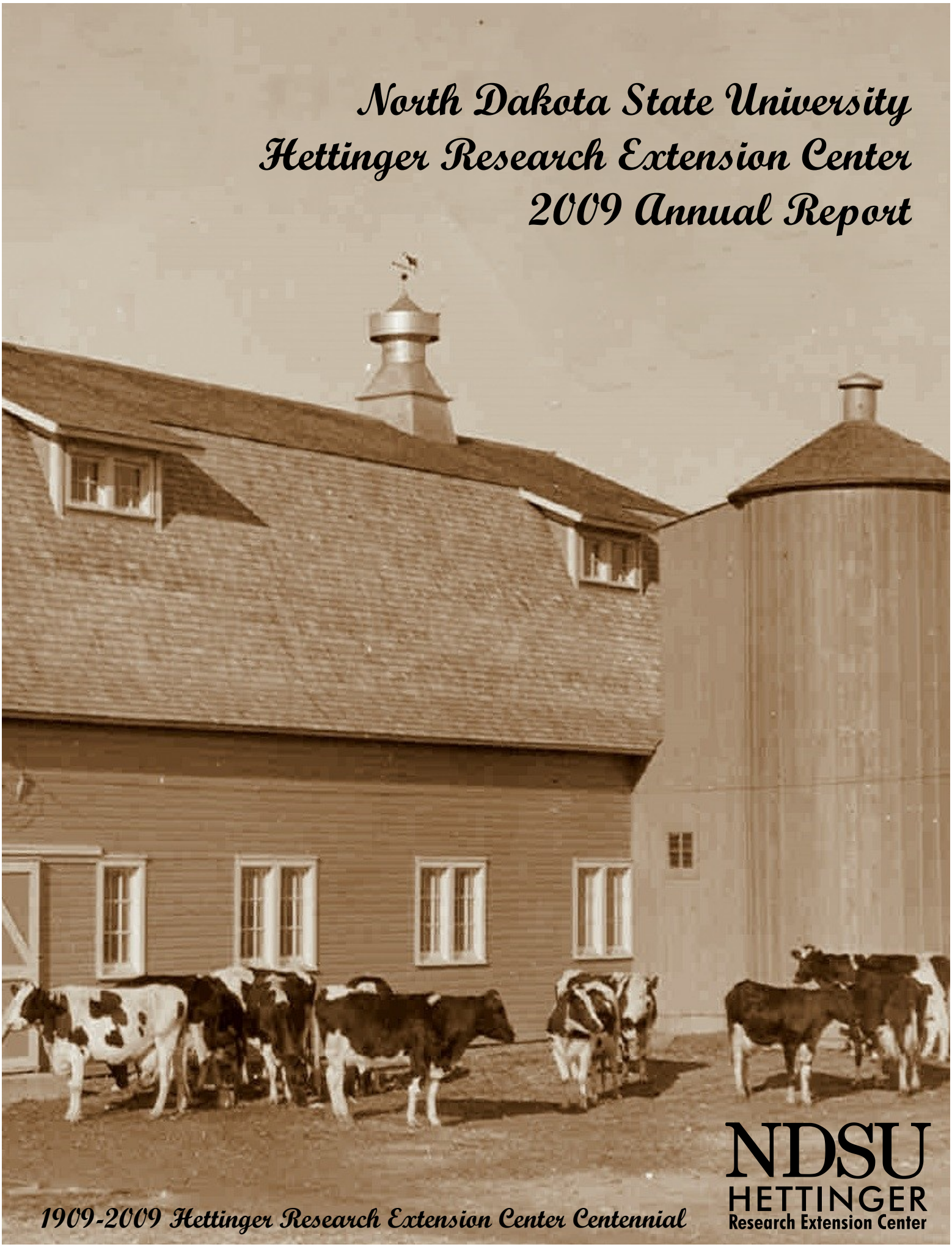
North Dakota State University
Hettinger Research Extension Center
2009 Annual Report



1909-2009 Hettinger Research Extension Center Centennial

NDSU
HETTINGER
Research Extension Center

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NORTH DAKOTA **AGRICULTURE EXPERIMENT STATION**

Hettinger Research Extension Center

HREC Research in Brief

- Integrated crops, livestock, range, and applied economics research
- Variety, herbicide, and crop production research
- Lamb and beef feedlot nutrition and management
- Reproductive management of fall, winter, and spring lambing ewes
- Alternative, co-product, and "Natural" feeds for ruminants
- Multiple-land use management including cropping systems, livestock, and wildlife as potential outputs
- Range monitoring techniques
- Land transfer patterns in SW North Dakota over the past 20 years

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NDSU HETTINGER Research Extension Center

The Hettinger Research Extension Center (HREC) was established from a gift of 160 acres by the residents of Adams County and the city of Hettinger in 1909. Original work at the HREC involved converting native prairie to farm land for the purpose of agronomic research. In 1912, through cooperation with the United States Department of Agriculture, a dry land farming trial began. In 1913 a herd of Guernsey and Jersey cows and bulls was purchased to aid local producers in the production of replacement dairy cattle. Following a brief closure during the Depression, the HREC continued to grow the research programs, focusing on agronomy and sheep breeding. In 1947, an option was secured for the purchase of an extra quarter of land to continue and expand sheep and agronomy research. In the 1980's the research programs were solidified with the addition of land bringing the total owned land to 1130 acres, and the hiring of an agricultural economist and an agronomist.

The HREC is a semi-arid site located in southwest North Dakota, providing the most southerly NDSU location in the non-glaciated portion of North Dakota as a site for its agronomy research program. The HREC also is located at the center of the North Dakota sheep industry, the focus of one of its animal research programs. Furthermore, the HREC is located an area of rapidly growing livestock feeding ventures, another focus of animal research at the HREC. Additionally, the HREC is located in a region where much of the land base is in the Conservation Reserve Program and Forest Service lands, which has resulted in additional research evaluating potential changes in the CRP program and how these changes may affect upland native and game bird populations. A new research program evaluating low-cost rangeland monitoring strategies on U.S. Forest Service lands has resulted in a significant increase in the quantity of rangeland, livestock, and wildlife interaction research conducted at the HREC throughout the Western Dakotas. Research at HREC involves the disciplines of animal science, range and wildlife science, agronomy, and agri-business and applied economics. Collaboration is with Main Station scientists, Branch Station scientists, U.S. Forest Service, grazing associations, university scientists from WY, SD, and MT, and USDA research entities in these research disciplines to improve the productivity of livestock and cropping systems and economic development of the region. Through these efforts, the center's research program has gained a national reputation for its involvement with sheep production systems as well as a strong regional and state reputation for its research in agronomy, multiple-land use, and applied economics.

AGRONOMY

- Distributed foundation seed produced at NDSU research centers, making new varieties available to southwest North Dakota producers.

- Conducted crop variety, forage, plant disease, and herbicide trials as well as off-station variety testing at Regent, Scranton, New Leipzig, Selfridge, Reeder, and Mandan.
- Conducted biofuel trial in conjunction with other REC's.
- Evaluate new varieties and technologies for drought tolerant corn and wheat and preventing damage from wheat stem sawfly.

RANGE AND LIVESTOCK

- Conducted trials across western North Dakota evaluating remote sensing technologies on the Grand River and McKenzie National Grasslands, and Medora Ranger District with the USDA-Forest Service and the respective Grazing Associations.

HREC Crops, Livestock, Range and Economics

- Conducted multiple research projects evaluating environmental and economic consequences of multiple-use management of agricultural lands in the Northern Great Plains including nesting success of upland birds, telemetry of upland chicks, restoration of cropped land to native range, and land transfer patterns in the region during the past 20 years.

- Continued research in “Value Added Animal Production”; a research program focused on evaluating forage, grain, byproduct, and marketing alternatives in calf backgrounding and finishing through a collaboration with the Carrington REC as well as lamb finishing. New projects are targeting “Natural” based production of meats.

- Conduct two Producer Ram Tests annually. The Spring Performance Test targets terminal sire rams and the Dakota Fall Performance Test targets the Rambouillet Certificate of Merit program, one of three Rambouillet Ram Tests in the nation.

- Evaluated novel techniques for decreasing embryonic death loss in ewes and fetal programming of offspring.

- Conduct annually the HREC Beef Day, Sheep Schools, Shearing Schools, Ram Test Field Days, Crops Tours, Crops Day, and Sportsmen's Night Out.

ECONOMICS

- Evaluation of opportunities and constraints created by changing land ownership patterns in the Northern Great Plains.

- Expanding Ruminant Livestock Production in the Northern Great Plains: An Assessment of Resources, Opportunities and Constraints.

HREC Research Faculty

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NDSU HETTINGER Research Extension Center

NDSU - Hettinger Research Extension Center History (1909 – 2009)

Christopher Schauer, Director, NDSU Hettinger Research Extension Center

Portions reprinted from "Hettinger, ND Centennial – 100 Years of Change and Challenge"

The Beginning: Hettinger Sub-Station

Each state in the United States is legally entitled to have an Agricultural Experiment Station. Two federal laws provide this legal basis: the Morril Act of 1862 and the Hatch Act of 1887. The agricultural college in Fargo was established by the adoption of the North Dakota Constitution in 1889. The Legislative Assembly of 1890 further solidified the importance of agriculture to North Dakota by establishing the agricultural experiment station in connection with the agricultural college. During these infancy years of North Dakota's legislature, provisions were made which allowed for branch experiment stations which were to receive maintenance and origin within the state legislative process. Following the donation of at least 160 acres of land, the legislature would consider establishing a sub-station at that location.

The Hettinger Research Extension Center, formally known as the Hettinger Sub-Station, was established from a gift of 160 acres by the residents of Adams County and the city of Hettinger in 1909. The 1909 session of the North Dakota legislature made an appropriation of $10,000 to establish a sub-station in the vicinity of Hettinger. The chief part of the appropriation for the first biennial period was spent in the construction of buildings as follows: horse barn built in 1909, $2,347.35; farm house built in 1910, $5,623; machine shed built in 1910, $1,200; and a poultry house built in 1910, $125. W.R. Lanxon was named as the first superintendent on June 1, 1910. Original work at the Hettinger Sub-Station involved converting native prairie to farm land for the purpose of agronomic research. In 1912, through cooperation with the United States Department of Agriculture, a dry land farming trial embracing one hundred thirty three $1/10^{th}$ acre plots was begun as the first large scale agronomic research trial for the Sub-Station. In the spring of 1913 a herd of 10 grade Guernsey cows, a registered Guernsey bull, and one high grade Jersey cow were purchased. Further agronomic research from 1909 until 1923 included the following: the evaluation of flax, prominent varieties of cereal crops, prominent varieties of forage crops, resistance to rust in wheat, and prominent varieties of potatoes and corn.

The Depression Era

In April of 1923, the North Dakota legislature placed the Sub-Station on a self-supporting basis, requiring the superintendent to discontinue agronomic research and concentrate efforts on dairying, hog raising, forage crops, tree planting, and the collection of weather data. The Sub-Station balanced the budget during this time period by selling sweet milk and cream in the city of Hettinger and providing the producers of the region with dairy herd bulls from their Holstein herd. Additional legislative funding in 1927 provided for maintenance of the facilities and enabled the Sub-Station to expand the agronomic research. In 1931 the legislature restored the Sub-Station appropriations to pre-war status of $5,000 a year. However, by 1933 the legislature had reduced the appropriation to $1,000 per year. The superintendent, partly through loyalty, and partly because they could not place themselves elsewhere, continued without a guaranteed salary, keeping some of the investigations alive. By 1935 the legislature had effectively closed the Hettinger Sub-Station. A caretaker was left in charge to prevent deterioration of buildings. Unofficial records from this period of closure indicate that the Hettinger Sub-Station residence was used as a boy's bunk-house for high school students. It was also one of the few places in the county where a bath could be taken.

A New Beginning

The 1942 annual report of the North Dakota Agricultural Experiment Station indicated that although no work was conducted at the Hettinger Sub-Station, it would be of good use as a sheep-breeding and sheep-feeding station to serve the growing sheep industry of the state. In 1943 the legislature appropriated $8,000 for the biennium to begin research in agronomy and sheep breeding. Edgar Martin was hired as the new superintendent, and by 1944 twenty Columbia ewes had been purchased to be used in a broad scale project on the improvement of sheep for conditions in North Dakota through selection and systems of breeding. By 1945, an additional group of Rambouillet ewes had been purchased. These two ewe flocks, Columbia and Rambouillet, were the foundation for the current sheep program at the Hettinger Research Extension Center. In 1947, an option was secured for the purchase of an extra quarter of land to continue and expand research. The crops research program began again in the early 1950's as an off-station site for the Dickinson Sub-Station. This signaled the first inter-station cooperative effort at the Hettinger Sub-Station. This was also the era when the name Sub-Station was changed to Experiment Station. The Hettinger Experiment Station grew to 400 acres by this time; however, the livestock and agronomy programs were still in their infancy and lacked definition.

An Era of Uncertainty

In 1959 a new superintendent, LeRoy Johnson, was hired. Under Johnson's tenure, the first formal field day was initiated in 1960 as the "Western Dakota Sheep Day". While the format has changed over the years, the field day continues today, however with a rotating emphasis on both beef and sheep.

A time of uncertainty for the future of the Hettinger Experiment Station came in 1967. The North Dakota legislature gave the Board of Higher Education permission to close the Edgeley and Hettinger Experiment Stations. However, they did not give the Board permission to sell the land on which the experiment stations were located. Because of this, the Board elected not to close the Hettinger Experiment Station until the next legislative session, hoping that either the station would be supported by the legislature or permission to sell the land would be granted. In 1968, following an outpouring of support by the Farmer's Union, Farm Bureau, National Farmers Organization, Missouri Slope Wool growers, and other supporting individuals, the region saved the Hettinger Experiment Station from closing.

Superintendent	**Dates of Service**
W.R. Lanxon	June 1, 1910 – March 31, 1915
A.J. Ogaard	April 1, 1915 – November 1, 1917
U.J. Downey	November 1, 1917 – 1927
C.H. Plath	1927 – 1931
Edgar Martin	1943 -
R.A. Woods	July 1, 1949 – 1951
Leslie O. Williamson	1952 – 1959
LeRoy Johnson	1959 – 1967
Charley McKay	1967 – 1968
LeRoy Johnson	1968 – 1969
Timothy Faller	1969 – February 14, 2006
Christopher Schauer	June 1, 2006 - present

An Era of Rebuilding and Expansion

Following the uncertainty of 1968, Timothy Faller was hired as the new superintendent of the Hettinger Experiment Station. During Faller's tenure as superintendent, many changes took place, one of which was the name change to the Hettinger Research Extension Center (HREC). During the 1970's confinement sheep production was a major focus, resulting in additional expansion of the barns and facilities and the hiring of a couple of technicians, Jack Stebbins and Nels Olson. In 1983, area producers went to the legislature with a request to expand the crops research program in southwest North Dakota. The result was a new agronomist, James Jakicic, who was located at the HREC. Cooperation continued with the Dickinson REC, and a plan was developed to have a late fall reporting event at Hettinger for both REC's. This was the beginning of the "Western Dakota Crops Day" program which continues today as one of the largest university programs of its type in the region. Acreage at the HREC grew to 1130 acres during this period, with additional outreach programs established to educate new producers in the principals of sheep production, specifically, economic development. This era also included the beginning of the first formal Extension Service involvement with the REC when a joint research and extension specialist, Dr. Kris Ringwall, was located at the HREC. Additionally, in 1988 an agricultural economist, Dan Nudell, and a new agronomist, Eric Eriksmoen, were hired. However, once again the HREC experienced a reduction in funding, with the 1980's concluding with a referral initiative which diminished support for both research and extension programs statewide.

Hettinger Research Center 1924

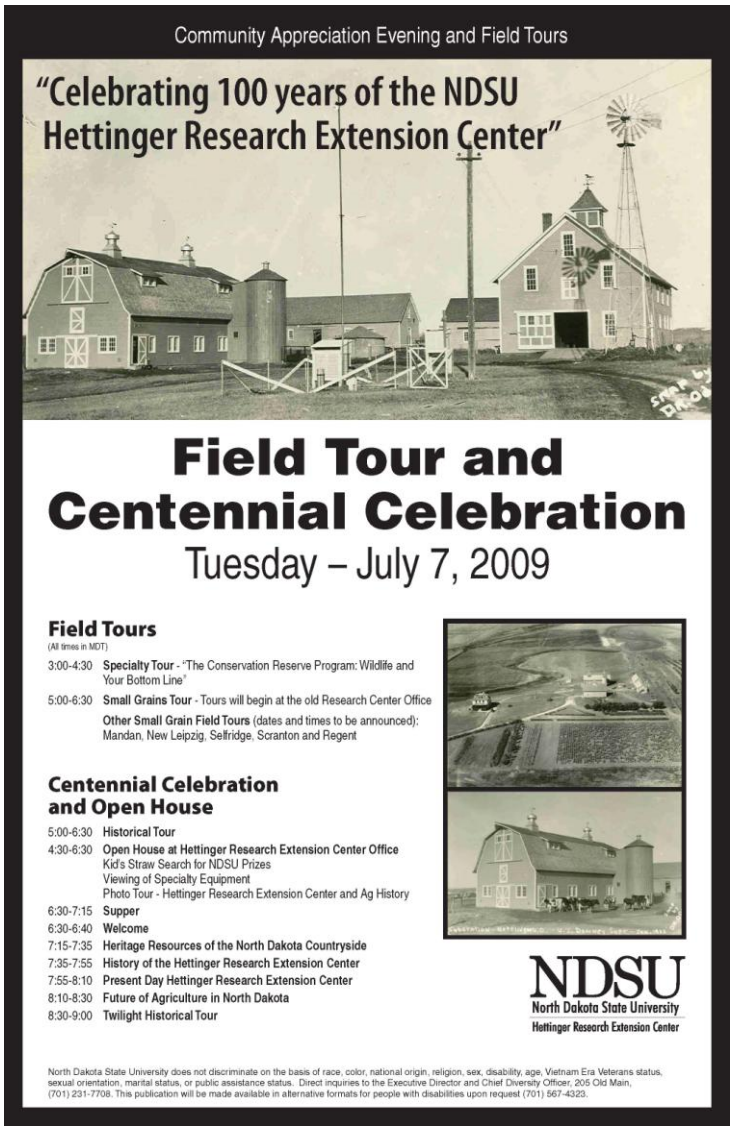
The 1990's began with a community effort to fund a new office and technology transfer facility to be located at the HREC. The new facilities, which included an animal physiology laboratory, computer cluster and a community conference center, were dedicated in May 1991. In the mid-1990's grant funds for economic development added the ability of the HREC conference center to broadcast and receive real-time video images through the statewide Interactive Video Network. Lack of available funds caused a set-back to growth of the HREC, and the formal extension program was moved to the Dickinson REC. As the 1990's drew to a close, new multi-agency/multi-discipline research projects at the HREC saw the land mass involved in the program grow to over 4,000 acres (both owned and research conducted on cooperator land). By 1997 the sheep numbers had grown to approximately 1,000 head. Additional research projects focused on the control and eradication of leafy spurge, a perennial noxious weed, through sheep grazing combined with the traditional cattle grazing of the region.

Modern Day Hettinger Research Extension Center

In 2002, the newest phase of expansion of services to the producers of southwestern North Dakota was begun. The Southwest Feeders Feedlot, a cattle and lamb feedlot, was established south of Highway 12. This facility allowed the HREC to expand their research to an industry rapidly expanding in southwestern North Dakota. Leif Anderson, an animal scientist, was hired as the first Southwest Feeders Coordinator. The Southwest Feeders Feedlot provided 24 pens for conducting extension and research on calves after weaning and prior to finishing, commonly referred to as backgrounding. This feedlot also allowed for the feeding of up to 960 head of lambs during the summer months, providing the region with one of the largest university owned and operated lamb feedlots in the nation. These facilities also allowed for the wintering of a newly acquired Angus cow herd to conduct research on Conservation Reserve Program lands.

While the focus of livestock research conducted at the HREC remains sheep and lambs, similar to when it was re-opened in 1943, the HREC has evolved into a much broader Research Extension Center. Research now focuses on ewe and lamb feeding and reproductive management, calf backgrounding and beef cow management, agronomic issues addressing fertilization, seed, and pesticide applications, land transfer issues related to the Conservation Reserve Program, nesting and brood rearing behaviors of pheasant and sharp-tailed grouse, and research with the National Forest Service on the Grand River National Grasslands

south of Hettinger. The HREC currently employs a director (Dr. Christopher Schauer), agronomist (Eric Eriksmoen), agriculture economist (Dan Nudell), animal scientist (Michele Thompson), range and wildlife scientists (Amanda Gearhart and Dr. Benjamin Geaumont), 6 full-time support staff (Don Stecher, Terri Lindquist, Cassie Dick, Dave Pearson, Don Drolc, and Nels Olson) and 3 part-time support staff (Matt Korang, Abbey Richards, and John White). During the summer of 2009, an additional 8 graduate students and 13 summer technicians can be observed roaming the prairies and fields around the HREC collecting research data on agronomic research, grassland responses to sheep and cattle grazing, pheasant and sharp-tailed nesting success, ewe reproductive management techniques, and lamb performance in the feedlot. The current HREC Advisory Board consists of the following individuals: Nathan Swindler (Mott), Ted Sailer (Lodgepole, SD), Joe Rohr (Elgin), Greg Seamands (Lemmon, SD), Steve Pfeifer (McLaughlin, SD), Rodney Howe (Hettinger), Gloria Payne (Elgin), Matthew Benz (Beulah), Denise Andress (Lodgepole, SD), Julie Kramlich (Hettinger), Forrest Nash (Hettinger), Larry Leistritz (NDSU – Fargo), Dennis Sabin (Morristown, SD), David Merwin (Hettinger), Dean Wehri (Mott), Cole Ehlers (Hettinger), and Shawn Arndorfer – Chairman (Hettinger). While the research at the HREC has changed in the last 100 years from a small dairy, poultry, swine, and cropping Sub-Station to the current HREC, the dedication of the staff and advisory board of local residents who have guided the HREC through its transitions has never wavered. Similar to the rest of the region and state, the only constant during the past 100 years has been change and challenge: change driven by the livestock and crop producers of the region and their desire to have an Agriculture Experiment Station of their own.



Agronomy Department
Hettinger Research Extension Center

Eric Eriksmoen - Agronomist
Rick Olson - Technician
Caitlin Pearson & Gwen Kristy - Summer Labors

2009 Field Research Projects

Drill Strips, HRSW - 50 cultivars, Durum - 45 cultivars, Barley - 22 cultivars, Oat - 27 cultivars.
Drill strips are grown to increase seed for future use at the research center and harvested seed is sent to the NDSU Dept. of Cereal Science for grain quality analysis. These strips are also used for demonstration during the annual summer field tours. Status: **Ongoing.**

Hard Red Winter Wheat Variety Trial. 27 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Hard Red Winter Wheat Northern Regional Performance Nursery. 25 cultivars.
This trial was composed of experimental cultivars developed by plant breeders located throughout the great plain states and Canada. The information is used to assist plant breeders in determining cultivar adaptation and performance of agronomic traits (plant height, insect resistance, etc.) used in variety development. This is a cooperative project with the USDA - ARS at Lincoln, NE. The trial had no winter survival. Status: **Ongoing**.

HRWW Seed Inoculation Trial. 3 trials.
This trial was composed of winter wheat seed that was treated with a proprietary micro-organism (Azospirillium), to enhance root, plant growth and other agronomic characteristics. The information will be used in the further development of this inoculant. This trial was conducted for a fee and was a cooperative project with INTX microbials, LLC. Status: **Completed**.

Winter Rye Variety Trial. 6 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Carrington Research Extension Center. Status: **Ongoing**.

Hard Red Spring Wheat Variety Trial. 55 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Dept. Plant Science and private seed

companies. Status: **Ongoing**.

Hard Red Spring Wheat Uniform Regional Nursery. 37 cultivars.
This trial was composed of experimental cultivars developed by plant breeders located throughout the United States and Canada. The information is used to assist plant breeders in determining cultivar adaptation and performance of agronomic traits (plant height, insect resistance, etc.) used in variety development. This is a cooperative project with the USDA - ARS at St. Paul, MN. Status: **Ongoing**.

Western Hard Red Spring Wheat Elite Yield Trial. 76 cultivars.
This trial was composed of elite experimental cultivars developed by the HRS wheat plant breeder at NDSU. The information is used to assist in the development of spring wheat varieties for Western North Dakota. Status: **Ongoing**.

IMI Tolerant Hard Red Spring Wheat Elite Yield Trial. 40 cultivars.
This trial was composed of experimental cultivars that are being developed to tolerate imazamox (Beyond) herbicide. Cultivars are being developed by the HRS wheat plant breeder at NDSU. The information is used to assist in the development of IMI tolerant spring wheat varieties for North Dakota. Status: **Ongoing**.

IMI Tolerant Hard Red Spring Wheat Advanced Yield Trial. 10 cultivars.
This trial was composed of experimental cultivars that are in the final stages of development for tolerance to imazamox (Beyond) herbicide. Cultivars were developed by the HRS wheat plant breeder at NDSU and this test is a requirement for final approval and release to the public. The information is used by plant breeders to assist in the development of IMI tolerant spring wheat varieties for North Dakota. Status: **Ongoing**

Commercial White Spring Wheat Nursery. 26 cultivars.
This trial was composed of commercial and experimental cultivars developed by plant breeders located throughout the United States and Canada. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Williston Research Extension Center. Status: **Ongoing**.

