance (SSQA) program.

RESULTS

The 1992 National Sheep Quality Audit revealed that lamb carcasses were too fat and significant losses occurred due to bruising and pelt defects.

The 2007/2008 audit revealed dramatic increases in quality in several areas, including the reduced incidence of carcass bruising and a decrease in excessively fat lambs. Wool contamination has been a continuing problem from 1992-2007. The introduction of hair sheep between audits has caused great concern among wool industry leaders.

The 2000 National Beef Audit shows that the road to improvement is a continuous process. Producer education, even in a small industry, requires constant attention. In some cases the dissemination of information throughout the production chain is more effective. For the most part many producers, feeders, packers and purveyors are closely linked in terms of operational efficiencies and communication between these levels has increased significantly.

Sources of lamb included local sale barn, private treaty from area producers, own operation, order buyers, and home raised. Results from the lamb feeder questionnaire indicate that feeders are concerned about genetics and health, as defects that cause quality issues. Seasonal supply in several face-to-face interviews with feeders and packers was of high concern. Typical early to mid-summer supply shortage affect not only cutability but quality grade. The questionnaire also asked for unsolicited comments about which quality defects could be corrected and by whom. A significant number of feeders indicated that producers need to supply lambs that are preconditioned that is vaccinated and wormed when necessary. Any feeders that had purchased or fed hair sheep had concerns with quality, primarily in terms of muscling. Seasonal supply of lambs to feeders was a constant quality concern of practically all lamb feeders interviewed. In order to supply lambs each and every week throughout the year feeders must manage accordingly, which causes variation in size and weight, excessive yield grades and in some cases penalties for excessive age. Feeders also high value lambs supplied by producers that have the genetics to grow and develop and are feed efficient. Feeders also note the extreme regional differences in feeder lamb supply. Lamb from the NW has earned the reputation for needing internal parasite treatment while lambs from the southern part of the country are hard to start on feed and tend to exhibit a slower growth pattern. Mud management and the potential quality issues with pelts were of concern. Mud and manure issues have been resolved to some degree with bedding during wet periods and proper management of manure within the pens. One feeder stated "what are worse than fat lambs are no lambs at all."

Both face-to-face interviews and questionnaires were used to generate feedback. The Face-to-Face interviews (Table 1) shows lamb feeders in five states; Colorado, Wyoming, South Dakota, Iowa and New Mexico. Face-to-face interviews with packers/purveyors (Table 2) were conducted with packers/purveyors that process over 80% of the slaughter volume and 60% of the purveyor volume. The five top concerns of wool quality audit (Table 3) shows the concerns of contamination in the wool by packers/purveyors.

APPLICATION

Sheep Quality Audit results have been used in producer meetings, sheep schools, and National Sheep Quality Assurance education.

Table 1. Face-to-Face Feeder Concerns

1. Seasonal supply of lambs
2. Quality of lamb supply – genetics
3. Lamb health including internal and external parasites
4. Freight costs
5. Grid-based marketing – when weight still dictates price

Table 2. Quality Assurance Issues with Lamb Processors

1. Seasonal supply
2. Excessive fat
3. Shelf life
4. Age discounts
5. Inconsistent USDA grading

Table 3. Five Top Concerns of Wool Quality Audit

1. Polypropylene contamination
2. Hair sheep contamination
3. Black fibers
4. Packaging
5. Fiber variability – strength

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EVALUATING GLYCERIN SUPPLEMENTATION ON REPRODUCTIVE PERFORMANCE OF SHEEP

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RESEARCH OBJECTIVE

The objective of this study was to determine the effect of glycerol supplementation on ewe reproductive efficiency, glucose and insulin blood concentrations.

RESULTS

Two hundred twenty-five mature crossbred Polypay (year 1, n = 75) and Rambouillet (years 2, n = 75 and 3, n = 75) May lambing ewes were stratified by weight. Ewes were orally dosed with glycerin following estrus synchronization at rates of 0, 50, 100, 200 or 300 g/hd. In year 3 an additional 16 ewes were supplemented (SUP) with 0.57 kg of range cake for 21 days prior to breeding. Blood samples were collected (n = 25 ewes) for 10 hours post-drenching. Blood was analyzed for insulin and glucose concentrations. Ewes were exposed to rams for 35 days. Pregnancy was determined by ultrasonography evaluation.