HRSW Sawfly Breeder Nursery. 20 cultivars.
This trial was composed of commercial and experimental cultivars developed to resist sawfly infestations. Sawfly infestations have become a major problem in western North Dakota where no-till spring wheat is the predominant crop. The information is used to assist in the development of sawfly resistant varieties for western North Dakota. This is a cooperative project with the NDSU Dept. of Plant Sci. Status: **Ongoing.**

Optimizing the Identification and Development of High-yielding Spring Wheats with Resistance to Wheat Stem Sawfly. 15 cultivars at 3 locations.
This trial was composed of commercial and experimental cultivars developed to resist sawfly infestations. The objectives of the trial were to expand the knowledge base of sawfly, variety and environmental interactions relating to stem solidity, stem infestation and timing of infestations. The trials were seeded into a natural sawfly infested areas near Hettinger, Scranton and Regent. The information is used to assist in the development of integrated pest management strategies for western North Dakota. This is a cooperative project with the NDSU Dept. of Plant Sciences and the NDSU Dept. of Entomology and was funded by SBARE. Status: **Ongoing.**

Specialty Wheat Advanced Yield Nursery. 38 cultivars.
This trial was composed of experimental cultivars developed by the specialty wheat plant breeder at NDSU. The information is used to assist in the development of cultivars with specific characteristics such as unique starch or protein composition. Status: **Ongoing**.

Durum Variety Trial. 47 cultivars.
This trial was composed of established and experimental varieties and is used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Barley Variety Trial. 26 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. Of these cultivars, 12 were two row types and the remaining were 6-row types. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Western Regional Dryland Spring Barley Nursery. 31 cultivars.
This trial was composed of experimental cultivars developed by plant breeders located throughout the western United States and Canada. The information is used to assist plant breeders in determining cultivar adaptation and performance of agronomic traits (plant height, insect resistance, etc.) used in variety development. This is a cooperative project with the USDA - ARS at Aberdeen, ID. Status: **Ongoing**.

Oat Variety Trial. 34 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Naked Oat Nursery. 36 cultivars.
This trial was composed of experimental cultivars that have been developed throughout the United Stated and Canada and that produce a naked or hulless kernel. The information is used to assist the NDSU oat breeding program in the development of varieties adapted to North Dakota. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.
Oat Kernel Quality Trial. 10 cultivars.
This trial was conducted to identify and better understand specific kernel quality characteristics of selected commercial and experimental cultivars. The information is used to assist the NDSU Dept. of Cereal Sciences in the identification and development of specific oat kernel quality characteristics. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Completed**.

Spring Triticale Variety Trial. 6 varieties.
This trial was composed of established varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation. This is a cooperative project with the NDSU North Central Research Extension Center. Status: **Ongoing**.

Spring Emmer Variety Trial. 7 cultivars.
This trial was composed of established and experimental cultivars and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation. This was a cooperative project with the

NDSU Carrington Research Extension Center. Status: **Ongoing**.

Winter Spelt Variety Trial. 2 cultivars.
This trial was composed of established and experimental cultivars and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation. This was a cooperative project with the NDSU Carrington Research Extension Center. Status: **Ongoing**.

Winter Triticale Variety Trial. 7 cultivars.
This trial was composed of established and experimental cultivars and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation. This was a cooperative project with the NDSU Carrington Research Extension Center. Status: **Ongoing**.

Flax Variety Trial, 18 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Fall Seeded Broadleaf Crops Trial, 4 crops.
This trial was composed of established and experimental varieties of 3 different species (pennycress, winter camelina and turnip) to determine adaptation as a potential fall seeded broadleaf crop. The information is used by scientists and plant breeders to determine adaptation of various varieties and crops. There was very little winter survival. Status: **Ongoing**.

Winter Canola Variety Trial, 5 cultivars.
This trial was composed of established varieties and was used to determine winter tolerance and adaptation to this region. There was no winter survival. Status: **Ongoing**.

Spring Camelina Variety Trial, 18 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. Camelina is an industrial oil seed that currently has no established market in North Dakota but is being looked at as a possible bio-diesel crop. The information is used to determine adapted varieties and to assist in the development of this crop. This is a cooperative project with the NDSU Williston REC, MT State Univ., and Great Plains Oil & Exploration. The trial was destroyed by hail. Status: **Ongoing**.

Safflower Variety Trial, 12 cultivars.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Williston Research Extension Center. Status: **Ongoing**.

Canola Varity Trial. 29 varieties.
This trial was composed of established and experimental varieties submitted by seed companies and tested for a fee. The information is used by growers to assist them with variety selection and by seed companies to assist them in determining adaptation. The trial was destroyed by hail. Status: **Ongoing**.

Canola Elite Yield Nursery. 50 cultivars.
This trial was composed of experimental cultivars being developed for adaptation to this growing region. The information is used by the NDSU canola breeder in the development of adapted varieties. Status: **Ongoing**.

Spring Canola Herbicide Systems and Hybrids Comparison Trial. 13 varieties.
This trial was composed elite varieties submitted by canola companies and tested for a fee. The information is used by growers to assist them with variety selection and by seed companies to assist them in determining adaptation. The trial was destroyed by hail. Status: **Ongoing**.

Juncea Variety Trial. 24 cultivars.
This trial was composed of experimental cultivars being developed by Viterra Inc. and was tested for a fee. This crop is being developed as an alternative to canola for areas that are more prone to heat and moisture stress. The information is used by plant breeders to assist them with variety development. This is a cooperative project with Viterra Inc. The trial was destroyed by hail. Status: **Ongoing**.

Mustard Variety Trial, 7 varieties.
This trial was composed of established varieties and is used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection. Four of the varieties were yellow types, one was an oriental type and two were brown types. This is a cooperative project with the NDSU Langdon Research Extension Center. The trial was destroyed by hail. Status: **Ongoing**.

Crambe Variety Trial, 6 cultivars.
This trial is composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. This is a cooperative project with the NDSU Williston Research Extension Center. Status: **Ongoing**.

Pennycress Evaluation.
This evaluation was composed of seed collected from locally growing field pennycress plants. Field pennycress is a winter annual (or spring annual) weed species in the mustard family which grows readily throughout ND. It has been reported to have a seed oil content of up to 40%. To my knowledge, it has never been tested as a potential oilseed crop in ND. The trial was destroyed by hail. Status: **Ongoing**.

Buckwheat Variety Trial, 3 varieties.
This trial was composed of established varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety. This is a cooperative project with the NDSU Langdon Research Extension Center. The trial was destroyed by hail. Status: **Ongoing**.

Proso Millet Variety Trial, 5 varieties.
This trial was composed of established varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection. The Hettinger Research Extension Center coordinates the statewide proso millet trials. The trial was destroyed by hail. Status: **Ongoing**.

Field Pea Variety Trial. 18 cultivars.
This trial was composed of established and experimental varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by seed companies to assist them in determining adaptation. Green and yellow types

were represented in this trial. This was a cooperative project with the NDSU Carrington Research Extension Center. Status: **Ongoing**.

Dry Pea Flowering Date Adaptation Nursery. 12 cultivars.
This trial was composed of experimental cultivars being developed by the NDSU field pea breeder, Dr. Kevin McPhee. The information is used in cultivar development. This is a cooperative project with the NDSU Dept. of Plant Sciences. Status: **Ongoing**.

Dry Pea Advanced Yield Nursery. 38 cultivars.
This trial was composed of experimental cultivars being developed by the NDSU field pea breeder, Dr. Kevin McPhee. The information is used in cultivar development. This is a cooperative project with the NDSU Dept. of Plant Sciences. Status: **Ongoing**.

Lentil Variety Trial. 22 varieties.
This trial was composed of established and experimental varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders in determining cultivar adaptation and performance of agronomic traits (plant height, insect resistance, etc.) used in variety development. . All market classes were represented in this trial. This is a cooperative project with the NDSU North Central Research Extension Center. Status: **Ongoing**.

Chickpea Variety Trial. 10 varieties.
This trial was composed of established and experimental varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by plant breeders to assist them with variety development and by growers to assist them with variety selection. Kaboli and Desi types were represented in this trial. This is a cooperative project with the NDSU North Central Research Extension Center. Status: **Ongoing**.

Soybean Variety Trial, 10 varieties.
This trial was composed of experimental, private and public varieties and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by growers to assist them with variety selection and by seed companies to establish parameters of adaptation. Both conventional and Roundup Ready types were represented in this trial. This is a cooperative project with the NDSU Dept. Plant Science and private seed companies. Status: **Ongoing**.

Faba Bean Variety Trial. 5 cultivars.
This trial was composed of established and experimental cultivars and was used to determine adaptation and agronomic parameters of individual varieties. The information is used by plant breeders to assist them with variety development and by growers to assist them with variety selection. This is a cooperative project with the NDSU Carrington Research Extension Center.
Status: **Ongoing**.

Dry Edible Bean Variety Trials, 21 varieties.
This trial was composed of established and experimental varieties and was used to determine agronomic and quality parameters of individual varieties. The information is used by growers to assist them with variety selection and by plant breeders to determine adaptation of elite experimental lines for release to the general public. The trial included pinto, navy, great northern, red, pink and black types. This is a cooperative project with the NDSU Dept. Plant Science. Status: **Ongoing**.

Hybrid Sunflower Trial, 42 oil type hybrids.
This trial was composed of established and experimental varieties submitted by seed companies and tested for a fee. The information is used by growers to assist them with variety selection and by seed companies to assist them in determining adaptation. Status: **Ongoing**.

Hybrid Corn Trial, 7 hybrids.
This trial is composed of established varieties submitted by seed companies and tested for a fee. The information is used by growers to assist them with variety selection and by seed companies to assist them in determining adaptation. The trial was destroyed by hail. Status: **Ongoing**.

Corn Breeder Nurseries, 576 plots.
These trials were established to determine agronomic and yield factors of corn varieties being developed by NDSU. The information will assist the NDSU plant breeder in the development of drought tolerance and early maturing cultivars. Status: **Ongoing**.

Hay Barley Trial, 4 varieties.
This trial was composed of commercial varieties that were developed specifically for the production of livestock feed. The information is used to assist plant breeders in determining cultivar adaptation and feed values used in variety development. Status: **Ongoing**

Off Station Variety Trials, Scranton, Regent, New Leipzig, Selfridge and Mandan.
Twelve hard red spring wheat varieties, six durum varieties, six barley varieties and seven oat varieties were tested for yield, agronomic and quality factors at five southwestern North Dakota locations. Field pea and HRWW variety trials were also located at Mandan and grain corn at Regent. The trials are used for demonstration purposes during the annual field tours and to enhance the data base on variety adaptation. The information is used by growers to assist them with variety selection. These trials are located in farmer fields with cooperation from the NDSU Extension Service, the ARS Northern Great Plains Research Lab, Ducks Unlimited, Pulse USA and Legume Logic. Status: **Ongoing**.

National Phenology Network, cloned Syringa chinensis lilac.
This study involves the observation and collection of biological information such as bud formation, flowering and leaf senescence based on a standard phenological clock (lilac). This is a cooperative project with the Dept. of Geography, Univ. of WI - Milwaukee. Status: **Ongoing.**

Foliar Disease Evaluations in Wheat, 55 HRSW, 27 HRWW and 47 durum varieties.
These evaluations were conducted to document varietal tolerance/sensitivity to foliar diseases.
The information will assist growers in determining varietal susceptibility to several commonly occurring diseases. Status: **Ongoing**.

Control of Wheat Stem Maggot in Wheat, 7 treatments.
This trial was conducted to document the efficacy of various insecticide treatments on wheat stem maggot. Insecticide treatments included seed treatments, foliar treatments and combinations of seed and foliar treatments. The information will be used to gain a better understanding of control methods of this insect. Status: **Completed.**

Joint Management of Wheat Stem Sawfly, Fusarium Crown Rot and Weeds: Assessing the Ecological Basis of a Total Systems Approach to Pest Management Strategies, 12 treatments.
This trial was conducted to document insect, plant disease and weed infestations under farming scenarios utilizing various seed varieties, herbicide treatments and seeding rates. The information will be used to gain a better understanding of the inter-relationships between various pests and farming practices. This

trial is a cooperative project with Montana St. Univ. Status: **One more year.**

Cover Crops as a Source of Extra Grazing, 9 treatments.
This trial was conducted to document the potential practice of interseeding cover crops into spring seeded wheat as a source of post-harvest livestock feed. The utilization of "cover crops" is currently being promoted by several organizations as a method of enhancing species diversity which ultimately enhances the productivity of the land. These claims have little scientific backing and provide almost no direction on how those claims were achieved. The information will assist scientists in the understanding of the role cover crops may play in our environment and crop/livestock systems. This trial is a cooperative USDA – Five States Ruminant Consortium project under the direction of Dr. Greg Lardy. Status: **One more year.**

Evaluation of Cereal Seed Treatments, 5 treatments.
This trial was conducted to evaluate the efficacy and crop safety of a new fungal seed treatment being developed for cereal crops. The information will be used by the manufacturer to establish guidelines for use. This trial was funded by BASF Corp. Status: **Completed.**

Carryover Weed Control of Valor Herbicide Applied as a Pre-harvest Desiccant in Lentil, 5 treatments.
This trial was conducted to document the carryover weed control of Valor Herbicide that was applied as a pre-harvest desiccant on lentil the previous year. The information will be used by researchers and manufacturers to gain a better understanding of potential herbicide use and weed efficacy. This trial was funded by Valent. Status: **Completed.**

Evaluation of Sharpen Herbicide Applied Pre-Plant to HRSW, 7 treatments.
This trial was conducted to determine the effectiveness and crop safety of Sharpen Herbicide applied to HRSW. Sharpen is a new herbicide being developed for the control of broadleaf weeds in several crops including HRSW. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by BASF. Status: **Completed.**

Evaluation of Sharpen Herbicide Applied to Summer Fallow, 8 treatments.
This trial was conducted to determine the effectiveness Sharpen Herbicide applied as an aid to chemical fallow. Sharpen is a new herbicide being developed for the control of broadleaf weeds in several crops. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by BASF. Status: **Completed.**

Evaluation of Rimfire Max Herbicide for Grassy Weed Control in HRSW, 8 treatments.
This trial was conducted to document the efficacy and crop safety of Rimfire Max Herbicide applied with various combinations of adjuvants and other broadleaf weed herbicides for the control of both broadleaf and grassy weeds in spring wheat. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by Bayer CropScience. Status: **Completed.**

Evaluation of PrePare Herbicide for Grassy Weed Control in HRSW, 15 treatments.
This trial was conducted to document the efficacy and crop safety of PrePare Herbicide applied in split applications and in combination with other herbicides for the control of grassy weeds (wild oat, Persian darnel, Japanese brome and downy brome) in spring wheat. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by Arysta. Status: **Completed.**

Evaluation of PrePare Herbicide for Grassy Weed Control in HRWW, 17 treatments.
This trial was conducted to document the efficacy and crop safety of PrePare Herbicide applied in split applications and in combination with other herbicides for the control of grassy weeds (wild oat, Persian darnel, Japanese brome and downy brome) in winter wheat. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by Arysta. Status: **Completed.**

Evaluation of Fall and Spring Applications of PowerFlex Herbicide for Grassy Weed Control in HRWW, 9 treatments.
This trial was conducted to document the efficacy and crop safety of PowerFlex Herbicide applied in split applications and in combination with other herbicides for the control of grassy weeds (wild oat, Persian darnel, Japanese brome and downy brome) in winter wheat. PowerFlex is a new herbicide for use in controlling tough grassy weeds in winter wheat. The information will be used by farmers and by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by Dow AgroSciencs. Status: **Completed.**

Evaluation of Application Timing of Fall Applied Herbicides in Pulse Crops and Flax, 6 herbicide treatments applied to 4 crops at 3 application timings.
This trial was conducted to document the efficacy and crop safety of 6 herbicide treatments applied at 3 different timings in the fall. Field peas, chickpeas, lentils and flax were then planted into these treatment combinations. The information will be used by farmers and by the manufacturers to establish guidelines for herbicide use. This trial was partly funded by Valent. Status: **Completed.**

Evaluation of Clearfield Wheat Varieties, 10 varieties x 2 herbicide treatments.
NDSU is developing HRSW varieties with genetic tolerance to imazimox and this trial is designed to demonstrate that tolerance. The information will be used by the plant breeder during submission of documentation for variety approval. This is a cooperative trial with the NDSU Dept. Plant Science and BASF. Status: **Ongoing.**

Evaluation of 2,4-D Applied Pre-Plant to HRSW, 15 treatments.
This trial was conducted to determine the effectiveness and crop safety of various formulations of 2,4-D herbicide applied pre-plant in spring wheat. The information will be used by the manufacturer to determine herbicide compatibility and use. This trial was funded by Loveland Products, Inc. Status: **Completed.**

Evaluation of Chemical Weed Control in Camelina, 13 treatments.
This trial was conducted to determine the efficacy and crop safety of 15 herbicides applied pre-emergence to camelina. Camelina is a crop being developed for the biofuel industry and appears to be well adapted to our growing region. Chemical weed control options need to be investigated and approved for successful production of this crop. The information will be used by researchers in the development of potential herbicide use in this crop. Status: **Ongoing**.

Broadleaf Weed Control in Wheat, 16 treatments.
This trial was conducted to determine the effectiveness of various herbicides and herbicide combinations at controlling various broadleaf weeds in wheat. There are many different broadleaf weed herbicides on the market and many different herbicide combinations being used by producers. The trial looked at various herbicides and herbicide combinations for injury to the crop and for herbicide effectiveness at controlling weeds. The information will be used by producers for herbicide tank mix selection and by manufacturers for tank mix and application guidelines. This trial is a cooperative project with the NDSU Dept. of Plant Sciences. Status: **Ongoing**.

Grassy Weed Control in Wheat, 14 treatments.
This trial was conducted to determine the effectiveness of various herbicides and herbicide combinations at controlling various grassy weeds in wheat. There are many different grassy weed herbicides on the market and many different herbicide combinations being used by producers. The trial looked at various herbicides and herbicide combinations for injury to the crop and for herbicide effectiveness at controlling weeds. The information will be used by producers for herbicide tank mix selection and by manufacturers for tank mix and application guidelines. This trial is a cooperative project with NDSU Dept. of Plant Sciences. Status: **Ongoing**.

Evaluation of Pulsar Herbicide for Broadleaf Weed Control in HRSW, 15 treatments.
This trial was conducted to document the efficacy, crop safety and tank mix compatibility of Pulsar Herbicide for the control of broadleaf weeds in spring wheat. Pulsar is a new herbicide for use in small grains. The information will be used by farmers and by the manufacturer to establish guidelines for herbicide use. This trial was funded by Syngenta. Status: **Completed.**

Evaluation of Pinoxaden TBC + Broadleaf Herbicide Combinations in HRSW, 15 treatments.
This trial was conducted to document the efficacy and crop safety of a new formulation of pinoxaden (Axial) used in combination with broadleaf herbicides in spring wheat. Pinoxaden is a popular herbicide that is very effective on most common grassy weeds found in small grains. The information will be used by the manufacturer to establish guidelines for herbicide compatibility and use. This trial was funded by Syngenta. Status: **Completed.**

Evaluation of Rate and Application Timing of Assure II Herbicide on Tough Grassy Weeds in Field Pea, 11 treatments.
This trial was conducted to document the efficacy and crop safety of various rate and timing combinations of Assure II Herbicide for the control of tough grassy weeds (wild oat, Persian darnel, Japanese brome and downy brome) in field pea. The information will be used by farmers and by the manufacturer to establish guidelines for herbicide use. This trial was funded by Dupont. Status: **Completed.**

Evaluation of Tough Grassy Weed Control in Spring Wheat, 7 treatments.
This trial was conducted to document the efficacy and crop safety of various herbicide combinations on tough grassy weeds (downy brome, Japanese brome, wild oat and Persian darnel) in spring wheat. There are many new herbicides on the market for grassy weed control in wheat, however, none of them have the ability to control all of the grassy weed species found in many farmer fields. This trial is an attempt to investigate new herbicide combinations that may have the ability to provide total grassy weed control. The information will be used by farmers, researchers and manufacturers to gain a better understanding of potential herbicide combinations and weed efficacy. Status: **Ongoing.**

Evaluation of Late Herbicide Applications for Tough Grassy Weed Control in Spring Wheat, 4 treatments.
This trial was conducted to document the efficacy and crop safety of various herbicide combinations applied at the end of the application window to tall tough grassy weeds (downy brome, Japanese brome, wild oat and Persian darnel) in spring wheat. The ability to control grassy weeds tends to diminish over time as the growing season progresses. This trial was an attempt to investigate a few herbicide combinations that may have the ability to provide higher levels of control to larger, more mature grassy weed species. The information will be used by farmers, researchers and manufacturers to gain a better understanding of potential herbicide combinations and weed efficacy. Status: **Ongoing.**

NDAWN and NOAA Weather Monitoring.
The Hettinger REC agronomy dept. is responsible for daily collection and transmission of weather data to the National Oceanic and Atmospheric Administration and for the maintenance of the North Dakota Ag. Weather Network weather station. Status: **Ongoing.**

Evaluation of Perennial Herbaceous Biomass Crops (Switchgrass).
This trial was established to document the appropriate grass species, harvest methods, production practices and economics in the production of perennial biomass stands. The trial was reseeded this year after very poor stand establishment in past years caused by drought. The information will assist in the feasibility of biomass production for conversion to bio-energy. This trial is being coordinated by the NDSU Central Grasslands REC, Streeter and is being funded by the ND Natural Resources Trust. Status: **Ongoing.**

Influence of Thiamin Supplementation on Feedlot Performance and Carcass Quality of Lambs Fed a 60% Distillers Dried Grain plus Solubles Finishing Ration[1]

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The objective of this research was to evaluate the influence of thiamin supplementation on feedlot performance and carcass characteristics of lambs fed a 60% dried distillers grain plus solubles finishing ration. Level of thiamin supplementation may influence performance and dry matter intake; however thiamin supplementation did not have an effect on the incidence of PEM in feedlot lambs. Feeding dried distillers grains plus solubles at 60% of dietary dry matter provided acceptable lamb performance and carcass composition.

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Introduction

Recent research indicates sheep can be fed higher levels of dried distillers grains plus solubles (DDGS) than previously considered optimal without affecting carcass characteristics (Schauer et al., 2008). This provides an opportunity for increase utilization of dried distillers grains plus solubles in lamb finishing rations, potentially resulting in cheaper feed costs for lamb finishers. One potential problem with feeding increased levels of dried distillers grains plus solubles is the high dietary sulfur levels which result. These can potentially lead to neurological problems (polioencephalomalacia; PEM) in ruminants. Polioencephalomalacia is thought to result from a thiamin deficiency induced by the conversion of sulfate to sulfite in the rumen. To avoid problems with PEM, supplementation of 100-500mg/d thiamin (McDowell, 2000) in diets containing more than 0.4% S in high concentrate diets and 0.5% S in higher roughage diets (NRC, 2005) has been adopted. However, no research has examined if level of thiamin in these diets will affect feedlot performance, carcass characteristics, and incidence of PEM in feedlot lambs. Therefore, our objective was to determine the influence of thiamin level on feedlot performance, carcass characteristics, and incidence of PEM in lambs fed 60% dried distillers grains plus solubles.

Procedures

The objective of this study was to determine the influence of thiamin level on feedlot performance, carcass characteristics, dry matter intake, and incidence of PEM. Two-hundred forty western white-face lambs (wethers and ewes) were utilized in a randomized complete design to evaluate the influence of level of thiamin supplementation in lamb finishing diets containing 60% dried distillers grains plus solubles. Lambs were assigned to one of sixteen pens and each pen assigned to one of four treatment diets (4 pens per treatment). The final finishing diet was balanced to contain 60% dried distillers grains plus solubles (DM basis), which resulted in a dietary S concentration of 0.72%. The NRC maximum tolerable level of S is 0.40% S (preliminary analysis of these diets are presented in Table 1).Treatments diets differed in the amount of supplemental thiamin supplied; these levels were: 1) **CON** (no supplemental thiamin), 2) **LOW** (15.8 mg/hd/d thiamin), 3) **MED** (48.4 mg/hd/d thiamin), or 4) **HIGH** (53.0 mg/hd/d thiamin). Rations were mixed in a

grinder-mixer and provided ad-libitum via bulk feeders. Content of feeders (feed refusals) were collected and weighed at the end of the study. Lambs were weighed on days 0, 27, 56, 84, and 110. Initial and final weights were the average of two-day weights. Following the 110 d finishing period, lambs were transported for harvest and subsequent carcass data collection to Iowa Lamb Corp, Hawarden, IA. One hundred eighty five lambs of the original 240 (77.08%) were shipped. Lambs with a live weight less than 110lbs 28d prior to slaughter were not shipped. Treatment distributions were as follows; 49 head of the CON treatment, 48 head of the LOW treatment, 44 head of the MED treatment, and 44 head of the HIGH treatment. Feedlot performance and carcass trait data were analyzed as a randomized complete design using the GLM procedures of SAS (SAS Inst. Inc., Cary, NY) with pen serving as the experimental unit. Carcass data was analyzed similarly, with missing data points from underweight lambs not included in the data set, but with pen still serving as experimental unit. The model included treatment. Linear, quadratic, and cubic contrasts for increase level of thiamin supplementation were evaluated.

Results

Based on preliminary analysis of feedstuffs and dry matter intake calculated daily intake of thiamin were 1.6, 15.8, 48.4, and 53.0 mg/hd/d for CON, LOW, MED, and HIGH respectively. Results for feedlot lamb performance and carcass quality are reported in Table 2. There was a tendency for quadratic ($P = 0.08$) increases in final BW; specifically the CON, LOW, and MED treatment lambs finished heavier than the group fed the HIGH level of thiamin. Average daily gain exhibited a similar response, although cubic ($P = 0.08$) in nature with the CON, LOW, and MED treatment groups gaining weight at a faster rate than the HIGH treatment group. Feed dry matter intake (DMI) as well as F:G or G:F were also affected cubically ($P < 0.03$) by level of thiamin supplementation.

Mortality was not affected ($P = 0.43$) by level of supplemental thiamin. Hot carcass weight (HCW) decreased quadratically ($P = 0.05$), while leg score had a quadratic tendency ($P = 0.06$) for a lower score with increased thiamin supplementation. Fat depth, body wall thickness, ribeye area, flank streaking, quality grade, yield grade, and percent boneless closely trimmed retail cuts (%BCTRC) were all unaffected ($P > 0.16$) by level of supplemental thiamin. However, there was a cubic tendency ($P = 0.10$) for differences in conformation score.

Discussion

The tendency for quadratic decrease in final weight with increasing level of thiamin was an unexpected result. Given that excess thiamin is cleared by the kidneys (McDowell, 2000), and that intake of upwards of 1000 times requirement are thought to be safe (NRC, 1987) it is difficult to attribute the decreased performance to thiamin toxicity at the levels fed in the present study. Further, it is unclear if the differences in performance are due to a negative effect of the 53 mg/hd/d thiamin intake or if the optimal level of supplementation is closer to 15.8 mg/hd/d. Palatability could be another possible cause for the differences in intake. Carcass characteristics with the exception of leg score and hot carcass weight were unaffected by treatment. The data from the present study as well as that of (Schauer et al., 2008) are largely comparable. Differences in HCW and leg score are more than likely driven by the similar differences observed in final BW.

As previously stated no differences ($P = 0.43$) in mortality were observed due to level of thiamin supplementation. During the course of this study one lamb did die; however the cause of death, as determined by a veterinarian, was chronic respiratory illness. Of further interest is that no (0) cases of polioencephalomalacia were observed during the entire 110 d feeding period; even with dietary S levels (0.72% S DM basis) nearly twice the maximum tolerable level of sulfur 0.4% for high concentrate diets reported by the NRC (2005). Contrary to the present study Krasicka et al. (1999) reported that all lambs fed a low fiber-high starch diet containing 0.72% S died from PEM after 12 weeks. Loneragan et al., (2005) hypothesized that the therapeutic effects of thiamin in PEM-affected animals is either due to an increased requirement for thiamin or a beneficial effect of thiamin on impaired brains. The present research discounts the proposed increased requirement; at least in feedlot lambs fed distillers grains as the sulfur source, In fact, our data suggests that thiamin was not required to prevent PEM. However, we cannot support or dismiss the second theory, relating to the beneficial effect of thiamin on impaired brains, as no cases of PEM occurred in our study.

Further links between sulfur induced PEM and ruminal pH change have been explored (Gould, 1998). Gould (1998) concluded that in diets with levels of sulfur exceeding 0.3 percent the combination of dietary sulfur, ruminal sulfide production, and increased thiaminase production may increase incidence of PEM. Alves de Oliveria et al. (1996) reported that decreasing ruminal pH did not decrease microbial production of thiamin; however, the decrease in rumen pH has been found to favor thiaminase producing bacteria (Morgan and Lawson, 1974; Boyd and Walton, 1977; Thomas et al., 1987). In the present study lambs were previously adapted to high concentrate diets prior to receiving the 60% dried distillers grains plus solubles diet which contained presumed toxic levels of sulfur. This along with the fact that no measurements of ruminal sulfide or thiaminase were conducted does not allow for a comparison of the present study to the previous data. However, in a second portion of this study (unpublished data) lambs which were individually fed the same diets presented here were adapted from a medium concentrate diet to a high concentrate diet while increasing the amount of dried distillers grains plus solubles and thus sulfur content of the diet. While this portion of the study is on-going no incidences of PEM have occurred even with the suspected increased susceptibility to PEM during diet adaptation.

A review of literature reporting the amount of S fed to ruminants in corn by-product based rations further demonstrates the inconsistencies in the amount of sulfur required to cause neurological problems, such as PEM. Similar to the present study (Schauer et al., 2008) fed lambs a finishing diet which contained 0, 20, 40, or 60% dried distillers grains plus solubles. In this study no differences in animal performance were reported; further, the 60% dried distillers grains plus solubles diet which contained 0.55% S (DM basis) did not cause any incidence of PEM. Contrary to the present study, (Niles et al., 2002) reported that 10 of 14 calves fed a corn gluten feed based diet exhibited PEM; those calves affected were fed diets that contained either 0.554 or 0.701% S (DM basis). Both authors reported water sulfate values; the water consumed by the lambs (Schauer et al., 2008) contained 141 ppm S, while the water consumed by the steers (Niles et al., 2002) contained 56ppm S. Unfortunately, Niles et al, (2002) did not report how much, if any, supplemental thiamin was provided to the steers in their study; however, Schauer et al, (2008) did report that their lambs did receive 142 mg/hd/d of supplemental thiamin. Huls et al. (2008) fed 50 percent modified dry distillers grains plus solubles while supplementing 150 mg/hd/d thiamin without affecting performance when compared to steers fed control diets. Contrary to these results Buckner et al. (2007) discontinued a 50 percent dried distillers grains plus solubles when multiple steers exhibited polioencephalomalacia while receiving 150 mg/hd/d thiamin.

Sulfur from water has also been implicated as a cause of PEM in ruminants. Ward and Paterson (2004) evaluated thiamin supplementation as a method of preventing PEM in steers consuming high sulfate (4000 ppm) water. Two steers on high sulfate water and one steer from high sulfate water supplemented with 1g/hd/d thiamin died; however, only one case from the unsupplemented group was confirmed to have died from PEM. Although no incidences of PEM occurred, (Loneragan et al, 2001) reported that steers consuming water of increasing sulfate concentrations negatively impacted performance and carcass characteristics. However, this decrease in performance was not observed in lambs fed dried distillers grains diets containing increasing amount of sulfur (Schauer et al, 2008).

The fact that the lambs fed 60% dried distillers grains plus solubles from (Schauer et al., 2008) as well as the lambs fed 60% dried distillers grains plus solubles in the present study did not develop PEM, even when not given supplemental thiamin, demonstrates repeatability of our results. Further, this data appears to indicate that either the NRC maximum tolerable level of S, or the need for supplemental thiamin, is in question. At a minimum Schauer et al. (2008) and the present study illustrate the need for additional research to further determine the interactive affects of sulfur, thiamin supplementation, and dietary grain concentration in finishing rations, and the effect they collectively have on the incidence of polioencephalomalacia.

Implications

The current research as well as previous work has demonstrated that dried distillers grains plus solubles can be included in lamb finishing rations at levels up to 60% of dietary dry matter in limited situations. Feeding dried distillers grains plus solubles at 60% of dietary dry matter does not appear to increase the incidence of

polioencephalomalacia in lambs when water with low sulfur (141 ppm sulfate) is available. Further, the use of thiamin as a dietary additive to aide in the prevention of polioencephalomalacia does not appear to be necessary in feeding environments with similar sulfur present in the feed and water as observed in the present study. However, the authors still strongly advise producers to have feed samples as well as water samples tested before determining their livestock's risk to developing PEM due to sulfur toxicity.

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Table 1. Ingredient and nutritional composition of diets fed to feedlot lambs.

	Diets[1]			
Item	CON	LOW	MED	HIGH
Ingredient	DM basis			
Alfalfa Hay, %	15.00	15.00	15.00	15.00
Corn, %	21.38	21.38	21.38	21.38
DDGS, %	60.00	60.00	60.00	60.00
Ammonium Chloride, %	0.5	0.5	0.5	0.5
Limestone, %	2.25	2.25	2.25	2.25
Bovetec, %	0.085	0.085	0.085	0.085
TM package[2], %	0.78	0.78	0.78	0.78
Copper Sulfate, %	0.002	0.002	0.002	0.002
Thiamin, %	0.00	0.004	0.007	0.011
Nutrient composition				
CP, %	23.7	23.3	23.4	23.6
TDN, %	84.5	84.4	84.5	85.1
NEm, Mcal/lb	0.92	0.92	0.92	0.93
NEg, Mcal/lb	0.61	0.61	0.61	0.62
Crude Fat, %	7.41	7.38	7.51	7.71
Acid Detergent Fiber, %	10.5	10.5	10.9	11.1
Sulfur, %	0.74	0.69	0.71	0.72
Calcium, %	1.33	1.59	1.17	1.08
Phosphorus, %	0.68	0.69	0.70	0.72
Copper, ppm	11.0	12.0	9.0	11.0
Zinc, ppm	71.0	67.0	63.0	59.0
Thiamin, ppm[3]	0.90	8.88	24.42	30.46

[1] Treatments abbreviations CON (no supplemental thiamin) LOW (15.8 mg/hd/d thiamin), MED (48.4 mg/hd/d thiamin), and HIGH (53.0 mg/hd/d thiamin).

[2] TM package contained: 11.7%Ca, 10.0% P, 14% salt, 0.1% K, 0.1% Mg, 20ppm Co, 100ppm I, 2,450ppm Mn, 50ppm Se, 2,700ppm Zn, 300,000 IU/lb Vitamin A, 30,000 IU/lb Vitamin D_3, and 600 IU/lb Vitamin E.

[3] Thiamin supplementation calculated based on laboratory analysis of premixed supplement multiplied by %composition of supplement in diet.

Table 2. Influence of thiamin supplementation on feedlot lamb performance and carcass characteristics

	Treatment[1]						*P*-value[3]		
Item	CON	LOW	MED	HIGH	SEM[2]	*P*-value	Linear	Quad	Cubic
Initial Wt, lbs	71.76	71.60	71.45	71.63	0.34	0.94	0.73	0.63	0.83
Final Wt, lbs	137.07	138.22	137.44	133.03	1.43	0.10	0.07	0.08	0.79
ADG, lbs/d	0.59	0.61	0.60	0.56	0.01	0.08	0.09	0.04	0.08
Intake, lbs/hd/d	3.90	3.92	4.36	3.83	0.08	0.001	0.49	0.004	0.002
F:G, lbs DMI: lbs gain	6.60	6.48	7.29	6.86	0.19	0.05	0.09	0.45	0.03
G:F, lbs gain; lbs DMI	0.15	0.15	0.14	0.15	0.004	0.05	0.08	0.57	0.03
Mortality, %	1.67	0	0	0	0.83	0.43	0.20	0.34	0.66
HCW, lbs	68.98	70.66	69.84	68.06	0.81	0.18	0.35	0.05	0.68
Leg Score[4]	11.32	11.48	11.60	11.05	0.17	0.16	0.36	0.06	0.41
Conformation score	11.50	11.42	11.57	11.23	0.09	0.09	0.12	0.17	0.10
Fat Depth, in[5]	0.31	0.34	0.30	0.33	0.02	0.59	0.96	0.96	0.18
Body Wall Thick, in	1.07	1.10	1.00	1.05	0.04	0.32	0.39	0.83	0.11
Ribeye Area, in^2	2.42	2.40	2.43	2.43	0.06	0.98	0.77	0.92	0.81
Flank Streaking[6]	336.92	340.25	353.33	336.36	6.74	0.29	0.71	0.16	0.21
Quality Grade	11.34	11.33	11.47	11.18	0.08	0.17	0.36	0.13	0.15
Yield Grade[7]	3.48	3.75	3.42	3.66	0.18	0.55	0.82	0.94	0.17
%BCTRC[8]	44.66	44.33	45.01	46.81	0.21	0.18	0.24	0.75	0.06

[1]Treatments abbreviations CON (no supplemental thiamin) LOW (15.8 mg/hd/d thiamin), MED (48.4 mg/hd/d thiamin), and HIGH (53.0 mg/hd/d thiamin).
[2]Standard Error of Mean; n = 4.
[3]*P*-value for linear, quadratic, and cubic effects of increasing level of thiamin supplementation.
[4]Leg score, conformation score, and quality grade: 1 = cull to 15 = high prime.
[5]Adjusted fat depth and yield grades.
[6]Flank streaking: 100-199 = practically devoid; 200-299 = traces; 300-399 = slight; 400-499 = small; 500-599 = modest.
[7]Yield Grade = 0.4 + (10 x adjusted fat depth).
[8]% Boneless closely trimmed retail cuts (49.936 - (0.0848 x Hot Carcass Weight, in.) - (4.376 x Fat Depth, in.) - (3.53 x BW, in.) + (2.456 x Ribeye Area, in^2)).

INFLUENCE OF THIAMIN SUPPLEMENTATION ON FEEDLOT PERFORMANCE, CARCASS QUALITY, AND INCIDENCE OF POLIOENCEPHALOMALACIA IN LAMBS FED A 60% DISTILLERS DRIED GRAINS WITH SOLUBLES FINISHING RATION[1]

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ABSTRACT: Limited data are available regarding the influence of thiamin supplementation on incidence of polioencephalomalacia (**PEM**) in lambs fed diets containing high S levels (> 0.7%). Therefore, our objective was to evaluate the influence of thiamin supplementation on feedlot performance, carcass quality, and incidence of PEM in lambs fed a finishing diet containing 60% distillers dried grains with solubles (**DDGS**). Two studies (Study 1, 16 pens, 240 lambs; Study 2, 55 individually fed lambs) were conducted using completely random designs to evaluate the influence of level of thiamin supplementation. Lamb finishing diets contained 60% DDGS which resulted in dietary S concentration of 0.7% (DM basis). Treatment diets were based on level of thiamin supplementation, 1) **CON** (no supplemental thiamin), 2) **LOW** (50 mg·hd-1·d-1), 3) **MED** (100 mg·hd-1·d-1), or 4) **HIGH** (150 mg·hd-1·d-1). Additionally in Study 2, a fifth treatment (**HIGH+S**) was added which contained 0.87% S (DM basis) and provided 150 mg·hd-1·d-1 thiamin. This increase in S was achieved by addition of dilute sulfuric acid to DDGS. In study 1, ADG changed quadratically ($P = 0.04$) with lambs fed CON, LOW, and MED gaining faster than lambs fed HIGH. In Study 1, DMI and G:F responded cubically ($P \leq 0.03$) to level of thiamin supplementation with MED lambs having greater DMI and decreased G:F. No differences in performance data were observed in Study 2. In both studies, most carcass characteristics were unaffected with the exception of carcass conformation (Study 1; $P = 0.05$) and flank streaking (Study 2; $P = 0.03$). No clinical cases of PEM were observed during the course of either study. These data indicate limited benefits for the use of thiamin to aide in the prevention of PEM in lambs fed diets containing 60% DDGS and greater than 0.7% S.

Introduction

One of the challenges with use of ethanol co-products is the potential for high dietary S levels. High S diets can cause polioencephalomalacia (**PEM**) in ruminants. Inclusion of large percentages of co-product feeds, like distillers dried grains with solubles (**DDGS**), in finishing rations has been avoided, in part, due to problems with PEM as well as concerns about optimal animal performance and carcass characteristics. While the common dogma is that including DDGS at over 40% of dietary DM in beef cattle finishing diets will decrease performance, research indicates sheep can be fed higher levels of DDGS without affecting animal performance (Schauer et al., 2008). This provides an opportunity for increased utilization of DDGS in lamb finishing rations. Concerns remain if increased S levels in DDGS-based rations will result in PEM, and if a method of reducing or preventing PEM exists. Thiamin supplementation is one proposed method of reducing or preventing PEM in ruminant animals. The efficacy of thiamin supplementation in

preventing PEM is likely impacted by the mechanisms by which PEM is caused (e.g. long-term thiamin deficiency or high hydrogen sulfide gas concentration). Further, the effect and dose of thiamin necessary to prevent such cases of PEM requires more investigation. For the purposes of this research, our hypothesis was that providing increased dietary thiamin would decrease the incidence of PEM in lambs fed high S diets without affecting animal performance. Therefore, our objectives were to determine the influence of thiamin level on feedlot performance, carcass characteristics, DMI, and incidence of PEM in lambs fed a 60% DDGS finishing ration.

Materials and Methods

Study 1. Prior to initiation of the research, all procedures were approved by the NDSU Animal Care and Use Committee. Two-hundred forty western white-face lambs (32.5 ± 4.8 kg; wethers and ewes) were utilized in a completely random design to evaluate the influence of level of thiamin supplementation in lamb finishing diets. The final finishing diet was balanced to contain 60% DDGS (DM basis), which resulted in a dietary S concentration averaging 0.72% (Table 1). Treatments diets differed in the amount of supplemental thiamin supplied; diets were formulated to provide: 1) **CON** (no supplemental thiamin), 2) **LOW** (50 mg·hd-1·d-1 thiamin), 3) **MED** (100 mg·hd-1·d-1 thiamin), or 4) **HIGH** (150 mg·hd-1·d-1 thiamin) based on an estimated daily DMI of 1.36 kg·hd-1·d-1. Rations were mixed in a grinder-mixer and provided ad-libitum via bulk feeders. Contents of feeders (feed refusals) were collected and weighed at the end of the study. Initial and final weights were the average of 2-d weights. Following the 110-d finishing period, lambs were transported for harvest and subsequent carcass data collection at Iowa Lamb Corporation Hawarden, IA by trained personnel. One-hundred eighty-five lambs of the original 240 (77.08%) were shipped. Lambs with a live weight less than 50 kg 28 d prior to slaughter were not shipped to this location and as a result carcass data were not collected on these lambs. Treatment distribution of the lambs shipped to Iowa Lamb Corporation was 49, 48, 44, and 44 head for CON, LOW, MED, and HIGH, respectively.

Study 2. Fifty-five western white-face wether lambs (38.4 ± 3.2 kg) were utilized in a completely random design to evaluate the influence of level of thiamin supplementation and increased S level in lamb finishing diets containing 60% DDGS (treatment diets for CON, LOW, MED, and HIGH previously described, study 1). Additionally, a fifth treatment was added in which dietary thiamin was supplemented at the HIGH level while dietary S was increased from 0.71% to 0.87% (DM basis) with the addition of dilute sulfuric acid to DDGS (**HIGH+S;** Table 2). The number of lambs on each treatment was: 12, 10, 10, 12, and 11 head for CON, LOW, MED, HIGH, and HIGH+S, respectively. Lambs were assigned to one of five treatment diets and fed in individual pens for 112 d. Feed was offered daily and refusals were collected and weighed weekly. Initial and final weights were the average of 2-d weights. Following the 112-d finishing period, lambs were harvested and carcass data collected at the NDSU Meats Laboratory by trained personnel.

Statistical Analysis. Lamb performance and carcass data were analyzed as a completely random design using the GLM procedures of SAS (SAS Inst. Inc., Cary, NY) with pen (Study 1) and lamb (Study 2) serving as the experimental unit. Carcass data for Study 1 was analyzed with missing data points from underweight lambs not included in the data set, but with pen still serving as experimental unit. For both studies, the model included treatment while linear, quadratic, and cubic contrasts for increasing level of thiamin supplementation as well as a direct comparison of the HIGH vs. HIGH+S treatments (Study 2) were evaluated. *P*-values < 0.05 were considered significant and values less than 0.10 and greater than 0.05 were considered tendencies. When an overall F-test was not significant, but a contrast *P*-value was significant the results will be discussed as a tendency.

Results

Study 1. There was a tendency for quadratic ($P = 0.08$; Table 3) decrease in final BW; specifically the CON, LOW, and MED treatment lambs finished at heavier weights than the group fed the HIGH level of thiamin. This coincides with ADG which also exhibited a quadratic decrease ($P = 0.04$) with the CON, LOW, and MED treatment groups gaining weight at a faster rate than the HIGH treatment group. Dry

matter intake as well as G:F responded cubically ($P \leq 0.03$) to level of thiamin supplementation with the MED fed lambs consuming more feed resulting in decreased G:F.

Mortality was not affected ($P = 0.43$) by level of supplemental thiamin and averaged 0.42% across all treatments. Hot carcass weight tended to decrease quadratically ($P = 0.05$), while leg score had a quadratic tendency ($P = 0.06$) for a lower score with increased thiamin supplementation. Fat depth, body wall thickness, ribeye area, flank streaking, quality grade, and yield grade were all unaffected ($P \geq 0.17$) by level of supplemental thiamin. However, there was a cubic tendency ($P = 0.07$) for differences in conformation score with CON and MED having greater scores than LOW or HIGH. Additionally, lambs in the HIGH group tended to have a greater percentage of boneless closely trimmed retail cuts ($P = 0.06$; cubic response).

Study 2. There were no differences ($P \geq 0.46$; Table 4) in initial BW, final BW, ADG, DMI, leg score, carcass conformation, fat depth, body wall thickness, ribeye area, yield grade, or percentage boneless closely trimmed retail cuts of the lambs in Study 2. Gain efficiency and HCW tended differ in a cubic fashion ($P \leq 0.08$). Specifically, the lambs in the MED group had poorer G:F and lower HCW than all other treatment groups. There was a difference in flank streaking between the HIGH and the HIGH+S groups (325 vs. 482, respectively for HIGH and HIGH+S; $P = 0.002$). The increase in flank streaking further resulted in a tendency ($P = 0.02$) for differences in quality grade between HIGH and HIGH+S treatment groups. No differences in the incidence of morbidity or mortality were noted in Study 2 as no lambs died or were treated for illness during the study.

Discussion

The decrease in final weight with increasing level of thiamin in Study 1 was an unexpected result. Given that excess thiamin is cleared by the kidneys (McDowell, 2000) and that intake of upwards of 1000 times requirement are thought to be safe (NRC, 1987), it is difficult to attribute the decreased performance to thiamin toxicity at the levels fed in the present study. Palatability differences due to the sulfurous odor and bitter taste (McDowell, 2000) associated with thiamin could be another possible explanation for the differences in intake. Results from Study 2 contradict Study 1, as there were no differences in final BW among the treatments. Differences in HCW and leg score are more than likely driven by the similar differences observed in final BW in Study 1.

There were no occurrences of PEM observed during either of these studies; even though dietary S levels (0.69 to 0.87% S DM basis) were nearly twice the recommended maximum tolerable level of S (0.4% for high concentrate diets; NRC, 2005). Contrary to the present studies, Krasicka et al. (1999) reported that all lambs fed a low fiber-high starch diet containing 0.72% S died from PEM after 12 weeks. Loneragan et al. (2005) hypothesized that the therapeutic effects of thiamin in PEM-affected animals are either due to an increased requirement for thiamin or a beneficial effect of thiamin on impaired brains. The present research discounts the proposed increased requirement at least in feedlot lambs fed high levels of DDGS as the S source. However, we cannot support or dismiss the second theory relating to the beneficial effect of thiamin on impaired brains as no clinical cases of PEM occurred in our studies. Our data suggests that PEM cannot be induced in lambs fed 0.69 to 0.87% S when the primary dietary S source is DDGS. This indicates the threshold level may be greater in lambs than previously thought, or that disposition of S (what form it is in the feed, its fate during ruminal fermentation, and its route of excretion) should be investigated more fully.

A review of literature reporting the amount of S fed to ruminants in corn co-product-based rations further demonstrates the inconsistencies in the amount of S required to cause neurological problems, such as PEM. The present study demonstrates that feeding DDGS at 60% of dietary DM does not appear to increase the incidence of PEM in lambs when water with low sulfate content (< 141 ppm) is available. Similar to the present studies the 60% DDGS diet fed by Schauer et al. (2008) contained 0.55% S (DM basis) did not result in any cases of PEM. Contrary to these studies Niles et al. (2002) reported that 10 of 14 calves fed corn gluten feed-based diets exhibited PEM; those calves affected were fed diets that contained either 0.55

or 0.70% S (DM basis). Huls et al. (2008) fed 50% modified wet distillers grains plus solubles while supplementing 150 mg·hd-1·d-1 thiamin without inducing PEM; while Buckner et al. (2007) discontinued feeding a treatment diet which contained 50% DDGS when multiple steers exhibited PEM while receiving 150 mg·hd-1·d-1 thiamin.

Further, our data indicates the NRC (2005) maximum tolerable level of S should be re-evaluated. At a minimum, Schauer et al. (2008) and the present studies illustrate the need for additional research to further determine the interactive affects of S, thiamin supplementation, and dietary grain concentration in finishing rations; and the effect they collectively have on the incidence of PEM. Further investigation into S metabolism in lambs as well as determining if beef cattle can be fed similar levels of S with out negative impacts on performance and health will be beneficial for not only livestock producers but also the ethanol industry.

Implications

The fact that lambs fed diets averaging 0.72% sulfur did not develop polioencephalomalacia while still maintaining adequate performance, even when given no supplemental thiamin demonstrates that feeding elevated levels of distillers dried grains with solubles is possible in lamb finishing diets. The use of thiamin as a dietary additive to aide in the prevention of polioencephalomalacia in finishing lambs does not appear to be necessary in feeding environments with similar feed and water sulfur levels as the present studies. Additionally, feeding 150 mg·hd-1·d-1 thiamin appears to prevent polioencephalomalacia in lambs fed diets containing 0.87% sulfur.

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Table 1. Ingredient and nutritional composition (DM basis) of final finishing ration fed to lambs in Study 1

	Treatments[1]			
Item	CON	LOW	MED	HIGH
Ingredient, %				
Alfalfa Hay	15.00	15.00	15.00	15.00
Corn	21.38	21.38	21.38	21.38
DDGS	60.00	60.00	60.00	60.00
Supplement[2]	3.62	3.62	3.62	3.62
Nutrient[3]				
CP, %	23.7	23.3	23.4	23.6
ADF, %	10.5	10.5	10.9	11.1
S, %	0.74	0.69	0.71	0.72
Ca, %	1.33	1.59	1.17	1.08
P, %	0.68	0.69	0.70	0.72
Thiamin[4]	0	50	100	150

[1] Treatments: CON (no supplemental thiamin), LOW (50 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), MED (100 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), and HIGH (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin).

[2] Supplement (% total diet): 0.5% Ammonium chloride, 2.25% limestone, 0.085% Lasalocid, 0.78% Sheep Mineral 12 (Hubbard Feeds, Mankato MN), 0.002% Copper sulfate, and either 0, 0.004, 0.007, or 0.11% thiamin mononitrate.

[3] Laboratory analysis of nutrient concentration.

[4] Formulated level (ppm), thiamin inclusion in diet calculated based on an estimated DMI of 1.36 $kg \cdot hd^{-1} \cdot d^{-1}$.