Number of lambs born per ewe exposed was not different ($P > 0.10$) between treatments (TRT) in year 1 and 2. Pregnancy rates were not different ($P = 0.55$) by TRT in year 3. In yr 1, a TRT x time interaction ($P < 0.01$)for insulin ($ng \cdot ml^{-1}$) concentrations was observed, with 200 g glycerin having lower insulin than 100 g glycerin. In yr 1, glucose exhibited a TRT x time interaction ($P < 0.01$); 50 g glycerin had lower glucose ($mg \cdot dl^{-1}$) than 0 g glycerin and 200 g glycerin having lower levels than 100 g glycerin. Glucose concentrations exhibited a quadratic response with a peak at hr 1 and returned to baseline by hr 7. In yr 2, insulin peaked at hr 4 and declined to hr 10. Glucose was higher ($P < 0.05$) for 200 and 300 g glycerin than 0, 50 and 100 g glycerin in yr 2. Glucose exhibited a quadratic response ($P < 0.01$) with a peak at hr 2. Glucose increased linearly in year 3, ($P < 0.01$; 135.8, 176.44, 163.12, 175.12, 195.63, and 161.44 $mg \cdot dl^{-1}$ for 0, 50, 100, 200, 300 g of glycerin and SUP, respectively). Glucose had a quadratic response ($P < 0.01$); glucose peaked at hr 1 and return to baseline by hr 7. In yr 3, insulin had a treatment by time interaction ($P < 0.05$); insulin peaked at hr 2, 50 and 100 g glycerin returned to baseline by hr 7; however, 200 and 300 g glycerin did not. Insulin ($P < 0.01$) increased with increasing levels of glycerin. Glycerin changed blood glucose and insulin concentrations; however, it did not influence reproductive performance.

APPLICATION

A single dose of glycerin at the initiation of breeding season does not appear to impact reproductive performance of ewes.

Table 1. Effect of glycerin treatment on pregnancy rate and number of lambs born per ewe exposed

	Glycerin Treatment (g/hd)						
	0	50	100	200	300	SUP[a]	*P*-value[b]
Number of lambs born/ewe exposed							
Year 1	1.67	1.66	1.76	1.47	1.72		.8991
Year 2	0.67	0.73	0.57	0.43	.053		.7506
Pregnancy Rate, %							
January							
Year 1	0.80	0.87	0.84	0.79	0.88		.9414
Year 2	1.00	0.93	0.86	1.00	1.00		.2207
Year 3	1.00	0.94	0.94	1.00	1.00	1.00	.5526
February							
Year 1	1.00	1.00	1.00	0.86	1.00		.0908
Year 2	0.93	0.87	0.57	0.79	0.73		.1710
Year 3	0.94	0.94	1.00	1.00	1.00	1.00	.5526

[a] SUP = Supplemented with 0.57 kg of range cake (14% CP)

[b]*P*-value for F-tests of treatment effect.

Table 2. Effect of glycerin treatment on insulin and glucose concentrations

	Glycerin Treatment (g/hd)							
	0	50	100	200	300	SUP[a]	Linear	Quadratic
Glucose, mg/dl								
Year 1[c]	213.93	181.70	250.34	231.30	265.99		.0018	.3827
Year 2	170.92	175.20	194.06	222.68	214.61		.0033	.7146
Year 3	135.80	176.44	163.12	175.12	195.63	161.44	<.0001	<.0001
Insulin, ng/ml								
Year 1[c]	0.14	0.22	0.62	0.43	Non-Est			
Year 2	0.76	1.43	1.27	1.30	1.35		.2989	.3808
Year 3[d]	0.52	1.04	0.99	1.32	2.05	1.26	.0007	.4362

[a] SUP = Supplemented with 0.57 kg of range cake (14% CP)

[b]*P*-value for t-tests of mean.

[c] *P*-value for TRT x Time ($P < 0.01$).

[d]*P*-value for TRT x Time ($P < 0.05$).

Table 3. Effect of glycerin treatment on insulin and glucose concentrations by sampling time

	Hours post glycerin administration									
	0	1	2	3	4	5	7	10	Linear	Quadratic
Glucose, mg/dl										
Year 1[b]	144.04	304.74	292.49	291.63	277.65	246.14	154.04	118.48	<.0001	<.0001
Year 2	130.80	253.79	245.03	232.53	213.17	187.93	158.81	148.31	.0002	<.0001
Year 3	137.90	226.37	210.01	187.69	169.22	151.77	137.13	133.68	<.0001	<.0001
Insulin, ng/ml										
Year 1[b]	0.14	Non-Est	0.47	0.94	0.86	0.94	0.53	0.14		
Year 2	0.49	0.91	1.38	1.76	1.97	1.51	0.87	0.88	.4201	<.0001
Year 3[c]	0.28	0.71	2.09	1.89	1.69	1.22	0.86	0.75	.6221	<.0001

[a]*P*-value for t-tests of mean.

[b] *P*-value for TRT x Time ($P < 0.01$).

[c]*P*-value for TRT x Time ($P < 0.05$).

Objective 2: Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products.

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PROGESTERONE CONCENTRATIONS AND LAMBING RATES IN EWES GIVEN HUMAN CHORIONIC GONADOTROPIN

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RESEARCH OBJECTIVE

The objective was to determine if hCG injected on d 4 or 7 after mating would increase serum progesterone (P4) concentrations in ewes and increase number of lambs born.

RESULTS

Sixty-two mixed aged Suffolk ewes (mean BW = 75.15 kg ± 9.36 kg) received an intravaginal P4-containing pessary (CIDR; 0.3 g P4) for 10 d. Ewes were mated with fertile rams on the second estrus after CIDR removal and were randomly assigned to one of three treatments. Ewes received 600 IU (4.8 mL) of hCG i.m. on d 4 (n = 21) or d 7 (n = 21) of the estrous cycle (d 0 = mating); control ewes (n = 20) received 4.8 mL of saline on d 4. Jugular blood samples were taken from 10 ewes of each treatment group starting on d 1 and through 7 d after administration of treatments and continued twice weekly through d 34. Ewes treated with hCG on d 4 had greater ($P < 0.05$) P4 concentrations, beginning on d 6 than control ewes and remained elevated through d 14. Ewes treated on d 7 with hCG had greater ($P < 0.05$) P4 concentrations than controls beginning on d 8 and through d 14. Ovulation rates, corpora lutea (CL) counted laproscopically on the ovaries 25 d after mating, differed ($P > 0.05$) among treatments. Fifty-five and 88% of ewes given hCG on d 4 and 7, respectively, had > 2 CL; whereas, 0% of control ewes had > 2 CL. Fetal numbers ($P > 0.36$) and lambs born per ewe ($P > 0.19$) were similar among treatments. In conclusion, hCG administered to ewes on 4 or 7 d after mating elevated serum P4 concentrations through d 14, increased number of CL on d 25 but did not appear to alter fetal numbers or the incidence of multiple births in Suffolk ewes.

APPLICATION

Based on previous research, administering hCG to ewes on d 4, 7 and 10 post-mating increased the number of lambs born (Lankford et al., 2010). However, in the current study a single injection on d 4 or d7 failed to elicit a similar response even though the amount of hCG was the same. Therefore, a single injection will not improve lamb crop percentage. Portions of this report are taken from Richardson, et al., 2011 (submitted).

Objective 2: Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products

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RFI IN SHEEP AND ITS RELATIONSHIP WITH GLUCOSE, INSULIN, AND NEFA CONCENTRATIONS AFTER A GLUCOSE CHALLENGE

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RESEARCH OBJECTIVE

Feed costs are a major cost of sheep production and reduction of feed required could be an approach to increased profitability. Reducing feed intake or increasing feed efficiency without compromising growth rate or carcass quality could have a significant positive economic impact on the sheep feedlot industry. However, it is widely accepted to be a major cost and improvements in output per unit of feed used over the whole production system would be of significant economic benefit. Residual feed intake (RFI) has been suggested as an alternative measure of feed efficiency that may be a more accurate representation of the actual biological differences in feed efficiency. It is the difference between actual feed intake and that predicted on the basis of requirements for maintenance of BW and production. Residual feed intake unlike feed conversion ratio is independent of growth and body size. Numerous research efforts have shown that there is considerable individual animal variation in RFI in cattle; however, limited research is available in sheep. The objectives of this research were to: 1) Determine individual animal intake using the GrowSafe feed intake system and calculate RFI; 2) evaluate the effect of a glucose challenge on glucose, insulin, and NEFA concentrations in high and low RFI ewes.

RESULTS

A 49-d trial was conducted on the yearling Targhee ewes at 9 mo of age to determine individual animal intake using the GrowSafe feed intake system. Forty-nine ewes were given ad libitum access to pelleted grower diet (16% CP). Residual feed intake was calculated for each individual as the difference between actual feed intake and expected feed intake. Expected feed intake was calculated by regressing the actual feed intake against the metabolic body weight and average daily gain during the trial. To further characterize RFI, ewes were classified into low, medium, and high efficiency groups. Low RFI ewes were less than half a standard deviation away from the mean and represent the high efficient group. Similarly, high RFI ewes were greater than half a standard deviation above the mean and represent the inefficient group. Ewes were ranked by RFI score and the 6 highest and 6 lowest RFI scoring ewes were selected for the glucose challenge.

Figure 1 illustrates the RFI values of all ewes ranked from the most efficient to the least efficient, smaller values represent higher efficiency. Ewe RFI had strong to moderate positive correlation between dry matter intake (0.78) and feed conversion ratio (0.47); however, no reportable correlations were found among RFI and ewe age, body weight, or average daily gain (Table 1). On the contrary, ewe feed conversion ratio was correlated with ewe age, initial weight, and growth. This was expected because the use of linear regression to compute RFI forced it to be independent of growth and ewe weight; whereas, feed conversion ratio does not account for those factors. Ewes in the low RFI group consumed 0.88 lb per day less than ewes in the high RFI group. Ewe weight and growth were similar among RFI groups (Table 2). Ewe EPD traits were similar among efficient groups; except for number of lambs born (Table 2). Low RFI (high efficiency) ewes had lower number of lambs born EPDs than high RFI (low efficiency). Similarly, ewe birth and rearing rate were numerically lower for the low RFI vs high RFI groups (Table 1). Concentrations of Gluc, I, and NEFA over time did not differ ($P > 0.10$) between ewes of the RFI classes. However, time to 50% disappearance of Gluc from circulation, estimated from quadratic equation fitting of concentrations after the maximum concentration tended ($P = 0.07$) to be greater in high RFI ewes than in low RFI ewes (110 and 86 min, respectively), and Gluc to I ratios tended ($P = 0.08$) to be greater in high RFI ewes than low RFI ewes (273 and 204, respectively). Thus, Targhee ewes selected for high RFI appeared to be more insulin-resistant than ewes selected for low RFI.