Table 2. Ingredient and nutritional composition (DM basis) of final finishing rations fed to lambs in Study 2

	Treatments[1]				
Item	CON	LOW	MED	HIGH	HIGH+S
Ingredient,%					
Alfalfa Hay	15.00	15.00	15.00	15.00	15.00
Corn	21.38	21.38	21.38	21.38	21.38
DDGS	60.00	60.00	60.00	60.00	60.00
Supplement[2]	3.62	3.62	3.62	3.62	3.62
Nutrient[3]					
CP, %	23.3	23.6	23.4	22.7	23.5
ADF, %	10.8	11.0	11.6	11.6	11.3
S, %	0.76	0.69	0.75	0.71	0.87
Ca, %	1.55	1.42	1.65	1.66	1.77
P, %	0.79	0.81	0.92	0.91	0.87
Thiamin[4]	0	50	100	150	150

[1] Treatments: CON (no supplemental thiamin), LOW (50 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), MED (100 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), HIGH (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), and HIGH+S (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin with 0.87% S).

[2] Supplement (% total diet): 0.5% Ammonium chloride, 2.25% limestone, 0.085% Lasalocid, 0.78% Sheep Mineral 12 (Hubbard Feeds, Mankato MN), 0.002% Copper sulfate, and either 0, 0.004, 0.007, or 0.11% thiamin mononitrate.

[3] Laboratory analysis of nutrient concentration.

[4] Formulated level (ppm), thiamin inclusion in diet calculated based on an estimated DMI of 1.36 $kg \cdot hd^{-1} \cdot d^{-1}$.

Table 3. Influence of thiamin supplementation on performance and carcass characteristics of lambs in Study 1

	Treatment[1]						*P*-value[3]		
Item	CON	LOW	MED	HIGH	SEM[2]	*P*-value	Linear	Quad	Cubic
Initial wt, kg	32.6	32.6	32.5	32.6	0.15	0.94	0.73	0.63	0.83
Final wt, kg	62.3	62.8	62.5	60.5	0.65	0.10	0.07	0.08	0.79
ADG, kg/d	0.27	0.28	0.27	0.25	0.005	0.08	0.09	0.04	0.76
Intake, kg·hd^{-1}·d^{-1}	1.77	1.78	1.98	1.74	0.04	0.001	0.49	0.004	0.002
G:F	0.15	0.15	0.14	0.15	0.004	0.05	0.08	0.57	0.03
Mortality, %	1.67	0	0	0	0.83	0.43	0.20	0.34	0.66
HCW, kg	31.4	32.1	31.7	30.9	0.37	0.18	0.35	0.05	0.68
Leg score[4]	11.3	11.5	11.6	11.0	0.17	0.16	0.36	0.06	0.41
Conformation score[4]	11.5	11.4	11.6	11.2	0.08	0.05	0.07	0.12	0.07
Fat depth, cm[5]	0.8	0.9	0.8	0.8	0.05	0.59	0.96	0.96	0.18
Body wall thick, cm	2.7	3.0	2.5	2.7	0.10	0.32	0.39	0.83	0.11
Ribeye area, cm^2	15.6	15.5	15.7	15.7	0.39	0.98	0.77	0.92	0.81
Flank streaking[6]	337	340	353	336	6.74	0.29	0.71	0.16	0.21
Quality grade[4]	11.3	11.3	11.5	11.2	0.08	0.17	0.36	0.13	0.15
Yield grade[7,5]	3.5	3.8	3.4	3.7	0.18	0.55	0.82	0.94	0.17
%BCTRC[8]	44.7	44.3	45.0	46.8	0.21	0.18	0.24	0.75	0.06

[1] Treatments: CON (no supplemental thiamin), LOW (50 mg·hd^{-1}·d^{-1} thiamin), MED (100 mg·hd^{-1}·d^{-1} thiamin), and HIGH (150 mg·hd^{-1}·d^{-1} thiamin).
[2] Standard Error of Mean; n = 4.
[3] *P*-value for linear, quadratic, and cubic effects of increasing level of thiamin supplementation.
[4] Leg score, conformation score, and quality grade: 1 = cull to 15 = high prime.
[5] Adjusted fat depth and yield grades.
[6] Flank streaking: 100-199 = practically devoid; 200-299 = traces; 300-399 = slight; 400-499 = small; 500-599 = modest.
[7] Yield Grade = 0.4 + (10 x adjusted fat depth).
[8] % Boneless closely trimmed retail cuts = (49.936 - (0.0848 x HCW, lbs) - (4.376 x fat depth, in) - (3.53 x body wall thickness, in) + (2.456 x ribeye area, in^2)).

Table 4. Influence of thiamin supplementation and added sulfur on performance and carcass characteristics of lambs in Study 2

	Treatment[1]							*P*-value[3]			
Item	CON	LOW	MED	HIGH	HIGH+S	SEM[2]	*P*-value	Linear	Quad	Cubic	HIGH vs. HIGH+S
Initial wt, kg	38.5	38.7	38.4	38.1	38.8	1.30	0.99	0.79	0.85	0.96	0.70
Final wt, kg	59.7	61.0	58.1	60.7	60.9	1.72	0.74	0.99	0.69	0.22	0.94
ADG, kg/d	0.19	0.20	0.18	0.20	0.20	0.01	0.48	0.76	0.46	0.11	0.77
Intake, kg·hd^{-1}·d^{-1}	1.30	1.30	1.24	1.27	1.30	0.05	0.86	0.44	0.70	0.49	0.68
G:F	0.15	0.15	0.14	0.16	0.15	0.005	0.17	0.15	0.32	0.07	0.20
HCW, kg	30.6	31.8	29.3	30.7	31.5	0.97	0.40	0.60	0.90	0.08	0.56
Leg score[4]	11.1	11.1	10.8	11.0	11.2	0.22	0.78	0.55	0.67	0.41	0.54
Conformation score[4]	10.8	10.9	10.7	10.8	11.1	0.19	0.56	0.80	0.79	0.48	0.18
Fat depth, cm[5]	0.8	0.7	0.7	0.7	0.9	0.10	0.60	0.71	0.35	0.99	0.35
Body wall thick, cm	2.6	2.4	2.4	2.5	2.7	0.13	0.46	0.37	0.36	0.99	0.21
Ribeye area, cm^2	14.4	14.1	13.7	14.9	14.3	0.58	0.70	0.62	0.21	0.56	0.45
Flank streaking[6]	392	370	350	325	482	37.25	0.03	0.16	0.96	0.97	0.002
Quality grade[4]	11.3	11.1	11.1	11.0	11.7	0.22	0.12	0.41	0.91	0.80	0.02
Yield grade[7,5]	3.5	3.1	3.1	3.3	3.8	0.36	0.60	0.71	0.35	0.99	0.35
%BCTRC[8]	44.7	44.7	45.2	45.1	44.3	0.47	0.59	0.35	0.93	0.69	0.16

[1] Treatments: CON (no supplemental thiamin), LOW (50 mg·hd^{-1}·d^{-1} thiamin), MED (100 mg·hd^{-1}·d^{-1} thiamin), HIGH (150 mg·hd^{-1}·d^{-1} thiamin), and HIGH+S (150 mg·hd^{-1}·d^{-1} thiamin with 0.87% S).
[2] Standard Error of Mean n = 12, 10, 10, 12, and 11 head for CON, LOW, MED, HIGH, and HIGH+S respectfully.
[3] *P*-value for linear, quadratic, and cubic effects of increasing level of thiamin supplementation; as well as direct comparison of HIGH and HIGH+S treatments.
[4] Leg score, conformation score, and quality grade: 1 = cull to 15 = high prime.
[5] Adjusted fat depth and yield grades.
[6] Flank streaking: 100-199 = practically devoid; 200-299 = traces; 300-399 = slight; 400-499 = small; 500-599 = modest.
[7] Yield Grade = 0.4 + (10 x adjusted fat depth).
[8] % Boneless closely trimmed retail cuts = (49.936 - (0.0848 x HCW, lbs) - (4.376 x fat depth, in) - (3.53 x body wall thickness, in) + (2.456 x ribeye area, in^2)).

Influence of thiamin supplementation on hydrogen sulfide gas concentrations in ruminants fed high-sulfur diets[1]

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The objective of this research was to evaluate the influence of thiamin supplementation on hydrogen sulfide gas concentration and ruminal pH in lambs fed high-sulfur diets. Moderate levels of thiamin supplementation seem to decrease hydrogen sulfide concentrations. Our data suggests that changes in ruminal hydrogen sulfide concentration cannot be attributed solely to ruminal pH and are likely affected by multiple factors that interact within the ruminal environment and in the animal.

[1] Partial support for this research and dried distillers grains with solubles were provided by Poet Nutrition, Sioux Falls, S.D. Disclaimer: Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of Poet Nutrition.

Summary

The objective of this study was to evaluate the effect of increasing levels of thiamin supplementation on ruminal gas cap hydrogen sulfide (H_2S) concentration and pH in lambs. Twenty crossbred lambs (84.5 ± 7 pounds) were adapted in 28 days to a finishing diet consisting of (dry-matter [DM] basis) 60 percent dried distillers grains with solubles, 21.4 percent corn, 15 percent alfalfa hay and 3.6 percent supplement. Treatment diets differed in the amount of supplemental thiamin supplied; diets were formulated to provide: 1) CON (no supplemental thiamin), 2) LOW (50 milligrams per head per day [$mg \cdot hd^{-1} \cdot d^{-1}$] thiamin), 3) MED (100 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), 4) HIGH (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin) or 5) HIGH+S (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin with dietary sulfur [S] increased from 0.71 percent to 0.87 percent (DM basis) with the addition of dilute sulfuric acid to dried distillers grains with solubles [DDGS]). Thiamin supplementation was based on an estimated daily dry-matter intake (DMI) of 3 $lb \cdot hd^{-1} \cdot d^{-1}$.

Hydrogen sulfide and rumen fluid pH were collected via rumen puncture on day minus 6, minus 3, 0, 3, 7, 10, 14, 17, 21, 24, 28 and 31. No differences in H_2S concentration ($P > 0.10$) among treatments were apparent until day 10, at which point lambs fed LOW had lower H_2S concentrations than all other treatments. Lambs fed HIGH had the greatest concentrations of H_2S on day 31 (7,700 parts per million [ppm] H_2S; $P < 0.009$). Ruminal pH for lambs fed CON and MED were not different from day 0 throughout sampling ($P > 0.18$). Ruminal pH of LOW, HIGH and HIGH+S groups decreased ($P < 0.03$) through time. Thiamin appears to influence ruminal H_2S concentrations, although the mechanism by which this occurred remains unknown. Changes in H_2S concentration cannot be attributed solely to ruminal pH and likely are affected by multiple factors that interact within the ruminal environment and in the animal.

Introduction

One of the challenges with use of ethanol co-products is the potential for high dietary S levels. High S diets can cause polioencephalomalacia (PEM) in ruminants. Inclusion of large percentages of co-product feeds, such as dried distillers grains with solubles (DDGS), in

finishing rations has been avoided, in part, due to problems with PEM as well as concerns about optimal animal performance and carcass characteristics. Thiamin supplementation is one proposed method of reducing or preventing PEM in ruminant animals. The efficacy of thiamin supplementation in preventing PEM likely is impacted by the mechanisms by which PEM is caused (for example,. long-term thiamin deficiency or high hydrogen sulfide gas concentration). Further, the effect and dose of thiamin necessary to prevent such cases of PEM requires more investigation. Hydrogen sulfide gas, as previously mentioned, has been implicated as a cause of PEM in ruminants. Both high-sulfur feed (Niles et al., 2002) and water (Loneragan et al., 2005) sources can cause increases in H_2S production. No published literature that evaluates the effect of dietary thiamin concentrations on ruminal H_2S gas concentration is available. Therefore, our objective was to evaluate the effect of increasing level of thiamin supplementation on ruminal gas cap H_2S concentration and ruminal pH in lambs being adapted to a finishing diet containing 60 percent DDGS.

Procedures

Twenty western white-face wether lambs (84.5 ± 7 pounds) were sampled during the adaptation period (receiving ration to a final finishing ration). Adaptation was accomplished by increasing the amount of concentrate on a weekly basis; adaptation diets are outlined in (Table 1). The final finishing diet was balanced to contain 60 percent DDGS (DM basis; Table 2). Treatment diets differed in the amount of supplemental thiamin supplied; diets were formulated to provide: 1) CON (no supplemental thiamin), 2) LOW (50 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), 3) MED (100 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin), 4) HIGH (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin) or 5) HIGH+S (150 $mg \cdot hd^{-1} \cdot d^{-1}$ thiamin with dietary S increased from 0.71 percent to 0.87 percent [DM basis] with the addition of dilute sulfuric acid to DDGS). Thiamin supplementation was based on an estimated daily DMI of 3 $lb \cdot hd^{-1} \cdot d^{-1}$. Feed was offered daily on an ad libitum basis with refusals collected and weighed weekly.

Sampling for ruminal H_2S was conducted on 12 occasions beginning six days prior to initiation of treatment diets. Gas cap samples from these lambs were collected on day minus 6, minus 3, 0, 3, 7, 10, 14, 17, 21, 24, 28 and 31 of the feeding period. Hydrogen sulfide gas was measured on H_2S detector tubes (GASTEC©, Kanagawa, Japan). Ruminal fluid also was collected at the same time for determination of rumen fluid pH.

Results and Discussion

The influence of hydrogen sulfide gas on incidence of PEM in ruminants could be impacted by the way H_2S concentration changes during adaptation to finishing rations. In the present study, no differences in H_2S concentration among treatments ($P > 0.10$; Table 3) were apparent until day 10, at which point lambs fed LOW had lower H_2S concentrations than all other treatments. At this point in adaptation, the amount of roughage included in the diet had not changed although the inclusion of DDGS had increased from 0 percent to 29 percent of dietary DM. Those lambs fed the HIGH treatment diet showed the most dramatic increases in ruminal H_2S concentration; on day 21 of adaptation, dietary hay was decreased from 35 percent to 25 percent and DDGS increased from 40 percent to 50 percent of dietary DM. During the course of the next three days, ruminal H_2S concentration increased by more than 3,000 ppm and within seven days had increased by 4,700 ppm H_2S.

While the hydrogen sulfide concentrations in our lambs did not reach the levels in steers reported by Niles et al. (2002), our peak concentrations were above those reported by Loneragan et al.

(2005); both of these studies had steers with positive cases of PEM. These results indicate that the concentration of H_2S required to cause symptoms of PEM may vary depending on species.

Of further interest is the way the H_2S concentration in lambs fed HIGH+S changed during adaptation. Specifically, on days 7, 14 and 21, the concentration of H_2S was greater in HIGH+S than HIGH; however, after three days of adaptation (days 10, 17, 24) the concentration of ruminal H_2S from HIGH+S was lower or equal to that found in HIGH fed lambs.

Multiple factors influence the conversion of dietary S into H_2S in the rumen during adaptation. Among these are decreases in ruminal fluid pH, increases in the proportion of sulfur-reducing bacteria and increases in dietary S. In our study, ruminal pH did not differ among treatments (P = 0.13) at any time point (data not shown). Lambs fed CON and MED were not different from day 0 throughout sampling ($P > 0.18$). However, ruminal pH of LOW, HIGH and HIGH+S groups did decrease ($P < 0.03$) through time. Decreases in ruminal pH also may impact incidence of PEM by other means.

Our research suggests that thiamin may influence ruminal H_2S concentrations, but we did not investigate the fate of the H_2S. Further, our data suggests that changes in ruminal hydrogen sulfide concentration cannot be attributed solely to ruminal pH and likely are affected by multiple factors that interact within the ruminal environment and in the animal.

Literature Cited

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Table 1. Adaptation diets fed to lambs (% DM basis).

	Arrival day -6	Step 1 day 0	Step 2 day 7	Step 3 day 14	Step 4 day 21	Step 5 day 28
Ingredient, %						
Alfalfa Hay	46.00	46.00	46.00	35.00	25.00	15.00
Corn	50.38	35.88	21.38	21.38	21.38	21.38
DDGS	0.00	14.50	29.00	40.00	50.00	60.00
Supplement[1]	3.62	3.62	3.62	3.62	3.62	3.62

[1]Supplement contained: (% of total diet DM) 0.5% ammonium chloride, 2.25% limestone, 0.085% lasalocid, 0.78% trace mineral and 0.002% copper sulfate, and were formulated to provide one of four levels of thiamin (0, 50, 100 or 150 $mg \cdot hd^{-1} \cdot d^{-1}$).

Table 2. Ingredient and nutritional composition (DM basis) of final finishing rations fed to lambs.

	Treatments[1]				
Item	CON	LOW	MED	HIGH	HIGH+S
Ingredient,%					
Alfalfa Hay	15.00	15.00	15.00	15.00	15.00
Corn	21.38	21.38	21.38	21.38	21.38
DDGS	60.00	60.00	60.00	60.00	60.00
Supplement[2]	3.62	3.62	3.62	3.62	3.62
Nutrient[3]					
CP, %	23.3	23.6	23.4	22.7	23.5
ADF, %	10.8	11.0	11.6	11.6	11.3
S, %	0.76	0.69	0.75	0.71	0.87
Ca, %	1.55	1.42	1.65	1.66	1.77
P, %	0.79	0.81	0.92	0.91	0.87
Thiamin[4]	0	50	100	150	150

[1] Treatments: CON (no supplemental thiamin), LOW (50 mg·hd^{-1}·d^{-1} thiamin), MED (100 mg·hd^{-1}·d^{-1} thiamin), HIGH (150 mg·hd^{-1}·d^{-1} thiamin) and HIGH+S (150 mg·hd^{-1}·d^{-1} thiamin with 0.87% S).
[2] Supplement (% total diet): 0.5% ammonium chloride, 2.25% limestone, 0.085% lasalocid, 0.78% sheep mineral 12 (Hubbard Feeds, Mankato, Minn.), 0.002% copper sulfate and 0, 0.004, 0.007 or 0.11% thiamin mononitrate.
[3] Laboratory analysis of nutrient concentration.
[4] Formulated level (ppm), thiamin inclusion in diet calculated based on an estimated DMI of 3.0 lb·hd^{-1}·d^{-1}.

Table 3. Influence of thiamin and sulfur level on hydrogen sulfide production in lambs fed a 60% DDGS-based finishing diet.

Treatment[1,2]				
CON	LOW	MED	HIGH	HIGH+S
0.0	0.0	0.0	190.6	75.0
66.7	0.0	112.5	25.0	28.1
71.5	0.0	146.9	71.9	93.8
531.3	375.0	310.5	737.5	475.0
778.1	575.0	759.4	1,237.5	1,350.0
2,200.0^{a}	887.5^{b}	2,200.0^{a}	2,453.1^{a}	2,378.1^{a}
2,390.6^{a}	1,087.5^{b}	1,875.0^{a}	1,906.3^{a}	2,015.6^{a}
2,852.6^{a}	1,418.8^{b}	2,609.4^{a}	2,406.3^{ab}	2,406.3^{ab}
3,312.5^{a}	1,531.3^{c}	2,328.1^{abc}	1,958.2^{bc}	3,140.6^{ab}
2,062.5^{a}	3,287.5^{b}	3,275.0^{b}	4,991.6^{c}	3,046.9^{ab}
4,687.5^{a}	2,662.5^{b}	2,906.3^{b}	6,657.8^{c}	4,390.6^{a}
5,687.5^{a}	2,650.0^{b}	3,843.8^{c}	7,701.3^{d}	4,859.4^{ac}

[1] Treatments: CON (no supplemental thiamin), LOW (50 mg·hd^{-1}·d^{-1} thiamin), MED (100 mg·hd^{-1}·d^{-1} thiamin), HIGH (150 mg·hd^{-1}·d^{-1} thiamin) and HIGH+S (150 mg·hd^{-1}·d^{-1} thiamin with 0.87% S).
[2] When tube measurement was below 100 ppm, tube was considered to read 0.
[abc] Means with different superscripts within a row differ $P < 0.10$.

Effect of weaning and production management strategies on calf growth and carcass traits*

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This study investigated the effects of weaning date (early vs. normal) and production system practices (natural vs. conventional) on calf growth and carcass traits in May-born Angus calves during the grow-finish period. Our research suggests that conventionally managed calves gained more weight in the background and finish periods than naturally managed calves, and early weaned calves may gain more slowly than normally weaned calves.

Summary
This study investigated the effects of weaning date (early vs. normal) and production system practices (natural vs. conventional) on calf growth and carcass traits in May-born Angus calves during the grow-finish period. One of four production management treatments (TRT) was assigned to 81 Angus steer and heifer calves at the NDSU Hettinger Research Extension Center: early wean-conventional production (EWC; 137 days old), early wean-natural production (EWN; 132 days old), normal wean-conventional production (NWC; 192 days old) and normal wean-natural production (NWN; 199 days old). After the background period (EW = 115 days and NW = 59 days), calves were shipped to the NDSU Carrington Research Extension Center for finishing.

Calves were fed to a common end weight (1,100 pounds) and back fat thickness (0.4 inch) prior to harvest. Calves were harvested and individual carcass measurements collected on two dates. The weaning date impacted weaning weights and background weight gain (P <0.001); however, background end weights were similar across TRT (P = 0.42) after 115 days. At the end of 133-day finish period, final weight, total gain and average daily gain (ADG) were different across TRT ($P \leq 0.01$). Most carcass traits were similar at harvest ($P > 0.05$) regardless of TRT, with the exception of hot carcass weights (P = 0.02). Our research suggests that conventionally managed calves gained more weight in the background and finish periods than naturally managed calves, and early weaned calves may gain more slowly than normally weaned calves.

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Introduction

Most cow-calf producers in the northern Great Plains calve beef cows in the late winter-early spring months (February-March), guaranteeing ranch resources, time, and labor will be readily available in the spring for annual crop planting and fieldwork needs. Conversely, some cattle producers have chosen to calve during the late spring months (May-June) to follow nature's traditional growth patterns for pasture grasses. With a later calving season, higher-quality grazing diets are provided for lactating brood cows and nursing calves, further maximizing milk production and calf growth. However, during drought when forage supplies become limited, calf-weaning date is moved forward, sparing necessary forage resources for gestating and/or lactating beef cows.

The definition of early weaning varies; generally, calves weaned before 150 days of age are considered early weaned (Loy et al., 1999). Most research on early weaning has focused on late winter-early spring

(February-March) calving cowherds (Schoonmaker et al., 2001; Story et al., 2000), with little research evaluating early weaning outcomes on late spring-born (May-June) calves. In recent years, marketing opportunities have grown for "natural" beef, which are cattle raised without antibiotics and growth-promoting technologies such as ionophores and implants. Cattle producers question how "never, ever" natural production practices measure up to mainstream conventional production systems.

Furthermore, few studies have examined the consequences of late spring-born calves raised under natural production system practices. Our study objective was to investigate the effects of weaning date (early vs. normal) and production system practices (natural vs. conventional) on calf growth and carcass traits in May-born Angus calves during the grow-finish period. We hypothesized the early weaned calves raised under natural production practices would have more morbidity, resulting in reduced performance and lower carcass quality as compared with the other three production systems (early weaned-conventional, normal weaning-conventional, and normal weaning-natural calves) studied.

Materials and Methods

The NDSU Institute for Animal Care and Use Committee approved all protocols. The experiment was conducted at the NDSU Hettinger Research Extension Center's feedlot in Hettinger, N.D., and the NDSU Carrington Research Extension Center's feedlot in Carrington, N.D. Eighty-one Angus steer and heifer calves (average birth date = May 3 ± 2.12 days) from the NDSU Hettinger Research Extension Center's cowherd were assigned to two weaning dates: early wean = Sept. 13 and Sept. 14, 2007, (EW) or normal wean = Nov. 15 and Nov. 16, 2007, (NW).

On respective weaning dates, EW and NW calves were hauled (5 miles) to the feedlot after morning gathering and weighing in the pasture. Calves assigned to the EW group averaged 422 pounds at weaning, while NW calves averaged 553 pounds at weaning. All calves were fed a receiving ration (total mixed ration) containing 27.6 percent barley silage, 7.4 percent protein supplement, 29.5 percent ground mixed hay, 29.8 percent whole barley, 2.7 percent deccox crumbles, 2.4 percent sodium bicarbonate and 0.6 percent calcium carbonate (dry-matter basis; 14.8 percent crude protein; 0.52 megacalories/pound of net energy for gain) for the first 17 days (EW) and 10 days (NW) after weaning.

On Oct. 2, 2007, (EW) and Nov. 27, 2007, (NW) calves were weighed following an overnight shrink, stratified by weight and sex, and allotted to one of 12 pens (six or seven calves/pen) for backgrounding (EW = 115 days; NW = 59 days). Pens were assigned to one of four production management treatments (TRT; n = 3): early wean-conventional production (EWC), early wean-natural production (EWN), normal wean-conventional production (NWC) and normal wean-natural production (NWN). Calves receiving "natural" treatments (EWM and NWN) did not receive growth-promoting implants and were not fed ionophores. When natural fed calves were treated with antibiotics for illness, they were removed from their respective treatment. Calves were fed a 58:42 forage:concentrate diet during the growing period (14 percent crude protein; 0.52 megacalories/pound of net energy for gain growing diet; dry-matter basis; Table 1). The conventional protein supplement for the growing diet contained 225 milligrams/hd/d of Rumensin (Elanco Animal Health, Indianapolis, I.N.) and 0.5 mg/lb MGA (melengestrol acetate, Pfizer Animal Health, N.Y., N.Y.), while the natural supplement was unmedicated.

Diets were formulated for 2.20 pounds of daily gain; diets were isonitrogenous and isocaloric at the study start. Diets were fed once daily (9 a.m.) and slick bunk management used to determine individual pen daily feed allotment. Calves had free access to water in ice-free automatic fence line water fountains. All calves were dewormed and vaccinated for respiratory and clostridial diseases, and conventional calves implanted with a Ralgro implant (36 mg zeranol; Schering-Plough Animal Health Corp., Kenilworth, N.J.) at the start of their respective background periods.

Calves were checked daily for signs of bloat and respiratory illness. Calf weights were recorded on day 0, 28, 56, 59, 85, and 114. Initial and final weights were determined by weighing each animal following an overnight shrink before feeding, while interim body weights were measured as unshrunk weights recorded

prior to feeding. Background diet samples were collected (day 1, 7, 36, 55, 74, 92, and 100), composited by treatment and analyzed by a commercial laboratory (Midwest Laboratories, Omaha, NE) for nutrient analysis.

After backgrounding, calves were shipped to the NDSU Carrington Research Extension Center for finishing on Jan. 28, 2008. Calves were dewormed, revaccinated for respiratory and clostridial diseases, and commingled into one of two finishing pens based on production practices (natural or conventional) at arrival. Calves were fed a 19:81 forage:concentrate diet (14 percent crude protein; 0.62 megacalories/pound of net energy for gain finishing diet; dry-matter basis; Table 1) to a common end weight (1,100 pounds) and backfat thickness (0.4 inch) prior to harvest**.** The finishing supplement for the natural calves contained Rumatec Finisher (Ralco Nutrition Inc, Marshall, Minn.), a natural feed additive (as previously described by Anderson et al., 2008) fed at 0.5 ounce/head/day. The conventional finishing supplement contained 300 mg Rumensin (Elanco Animal Health, Indianapolis, Ind.) and 0.5 mg MGA (melengestrol acetate, Pfizer Animal Health, N.Y., N.Y.).

Unshrunk calf weights were recorded (day 44, 86, 99, 119 and 133). Final weights were measured on all calves prior to shipping for harvest. Conventional calves were reimplanted (day 86; Synovex Choice, 100 mg trenbolone acetate and 14 mg estradiol benzoate; Wyeth Animal Health, Madison, N.J.) and all calves were given an ultra sound test to measure fat thickness for determining marketing date (day 99).

Calves (n = 77) were harvested and individual carcass measurements collected on two dates (May 28 and June 11, 2008) at Tyson Foods (Dakota City, Neb.). On the first harvest date, 20 calves were harvested (10 from each pen), while the remaining calves were fed for 14 more days. Following a 24-hour chill, qualified university personnel, in concert with USDA graders, collected carcass data on the individual carcasses. Carcass traits measured included hot carcass weight; marbling scores; 12^{th} rib fat thickness; longissimus area; kidney, pelvic and heart fat; and USDA yield grade. Calf growth and carcass traits were analyzed as a completely randomized design with the backgrounding pen serving as the experimental unit. Treatment means were separated by least square means following a protected F-test ($P < 0.05$).

Results and Discussion

Growing Performance. The effects of weaning and management strategies on calf performance and health are shown in Table 2. One calf (EWN) died because of bloat during the background period. All performance data from the removed calf was deleted from subsequent performance analyses.

Additionally, three more calves were treated for ruminal bloat (EWC = one and EWN = two) and five calves were treated for respiratory illness (EWC = one, NWC = one, NWN = one and EWN = two). Of the calves treated for respiratory symptoms, three of the five calves required additional treatment with a second antibiotic (one calf each for EWN, EWC and NWN, respectively) during the background period. Natural calves treated with antibiotics remained with their respective pens during the background period. Because of treatment, these natural calves no longer were considered natural and were marketed as conventional calves at harvest, resulting in lost premiums for natural production. Calves were revaccinated for respiratory diseases on day 85 because of intermittent nasal discharges during backgrounding. Final veterinary medicine costs, bloat events, respiratory illness treatments and calf mortality were unaffected by TRT during backgrounding ($P > 0.05$; Table 1).

By design, weaning date impacted weaning weights; early weaned calves were lighter and younger at weaning (422 pounds; 135 days of age) compared to normally weaned calves (553 pounds; 196 day of age; $P < 0.001$). Weight gain, ADG and feed efficiencies (gain:feed) were higher for EWC compared with EWN during the first 28 days on feed ($P \leq 0.01$), although feed cost/pound of gain did not differ across TRT ($P = 0.05$). Similarly, in period two, weight gain, ADG and gain:feed were greater for EWC calves than EWN calves ($P \leq 0.02$), while feed cost/pound of gain and veterinary medicine costs were similar across TRT ($P \geq 0.05$). Dry- matter intakes (DMI) were also similar in this period, averaging 12.75 pounds ($P = 0.85$). No significant differences were observed among TRT for DMI, gain, ADG, feed

efficiencies, veterinary medicine costs and feed cost/pound of gain for the remaining background periods (periods three and four; $P \geq 0.16$).

Although background ending weights were similar across TRT (708 ± 13.6 pounds; $P = 0.42$) after 115 days, background weight gain was impacted by TRT (268, 235,153, and 138 pounds for EWC, EWN, NWC and NWN, respectively; $P < 0.001$). Calf weight gain was influenced directly by the number of days on feed. Early weaned calves spent 56 days more on higher energy rations (based on weaning date) as compared with the NW calves (EW = 115 days vs. NW = 59 days). Although EWC and EWN calves had higher feed costs at the end of 115 days than NWC and NWN calves (data not shown), feed cost/pound of gain was comparable, averaging $0.588/lb for 115 days ($P = 0.74$). Overall, EW calves had 11.9 percent lower DMI intakes as compared with NW calves ($P = 0.009$). This may be attributed to their weaning date and weight, incidences of bloat and respiratory illness events that affected the calves, resulting in lower DMI during periods one and two of the background phase.

Finishing Performance. The effects of weaning and management strategies on calf finishing performance are reported in Table 3. During the finish period, one NWN calf was removed from the study because of chronic infection and one EWC calf died due to complications from a broken shoulder. All performance data from the two removed calves was deleted from subsequent performance analyses. Additionally, feed intake data was not analyzed during finishing, since treatment pens were commingled into two pens during the finish period. Body weights were greatest for NWC calves during periods one and two with no differences for gain and ADG among TRT ($P = 0.02$). This difference in weight gain can be attributed to ionophore (Rumensin) feeding in the conventional diet and implant efficacy. Ionophores can increase ADG by one percent to six percent and improve feed efficiency by 6 percent to 8 percent (Preston, 1987). When ionophores and implants are used together at the same time, they have a synergistic effect (additive) on an animal's weight gain and feed efficiency. This additive effect can increase daily gains by 0.15 to 0.20 pounds/day.

The Ralgro implants still were working (potent) to improve feed efficiency in NWC calves during finish periods one and two. However, the Ralgro implants for the EWC calves had expired (run out) by this time (Ralgro implant potency period is approximately 90 days post implanting). At the start of period three, all conventional calves (EWC and NWC) were implanted with Synovex Choice. During period three, NWC had the highest weight gain and ADG, followed by EWC, EWN and NWN calves ($P = 0.002$).

Performance data for the 20 early harvested calves (May 28, 2008; EWC = two, EWN = three, NWC = eight and NWN = seven) is shown as period four (Table 3). Of the few head harvested, EWC, NWC and NWN calves had similar ending weights, which were greater than EWN calves ($P = 0.03$). The performance data for the remaining 58 calves is reported in period five. For these calves, conventionally managed calves (EWC and NWC) weighed the heaviest, gained the most and had the highest ADG when compared with naturally managed calves, within their respective weaning group (EWN and NWN; $P \leq 0.03$). Overall, the NWC and EWC calves had the greatest gains (total gain and ADG) compared with EWN and NWN calves for the 133-day finish period.

When the remaining calves (n = 58) were weighed before shipping for harvest (June 10, 2007), the decision was made to send one EWC calf to a local abattoir (Barton Meats, Carrington, ND) for harvest, since this calf would be discounted as a small carcass at the commercial plant and required more days on feed to reach market weight. In this study, most carcass traits were similar at harvest ($P > 0.05$) regardless of TRT, with the exception of hot carcass weights ($P = 0.02$, Table 3) which followed the trend of final weight. Harvest weights were six percent heavier for conventional calves (EWC and NWC) as compared to natural calves (EWN and NWN).

Implications

In the present study, calves that were managed as "natural", with no growth-promoting implants, ionophores, or antibiotics, gained less weight during backgrounding and finishing as compared with their

contemporaries that were managed conventionally (implanted with a growth- promoting implant, fed an ionophore and treated with antibiotics during periods of morbidity). Harvest weights were 6 percent heavier for conventional calves as compared with natural calves. Additional research on breakeven costs for naturally raised versus conventionally raised calves is needed. In this trial, early weaned (135-day-old) May-born calves tended to gain less weight during the background and finish phases when compared with normally weaned (195-day-old) calves. While early weaning is a viable option for managing grazing lands during drought, the result may be lighter calves at harvest.

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Table 1. Dietary ingredient and nutrient concentration of calf growing and finishing diets.

Item	Growing Diet	Finishing diet
Ingredient, % DM		
Barley silage	27.8	-
Calcium carbonate	0.60	-
Corn silage	-	13.3
Deccox crumbles	2.7	-
Growing supplement[a,b]	7.5	-
Finishing supplement[c,d]	-	1.4
Mixed hay, ground[e]	29.8	-
Rolled corn	-	45.0
Sodium bicarbonate	1.60	-
Wet distillers grain	-	35.0
Wheat straw, chopped	-	5.30
Whole barley	30.0	-
Nutrient concentration[f]		
% DM	57.8	67.0
CP, % DM	14.0	14.0
NE_g, Mcal/lb DM	0.52	0.62
Ca: P	2.55	2.0

[a]Natural calf growing supplement contained min 26% CP, 3.4% Ca, 0.7% P, 1.38% K, no animal byproducts and no medications.
[b]Conventional calf growing supplement contained min 26% CP, 3.4% Ca, 0.7% P, 1.38% K, no animal byproducts, 225 mg/lb Rumensin® and 0.5 mg/lb MGA (melengestrol acetate).
[c]Natural calf finishing supplement contained Rumatec® Finisher at 0.5 ounces/day (as fed).
[d]Conventional calf finishing supplement contained Rumensin® at 300 mg and MGA (melengestrol acetate) at 0.50 mg (as fed).
[e]Mixed hay composed of equal parts barley and alfalfa-grass hays.
[f]Analytical results for growing diet are from composited samples; analytical results for finishing diet are from balanced feeding rations.

Table 2. Effect of weaning and management strategies on calf performance and health.

Item	Treatments				SEM[e]	*P*-value[f]
	EWC[a]	EWN[b]	NWC[c]	NWN[d]		
No. head	20	21	19	21	-	-
Wean weight, lb.	423[g]	420[g]	546[h]	560[h]	6.41	< 0.001
Age at weaning, days	137[g]	132[g]	192[h]	199[h]	2.04	< 0.001
Initial weight, lb.	426[g]	456[g]	574[h]	572[h]	6.39	< 0.001
Period 1, day 0-27						
DMI, lb./d	10.3[g]	12.7[h]	-	-	0.36	0.01
28-day gain, lb.	72[h]	37[g]	-	-	5.93	0.01
ADG, lb./d	2.56[h]	1.32[g]	-	-	0.21	0.01
Gain:feed	0.25[h]	0.10[g]	-	-	0.02	0.01
Feed cost/lb gain, $/lb.	0.37	0.78	-	-	0.11	0.05
Veterinary medicine costs, $/hd	9.97	10.02	-	-	1.77	0.98
Period 2, day 28-58						
DMI, lb./d	12.7	12.8	-	-	0.30	0.85
31-day gain, lb.	49[h]	30[g]	-	-	2.66	0.007
ADG, lb./d	1.52[h]	0.92[g]	-	-	0.08	0.006
Gain:feed	0.12[h]	0.07[g]	-	-	0.009	0.02
Feed cost/lb gain, $/lb.	0.75[g]	1.16[h]	-	-	0.07	0.01
Veterinary medicine costs, $/hd	0.93[g]	1.11[g]	8.15[h]	7.79[h]	0.75	< 0.001
Period 3, day 59-84						
DMI, lb./d	15.9	16.4	16.1	14.9	0.44	0.16
26-day gain, lb.	104	99	109	98	6.0	0.59
ADG, lb./d	4.01	3.80	3.74	3.44	0.20	0.33
Gain:feed	0.25	0.23	0.23	0.23	0.01	0.58
Feed cost/lb gain, $/lb.	0.36	0.37	0.35	0.37	0.02	0.85
Veterinary medicine costs, $/hd	0.06	0.16	0.47	0.41	0.32	0.77
Period 4, day 85-114						
DMI, lb./d	17.9	18.6	18.4	18	0.55	0.77
30-day gain, lb.	43	70	44	39	10.9	0.25
ADG, lb./d	1.50	2.41	1.51	1.35	0.37	0.24
Gain:feed	0.08	0.13	0.08	0.08	0.02	0.25
Feed cost/lb gain, $/lb.	1.37	0.68	1.61	1.20	0.42	0.49
Veterinary medicine costs, $/hd	2.14	2.03	2.14	3.43	0.65	0.42
Overall, day 0-114						
Background period end weight, lb.	694	700	726	711	13.6	0.42
DMI, lb./d	14.2[g]	14.8[g]	16.4[h]	16.5[h]	0.41	0.009
115-day gain, lb.	268[h]	235[h]	153[g]	138[g]	12.81	< 0.001
ADG, lb./d	2.33	2.04	2.58	2.35	0.195	0.34
Gain:feed	0.164	0.137	0.157	0.142	0.011	0.31
Feed cost/lb gain, $/lb.	0.551	0.615	0.591	0.593	0.041	0.74
Veterinary medicine costs, $/hd	12.34	13.73	10.75	11.63	2.02	0.77
Incidence of bloat, %	5.0	19.0	0	0	9.82	0.34
Treatment for respiratory illness, %						
Once	5.56	9.52	5.56	4.76	6.62	0.95
Twice	5.56	4.76	0	4.76	4.37	0.80
Mortality, %	0	4.76	0	0	2.38	0.44

[a]EWC: Early wean, conventional calves; wean date = Sept. 13 and 14, 2007.
[b]EWN: Early wean, natural calves; wean date = Sept. 13 and 14, 2007.
[c]NWC: Normal wean, conventional calves; wean date = Nov. 16 and 17, 2007.
[d]NWN: Normal wean, natural calves; wean date = Nov. 16 and 17, 2007.
[e]Standard error of mean; n = 3 observations per treatment.
[f]*P*-value for F-test of treatment.
[g, h]Means with different subscripts differ ($P < 0.05$).

Table 3. Effect of weaning and management strategies on calf finishing performance and carcass traits.

	Treatments					
Item	**EWC[a]**	**EWN[b]**	**NWC[c]**	**NWN[d]**	**SEM[e]**	***P*-value[f]**
Finishing performance						
No. head	19	20	19	20	-	-
Initial weight, lb.	694	700	726	711	13.6	0.42
Period 1, day 0-44						
Weight, lb.	821[h,i]	804[h]	878[j]	853[i,j]	13.7	0.02
43-day gain, lb.	125	115	147	133	7.10	0.06
ADG, lb./d	2.91	2.67	3.42	3.09	0.17	0.06
Period 2, day 45-86						
Weight, lb.	967[h]	969[h]	1045[i]	1009[h,i]	15.8	0.02
42-day gain, lb.	151	165	168	164	4.69	0.14
ADG, lb./d	3.60	3.92	3.99	3.90	0.11	0.14
Period 3, day 87-99						
Weight, lb.	1013[h]	1007[h]	1105[i]	1045[h]	17.1	0.01
13-day gain, lb.	45[h]	38[h]	60[i]	36[h]	3.13	0.002
ADG, lb./d	3.48[h]	2.94[h]	4.61[i]	2.73[h]	0.24	0.002
Period 4, day 100-119						
No. head	2	3	8	7	-	-
Weight, lb.	1206[i]	1099[h]	1257[i]	1215[i]	29.4	0.03
20-day gain, lb.	89[i]	51[h]	83[i]	48[h]	8.75	0.03
ADG, lb./d	4.43[i]	2.54[h]	4.17[i]	2.38[h]	0.44	0.03
Period 5, day 100-133						
No. head	17	17	11	13	-	-
Weight, lb.	1128[h,i]	1097[h]	1162[i]	1087[h]	15	0.03
34-day gain, lb.	127[i]	97[h]	130[i]	93[h]	5.26	0.002
ADG, lb./d	3.73[i]	2.85[h]	3.82[i]	2.73[h]	0.15	0.002
Overall, day 0-133						
Final weight, lb.	1136[h]	1097[h]	1211[i]	1122[h]	16.1	0.005
Total gain, lb.	443[i]	408[h]	484[i]	411[h]	10.3	0.003
ADG, lb./d	3.38[i]	3.11[h]	3.82[j]	3.22[h,i]	0.11	0.01
Carcass Traits						
No. head	18	20	19	20	-	-
Hot carcass weight, lb.	672[h]	644[h]	721[i]	659[h]	13.7	0.02
Marbling score[g]	409	430.7	403.3	425.3	15.3	0.57
12th rib fat thickness, in.	0.57	0.51	0.56	0.58	0.04	0.68
Longissimus area, in^2	11.7	11.2	12	11.5	0.36	0.53
Kidney, pelvic and heart fat, %	1.93	2.07	1.90	1.97	0.07	0.40
USDA Yield grade (adjusted)	3.20	3.11	3.23	3.19	0.15	0.94

[a]EWC: Early wean, conventional calves; wean date = Sept. 13 and 14, 2007.
[b]EWN: Early wean, natural calves; wean date = Sept. 13 and 14, 2007.
[c]NWC: Normal wean, conventional calves; wean date = Nov. 16 and 17, 2007.
[d]NWN: Normal wean, natural calves; wean date = Nov. 16 and 17, 2007.
[e]Standard error of mean; n = 3 observations per treatment.
[f]*P*-value for F-test of treatment.
[g]Slight = 200 to 299; Small = 300 to 399; Modest = 400 to 499; Moderate = 500 to 599.
[h, i, j]Means with different subscripts differ ($P < 0.05$).

EFFECTS OF FEEDING STRATEGY ON MARKET COW PERFORMANCE, CARCASS QUALITY, AND ECONOMICS*

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The objective of this study was to investigate the effects of feeding strategy on cow feedlot performance, carcass traits and economics. Despite cows consuming less feed and lower labor costs, cows on self-fed diets had the highest feed cost of gain. Although self-fed diets can improve market cow quality, other low-cost alternatives require further investigation.

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Summary

Forty-eight cull (market) cows were blocked by weight and body condition to investigate the effects of feeding strategy on feedlot performance, carcass traits, and economics. Diets evaluated were (1) corn-mixed hay (HAY), (2) barley-barley silage (SILAGE), and (3) a self-fed ground diet using a controlled intake system (LIMIT). All diets were formulated to provide 60 megacalories per pound (Mcals/lb) of net energy for gain (NE_g) and 11.5 percent crude protein (CP) using mixed hay, barley silage, and a commercial supplement containing soy hulls as roughage sources for HAY, SILAGE and LIMIT, respectively.

After a 104-day feeding period, 14 cows were sold at auction locally to evaluate market prices for fattened cull cows. The remaining cows were harvested at Dakota Premium Foods LLC, South St. Paul, Minn., with individual carcasss data collected. HAY and SILAGE cows gained faster ($P < 0.01$) because LIMIT cows acclimated slowly to their diet the first 46 days of study, resulting in lower dry matter intake (DMI), average daily gain (ADG) and gain efficiencies (G:F) for LIMIT cows ($P < 0.02$). LIMIT cows had higher feed costs than HAY and SILAGE cows ($P = 0.02$). Despite similar final body condition scores ($P = 0.19$), LIMIT cows gained the least ($P = 0.04$). Carcass traits and total cow value were similar across treatments for harvested cows ($P = 0.10$). HAY cows had the lowest breakeven and greatest return for harvested cows ($P \leq 0.02$); however, breakevens and returns for sold cows did not differ across treatment ($P = 0.15$). Although self-fed diets can improve market cow quality, other low-cost alternatives require further investigation.

Introduction

The sale of market cows (cull cows) can contribute a considerable portion of income (15 percent to 30 percent) to the annual receipts of cow-calf producers (Feuz, 2006). Six million to 8 million market cows are slaughtered annually, providing a sizeable supply of muscle cuts to the packing industry (Stalcup, 2008). Generally, spring calving market cows are sold in the fall (following weaning and pregnancy checking) at a time when cow supply is large and economic returns are low. Often, cow-calf producers give little forethought to adding value to market cows before culling. One method of enhancing market cow value is to feed the cows for a short time (60 to 100 days) and then sell the cows when market prices are seasonally higher (Strohbehn et al., 2004; Strohbehn and Sellers, 2002). As well as increasing market value, a feeding period enables cow-calf producers to improve cow carcass quality (Wright, 2005).

Moreover, little research has examined the use of self-feeding protocols as a system of adding value to market cows. As volatility continues in the feed ingredient markets and fuel and other production input expenses increase, re-evaluation of market cow feeding strategies and economic profitability is crucial (Niemela et. al., 2008). Our study objective was to investigate the effects of feeding strategy on cow feedlot performance, carcass characteristics and economics. Our hypothesis was that the three feeding strategies would have similar

performance and carcass quality, but the self-fed system would have lower feed and labor costs associated with it as compared to the other two systems.

Materials and Methods

The NDSU Animal Care and Use Committee approved all protocols. Sixty-eight Angus cross and Hereford market cows were purchased locally during a two-week period (Oct. 22 and 29, 2007). After purchase, cows were delivered to the NDSU Hettinger Research Extension Center. On day 0 and 1, purchased cows were weighed, had their body condition scored on a scale of 1 to 9 (body condition score [BCS], Herd and Sprott, 1986); and were evaluated for pregnancy status, temperament and overall health. From this group, 48 nonpregnant cows were selected as study subjects. Cows were vaccinated for respiratory and clostridial diseases, dewormed and implanted (Finaplex H, Intervet, Millsboro, Del.) on day 1. Cows were stratified by weight (body weight [BW] = 1,313 ± 14.7 pounds) and BCS (5.71 ± 0.07) and allotted to one of 12 pens (four cows/pen). Pens were assigned randomly to one of three treatments: corn-mixed hay (HAY), barley-barley silage (SILAGE) and a self-fed ground diet using a controlled intake system (LIMIT). Diets were formulated to provide 60 Mcals/lb NE_g and 11.5 percent CP using ground mixed hay, barley silage, and a commercial supplement containing soy hulls as roughage sources for HAY, SILAGE, and LIMIT respectively (Table 1).

Alfalfa haylage and soybean meal (47.5 percent CP) were included in the HAY diet to prevent ration separation and increase CP level. Ground hay was added to the SILAGE diet to increase ration dry matter (DM). Four rations of increasing energy density (data not reported) were fed to HAY and SILAGE cows during the first 40 days to acclimate cows to high-grain finishing diets. Fence line feed bunks were read daily at 7 a.m. and slick bunk management was used to determine individual pen daily feed allotment. HAY and SILAGE cows were fed once daily at 9 a.m. Purina Mills developed the feeding protocol used for the LIMIT cows. Creep feeders (self-feeders) were means of diet delivery for LIMIT cows. LIMIT cows had continual access to self-feeders containing respective diets (Table 1); LIMIT cows were fed small amounts of baled grass hay daily (6.4 pounds/cow; as fed). LIMIT diets were ground and feeders filled on day 0, 8, 22, 36, 42, 45, 47, 53, 63, and 74. All cows had free access to water in ice-free automatic fence line water fountains and white salt blocks. To prevent estrus, MGA pellets were added to all diets.

Due to deteriorating pen conditions because of inclement weather, all cows were removed from feedlot pens on day 76, commingled into one group and placed into a larger pen. From day 76 to 103, cows were fed a mixed ration at 2.6 percent BW (based on day 75 BW) containing 25 percent barley silage, 25 percent ground mixed hay, 22.5 percent whole barley, 22.6 percent cracked corn, 1.9 percent finishing supplement, 2.5 percent MGA pellets and 1.9 percent calcium carbonate (DM basis, 13.7 percent CP, 52 Mcal/lb NE_g) for the last 28 days prior to harvest. The roughage-based diet was fed because of concerns about possible cow lameness and cows going down during the long transport to harvest.

Cows were weighed and had their body condition scored on day 0, 1, 28, 45, 46, 74, 75, 102 and 103. Initial and final weights were determined by averaging two-day unshrunk weights. HAY and SILAGE diet samples were collected on day 6, 22, 43, 60 and 74. LIMIT diet samples were collected on day 1, 6, 36, 60, 63 and 74. Diet samples from the commingled group were collected on day 80, 90 and 100. Diet samples were composited by treatment and analyzed by a commercial laboratory (Midwest Laboratories, Omaha, Neb.) for nutrient analysis. After the 104-day feeding period, 14 cows were sold at auction locally (n = 4 for SILAGE and n = 5 for HAY and LIMIT, respectively) to evaluate local market prices (Lemmon Livestock Inc., Lemmon, S.D., Feb. 13, 2008) for fattened cull cows. The remaining cows (n=33) were harvested at Dakota Premium Foods LLC, South St. Paul, Minn., on day 104 and individual carcass data was collected following a 24-hour chill.

Economic values for feedstuffs and other service fees was obtained from purchased costs, local cash grain bids and the US Department of Agriculture National Agricultural Statistics Service's North Dakota monthly commodity prices (www.nass.usda.gov/nd). Breakeven and closeout information were calculated using the NDSU Extension CalfWEB closeout analysis program (www.chaps2000.com/calfweb/closeout.asp). Cow performance, carcass traits and economic data were analyzed as a completely randomized design with the pen serving as the experimental unit. Carcass data was analyzed similarly, with missing data points from auctioned cows not included in the data set, but with the pen still serving as the experimental unit. Treatment means are separated by least square means following a protected F-test ($P < 0.05$).