APPLICATION

Residual feed intake differences in sheep are evident and apparent reductions in feed intake could reduce input costs of sheep producers considerably. This data strongly suggests that sheep with desirable RFIs would have substantially lowered feedlot costs. However, this data also suggests that there may be a relationship between RFI and reproductive performance. Therefore, more research is needed to understand the effects of using RFI as a selection trait.

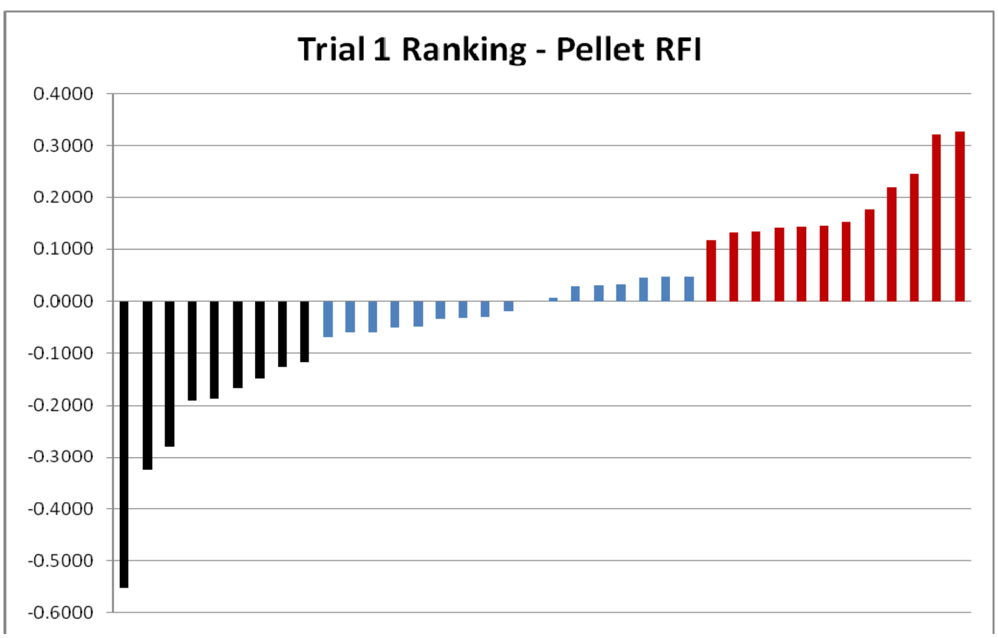

Figure 1. Distribution of residual feed intake (RFI) of ewes ranked from lowest to highest. Each ewe's RFI (kg) value is represented by a bar. Black, blue, and red bars are the high, medium, and low efficiency groups, respectively.

Table 1. Phenotypic Pearson correlations among age, performance, and feed efficiency ewes in Exp. 1

Item[1]	IBW	ADG	DMI	RFI	FCR
Age	0.287	-0.336*	-0.018	0.192	0.373*
IBW		-0.401*	0.130	0.002	0.564*
ADG			0.496*	-0.009	-0.770*
DMI				0.769*	0.101
RFI					0.474*

[1]IBW = initial BW; FBW = final BW; RFI = residual feed intake; FCR = feed conversion ratio.

*Correlations are different from zero at $P < 0.05$.

Table 2. Effect of residual feed intake (RFI) group in Exp. 1 on RFI, DMI, ADG, and MBW in Exp. 1 and 2, and ewe EDPs

	RFI Groups – Pellet Diet (Exp. 1)				
	Low RFI	Medium RFI	High RFI	SE	*P*-value
No. of ewes	9	17	12		
Exp. 1					
RFI, kg	-0.23[a]	-0.01b	0.188c	0.03	<0.01
DMI, kg	1.9[a]	2.0a	2.3b	0.06	<0.01
ADG, kg/d	0.35	0.32	0.36	0.02	0.49
MBW, kg	36.0	35.1	35.4	0.62	0.17
EPDs					
WW, lb	0.82	1.01	0.56	0.26	0.34
YW, lb	2.19	2.2	2.0	0.51	0.94
M, lb	-0.26	-0.24	-0.53	0.13	0.13
M + G, lb	0.19	0.29	-0.20	0.19	0.06
FW, lb	0.22	0.17	0.28	0.19	0.24
FG, micron	-0.13	-0.20	0.05	0.11	0.12
SL, in	0.04	0.04	0.01	0.02	0.44
LC, %	0.60[a]	4.33b	5.52b	0.99	<0.01
WRI, $	0.89[a]	2.35b	2.40b	0.39	<0.01
Actual					
NLB, %	125	138	138	-	-
NLR, %	125	123	138	-	-
Behavior					
MDUR, min/d	54.5[a]	59.3ab	73.8b	6.90	0.08
HDUR, min/d	40.8[a]	46.6ab	55.5b	5.53	0.13
MFREQ, events/d	60.6	57.6	72.2	6.00	0.11
MRATE, g/min	43.2	42.7	37.5	4.29	0.49

[a,b]Within a row, means that do not have a common superscript differ, $P < 0.05$.