Results and Discussion

Cow feedlot performance is shown in Table 2. One cow (HAY) was removed from the study because of founder (day 57). All performance data from the removed cow was deleted from subsequent performance analyses. Additionally, two cows were treated for foot rot (LIMIT and HAY, day 49 and 55, respectively). Veterinary medicine costs did not differ between treatments and averaged $12.15 ± 0.59 per cow ($P = 0.69$; Table 2). In general, dry-matter intakes for market cows are greater compared to calf-feds or yearling DMI.

Calf-fed DMI typically range from 20 to 24 pounds/day, yearlings from 23 to 28 pounds/day DMI and mature cows from 28 to 45 pounds/day DMI, depending on respective body weights. In this study, HAY and SILAGE cows gained faster ($P < 0.01$) because LIMIT cows acclimated slowly to their diet the first 46 days of study, resulting in lower DMI, ADG and feed efficiencies (gain:feed ratios, G:F) for LIMIT cows ($P < 0.02$). LIMIT cows' DMI and ADG increased when the cows consumed the final self-fed diet during Period 2 (Table 2). At the end of 75 days, LIMIT and SILAGE cows had similar DMI, but differed from HAY cows ($P = 0.007$). Despite final G:F being similar across treatments ($P = 0.13$), LIMIT cows had the lowest DMI and ADG and the highest feed cost/lb. of gain ($P < 0.02$). Feed costs/lb. gained were similar for HAY and SILAGE cows ($P = 0.02$). Although final BCS were similar across treatments ($P = 0.19$), HAY cows were the heaviest, SILAGE cows intermediate and LIMIT cows the lightest before commingling ($P = 0.02$).

Yardage costs were 20 percent lower for LIMIT cows as compared to HAY and SILAGE cows ($P < 0.001$). Yardage charges were determined by surveying cattle feeders about yardage fees they charged out to their commercial feeding clients. Yardage fees were 25 cents per head per day for LIMIT cows and 35 cents per head per day for HAY and SILAGE cows. The use of self-feeders decreased labor and equipment needs during the 75-day period as compared to more traditional feeding methods (totally mixed rations fed by a feeder wagon).

Cow weight gain and ADG during the commingled period (day 76 to103) is reported in Table 2. Because of combining all pens into one large group, treatment effects could not be separated out statistically during the commingled period. As a result, weight gain data from the commingled period is reported to illustrate the continued weight gain all cows experienced during the 28 days preceding harvest.

Carcass traits and total cow value were similar across treatments for harvested cows ($P = 0.10$; Table 3). This may be attributed to greater compensatory gain and DMI exhibited by LIMIT cows during the commingled period than is shown by the weight gain data before harvest (day 76 to 103, Table 2). Cows sent to the commercial abattoir received the same price at harvest ($1.08/pound of hot carcass weight). The effect of feeding strategy on auctioned cows and closeout returns is reported in Table 3. Initial average value for the cull cows used in this study was $0.455/pound or $596.70/head. Feeding these cows for an additional 104 days increased the average cow value to $1,009.31/head ± $16.26 for harvested cows, with no difference

among treatments ($P = 0.14$). Additionally, cows sold at auction had increased value, averaging $958.18/head, with no difference between treatments ($P = 0.29$).

Sale cow BW was similar at local auction on sale day ($P = 0.08$). Although cow values were increased for both auctioned and harvested cows, these increased values do not reflect the added expense of feeding these cows for an additional 104 days. HAY cows had the lowest breakeven and greatest return for harvested cows ($P \leq 0.02$); however, the breakevens and economic returns for sold cows did not differ across treatments ($P = 0.15$). Cows sold at auction received similar market prices across treatments, with cows averaging $0.595/pound ($P = 0.34$).

Implications

Feeding hay-based, silage-based or self-fed rations for a short time (during late fall-early winter) resulted in a net profit for feeding market cows. Despite the increased dietary adjustment time, LIMIT cows gained more efficiently when consuming their final self-fed diet. Although LIMIT cows consumed less feed and had lower labor costs, feed cost of gain was highest for this group. Potential economic returns by feeding market cows will be highly dependent on several factors: availability of local resources, initial cow body condition, feed costs and availability, days on feed and final carcass characteristics. Self-feeders are a viable alternative system of feeding and improving market cow value. Although self-fed diets can improve market cow quality, other low-cost alternative require further investigation.

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Table 1. Dietary ingredient and nutrient concentration of HAY, SILAGE, and LIMIT diets.

			Limit		
			Accuration[a]		Impact[b]
Item	**Hay**	**Silage**	**d 0-21**	**d 22-46**	**d 47-75**
Ingredient , % DM					
Alfalfa haylage	8.5	-	-	-	-
Barley silage	-	16.1	-	-	-
Calcium carbonate	0.7	0.7	-	-	-
Whole barley	-	67.2	-	-	-
Cracked corn	71.4	-	34.8	60.8	78.5
Finish supplement[c]	2.0	1.8	-	-	-
Purina supplement	-	-	52.1	26.1	8.7
MGA pellets[d]	2.6	2.4	2.8	2.8	2.8
Ground mixed hay[e]	12.7	11.8	-	-	-
Soybean meal (47.5% CP)	2.1	-	-	-	-
Grass hay	-	-	10.0	10.0	10.0
12:12 mineral	-	-	0.3	0.3	-
Nutrient concentration[f]					
% DM	76.92	69.22	88.19	87.52	85.2
CP, % DM	11.7	14.5	23.7	22.9	14.8
NE_m, Mcal/lb. DM	0.82	0.80	0.92	0.93	0.87
NE_g, Mcal/lb. DM	0.55	0.54	0.61	0.62	0.58
Ca:P	2.76	2.81	1.56	1.50	1.62

[a]Purina supplement contained 65 mg/lb Monensin sodium.
[b]Purina supplement contained 113.5 mg/lb Monensin sodium and 45 mg/lb Tylosin phosphate.
[c]Supplement contained 500 mg/lb Monensin sodium.
[d]Supplement contained 0.00011% Melengestrol Acetate.
[e]Mixed hay composed of equal parts barley and alfalfa-grass hays.
[f]Analytical results are from composited samples.

Table 2. Influence of market cow feeding strategy on feedlot performance and associated costs.

Item	HAY[a]	SILAGE[b]	LIMIT[c]	SEM[d]	*P*-value[e]
No. head	16	15	16	-	-
No. pens	4	4	4	-	-
Initial BW, lb.	1324	1300	1315	14.74	0.55
Initial BCS	5.68	5.71	5.75	0.07	0.74
Period 1, day 0-46					
DMI, lb./d	38[f]	28[g]	25.6[h]	0.59	< 0.001
46-day gain, lb.	185.8[f]	153.5[f]	40.8[g]	27.2	0.01
ADG, lb./d	4.09[f]	3.54[f]	0.89[g]	0.60	0.01
G:F	0.11[f]	0.13[f]	0.03[g]	0.02	0.02
Feed cost/lb. gain, $/lb.	0.79	0.83	2.21	1.44	0.74
Period 2, day 47-75					
DMI, lb./d	40	37.9	37.8	1.58	0.56
29-day gain, lb.	120.3	157.5	161.8	14.4	0.14
ADG, lb./d	4.14	5.42	5.58	0.50	0.14
G:F	0.10	0.14	0.15	0.01	0.09
Feed cost/lb. gain, $/lb.	0.82	0.71	0.70	0.08	0.52
Final, day 0-75					
DMI, lb./d	38.8[f]	33.5[g]	31[g]	1.06	0.002
75-day gain, lb.	308.3[f]	281[f]	195.3[g]	26.8	0.04
ADG, lb./d	4.11[f]	3.75[f,g]	2.61[g]	0.36	0.04
G:F	0.11	0.11	0.08	0.01	0.13
Feed cost/lb. gain, $/lb.	0.79[g]	0.80[g]	1.72[f]	0.15	0.002
Final BW, lb.	1629.3	1600.5	1517.5	27.8	0.047
Final BCS (1-9)	7.45	7.48	7.10	0.16	0.19
Commingled period, day 76-103					
28-day gain, lb.	98.8	124.8	155.5	-	-
ADG, lb./d	3.40	4.30	5.35	-	-
Yardage costs, $/cow[h]	36.75[f]	36.75[f]	29.15[g]	-	< 0.001
Veterinary medicine costs, $/cow	11.88	12.59	11.99	0.59	0.69

[a]HAY: Hay-based finishing diet consisted of ground mixed hay, cracked corn, alfalfa haylage, finish supplement, soybean meal, MGA® pellets and calcium carbonate.

[b] SILAGE: Silage-based finishing diet consisted of barley silage, cracked barley, ground mixed hay, finish supplement, MGA® pellets and calcium carbonate.

[C]LIMIT: Self-fed finishing diet, offered ad-libitum via self-feeders placed in pens.

[d]Standard error of mean; n = 4 observations per treatment.

[e]*P*-value for protected F test.

[f, g, h] Means with different subscripts differ ($P < 0.05$).

Table 3. Influence of market cow feeding strategy on carcass traits and economics.

Item	HAY[a]	SILAGE[b]	LIMIT[c]	SEM[d]	*P*-value[e]
Harvested cows					
Hot carcass weight, lb.	961.5	925.3	917.3	15.1	0.14
Dressing %	54	53	54	0.78	0.88
Lean maturity[f]	448	453	445	19.61	0.96
Skeletal maturity[f]	441	477	446	16.09	0.29
Marbling score[g]	398	390	422	21.81	0.58
12th rib fat thickness, in.	0.56	0.74	0.59	0.05	0.10
Longissimus area, in.^{2}	13.7	12.5	12	0.7	0.25
Muscling score[h]	2.75	3.25	3.75	0.34	0.18
Fat color[i]	2.75	3.25	2.50	0.26	0.18
Lean color[j]	5.25	6.0	5.50	0.40	0.44
Total cow value, $	1,038.33	999.27	990.32	16.26	0.14
Auctioned cows					
Sale BW, lb.	1656.3	1776.3	1584.5	52.8	0.08
Sale price, $/lb.	0.595	0.603	0.588	0.64	0.34
Total cow value, $	962.74	1005.51	906.29	41.78	0.29
Breakevens					
Harvested cows, $/lb.	0.53[l]	0.54[k, l]	0.56[k]	0.007	0.03
Auctioned cows, $/lb.	0.52	0.50	0.56	0.02	0.11
Closeouts, profit or loss					
Harvested cows, $/head	155.34[k]	125.22[k, l]	94.92[l]	13.35	0.03
Auctioned cows, $/head	122.41	175.61	53.62	40.09	0.15

[a]HAY: Hay-based finishing diet consisted of ground mixed hay, cracked corn, alfalfa haylage, finish supplement, soybean meal, MGA® pellets and calcium carbonate.
[b] SILAGE: Silage-based finishing diet consisted of barley silage, cracked barley, ground mixed hay, finish supplement, MGA® pellets and calcium carbonate.
[c] LIMIT: Self-fed finishing diet, offered ad-libitum via self-feeders placed in pens.
[d]Standard error of mean; n = 4 observations per treatment.
[e]*P*-value for protected F test.
[f]A = 100 to199, B = 200 to 299, C = 300 to 399, D = 400 to 499, and E = 500 to 599.
[g]Slight = 300 to 399 and Small = 400 to 499.
[h]Thin = 1, Average = 3, and Thick = 5.
[i] Pure white = 1, Yellow = 5.
[j] Light red = 1, Cherry red = 4, and Very dark red = 8.
[k, l] Means with different subscripts differ ($P < 0.05$).

Effect of Distillers Grains on Natural vs. Conventional Supplements and Production Methods on Feedlot Performance, and Carcass Characteristics

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Abstract

This trial was initiated to determine the effects of natural production methods for beef cattle during the finishing period versus conventional management in diets containing 20 percent modified distillers grains with solubles (MDGS). Seventy-two backgrounded steers were assigned to one of two treatments: 1) conventionally (CON) managed calves received growth promotants (implants/ ionophores) and antibiotics if required and 2) natural (NAT) calves were not given growth promotants or antibiotics. In place of the ionophore in the natural diet, a supplement comprised of a commercially-produced, live yeast, *Saccharomyces cerevisiae,* was included in the totally-mixed ration. Overall the steers managed and fed conventionally consumed more feed, were heavier and had greater average daily gains compared to naturally-managed calves ($P < 0.0001$). Efficiency overall for pounds of feed/ pound of gain was significantly different due to treatment ($P = 0.02$) and hot carcass weight, REA, and KPH were all significantly affected ($P < 0.04$) by treatment. Backfat was not affected by treatment ($P = 0.48$). Yield grade was not significantly different due to treatment ($P = 0.53$). However, NAT steers had higher marbling score ($P = 0.02$).

Introduction

Growth in the ethanol industry has increased the amount of distillers grains available for feed. Natural beef production has become of interest and demand. Natural beef, which must meet the criteria of "never-ever" receiving implants, ionophore or antibiotics, and reasonably priced ethanol byproducts could allow North Dakota's cattlemen to create a natural cattle feeding industry within the state.

Materials and Methods

Seventy-two black Angus steers were backgrounded at the Hettinger Research Extension Center and shipped to the Carrington Research Extension Center for finishing. Upon arrival at Carrington, the steers were allotted in one of two production management treatments: natural (NAT) in which the steers received no implants, antibiotics or ionophores, or conventional (CON) in which the steers were managed receiving all common conventional finishing practices. Finishing diets (65 Mcal/lb.) were formulated to meet or exceed NRC (1996) nutritional beef cattle recommendations (Table 1).

Steers fed the finishing diet including 20% MDGS with natural or conventional supplement.

Table 1. Finishing ration with 20% MDGS in natural and conventional diets.

	----------% DM----------	
Item	Conventional	Natural
Corn	58.40	58.71
Canola	2.89	2.93
MDGS	22.19	22.29
Silage	7.21	7.56
Straw	7.58	7.65
$CaCO_3$	0.50	0.57
Ionophore	1.21	-
Natural Suppl	-	0.28

The finishing ration was formulated to contain a minimum of 20 percent modified distillers grains with solubles (MDGS) and to include a conventional supplement in the form of an ionophore at 300 mg/hd/d, or a natural yeast-based supplement *Saccharomyces cerevisiae* at 400 mg/hd/day. Steers were fed once daily ad libitium and had free access to fenceline waterers. Steers were weighed every 28 d and feed delivery was recorded daily until harvest. Conventional steers were re-implanted with a terminal trenbolone acetate (TBA) commercial implant. Steers were harvested when cattle were observed to have obtained 60 percent choice by trained CREC personnel. Steers in the CON treatment reached this visible appraisal 13 d earlier than the NAT steers, so steers were harvested by treatment block 13 d apart.

Results

Growth Performance and Efficiency

Dry matter intake for all periods except period one was significantly different (Table 2). Overall the steers managed and fed conventionally consumed 24.63 pounds/hd/d where as the natural consumed only 21.50 ± 0.62 pounds/hd/d. Final body weight ($P < 0.0001$) was 1383.15 vs. 1296.40 ± 13.89 pounds for CON versus NAT, respectively. Overall ADG ($P< 0.0001$) was 3.97 vs. 3.26 ± 0.07 pounds for CON versus NAT treatments. Anderson et al. (2008) did not report significant differences in DMI or ADG in cattle managed conventionally versus naturally, but did report differences in efficiency in favor of the ionophore supplement that was comprised of *yucca schidigera* extract and cobalt. Efficiency overall for pounds of feed/ pound of gain was significantly different due to treatment ($P = 0.02$; CON 6.18 vs. NAT 6.60 ± 0.15). Gain pounds / feed pounds was not significantly different overall ($P = 0.09$; 0.16 vs. 0.15 ± 0.01) for CON versus NAT, respectively.

Table 2. Intake gain and efficiency of calves fed using natural or conventional production methods.

Item	Conventional	Natural	St. Error	P-value[a]
Weight, lb.				
Initial Wt., Feb 11	856.31	832.53	7.50	0.010
Period 1, Mar. 11	974.74	927.49	12.86	0.004
Period 2, Apr 8	1114.82	1033.11	12.70	<0.0001
Period 3, May 7	1237.28	1126.21	13.86	<0.0001
Final Wt. (Period 4)	1383.15	1296.40	13.89	<0.0001
Dry Matter Intake, lb./hd/day				
Period 1	19.62	18.50	0.96	0.271
Period 2	25.03	20.53	1.10	0.002
Period 3	25.32	23.38	0.70	0.020
Period 4	27.45	23.00	0.68	<0.0001
Overall	24.63	21.50	0.66	0.001
Average Daily Gain, lb./hd/day				
Period 1	4.23	3.39	0.32	0.028
Period 2	5.00	3.77	0.26	0.001
Period 3	4.22	3.20	0.17	0.000
Period 4	3.65	3.21	0.12	0.005
Overall	3.97	3.26	0.07	<0.0001
Feed Efficiency				
Feed (DM)/Gain				
Period 1	4.67	5.53	0.34	0.030
Period 2	5.03	5.47	0.37	0.268
Period 3	6.00	7.33	0.35	0.003
Period 4	7.53	7.20	0.31	0.312
Overall	6.18	6.60	0.15	0.021
Gain/Feed (DM)				
Period 1	0.22	0.18	0.01	0.023
Period 2	0.20	0.19	0.01	0.282
Period 3	0.17	0.14	0.01	0.000
Period 4	0.14	0.14	0.00	0.615
Overall	0.16	0.15	0.00	0.095

[a]*P*-values < 0.05 are considered significant.

Carcass

Carcass quality traits are reported in Table 3. Hot carcass weight, REA, and KPH were all significantly affected ($P < 0.04$) by treatment. Conventionally-managed cattle had a greater HCW than the NAT (860.7 vs. 764 ± 6.36 lbs.) and greater REA (14.00 vs. 12.96 ± 0.12 sq in). Backfat, also, was not affected by treatment ($P = 0.48$). Final yield grade is a composite calculated score which encompasses fat cover, HCW, KPH and REA to determine the ratio of muscle to fat of the carcass which was not found to be significantly different due to treatment ($P = 0.53$). However, NAT versus CON steers had greater marbling score (515.8 vs. 487.3). Berthiaume et al. (2006) reported similar quality grade results in steers receiving growth promotants in a conventional production scenario versus a natural system. Anderson et al. (2008)

reported that steers fed a natural supplement had similar carcass characteristics of those receiving an ionophore.

Table 3. Carcass performance of calves fed MDGS using natural or conventional production methods.

Item	Conventional	Natural	St. Error	P-value[a]
HCW lb.	860.72	764.00	6.36	<0.0001
Marbling in.[b]	487.27	515.82	7.52	0.023
Back Fat	0.58	0.53	0.05	0.390
Ribeye area, sq. in.	14.00	12.97	0.12	0.000
Kidney, pelvic, heart[c]	2.42	2.63	0.07	0.043
Final YG[d]	3.25	3.12	0.15	0.534

[a] *P*- values < 0.05 are considered significant.

[b] Marbling score is based on intramuscular fat in the ribeye, 300-399 = select; 400-499 = low choice.

[c] Kidney, pelvic, heart fat is estimated as a percent of carcass weight.

[d] Yield grade is a composite score for describing the proportion of muscle to fat in the carcass. It is based on several criteria and used for determining value. Low numbers indicate a very lean carcass, high numbers a fat carcass.

Summary

In summary, steers that were managed using modern conventional production practices had a greater live weight, DMI and ADG, but a lower feed to gain ratio than steers finished naturally without the use of implants or ionophores. Hot carcass weights of the CON steers were significantly heavier than NAT, with CON steers having larger ribeye areas. No difference across treatments was seen for backfat and yield grade. However, NAT steers had better marbling score.

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Literature Review

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Duck production on post-contract Conservation Reserve Program grasslands in southwestern North Dakota

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The objective of this study was to evaluate the effect of multiuse land management systems on post-Conservation Reserve Program lands and demonstrate the potential viability and sustainability of producing both agricultural and wildlife outputs. Our findings suggest that occasional grazing or moderate levels of grazing pressure of Conservation Reserve Program grasslands may decrease duck hen recruitment but improve duck nesting success.

Summary
The objective of this study was to evaluate the effect of multiuse land management systems on post-Conservation Reserve Program lands and demonstrate the potential viability and sustainability of producing both agricultural and wildlife outputs. Six species of ducks utilized research plots as nesting cover, with the highest nest densities occurring in idled land (7.1 nests/100 acres). Overall nest success was highest in the seasonlong grazed pasture at 60 percent success. Our study provides additional evidence to support the importance of permanent cover as nesting habitat for ducks. However, our data also supports earlier findings of higher nesting success rates in seasonlong pastures versus idled lands. Our findings suggest that occasional grazing or moderate levels of grazing pressure of Conservation Reserve Program grasslands may decrease hen recruitment but improve nesting success. Moderately grazed lands may compensate for decreased nest density through increased nest success or may even improve duck production efficiency.

Introduction
The importance of the Prairie Pothole Region (PPR) in North Dakota for duck production has been well-established (Smith et al., 1964). The PPR is composed of numerous wetlands of various classifications that provide exceptional brood-rearing habitat in most years. A plethora of research has focused on duck production within the region; however, little research regarding duck production has been done outside the PPR.

The importance of permanent cover as nesting habitat has been well-documented for ducks (Kruse and Bowen, 1996; Stephens et al., 2005). The Conservation Reserve Program (CRP) has provided millions of acres of permanent cover, restored thousands of wetland acres and protected other wetland habitats throughout the United States. Reynolds et al. (2001) reported 23 percent of duck nests were successful in CRP cover and suggest that CRP has increased duck recruitment by 30 percent in the PPR. Given these findings, CRP grasslands outside the PPR may be expected to provide even more valuable nesting cover for ducks.

Livestock production, although not common on CRP lands due to regulation, is a common land use of many permanent cover types throughout much of the Dakotas. The effects of grazing on duck production have been evaluated with mixed results (Kirsch, 1969; Barker et al., 1990; Ignatiuk and Duncan, 2001).

Although duck production and its interaction with livestock have been investigated in the PPR, few studies have focused on this relationship outside the region.

The Hettinger Research Extension Center (HREC) began a research trial evaluating a multiple land use strategy on post-contract CRP lands and its effect on ring-necked pheasant (*Phasianus colchicus*) production in 2006. A total of 156 duck nests were monitored from 2006 through 2008. This report documents the effects of the multiple land use strategy on duck production.

Procedures

Study sites were located in Adams County, which is in southwestern North Dakota. Both study sites were within three miles of Hettinger, N.D. Each study site consists of approximately 640 acres. A randomized complete block design was used to test if nest success and nest density of ducks were different among several land uses. Each 640-acre study site was divided into one seasonlong (SL) pasture 320 acres in size. The other four treatments were 80 acres in size and were assigned the following treatments or control: no-till barley (NTB), no-till corn (NTC), hayed (HAY) or idle (**ID**) control.

The SL was grazed with 33 to 45 Angus x Hereford cows from June 1 to Jan, 1 each year, targeting a 50 percent degree of disappearance of forage. Stocking densities were adjusted each year to achieve approximately the targeted use. The HAY was harvested annually during the second week in July. The NTB was harvested for forage and NTC was grazed from Jan. 1 to April 1, at which time the cows were returned to the HREC for calving and fed harvested feeds until June 1. The ID remained intact to represent continuation of CRP, with no forage harvested, and provide habitat for ducks, pheasant and other wildlife. The NTC and NTB treatments were rotated between the two selected 80-acre parcels annually to represent traditional crop rotations.

Duck utilization of each land management type (SL, NTB, NTC, HAY and ID) was determined using a technique described by Higgins et al. (1969). Duck nests were located by dragging a 100-foot chain, 0.31 inch in diameter, between two all-terrain vehicles. The presence of a nest was determined when a hen was flushed from her nest. Each study site was searched in its entirety once every two weeks beginning in late April or early May and continuing until July 15 to determine the presence of nests and timing of the primary nesting season. Upon locating each nest, time of nest initiation was determined utilizing a candling technique (Weller 1956). Each nest was revisited every three to five days to determine nest fate.

Duck nest success was calculated using a modified Mayfield method as described by Miller and Johnson (1978). A nest was considered successful when at least one chick hatched and left the nest. Mean nest density was calculated for each treatment. A repeated measure ANOVA using PROC MIXED was used to analyze egg initiation data. The null hypothesis tested was that no difference in nest success or density would occur among treatments and years. A P-value ≤ 0.05 was considered significant. When a significant P-value was obtained regarding treatments, year and treatment X year interaction, the Tukey's Honesty Significance Test procedure was used to separate means.

Results

The degree of herbage disappearance was lower than the target of 50 percent on all ecological sites for 2006 and 2007 (Table 1). Disappearance was greatest on the loamy overflow ecological site when compared with the loamy and shallow loamy sites in 2006 and 2007. The loamy site had a greater degree of utilization than the shallow loamy site in 2006; however, the shallow loamy site was utilized at a greater level than the loamy site in 2007. The degree of disappearance could not be calculated for 2008 due to early and prolonged snowfall during the fall.

Several species of ducks, including mallard (*Anas platyrhyncos*), gadwall (*A. strepera*), northern pintail

(*A.acuta*) and blue-winged teal (*A. discors*), were observed nesting on trial plots, with gadwall being the most abundant. In general, the number of duck nests declined from 2006 to 2008. A year effect occurred between 2006 and 2007, with overall nest density lower in 2006 than 2007 ($P \leq 0.05$; Table 2). The SL grazing treatment (5.1 nests/100 acres) and ID control (7.1 nests/100 acres) had greater duck nest density ($P<0.05$) than NTC and NTB (0.6 and 0.4 nests/100 acre, respectively).

Predation by skunks (*Mephitis mephitis*) and other mammalian predators accounted for the majority of nest failures. Nest failures resulted in the destruction of the nest and eggs but generally showed no signs of hen predation. Duck nest success was greater ($P \leq 0.05$) on the SL (61 percent) compared with NTC (2 percent) and NTB (1 percent) (Table 3). Duck nest success on ID (41 percent) was trending toward being different from NTB and NTC ($P=0.09$).

Discussion

Ducks predominantly chose habitats that consisted of permanent grassland cover for nest sites during the study and avoided cropped land entirely following 2006. Duck nest density was highest in ID CRP lands throughout the study period. Kirsch (1969) reported similar findings of 0.28 nest/acre in idle lands versus 0.17 nest/acre in grazed lands. Barker et al. (1990) reported greater nest densities in idle lands than grazed treatments in six of seven years in a study in south-central North Dakota.

The nest success rates recorded in this trial were high compared with most studies found in the literature. Nests initiated in the SL treatment were more successful than all other treatments, including ID. Barker et al. (1990) reported an average Mayfield nest success rate of 26.6 percent in seasonlong pastures versus 11.3 percent in idle lands from 1983 to1989. Ignatiuk and Duncan (2001) found duck nests initiated in seasonlong pastures averaged 25 percent success in Saskatchewan. Conversely, Kirsch (1969) reported higher apparent success rates in idled lands (28 percent) versus grazed (14 percent). Stocking rates in our study, as well as those in Barker et al. (1990) and Ignatiuk and Duncan (2001), were designed to achieve a 50 percent degree of disappearance, while those in Kirsch (1969) varied, often exceeding 50 percent disappearance.

As with earlier research, nest success did not appear to be impacted negatively by the presence of cattle. Many opinions have been offered as to why this phenomenon may occur, but the likely answer is cattle presence discourages predators, either directly or indirectly. Although the ability to graze CRP is limited by federal CRP requirements, future agriculture and land management considerations may want to be given to the occasional grazing of CRP. When proper stocking rates are applied, which allows for residual vegetation to remain following the completion of grazing, ducks may initiate fewer nests. However, nests initiated in properly stocked seasonlong pastures are more likely to have greater nesting success and potentially more ducklings produced than idled lands.

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Table 1. Degree of herbage disappearance (percent) for the loamy, loamy overflow and shallow loamy ecological sites near Hettinger, N.D., in 2006 and 2007.

	2006		2007	
Ecological Site	Grass	Forbs	Grass	Forbs
Loamy	45.2 ± 10.4	32.4 ± 7.6	28.0 ± 6.8	70.0 ± 10.0
Loamy Overflow	53.7 ± 1.6	21.2 ± 0.0	44.2 ± 8.8	50.0 ± 0.0
Shallow Loamy	27.5 ± 15.0	39.8 ± 10.6	31.3 ± 8.5	80.0 ± 10.0

Table 2. Mean values of duck nest density (nests/100 acre) on NTC, NTB, HAY, SL, treatments and ID control on post-Conservation Reserve Program lands near Hettinger, N.D., 2006-2008.

	Treatment[1]				
Year(s)	SL	ID	HAY	NTC	NTB
2006-2008	5.1[a]	7.1[a]	2.9[ab]	0.6[b]	0.4[b]
2006[2]	5.8	8.7	5.6	1.9	1.3
2007	4.4	5.7	1.7	0	0
2008	5.2	7.0	1.3	0	0

[1]Treatment abbreviations: SL = seasonlong grazing, ID = idle, HAY = hay lands, NTC = no-till corn, NTB = no-till barley.

[2] The HAY treatment was idle prior to study initiation and not hayed until mid-July, thus reacting like an idle treatment during the primary nesting season in 2006.

[a,b]Means within rows having differing superscripts differ $P \leq 0.05$.

Table 3. Mean nest success (percent) on NTC, NTB, HAY, SL and ID treatments on post-Conservation Reserve Program lands near Hettinger, N.D., in 2006 and 2007.

	Treatment[1]				
Year(s)	SL	ID	HAY	NTC	NTB
2006-2008	61[a]	41[ab]	29[ab]	2[b]	1[b]
2006	56	29	57	0	0
2007	62	70	32	0	0
2008	66	25	0	0	0

[1]Treatment abbreviations: SL = seasonlong grazing, ID = idle, HAY = hay lands, NTC = no-till corn, NTB = no-till barley.

[a,b]Means within rows having differing superscripts differ $P \leq 0.05$.

Economic Implications of Grazing Management Changes On The Grand River Grazing District

Dan Nudell, Hettinger Research Extension Center

SUMMARY

The Grand River Cooperative Grazing Association (GRGA) and the United States Department of Agriculture, Forest Service, (FS) have a long standing agreement for livestock grazing on public lands managed by the FS near Lemmon South Dakota. The public lands are managed for multiple uses including conservation, grazing, wildlife and recreation. The FS is proposing changes in the management plan that would result in reductions in grazing.

The proposed changes will have an adverse financial effect on the profitability of livestock grazed on these lands by individual members of the GRGA. Changes in grazing days per allotment range from reductions of 6 percent to 46 percent of the original contracted days of grazing. The changes proposed were modeled for each producer to determine the estimated financial change in cost of production for the cattle assigned to each unit1 based on the proposed changes. The estimated costs used in the model were to replace the public lands grazing with private pasture priced at $25 per animal unit month and hay at $67 per ton. Estimated changes in production costs per unit ranged from less than $200 per unit to several thousand dollars per unit. Per animal cost increased from less than $10 to over $40 per head per year based on the proposed reductions. This estimate is for the entire group of animals assigned to the unit. Profit margins in cow-calf production in the region are often thin and can be very volatile. Livestock enterprise analysis of beef cow-calf producers in North Dakota (SD numbers not available) for the years 2000 to 2007 show a range of returns of less than $18 to about $160 per cow. Clearly an increase of even a few dollars per animal per year can have a profound impact on the enterprise. The North Dakota enterprise analysis numbers do not allow segregation of public lands grazers and those who have no access to public lands. No enterprise analysis of beef cow-calf production on public lands was available. This means the profitability numbers referenced above need to be used with caution. Because information about total cost structure differences in GRGA is unknown, profitability comparisons are problematic.

The estimated changes in spending by GRGA members under the proposed changes in the grazing plan were modeled to assess the changes in regional economic impact. Reductions in public lands grazing were estimated to increase costs of production and reduce net income for the cattle in the allotment. Reduced net income from the cow herd was modeled as a loss of household income in the scenarios studied. Sector data was estimated from compiled enterprise analysis records from western North Dakota (No SD or GRGA records available).

1 Defined as a specific permittee in a specific pasture in a specific allotment, an individual may operate in several units and each was analyzed separately

Agriculture is the driving force in the economy of Perkins County SD. Cattle production is certainly an integral part of that economy and the production of the affected allotments is an important part of the total economy of the region. The baseline estimate for annual direct and secondary business activity generated by the cattle production in pastures 1 – 5 of the Grand River Grazing District is approximately $8 million dollars.

GRGA members are concerned about the reduction in grazing availability and thus the increase in cost of production and their effects on the regions economy.

Two scenarios have been suggested as possible outcomes of the reduction. One is an increase in costs causing a reduction in profit and thus a reduction in business activity in the region. The second is that members of the association will cease production due to the increased costs and all the business activity related to the association will be lost.

Estimates of business activity changes under the proposed grazing reductions do not support this argument. Modeling this question involved several assumptions. Because cow-calf production is assumed to be profitable and the changes in costs are small in relation to the total year feed cost (this does not mean that they are not painful) total production is assumed to remain the same. As livestock production costs rise and net income is reduced the changes are modeled as increases in ag-crop sector spending and decreases in household spending. Because ag-crop spending is direct, immediate and mostly local (Ag-crop has a very high multiplier in the ND model) while household spending is less so, the model shows essentially no change in business activity with the grazing reductions (actual number is an approximate $26,000 to $76,000 increase in business activity with the grazing reductions. This is an extremely small change compared to $8 million total regional activity, less than 1/10 percent).

Secondly is the question of individual members of GRGA ceasing production and removing the entire direct and secondary effects of their activities from the regional economy. It is entirely plausible that some members may cease production and remove their contribution from the regional economy. The problem with this argument is that it is equally implausible that the resources that a departing member does not use would be allowed to lie fallow. Since beef cowcalf production is assumed profitable, other producers would bid for use of the fallow resources made available by a departing producer and total production is unlikely to change significantly.

Thus, under the parameters of this study the changes proposed will have a negative effect on the profitability of the producers involved but are not forecast to adversely affect the regional economy.

Introduction

The Grand River Cooperative Grazing Association (GRGA) and the United States Department of Agriculture, Forest Service, (FS) have a long standing agreement for livestock grazing on public lands managed by the FS near Lemmon South Dakota. The public lands are managed for multiple uses including conservation, grazing, wildlife and recreation. The FS is proposing changes in the management plan that would result in reductions in grazing use by the GRGA.

The two parties agreed to conduct a study of economic impacts of the changes proposed. This paper outlines some possible outcomes from the study.

Proposed Changes
The suggested changes in the grazing agreement are to reduce the total animal days of grazing on pastures 1 thru 5 by varying amounts. The purpose of the change is to reduce the total amount of forage harvested in the pastures and to improve the overall pasture conditions to meet Forest Service goals for care of the resource they manage. The proposed changes are vigorously opposed by the grazing association.

The assessment of the economic impact of the changes had three phases. First the grazing association sent their members a questionnaire designed to gather some of the data needed to establish a baseline for comparison of before and after changes.

Secondly a computer program modeling one years forage needs for a beef cow of various sizes and production systems was created and used to estimate changes in producer costs incurred under various amounts of reduction in the days of grazing available to members of the GRGA. The financial costs of the proposed changes were then calculated and compiled by each unit and producer and reported by producer. Finally the total estimated changes were modeled with the North Dakota Input-Output Model to estimate changes in regional economic activities.

Questionnaire
The short questionnaire sent to all GRGA members who graze in pastures 1 thru 5 is reprinted below. Approximately 40 were sent to producers and eight were returned to the grazing association office. Several of the eight were incomplete. The small return rate reduced the usefulness of the questionnaire. Some information was gleaned from the document including cow size, location of home ranches, and trade areas. All results of the questionnaire are printed in the tables below.

Dear Grand Rivet Grazing Member,

The Grazing Association is cooperating with a study to assess the economic impact of the proposed grazing reductions in pastures 1 – 5 on the local economy. Part of the process is to develop a computer model of a ranch that uses Forest Service grazing and that is representative of our members operations.

The purpose of this questionnaire is to get a solid understanding of your current operations and the area of the economy influenced by your cow-calf production. The better you answer these questions, the better our estimates of the impacts of potential Forest Service grazing reductions will be. Please complete one form for each operation and also please answer each question for the last three years.

Please complete this questionnaire **AS SOON AS POSSIBLE** and return to Jane in the stamped addressed envelope provided.

We take your privacy very seriously. No personally identifiable information gathered by this questionnaire will be revealed or shared in any way.

Dear Member,

The Grazing Association is cooperating with a study to assess the economic impact of the proposed grazing reductions in pastures 1 – 5 on the local economy. Part of the process is to develop a computer model of a ranch that uses Forest Service grazing and that is representative of our members operations.

The purpose of this questionnaire is to get a solid understanding of your current operations and the area of the economy influenced by your cow-calf production. The better you answer these questions, the better our estimates of the impacts of potential Forest Service grazing reductions will be. Please complete one form for each operation and also please answer each question for the last three years. **We take your privacy very seriously. No personally identifiable information gathered by this questionnaire will be revealed or shared in any way.**

1. What was your inventory of all cows and calves at January 1 for each of the last three years?

2005 Cows_____ 2005 Heifers_____
2006 Cows_____ 2006 Heifers_____
2007 Cows_____ 2007 Heifers_____

2. Do you run grass calves or yearlings? YES NO If yes how many?

2005 grass cattle _____
2006 grass cattle _____
2007 grass cattle _____

3. What was the number of cows and calves sold for the last three years?

2005 Cows_____ 2005 Calves_____ 2005 Grass Cattle_____
2006 Cows_____ 2006 Calves_____ 2006 Grass Cattle_____
2007 Cows_____ 2007 Calves_____ 2007 Grass Cattle_____

4. Do you raise and/or purchase your replacements? Please include number of head for each category

2005 raise_____ 2005 purchase_____
2006 raise_____ 2006 purchase_____
2007 raise_____ 2007 purchase_____

5. What month did you sell your calves?

2005_____ 2006_____ 2007_____

6. What month did you sell your cull cows?

2005_____ 2006_____ 2007_____

7. If you raise grass cattle what month do you sell grass cattle?

2005_____ 2006_____ 2007_____

8. What was the average sell weight of your animals?

2005 Cows_____lbs. 2005 Steers_____lbs. 2005 Heifers_____lbs.

2006 Cows_____lbs. 2006 Steers_____lbs. 2006 Heifers_____lbs

2007 Cows_____lbs. 2007 Steers_____lbs. 2007 Heifers_____lbs

9. What date(s) did you turn your cows and calves out onto Forest Service allotment? (Month/Day)

2005_____ 2006_____ 2007_____

10. What date(s) did you collect your cows and calves from Forest Service allotments? (Month/Day)

2005_____ 2006_____ 2007_____

11. What portion of the land associated with your operation is owned private land? ___%

12. What portion of the land associated with your operation is rented private land? ___%

13. What portion of the land associated with your allotment is national grassland? ___%

14. What portion belongs to some other entities? Please list

A._____ ___%

B._____ ___%

C._____ ___%

Please add up the percents in question 11, 12, 13, and 14 and make sure they sum to 100%

Does the percent of land area in each portion in questions 11, 12, 13 and 14 also accurately represent the head months of grazing for your herd in each area?

_____ Yes ___No

If not, please write in the percent of HMs to the right of the % above.

15. If the Forest Service does reduce the head months for this allotment please select what you plan to do in response?

a. ___% cut in herd size, shift to other agriculture ventures
b. ___% cut in herd size, shift to other work
c. keep inventory the same and shift to some other supply of feed, if so please indicate what method you would use, for example rent grass, buy more land, haul in feed, etc. and also indicate where the new supply of feed would be located by county and state.

_____

_____

_____

_____

_____

d. keep inventory the same but shorten time out on the allotments
e. shift to an earlier weaning date
g. abandon cattle ranching, keep ranch, lease to other ranchers
g. abandon cattle ranching, sell part or all of the ranch
h. other. Please describe_____

16. Is there some threshold of reduction that would change your answer?
_____

17. Please list the county or counties where you purchase all of your ranch inputs (feed, fencing, fuel, inoculations, etc)
_____

18. Please list the county or counties where you sell your cows and calves
_____

19. What percent of your total operation is each category of activity?
____Beef cow-calf
____Stocker Cattle
____Other Livestock
____Farming
____Off-Farm Work

20. What percent of your total household earnings were derived from cows and calves compared to other activities and sectors?

2005_____ 2006_____ 2007_____

21 Please list the county or counties where you spend your income on household expenditures.

_____

22. Please list the county where you ranch's home office is located _____

Thank you for participating in this survey. The information you provide will be used to help model the current contribution your cow calf production makes to the local economy as well as modeling how potential changes in Forest Service allotment management would impact the local economy.

Are there any additional thoughts you would like to share with us to help us understand your concerns or plans?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for participating!

Average Results from GRGA Questionaire

Inventory Numbers

232	2005 cows
42	2005 heifers
237	2006 cows
43	2006 heifers
240	2007 cows
46	2007 heifers
0	2005 grass cattle
0	2006 grass cattle
0	2007 grass cattle

Average Results from GRGA Questionaire

Sales Numbers

26	2005 cows sold
248	2005 calves sold
0	2005 grass cattle sold
27	2006 cows sold
256	2006 calves sold
0	2006 grass cattle sold
31	2007 cows sold
251	2007 calves sold
0	2007 grass cattle sold

Average Results from GRGA Questionaire

Heifer Numbers

38	2005 raised heifers
19	2005 purchased heifers
35	2006 raised heifers
22	2006 purchased heifers
44	2007 raised heifers
8	2007 purchased heifers

Average Results from GRGA Questionaire

Sale Dates

3 in Oct. 2 in Jan	2005 month sold calves
4 in Oct 2 in Jan	2006 month sold calves
4 in Oct 2 in Jan	2007 month sold calves
3 in Nov	2005 month sold cows
3 in Nov	2006 month sold cows
4 in Nov	2007 month sold cows
NA	2005 month sold grass cattle
NA	2006 month soid grass cattle
NA	2007 month sold grass cattle

Average Results from GRGA Questionaire

Sell Weights

1209	2005 ave sell wt cows
637	2005 ave sell wt steers
603	2005 ave sell wt heifers
1200	2006 ave sell wt cows
647	2006 ave sell wt steers
602	2006 ave sell wt heifers
1228	2007 ave sell wt cows
650	2007 ave sell wt steers
612	2007 ave sell wt heifers

Average Results from GRGA Questionaire

Turnout Days Not Reported

NA	2005 FS turnout
NA	2006 FS turnout
NA	2007 FS turnout
NA	2005 FS remove
NA	2006 FS remove
NA	2007 FS remove

Average Results from GRGA Questionaire

Ownership Information

51 %	owned private
22 %	rented private
29 %	FS land
NA	14a Other Entity Ownership
NA	14b Other Entity Ownership
NA	14c Other Entity Ownership
5 yes 3 na	land % equal graze %

Average Results from GRGA Questionaire

Response to Reduction

2 respondents indicated they would reduce herd size, 2 respondents said they would maintain herd size and would shift to some other source of feed, 1 respondent said they would maintain size but shorten grazing days, 1 respondent said they would abandon cattle ranching but keep the ranch, 2 respondents said they would abandon cattle ranching and sell the ranch to others, and 1 respondent said they would use a combination of the above strategies.	If reduction occurs what will you do?
1 respondent answered 10 % the other 7 did not answer this question.	What % reduction that would change answer?

Average Results from GRGA Questionaire
Economic Impact Counties

Perkins, Adams	counties inputs
Perkins , Adams, Meade	counties sales
Perkins, Adams, Pennington	counties household expenditures
Perkins	home county

Average Results from GRGA Questionaire
Producer Data

78 %	beef of total operation
NA %	stocker of total operation
NA %	other livestock of total operation
16 %	farming of total operation
NA %	off-farm of total operation
81 %	of total household earnings in 2005 from cow-calf
83 %	of total household earnings in 2006 from cow-calf
84 %	of total household earnings in 2007 from cow-calf

Forage Cost Model

A computer program was developed to calculate quantities and costs of forage required to feed a beef cow for a year under various production scenarios. The model bases it forage use on cow size, calving date, pasture turn out dates and pasture remove dates. It allows for private pasture use before public lands pasture use and for private pasture use after removal form public lands. The program calculates the cost and quantity of hay required during the winter and then calculates a per year forage cost for a beef cow under the production scenario entered. Hay prices, public lands grazing costs and private lands grazing costs are all entered separately and calculated in the total cost according to the size of the cow, the calving system she is under, and the dates of both public and private grazing.

A baseline cost for each unit was developed using this model with the preproposal grazing agreement. Cow size was estimated at 1300 pounds1. Hay price was $67 per ton2 and TDN value of hay was set at 50 percent3. In the baseline calculation the model assumed private grazing from May 1 to the GRGA turn-out date and private grazing from the end date of GRGA pasture till November 1. All other feed was assumed to be hay. Private grazing was modeled at $25 per AUM.

Then each unit was remodeled for a 10 year period using the Forest Service proposed changes in grazing days. The reductions were phased in over time to match the proposed changes4. Grazing days were removed from the end of the grazing period in this modeling. A new yearly forage cost was calculated per cow for each year in the 10 year modeling cycle5.

The outputs from this exercise are included in the appendix of this paper.

1 Questionnaire indicated cow sell weights of 1200 to 1228 pounds
2 2007 South Dakota average price
3 TDN values are not indicated in price report, a TDN value of 50% would be poor quality hay and thus the model would use more of it per cow to meet her nutrition requirements.
4 No more than a 10% reduction per year followed by a 5 year wait before the second reduction would take place.
5 Prices were held constant during this modeling cycle, no changes were assumed for inflation or commodity price variations.

IO Model

To estimate regional impact from activities associated with the GRGA leases of pastures 1 – 5 an estimate of business activity for beef cow-calf production was obtained6. The best source of financial data available was from the North Dakota Farm Business Managers(NDFBM) database available from the University of Minnesota. NDFBM instructors work with individual producers all year long on farm management issues and also complete a whole farm financial analysis7 for each producer every year. This data is compiled and available at the University of Minnesota. Data from beef producers from the western third of North Dakota8 was used to determine sector allocations for the I-O model.

Based on NDFBM records it was assumed that the number of cattle in pasture 1-5 would generate approximately $2 million in business activity before the changes proposed in the grazing plan. This was based on direct spending of $1,487,000 in the Ag-Livestock sector and net income to the producers of approximately $441,000. Net income was assumed to accrue to the household sector of the model. Secondary effects generated by the nearly $2 million direct activity total slightly more than $6 million.

Baseline Economic Activity
GRGA Pastures 1-5

Baseline	Direct	Secondary	Total
Ag-lvstk	1,487	338	1,825
Ag-crops	0	597	597
Nonmetal mining		15	15
Construction		147	147
Transportation		27	27
Comm and Pub Util		183	183
Ag Proc and Misc Mnfg		870	870
Retail Trade		1,380	1,380
FIRE		301	301
Bus and Pers Services		110	110
Prof and Social Services		149	149
Households	441	1,799	2,240
Government		194	194
Totals	1,928	6,110	8,038
Secondary Employment			19

6 GRGA indicated that no financial data from members was to be requested
7 Finpack
8 The closest geographic regional report available

Then the model was changed to reflect minimum proposed grazing changes. The increased costs of forage to replace lost grazing were input as direct spending in the AG-Crops sector. This increased cost was removed from the household sector. Cow numbers and gross revenue were the same but profits, which were attributed to the household, were reduced by the increased cost that must be paid by the grazers.

Economic Activity
Low End of Proposed Change
GRGA Pastures 1-5

Least Change	Direct	Secondary	Total
Ag-lvstk	1,487	338	1,825
Ag-crops	38	600	638
Nonmetal mining		15	15
Construction		147	147
Transportation		27	27
Comm and Pub Util		183	183
Ag Proc and Misc Mnfg		875	875
Retail Trade		1,383	1,383
FIRE		301	301
Bus and Pers Services		111	111
Prof and Social Services		148	148
Households	404	1,815	2,219
Government		194	194
Totals	1,929	6,137	8,066
Secondary Employment			19

Finally the model was used to estimate the changes if the maximum reductions in grazing were implemented. No changes were assumed for inflation or commodity price variations over the 10 years of modeling. The maximum additional cost to the producers to purchase additional forage modeled was added to the Ag-Crops sector and the household income was reduced by the same amount.

Economic Activity
High End of Proposed Change
GRGA Pastures 1-5

Max Change	Direct	Secondary	Total
Ag-lvstk	1,487	339	1,826
Ag-crops	120	605	725
Nonmetal mining		15	15
Construction		146	146
Transportation		27	27
Comm and Pub Util		181	181
Ag Proc and Misc Mnfg		885	885
Retail Trade		1,389	1,389
FIRE		301	301
Bus and Pers Services		111	111
Prof and Social Services		145	145
Households	322	1,849	2,171
Government		193	193
Totals	1,929	6,186	8,115
Secondary Employment			20

Conclusion

Agriculture is the driving force in the economy of Perkins County SD. Cattle production is certainly an integral part of that economy and the production of the affected allotments is an important part of the total economy of the region. The baseline estimate for annual direct and secondary business activity generated by the cattle production in pastures 1 – 5 of the Grand River Grazing District is approximately $8 million dollars.

Cow calf production is often a high risk and low margin enterprise. Increases in costs can quickly erode small profit margins, the proposed changes in grazing rules will cause an increase in costs for the affected producers. As the tables in the appendix show some producers will incur substantial additional costs under the proposed changes.

Two scenarios have been suggested as possible outcomes of the reduction. One is an increase in costs causing a reduction in profit and thus a reduction in business activity in the region. The second is that members of the association will cease production due to the increased costs and all the business activity related to the association will be lost.

Estimates of business activity changes under the proposed grazing reductions do not support this argument. Modeling this question involved several assumptions. Because cow-calf production is assumed to be profitable and the changes in costs are small in relation to the total year feed cost (this does not mean that they are not painful) total production is assumed to remain the same. As livestock production costs rise and net income is reduced the changes are modeled as increases in ag-crop sector spending and decreases in household spending. Because ag-crop spending is direct, immediate and mostly local (Ag-crop has a very high multiplier in the ND model) while household spending is less so, the model shows essentially no change in business activity with the grazing reductions (actual number is an approximate $26,000 to $76,000 increase in business activity with the grazing reductions. This is an extremely small change compared to $8 million total regional activity, less than 1/10 percent).

Secondly is the question of individual members of GRGA ceasing production and removing the entire direct and secondary effects of their activities from the regional economy. It is entirely plausible that some members may cease production and remove their contribution from the regional economy. The problem with this argument is that it is equally implausible that the resources that a departing member does not use would be allowed to lie fallow. Since beef cowcalf production is profitable, other producers would bid for use of the fallow resources made available by a departing producer and total production is unlikely to change significantly. Thus, under the parameters of this study the changes proposed will have a negative effect on the profitability of the producers involved but are not forecast to adversely affect the regional economy.