*Objective 2. Develop sheep and goat management strategies that enhance the efficiency for production of high quality, marketable end products by**: a) improving biological efficiency through better understanding of environmental and genetic events that influence meat and fiber production.***

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EFFECT OF SUPPLEMENTING EWES DURING LATE GESTATION WITH METABOLIZABLE PROTEIN ON WETHER LAMB FEEDLOT PERFORMANCE, CARCASS CHARACTERISTICS, AND NITROGEN BALANCE

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RESEARCH OBJECTIVE

The objective of this study was to determine the influence of metabolizable protein supplementation during the last 50 days of gestation on wether offspring nitrogen balance, feedlot performance, and carcass characteristics.

RESULTS

Maternal dietary treatments were isocaloric and contained 100% (**CON**), 80% (**MED**), and 60% (**LOW**) of MP requirements for ewes bearing twins during the last 50 days of gestation. Previous research in our laboratory has reported that metabolizable protein supplementation to ewes during the last 1/3 of gestation affected birth weights of lambs and fetal development. Additionally, ewe lambs born from ewes supplemented with MP had heavier ovaries, indicating the fetal programming may have taken place. Feedlot (29 ± 2 kg) and N balance wethers (32 ± 0.4 kg) were fed a common feedlot ration (84.4% whole corn, 15.6% commercial market lamb pellet). Initial and final feedlot BW, ADG, and G:F were not affected ($P \geq 0.17$) by maternal dietary treatment. Wethers born to ewes fed the LOW diet had increased ($P = 0.01$) DMI compared with the wethers born to ewes fed the MED diet during the feedlot phase. Wethers born to CON had reduced ($P = 0.10$) days on feed compared with wethers born to MED ewes. Wethers born to CON ewes had increased ($P = 0.04$) percent boneless, closely trimmed, retail cuts compared with wethers born to the LOW and MED ewes, with all other carcass characteristics not affected ($P \geq 0.13$). Nitrogen balance trial DMI, NDF intake, total tract digestibility of DM, NDF, and N, fecal N excretion, and N balance were not affected ($P \geq 0.12$) by maternal dietary treatment. Wethers born to LOW ewes had increased ($P = 0.08$) daily N intake and reduced ($P = 0.08$) daily digested N retained compared with wethers born to CON and MED ewes. Wethers born to LOW ewes had increased ($P = 0.03$) daily urinary N excretion compared with wethers born to the MED and CON ewes. A treatment x day interaction was observed ($P = 0.004$) for serum urea N concentrations. On collection d 2, 4, 5, and 6 of a 7 d collection period, the wethers born to LOW ewes had increased ($P \leq 0.001$) serum urea N concentrations compared with the wethers born to MED and CON ewes.

APPLICATION

These results suggest that wethers born to ewes fed below MP requirements are less efficient in N retention, require more feed to finish in the feedlot, and have decreased retail product.

OBJECTIVE 3

Rapidly and accurately disseminate new information to the producer through: a) development of novel technology transfer platforms; b) hosting field days at research centers; and c) organizing on-farm demonstration projects.

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2011 UTAH SHEEP AND GOAT EDUCATION DAY

C.K. Chapman[1], K.A. Rood[2], A. Sulser[3], and T. Boyer[4]

EDUCATIONAL OBJECTIVE

Provide current information regarding sheep and goat husbandry practices to Intermountain producers, targeting small flock/herd growers, extensive range producers and youth in 4-H and FFA programs.

RESULTS

Over 120 sheep and goat producers from several Intermountain states attended the 2011 Utah Sheep and Goat Education Day. A change in location, coupled with a severe winter storm, negatively impacted attendance at this year's event. The event theme was "Entrepreneurial Strategies in Agriculture" and centered on production economics and various funding strategies.

The keynote address was entitled "Creative Entrepreneurial Strategies for Sheep & Goat Producers" and focused on applying successful business management principles to sheep and goat production. Other morning sessions included presentations on cutting-edge veterinary tips and practices and new financial options, products and programs. A legislative report and its potential impacts for the Utah's livestock industry was presented during lunch by Utah Commissioner of Agriculture, Leonard Blackham. Afternoon sessions were divided into three tracks: Creative Entrepreneurship - Business management opportunities, Winning Today - Entrepreneurial skills for club lamb/kid producers, and Maximizing profit using various management strategies.

The Entrepreneurship track included sessions on viewing management in non-traditional ways, using financial records as a management tool, and implementing/using the financial options, products and programs presented in the morning session. The club lamb/kid track focused on basic skills for successful youth projects like selecting show animals, basic nutrition, showmanship skills and understanding how show animal economics differ from commercial production economics. The track dealing with management to maximize profitability included sessions on ram/buck selection and management, vaccination programs/protocols and flock/herd nutrition.

In post-workshop surveys, 75% of respondents stated the knowledge gained during the workshop would benefit them economically and that the workshop should be continued in the future. The topic most respondents reported to get the most information from, were the sessions dealing with veterinary/vaccination protocols.

Impact Statements

Submission Form for WAAESD Impact Statements

Incorporating sheep into farming systems

Impact Nugget:
Using sheep to control weeds on summer fallowed ground is a more effective method of cheatgrass control, has a positive impact on beneficial parasitoid insects, and results in the same grain yield and greenhouse gas emission as chemical fallowed treatments, although more N fertilization is required on rotations using sheep for summer fallow management.

Issue:
As off farm petroleum based fuels, fertilizer, and pesticides become more expensive and in the case of herbicides, some weeds develop resistance farmers will look to develop mutually beneficial partnerships to maintain economically and environmentally sustainable production.

What has the project done so far?
The project has over the past 10 years documented successes of incorporating sheep into farming systems for weed and insect control

Impact Statements:
- Reduce pesticide application
- Replace tillage with grazing sheep
- Offer alternatives to traditional pest weed and insect control

Research Needs for Future Impacts:
- Systems based and food web research

Contact Information:

Submission Form for WAAESD Impact Statements

A comparison between Texas Rambouillet sheep and Merino F1 crosses - Year 4

Impact Nugget:
The market value of wool produced by Merino X Rambouillet ewes shorn in April 2011 was $38.60/head versus $29.26 for the contemporary Rambouillet sheep. Weight of weaned lamb per ewe exposed did not differ between the two genotypes in 2008 and 2009.

Issue:
Range operators who are not willing or able to increase labor or nutritional inputs into their flocks but desire a strategy to increase profitability.

What has the project done so far?
Starting in 2007, three sets of Merino crossbred lambs and their Rambouillet contemporaries were produced by laparoscopic artificial insemination and natural breeding. Bodyweights and fleece traits have been measured on ewes and rams born in the fall of 2007 and the springs of 2009 and 2010. Lamb production is being monitored for all ewes born into the project and bred to Rambouillet sires.

Impact Statements:
- The market value of wool produced by Merino X Rambouillet ewes shorn in April 2011 was $38.60/head versus $29.26 for the contemporary Rambouillet sheep.
- Wool is produced more efficiently (in terms of g of clean wool per kg of BW) by Merino crossbred sheep compared to straight Rambouillets (58.8 versus 48.0 g/kg).

Research Needs for Future Impacts:
Because of multiple difficulties weaning a substantial lamb crop, data on lamb production are lacking. Ewes produced in the program should be bred and evaluated for at least 2 more years in order to obtain more authoritative data.

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Submission Form for WAAESD Impact Statements

National Sheep Quality Audit

Impact Nugget:
Summarized both face-to-face and questionnaires concerning quality defects for sheep meat and wool; compared to previous quality audit results.

Issue:
All producers of sheep meat and wool.

What has the project done so far?
Documented quality issues between 1992 audit and 2007 audit.

Impact Statements:

- Significant reduction on incidences of carcass bruising.
- Increase in concern and action plans for hair sheep.
- Realize seasonal supply issues.
- Identified world wide wool distribution.

Research Needs for Future Impacts:
Audit should be conducted every 5 years so that more timely quality concerns can be identified and corrective action taken.

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Submission Form for WAAESD Impact Statements

<u>Residual Feed Intake in Sheep</u>

Impact Nugget:
Producer adoption of residual feed intake as an efficiency trait of economic importance is necessary for development of selection schemes for genetic improvement.

Issue:
These projects have direct implications for area sheep producers. Sheep producers are looking for ways to improve efficiency, and ultimately profitability, of their operations. Improvements in feed efficiency, specifically residual feed intake, reduce input costs through decreased feed usage. Alternatively, higher stocking rates may result from improvements in feed efficiency. However, it is currently unknown yet how factors such as age and/or puberty affect measures of feed efficiency, such as residual feed intake.

What has the project done so far?
Project 1. Data has been collected from University of Wyoming ram tests over the last two years (both whiteface and blackface tests). These ram tests have been conducted using a GrowSafe system, so individual feed intake data is collected. This data is shared with participating producers, and has also been used as preliminary data in other studies. Producer surveys have been collected to determine interest level and other feedback.
Project 2. Data has been collected on pre-pubertal ewes at the University of Wyoming using GrowSafe units to collect feed intake data on individual animals. Data is currently being collected on those same ewes post-puberty. Hormone profiles and reproductive measures will be collected. Also, lambs from these ewes will performance tested in a similar manner.

Impact Statements:
- Improved awareness of residual feed intake as a measure of feed efficiency in > 40 producers
- Direct partnerships with producers for research projects. Participating partners are charged a reduced cost for ram testing

Research Needs for Future Impacts:
Additional individual feed intake data from sheep. Increased producer participation.

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Submission Form for WAAESD Impact Statements

<u>Evaluating glycerin supplementation on reproductive performance of sheep</u>

Impact Nugget:
A single dose of glycerin is being examined for increasing profitability of range sheep operations by increasing lamb production without increasing costs.

Issue:
Producers are depending on lambing crop over 100% to maintain their profitability. Under range lambing conditions this requires a high percentage of twins. Glycerin supplementation has showed increased number of follicles ovulated; however, information is lacking to the number of lamb born per ewe.