Outreach, Presentations and Publications

Christopher Schauer, Hettinger REC Director

Presentations

Sheep and Leafy Spurge: How well do sheep control noxious weeds?
ND Weed Control Association Annual Meeting and Convention, Mandan, ND
January 14, 2009

Nutritional Strategies for Increasing the Efficiency of Sheep Production
American Sheep Industry Association Annual Meeting, San Diego, CA
January 22, 2009

Geospatial Analysis of Aerial Photography to Identify Patterns of Grazing on Northern Great Plains Rangelands.
Society of Range Management Annual Meeting, Albuquerque, NM
February 8-12

Waterfowl Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands in Southwest North Dakota.
Society of Range Management Annual Meeting, Albuquerque, NM
February 8-12

Ring-Necked Pheasant (*Phasianus colchicus*) Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands.
Society of Range Management Annual Meeting, Albuquerque, NM
February 8-12

Comparison of Two Nest Searching Techniques Used in Ring-necked Pheasant Nesting Studies.
Society of Range Management Annual Meeting, Albuquerque, NM
February 8-12

Comparison of ground and aerial survey methods on the Grand River National Grasslands.
Society of Range Management Annual Meeting, Albuquerque, NM
February 8-12

Influence of dietary thiamin supplementation on ruminal pH and hydrogen sulfide gas concentration in lambs fed a ration containing 60% distillers dried grains with solubles.
Midwest Section of ASAS, Des Moines, IA
March 16-18, 2009

Does administration of anabolic growth implants to finishing beef cattle influence carcass attributes of cattle genetically indexing for enhanced beef palatability?
Midwest Section of ASAS, Des Moines, IA
March 16-18, 2009

Nutrition for Growing and Finishing Lambs (and Use of Co-products)
Shepherd's Clinic, Granville, ND
March 19, 2009

Market Cow Feeding Using Different Management Strategies.
Western Section ASAS, Fort Collins, CO
June 16-18, 2009

Influence of thiamin supplementation on feedlot performance, carcass quality, and incidence of polioencephalomalacia in lambs fed a 60% distillers dried grains plus solubles finishing ration.
Western Section ASAS, Fort Collins, CO
June 16-18, 2009

Sheep/Goat Nutrition and Production using DDGS.

NCI – US Grains Council
June, 2009

Sheep/Goat Nutrition and Production using DDGS
NCI – US Grains Council Mexican Delegation
September 2, 2009

NDLWPA Graduate Student Updates (DDGS, Natural Lamb, and Metabolizable Protein)
NDLWPA Annual Convention
November 20, 2009

Carcass Ultrasound Demonstration for Dakota Lamb Growers
December 12, 2009

Publications

Loken, B., R. Maddock, M. Stamm, **C. Schauer**, I. Rush, S. Quinn, and G. Lardy. 2009. Growing rate of gain on subsequent feedlot performance, meat, and carcass quality of beef steers. J. Anim. Sci. 87:3791-3797.

Thompson, M.M., **C.S. Schauer**, R.J. Maddock, and C.L. Wright. 2009. Market Cow Feeding Using Different Management Strategies. J. Anim. Sci. Proc. 60:390-393.

Neville, B.W., **C.S. Schauer**, K. Karges, M.L. Gibson, M.M. Thompson, P.T. Berg, and G.P. Lardy. 2009. Influence of thiamin supplementation on feedlot performance, carcass quality, and incidence of polioencephalomalacia in lambs fed a 60% distillers dried grains plus solubles finishing ration. J. Anim. Sci. Proc. 60:135-139.

C.S. Schauer, and J.S. Luther. 2009. Nutritional strategies for increasing the efficiency of sheep production. Proceedings of U.S. Sheep Research Programs. p. 27-28.

Peterson, J.M., M. Hubert, A. Gearhart, K.C. Olson, **C. Schauer**, P.S. Johnson, and D.T. Booth. 2009. Geospatial Analysis of Aerial Photography to Identify Patterns of Grazing on Northern Great Plains Rangelands. Soc. Range Manage. 70:2060-27.

Geaumont, B.A., K.K. Sedivec, and **C.S. Schauer**. 2009. Waterfowl Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands in Southwest North Dakota. Soc. Range Manage. 70:170-5.

Geaumont, B.A., K.K. Sedivec, and **C.S. Schauer**. 2009. Ring-Necked Pheasant (*Phasianus colchicus*) Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands. Soc. Range Manage. 70:170-4.

Geaumont, B.A., K.K. Sedivec, and **C.S. Schauer.** 2009. Comparison of Two Nest Searching Techniques Used in Ring-necked Pheasant Nesting Studies. Soc. Range Manage. 70:170-6.

Gearhart, A.L., D.T. Booth, K.K. Sedivec, S.E. Cox, and **C.S. Schauer**. 2009. Comparison of ground and aerial survey methods on the Grand River National Grasslands. Soc. Range Manage. 70:90-5.

Neville, B.W., **C.S. Schauer,** L.A. Kirschten, K. Karges, M.L. Gibson, and G.P. Lardy. 2009. Influence of dietary thiamin supplementation on ruminal pH and hydrogen sulfide gas concentration in lambs fed a ration containing 60% distillers dried grains with solubles. J. Anim. Sci. 87(Suppl. 2):#293.

Galbreath, J.C., R.J. Maddock, G.P. Lardy, V.L. Anderson, **C.S. Schauer,** N.L. Hall, and E.P. Berg.

2009. Does administration of anabolic growth implants to finishing beef cattle influence carcass attributes of cattle genetically indexing for enhanced beef palatability? J. Anim. Sci. 87(Suppl. 2):#91.

Neville, **C.S. Schauer**, and G.P. Lardy. 2009. Influence of thiamin supplementation on hydrogen sulfide gas concentrations in ruminants fed high-sulfur diets. 2009 NDSU Beef Feedlot Research Report. 32:11-15.

Thompson, M.M., **C.S. Schauer**, V.L. Anderson, B.R. Ilse, and R.J. Maddock. 2009. Impact of weaning date on calf growth and carcass traits. 2009 NDSU Beef Feedlot Research report. 32:30-36.

Ilse, B.R., V.L. Anderson, M.M. Thompson, and **C.S. Schauer**. 2009. Effect of distillers grains on Natural vs. Conventional supplements and production methods on feedlot performance, and carcass characteristics. 2009 NDSU Beef Feedlot Research Report. 32:41-44.

Neville, **C.S. Schauer**, and G.P. Lardy. 2009. Influence of thiamin supplementation on hydrogen sulfide gas concentrations in ruminants fed high-sulfur diets. 2008 Beef Cattle and Range Research Report. 25-27.

Anderson, V.L., B.R. Ilse, and **C.S. Schauer**. 2009. Effects of mineral supplementation and inorganic vs. organic mineral sources on liver and blood serum levels and performance of beef cows and their calves. 2008 Beef Cattle and Range Research Report. 16-20.

Eric Eriksmoen, Agronomist

Grants, Gifts and Grant Proposals

Northern Pulse Growers Association - Pulse Crop Evaluations - $9850
Contracted Variety Trials - Canola, Corn, Sunflower, Small grains and field peas - $35,090
Herbicide Trials – $46,250
Herbicide and Seed Company Product Donations - $4750
Crops Day & Field Tour Sponsorships - $2200
SBARE – IPM Strategies to Control Wheat Stem Sawfly - $9000
UDSA- RAMP – IPM Strategies to Control Wheat Stem Sawfly - $15,000
USDA-CREES – 5 State Consortium, Cover Crops - $5868
Northern Pulse Growers Association – Spartin Herb. on Lentil - not funded.

Professional and Community Activities

ND Crop Variety Selection committee member
Paramedic with West River Ambulance
Member ND EMT Testing Team
Hettinger Chamber of Commerce member
Hettinger Ag. Marketing Club
Treasurer for the West River Breeders Association
Coordinator - ND Uniform Proso Millet Trials
Coordinator - ND Uniform Winter Lentil Trials
Coordinator - ND Uniform Winter Pea Trials
Hettinger REC Safety Officer
Crops judge - Adams Co. & Hettinger Co. Fairs
Certified □First Detector□ with the National Plant Diagnostic Network

Meetings Training and Presentations

Everest Herbicide Research Exchange - Denver, CO
ND Variety Release meeting - Fargo
ND REC Agronomists meeting - Dickinson
Dickinson REC and Extension Advisory Board – Dickinson
Hettinger REC Advisory Board meetings - Hettinger
Hettinger Co. Crop Improvement Assn. meeting – Regent
Dunn Co. Crop Improvement Assn. meeting – Killdeer
Stark Co. Crop Improvement Assn. meeting – Taylor
ND Crop Improvement and Seed Assn. Annual Convention - Bismarck
Best of the Best Wheat Research & Marketing Forum - Bismarck
ManDak Zero Till Association Convention – Brandon, MB
Skip-Row Corn meeting - Bison
Adams Co. Crop Improvement meeting – Reeder
Mandan ARS Board of Directors Meeting - Mandan
Mandan ARS Annual Growers Workshop – Mandan
ND Legislative Session - Bismarck
NDSU Branch Station Conferences – Fargo
Seed & Ag. Chemical meeting, Alliance Ag. – Hettinger
Dow Chem., Goldsky Herb. launch – Dickinson
NDSU Ext. Horticultural Workshop – Hettinger
Valor Herbicide on Pulse Crops field tour – Hettinger
Chemical Sawfly Control meeting - Mott
Hettinger Ag. Marketing Club - Hettinger
Hettinger Chamber of Commerce Ag. Committee meetings – Hettinger
Plot Tours - Hettinger, Scranton, Regent, New Leipzig, Mandan, Ralph and Selfridge
Mandan USDA-ARS Grower Appreciation Tour – Mandan
Syngenta and Agripro Field Tour – Coal Harbor
Rimfire Max Research Exchange – Minneapolis, MN
26th Annual Western Dakota Crops Day show - Hettinger

Presentations

Everest Herbicide in SW ND - Everest Research Exchange - Denver, CO
Variety Update, Skip Row Corn and Sawfly Strategies – Dunn Co. Crop Imp. Assn. – Killdeer
Small Grain Varieties & Sawfly Strategies - Hettinger Co. Crop Improvement Assn. - Regent
Planned Research - HREC Advisory Board
Small Grain Varieties & Sawfly Strategies - 60th Annual Taylor Institute – Taylor
Skip-Row Corn - ManDak Zero Till Association Convention – Brandon, MB
Skip-Row Corn – Perkins Co. Extension meeting - Bison
Small Grain Variety Update - West River Breeders - Reeder
Research at the HREC (Poster) - Mandan ARS Annual Convention – Mandan
HREC Employee Safety Training - Hettinger
HREC Small Grain Variety Trial Field Tour - Hettinger
Small Grain Variety Trial Field Tour - Scranton
Small Grain Variety Trial Field Tour - Regent
Small Grain Variety Trial Field Tour - Mandan
Small Grain Variety Trial Field Tour - New Leipzig
Small Grain Variety Trial Field Tour - Selfridge

Rimfire Max in SW ND – Rimfire Max Research Exchange – Minneapolis, MN
26th Annual Western Dakota Crops Day Show - Hettinger

Publications

USDA-ARS. Annual Report. W. Regional Dryland Spring Barley Nursery 2008. National Small Grains Germplasm Research Facility, Aberdeen, ID. Jan. 2009.

USDA-ARS. Annual Report. Report on Wheat Varieties Grown in Cooperative Plot and Nursery Experiments in Spring Wheat Region in 2008. USDA-ARS Midwest Area. St. Paul, MN. Jan. 2009.

Eric Eriksmoen. HRSW, HRWW, Durum and Oat Variety Trial Results from Mandan. In Proc. 2009 Research Results and Technology Conference. Feb. 24, 2009. Mandan, ND.

NDSU Ext. Bul. A-1105. 2008 ND Alternative Crop Variety Performance. Feb. 2009.

NDSU Dept. Report. 2008 ND Weed Control Research. Feb. 2009.

NDSU Dept. Report. Quality Evaluation Program. HRSW Field Plot Variety Trials - 2008 Crop. May 2009.

NDSU Ext. Bul A-1096 rev. ND Hard Winter Wheat Variety Trial Results for 2009 and Selection Guide. Oct. 2009.

NDSU Ext. Bul A-1067 rev. ND Durum Wheat Variety Trial Results for 2009 and Selection Guide. Nov. 2009.

NDSU Ext. Bul. A-1049. ND Barley, Oat, Rye and Flax Variety Trial Results for 2009 and Selection Guide. Nov. 2009.

NDSU Ext. Bul. A-574. ND Hard Red Spring Wheat Variety Trial Results for 2009 and Selection Guide. Dec. 2009.

NDSU Ext. Bul. A-843 rev. ND Soybean Performance Testing 2009. Dec. 2009.

NDSU HREC Ag. Report 26. 26th Annual Western Dakota Crops Day Research Report. Dec. 2009.

NDSU Ext. Bul. A-1196 (rev.) ND Hard Red Winter Wheat Variety Results for 2008 and Selection Guide. Dec. 2008.

M.J. Carena, G. Bergman, N. Riveland, **E. Eriksmoen**, M. Halvorson. Breeding Maize for Higher Yield and Quality under Drought Stress. Mydica 54 (2009), pp 1-10.

Dan Nudell, Agriculture Economist

Presentations

Beef Day Talk
Science Fair Judge in Scranton
Host Farm Transistion workshop

Host Ag Outlook for Producers workshop

Public Service

Hettinger Housing Authority
SW REAP board
REAP Investment Board

Michele (Stamm) Thompson, Southwest Feeders Coordinator

Outreach Summary

January 13, 2009	NDSU Extension Service Beef Day	Rhame
January 13, 2009	NDSU Extension Service Beef Day	Killdeer
January 14, 2009	NDSU Extension Service Beef Day	Medora
February 5, 2009	HREC Beef Research Review	Hettinger
March 16, 2009	Scranton Public School Science Fair Judging	Scranton

Twenty-one local Cattle producers: Further information and topics covered: custom heifer raising, water analysis, co-product feeding recommendations, rations with DDGS, calf growing rations and breakevens, 2009 HREC Beef Research Review handouts, pen size, managing shrink, leasing beef cows, raising beef stockers, costs of gains for grazing cattle, barley cultivars for forage (silage and hay), cull cow study results, prices of hay and forages for custom feeding, grass calf rations, bred heifer rations, carcass traits on natural and conventional calves, modified distillers grains rations, causes of rectal prolapses, ration evaluation, vomitoxin and mycotoxin in grains and distillers grains, sainfoin production, forage options, use of liquid feeds in calf growing diets, heifer rations and growing heifer diets, how to price wet corn in the feedlot, information on cattle feeding pen sizes and level of Rumensin feeding.

One local horse producer: Further information on sainfoin production and forage options.

Three local sheep producers: Further information and topics covered: use of dried distillers' grains in sheep finishing diets, sheep feedlot research, sheep minerals, mineral prices and feed pricing.

Newspaper interviews

Farm and Ranch Guide. Jan. 2, 2009. "Natural calf feedlot study looks at economics, use of ionophores." S. Roesler.

Farm and Ranch Guide. Mar. 12, 2009. "Cow-calf producers have options to selling cull cows in the fall". S. Roesler.

Farm and Ranch Guide 2010 Livestock Guide. Dec. 11, 2009. "Condition yearling bulls like an athlete in training." S. Roesler.

Presentations

Natural vs. Conventional Beef Production Practices. NDSU Ext. Service Beef Day, Rhame and Killdeer, ND. Jan. 13, 2009. (30 producers at Bowman; 10 producers at Killdeer)

Natural vs. Conventional Beef Production Practices. NDSU Ext. Service Beef Day, Medora, ND. Jan. 14, 2009. (40 producers)

Economics of Market Cow Feeding. NDSU HREC Beef Research Review, Hettinger, ND. Feb. 5, 2009.

(27 producers; program covered by the Adams County Record and KFYR news station in Dickinson)

Publications

C. S. Schauer, **M. M. Stamm**, T. D. Maddock and P. B. Berg. 2008. Feeding of DDGS in lamb rations: Feeding dried distillers' grains with solubles as 60 percent of lamb finishing rations results in acceptable performance and carcass quality. Sheep and Goat Res. J. 23: 15-19.

Neville, B. W., C. S. Schauer, **M. M. Thompson**, P. B. Berg and G. P. Lardy. 2009. Influence of thiamin supplementation on feedlot performance and carcass quality of lambs fed 60% distillers dried grain plus solubles finishing ration. NDSU Sheep Report. 50: 5-10.

Neville, B. W., C. S. Schauer, K. Karges, M. L Gibson, **M. M. Thompson**, P. T. Berg and G. P. Lardy. 2009. Influence of thiamin supplementation on feedlot performance, carcass quality, and incidence of polioencephalomalacia in lambs fed 60% distillers dried grains with solubles finishing ration. Proc. West. Am. Soc. Anim. Sci. 60: 135-139.

Thompson, M. M., C. S. Schauer, R. J. Maddock and C. L. Wright. 2009. Market cow feeding using different management strategies. Proc. West. Sec. Am. Soc. Anim. Sci. 60:392-395.

Thompson, M. M., C. S. Schauer, V. L. Anderson B. R. Ilse. J. C. Galbreath and R. J. Maddock. 2009. Effect of weaning and production management strategies on calf growth and carcass traits. NDSU Beef Cattle and Range Research Report, p. 28-33.

Thompson, M. M., C. S. Schauer, R. J. Maddock and C. L. Wright. 2009. Effects of feeding strategy on market cow performance, carcass quality and economics. NDSU Beef Cattle and Range Research Report, p. 41-45.

Loken, B. A., R. J. Maddock, **M. M. Stamm**, C. S. Schauer, I. Rush, S. Quinn and G. P. Lardy. 2009. Growing rate of gain on subsequent feedlot performance, meat, and carcass quality of beef steers. J. Anim. Sci. 87: 37491-3797.

B. R. Ilse, V. L. Anderson, **M. M. Thompson** and C. S. Schauer. 2009. Effect of distillers grains on natural vs. conventional supplements and production methods on feedlot performance and carcass characteristics. NDSU Feedlot Report. 32: 41-44.

M. M. Thompson, C. S. Schauer, V. L. Anderson, B. R. Ilse and R. J. Maddock. 2009. Impact of weaning date on calf growth and carcass traits. NDSU Feedlot Report. 32: 30-36.

Ben Geaumont, Post- Doctorate Research Fellow

Presentations

Geaumont, B.A., K.K. Sedivec, and C.S. Schauer. 2009. Ring-Necked Pheasant (Phasianus colchicus) Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands. 2009 Annual Society of Range Management Conference, Albuquerque, NM.

Geaumont, B.A., K.K. Sedivec, and C.S. Schauer. 2009. Comparison of Two Nest Searching Techniques Used in Ring-necked Pheasant Nesting Studies. 2009 Annual Society of Range Management Conference, Albuquerque, NM.

Geaumont, B.A., K.K. Sedivec, and C.S. Schauer. 2009. Waterfowl Production and Nest Site Selection on Post-contract Conservation Reserve Program Lands. 2009 Annual Society of Range Management Conference, Albuquerque, NM.

Geaumont, B.A. and D. Nudell. 2009. Specialty Tour. Wildlife, CRP, and Economics. Hettinger Research Extension Center

Geaumont, B.A., K.K. Sedivec, and C.S. Schauer. 2009. Ring-necked pheasant production and brood survival in southwest North Dakota. Regent, North Dakota September 2009

Geaumont, B.A. 2009. Grazing and Wildlife. Hettinger Research Extension Center October 2009

Outreach

Met with multiple landowners regarding expiring CRP and wildlife management

Advisory Board Meeting Minutes

Advisory Board Meeting
Hettinger Research Extension Center
February 3, 2009

After a noon lunch the meeting was called to order by Chairman Shawn Arndorfer at 12:40 PM at the Hettinger Research Extension Center.

Board members present: Gloria Payne, Denise Andress, Matthew Benz, Julie Kramlich, Anthony Larson, Shawn Arndorfer, David Merwin and Joe Rohr. Staff present: Eric Eriksmoen, Chris Schauer, Dan Nudell, Michele Thompson, Amanda Gearhart and Cassie Dick. Administration and guests: Tim Faller and Dwain Barondeau, Hettinger Co. Agent.

Anthony Larson moved to approve the minutes from the previous meeting. Joe Rohr seconded and the motion passed.

Anthony Larson moved to approve the agenda. Joe Rohr seconded and the motion passed.

Administration/Legislative update:

1. Tim Faller
    a. Updates on legislature funding for building/one time projects, not programming
    b. Extension engineers

Director's Report- Chris Schauer

1. Handout
    a. July 7, 2009- centennial, rededication of building and tours
    b. Positions- Post-doctoral research associate should be hired May 1
    c. ARS funding for SW feeders is in limbo, but looks promising at this point

Animal & Range Science Report

1. Chris Schauer- Handout
    a. Feeding distillers grain to sheep
    b. Increased fertility in sheep
2. Michele Thompson- Handout
    a. Natural vs. Conventional management
3. Amanda Gearhart

a. Range update- project completed Grand River, ongoing McKenzie Co. and Medora Grazing District

Agronomy Report

1. Eric Eriksmoen- Handout

    a. Sawfly

    b. Skip-row corn

Ag Economics Report

1. Dan Nudell

    a. Four-state project farm/ranch tenure study

    b. Forrest Service/Grazing Association project

Strategic Plan

1. Staff will work on a plan to have prepared for the February 2010 meeting

Open discussion

1. Hettinger REC plans to continue working with local Extension Agents/Programming

Elections

1. Shawn Arndorfer called for nominations

    a. Gloria Payne nominated Dennis Sabin from the Morristown area

    b. Anthony Larson nominated Dean Wheri from Farm Credit Services, Mott

    c. Shawn Arndorfer nominated Cole Ehlers, a local cattle producer

    d. Shawn opened the floor for discussion

        i. Chris Schauer mentioned bringing a person from the grazing association to be a part of the advisory board in coming years

2. Gloria Payne motioned to elect Dennis Sabin, Dean Wheri, Cole Ehlers and look into a grazing association nomination for the next elections. Julie Kramlich seconded the motion. Shawn Arndorfer called for any opposition, there was none, motion passed.

Shawn Arndorfer adjourned the meeting at 2:45 PM. The next meeting is scheduled for July 7, 2009.

Advisory Board Meeting
Hettinger Research Extension Center
July 7, 2009

After a noon lunch the meeting was called to order by Chairman Shawn Arndorfer, Hettinger Research Extension Center, 12:50 PM.

Board members present: Gloria Payne, Denise Andress, Julie Kramlich, Shawn Arndorfer, David Merwin, Joe Rohr, Nathan Swindler, Steve Pfeifer, Ted Sailer, Rodney Howe, Larry Leistritz, Cole Ehlers, Dennis Sabin and Dean Wehri. Staff present: Eric Eriksmoen, Chris Schauer, Dan Nudell, Amanda Gearhart, Megan Van Emon, Steve Eckerman, Brian Neville and Cassie Dick. Administration and guests: Tim Faller, Roger Haugen, D.C. Coston, Duane Hauck and Ken Grafton.

Shawn Arndorfer moved to approve the minutes from the previous meeting. Julie Kramlich motioned to approve minutes and Gloria Payne seconded, motion passed.

Chris Schauer asked if the agenda could be changed for timing reasons, Shawn Arndorfer called for a motion to change the agenda, Rodney Howe motioned to change the agenda, Ted Sailer seconded, motion passed.

Animal & Range Science Report

1. Chris Schauer- Handout
    a. "Animal & Range Science Report and progress towards 2005-2010 goals"
2. Ben Geaumont- Handout
    a. "Wildlife and Range Research Update"
3. Amanda Gearhart- Handout
    a. 'NDSU HREC Cooperative Range Research"

Agronomy Report

2. Eric Eriksmoen
    a. Sawfly issues & upcoming trials
    b. Rain and weather conditions, hailed plots

Ag Economics Report

2. Dan Nudell
    a. Starting a new 5-state project this fall, evaluating changes in farming economy-switching from owned to leased land, out of state and recreational dollars

Director's Report- Chris Schauer- Handout

d. "Director's Report"

Administration/Legislative update:

2. Ken Grafton

a. Legislative Update- budget, positions and capital improvements

3. Duane Hauck

a. Extension budget update and extension programming

4. Rodney Howe

a. SBARE legislation updates

b. Encourages advisory board members to be active

Strategic Plan

2. Staff will work on a plan to have prepared for the February 2010 meeting

Open discussion

2. Adams County zoning discussion meeting- handout was given to members

3. CRP decline discussion

4. Sawfly solutions? Private industry becoming involved is a good thing bigger plots for research

5. Outreach from Hettinger REC

a. Sportsman's Night Out in Hettinger County for fall 2009

6. Recreation or Agriculture land use

a. Use the NRCS to get information out to land owners

b. Work with Game and Fish department

Shawn Arndorfer called for a motion to adjourned the meeting, Larry Leistritz motioned and seconded, motion passed meeting adjourned.

The next meeting date has not been set.

Personnel

Hettinger Research Extension Center

Christopher Schauer	Director/ Animal and Range Science
Dan Nudell	Assistant R/E Center Specialist/ Ag Economics
Eric Eriksmoen	Associate R/E Center Specialist/ Agronomy
Michele Thompson	Assistant R/E Center Specialist/ Livestock
Ben Geaumont	Post-Doctorate Research Fellow/ Wildlife
Amanda Gearhart	Research Specialist/ Range
Terri Lindquist	Finance Paraprofessional
Cassie Dick	Administrative Secretary
Don Stecher	Manager of Ag Operations
Nels Olson	Research Technician/ Agronomy
David Pearson	Research Technician/ Shepherd
Donald Drolc	Research Technician/Livestock

The Hettinger Research Extension Center hires individuals on a part-time basis to help in the research effort. Many of these are students as well as local residence. We would like to acknowledge the following people who helped at some time during the past year: Dean Houchen, Kristine Larson, Megan vanEmon, Steve Eckerman, John White, Josh Wolff, Caitlin Pearson, Matt Kornag, Brian Danish, Cole Turned, Samantha Kristy, Gwen Kristy, Alix Pearson, Samantha Sayler, Abbey Richards, Derrick Stecher, Melisa Eriksmoen.

Advisory Board Members

Denise Andress	Hettinger, ND
Shawn Arndorfer	Hettinger, ND
Cole Ehlers	Hettinger, ND
Rodney Howe	Hettinger, ND
Julie Kramlich	Hettinger, ND
Larry Leistritz	Fargo, ND
David Merwin	Hettinger, ND
Gloria Payne	Elgin, ND
Steve Pfeifer	McLaughlin, SD
Joe Rohr	Elgin, ND
Dennis Sabin	Morristown, SD
Ted Sailer	Lodgepole, SD
Nathan Swindler	Mott, ND
Dean Wehri	Mott, ND

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