What has the project done so far?
This project has evaluated the influence of glycerin on ewe's reproductive performance for three years. Ewes were synchronized using a Controlled Internal Drug Releasing (CIDR) devise and given 10 mg of $PGF_{2\alpha}$ following CIDR removal. Ewes were dosed with glycerin on day 1 of the breeding season. Glycerin concentrations were 1, 50, 100, 200 and 300 g per head. Eight rams (black-faced and Rambouillet rams, year 1; Rambouillet rams in years 2 & 3) were placed with ewes for 35 days. Pregnancy was determined by ultrasonography evaluation at 45 and 86 d post ram exposure. Numbers of lambs born per ewes were recorded. Glucose and insulin concentrations were determined for 10 hours post glycerin consumption.

Impact Statements:
- No increase in number of lambs born per ewe was reported in the first two years of this project.
- Dosing with glycerin at the start of the breeding season was not beneficial to reproductive performance.

Research Needs for Future Impacts:
Providing glycerin at the initiation of the breeding season did not impact the reproductive performance of the ewes. Additional research to evaluate the timing of the glycerin could be beneficial. If they timing of glycerin dosing showed an improvement in number of lambs born per ewe when finding a practical method of delivery for producers would be warranted.

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Submission Form for WAAESD Impact Statements

RFI in sheep and its relationship with Glucose, Insulin, and NEFA concentrations after a glucose challenge

Impact Nugget:
Residual feed intake differences in sheep are evident and apparent reductions in feed intake could reduce input costs of sheep producers considerably and suggests that sheep with desirable RFIs would have substantially lowered feedlot costs.

Issue:
Feed costs are a major cost of sheep production and reduction of feed required could be an approach to increased profitability. Reducing feed intake or increasing feed efficiency without compromising growth rate or carcass quality could have a significant positive economic impact on the sheep feedlot industry. However, it is widely accepted to be a major cost and improvements in output per unit of feed used over the whole production system would be of significant economic benefit.

What has the project done so far?
A 49-d trial was conducted on the yearling Targhee ewes at 9 mo of age to determine individual animal intake using the GrowSafe feed intake system. Forty-nine ewes were given ad libitum access to pelleted grower diet (16% CP). Residual feed intake was calculated for each individual as the difference between actual feed intake and expected feed intake. Expected feed intake was calculated by regressing the actual feed intake against the metabolic body weight and average daily gain during the trial. To further characterize RFI, ewes were classified into low, medium, and high efficiency groups. Low RFI ewes were less than half a standard deviation away from the mean and represent the high efficient group. Similarly, high RFI ewes were greater than half a standard deviation above the mean and represent the inefficient group. Ewes were ranked by RFI score and the 6 highest and 6 lowest RFI scoring ewes were selected for the glucose challenge. Ewes in the low RFI group consumed 0.88 lb per day less than ewes in the high RFI group. Ewe weight and growth were similar among RFI groups. Ewe EPD traits were similar among efficient groups; except for number of lambs born. Low RFI (high efficiency) ewes had lower number of lambs born EPDs than high RFI (low efficiency). Similarly, ewe birth and rearing rate were numerically lower for the low RFI vs high RFI groups. Concentrations of Gluc, I, and NEFA over time did not differ ($P > 0.10$) between ewes of the RFI classes. However, time to 50% disappearance of Gluc from circulation, estimated from quadratic equation fitting of concentrations after the maximum concentration tended ($P = 0.07$) to be greater in high RFI ewes than in low RFI ewes (110 and 86 min, respectively), and Gluc to I ratios tended ($P = 0.08$) to be greater in high RFI ewes than low RFI ewes (273 and 204, respectively). Thus, Targhee ewes selected for high RFI appeared to be more insulin-resistant than ewes selected for low RFI.

Impact Statements:
- Considerable variation in feed efficiency was detected in a flock of Targhee ewes.
- Low and high efficiency ewe had similar gains (0.75 lb/day).
- High efficiency ewes consumed ~20% less feed than low efficiency ewes but gained at the same rate. During a 30 to 60 day feedlot period this result would represent a substantial cost savings the feeder.
- Ewes that were more feed efficient spent 25% less time at the feed bunk.
- Residual feed intake appears to not be related to growth and wool traits.

Research Needs for Future Impacts:

The relationship between a yearling RFI and reproductive rate must be better understood before RFI values are incorporated into selection programs. Therefore, more research is needed to understand the effects of using RFI as a selection trait.

Contact Information:

Submission Form for WAAESD Impact Statements

Utah Sheep and Goat Education Day

Impact Nugget:
Nearly 2,000 sheep and goat producers from throughout the Intermountain West have received production-oriented education to increase their husbandry and management skills aimed to improve the economic and environmental viability of their respective operations.

Issue:
Utah sheep and goat producers, especially small flock/herd growers, were an under-served audience during the late 1990's through 2001. Since many are part-time producers, it was difficult to disseminate husbandry/production information to them effectively. Since there is an increasingly large number of individuals and animals represented by this group, the Utah Wool Growers Association, in cooperation with Utah State University Extension, and more recently the Mountain States Meat Goat Association, established the Utah Sheep and Goat Education Days to meet these educational needs. This year's event also targeted youth lamb and kid exhibitors in an effort to increase their understanding of basic husbandry principles.

What has the project done so far?
Since 2002, annual Education Days have been held in various locations throughout Utah to present timely production information to sheep and goat producers from throughout the Intermountain states. To date, nearly 2,000 producers have attended at least one of the events. Producers have come from Utah, Idaho, Wyoming, Nevada, California, Arizona, New Mexico, Colorado and Nebraska to attend the events. In 2004, the Mountain States Meat Goat Association agreed to become a partner and the event then became the Utah Sheep & Goat Education Day.

Impact Statements:
- 75% of 2011 workshop participants indicated the information gained from the event would benefit them economically and that future workshops should continue.
- 100% of 2011 workshop participants ranked the relevance of topics presented as excellent or good.
- The Utah Sheep and Goat Education Days have provided a setting for sheep and goat producers to network and exchange ideas amongst themselves, while receiving current information regarding husbandry and management from recognized national and regional sheep and goat experts.

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Submission Form for WAAESD Impact Statements

Effect of supplementing ewes during late gestation with metabolizable protein on wether lam feedlot performance, carcass characteristics, and nitrogen balance

Impact Nugget:
Increased metabolizable protein during late gestation in ewes may result in lambs that are more efficient in the feedlot.

Issue:
Sheep producers providing supplemental metabolizable protein (MP) during late gestation may impact fetal growth and development, potentially affecting future feedlot performance of offspring. The results from this trial suggest that wethers born to ewes fed below MP requirements are less efficient in N retention, require more feed to finish in the feedlot, and have decreased retail product.

What has the project done so far?
Previous research in our laboratory has reported that metabolizable protein supplementation to ewes during the last 1/3 of gestation affected birth weights of lambs and fetal development. Additionally, ewe lambs born from ewes supplemented with MP had heavier ovaries, indicating the fetal programming may have taken place. The results from the current trial indicate that these fetal programming affects are also influencing wether lamb performance in the feedlot.

Impact Statements:

- Increasing metabolizable protein supply in the last 1/3 of gestation may impact the fetus, potentially affecting future reproductive and feedlot performance. With escalating feed prices, decreasing time on feed in the feedlot phase is economically important to feedlot managers.

Research Needs for Future Impacts:
Offspring will be evaluated for reproductive performance to determine if fetal programming occurred. More research needs to be conducted to determine how much metabolizable protein, above requirements, can be fed to ewes before it is no longer economical and justifiable to the sheep producer.

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WERA039
Participant Publications
(2010-2011)

COLORADO

TECHNICAL REPORTS

Carvalho, F.A., Woerner, D.R., Tatum, J.D., LeValley, S.B., and Pendell, D.L. 2010. Comprehensive Consumer Sensory Panel Ratings and Establishing Baseline Tenderness of American Lamb Meat. Final Report. Colorado State Univ.

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MONTANA

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Kott, R. W., L. M. M. Surber, A. V. Grove, P. G. Hatfield, J.A. Boles, C. R Flynn and J. W. Bergman. 2010. Feedlot performance, carcass characteristics, and muscle CLA concentration of lambs fed diets supplemented with safflower seeds and vitamin E. Sheep and Goat Res. J. 25:16–22.

Moreaux, J. J., J. L, Nichols, J.G. P. Bowman, and P. G. Hatfield. In press. Psyllium Lowers Blood Glucose and Insulin Concentrations in Horses. J. Equine Vet. Sci 31:160–165.

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Graves, M., J. Mangold, H. Goosey, P. Hatfield, and F. Menalled. 2011. Impact of sheep grazing on demographic parameters of cheatgrass (*Bromus tectorum*) and wild oat (*Avena fatua*) in three common Montana agricultural systems. SRM

Hanson, M., P. G. Hatfield, H. Goosey, and F. Menalled. 2010. Impact of strategic sheep grazing on weed communities. Abstr. Joint annual meeting, Soc. Range Manage. And Weed Sci. Soc. Of Am. Denver CO., February, 2010

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NEW MEXICO

PROCEEDINGS and ABSTRACTS

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NORTH DAKOTA

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Neville, B.W., G.P. Lardy, K.K. Karges, L.A. Kirschten, and **C.S. Schauer**. 2011. Sulfur balance in lambs fed increasing concentrations of distillers dried grains with solubles. 2011 NDSU Sheep Research Report. 52:23-25.

Saevre, C.B., A.M. Meyer, M.L. VanEmon, D.A. Redmer, J.S. Caton, J.D. Kirsch, J.S. Luther, and **C.S. Schauer**. 2011. Impacts of arginine on ovarian function and reproductive performance at the time of maternal recognition of pregnancy in ewes. 2011 NDSU Sheep Research Report. 52:13-16.

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TEXAS

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Campbell, E. S., R. A. Frost, T. K. Mosley, J. C. Mosley, C. J. Lupton, C. A. Taylor, Jr., J. W. Walker, D. F. Waldron, and J. Musser. 2010. Pharmacokinetic differences in exposure to camphor after intraruminal dosing in selectively bred lines of goats J. Anim. Sci. 88:2620-2626.

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