The beef feedlot unit purchases approximately 2,500 steer calves each fall for research trials throughout the year. The steers are either fed in the winter/spring as calf-feds, or grown into yearlings on different forage-based systems, and then used in feedlot experiments for finishing studies in the summer or fall. Carcass performance is also measured on all cattle. The main research includes:

**Byproduct utilization:** Research focuses on methods to use wet distillers grains plus solubles, dry distillers grains plus solubles, modified wet distillers grains plus solubles, distillers solubles, wet corn gluten feed, or combinations of these. The goal of this research is to optimize the amount of ethanol byproducts, determine the impact of drying on energy values, optimize diet ingredients such as corn processing, roughage amounts, and feed additives when byproducts are fed, and determine methods to feed very large amounts in the diet.

**Production systems:** Research focuses on optimizing production systems and comparing yearlings to finishing cattle as calf-feds. The research also includes supplementation studies for cattle on pasture or backgrounded through the winter in different forage-based systems. Use of byproducts for growing cattle, including stored distillers grains in combination with low-quality forages, is an important aspect to this research area. Research has concluded that yearling production systems can be very profitable when grain prices are high, but winter feed supplementation costs are critical to how profitable this system may be.

**Environment-nutrition interaction:** Numerous research projects (2 per year for the past 12 years) have focused on methods to decrease Nitrogen (N) lost into the air and increase the amount of manure N, as well as methods to improve the use of phosphorus and make manure management more economical. Dietary and management strategies have been tested that may decrease N losses by 25 to 50%, but more progress is needed.

**Starch utilization:** Research is being conducted on corn hybrids to improve cattle performance when fed different hybrids with different kernel characteristics, as well as evaluating genetically-enhanced hybrids such as herbicide and insect-tolerant hybrids. Research includes adapting cattle to high-grain rations with either forages or byproducts.

**Growth and feed efficiency enhancement:** Research focuses on methods to improve growth rates of finishing cattle such as use of feed additives like Optaflexx, or use of implants to increase growth rates. Current byproduct research studies include methods to feed greater than 70% wet distillers grains plus solubles, the impact of sulfur (which is elevated in diets containing distillers diets) on feedlot cattle performance, use of Optaflexx at the end of the feeding period, and the impact of drying distillers grains on the energy value and greenhouse gas emissions. The impact of feeding distillers grains on N losses from feedlots, as well as the impact of increasing the frequency of cleaning pens on N losses, is being evaluated.
The **Cow/Calf Research Herd** is used to conduct basic and applied research in beef cattle reproductive physiology and includes 220 cows mostly of MARC III (red angus, pinzgauer, red poll and hereford) and red angus composition.

**Ovarian Reserve and Reproductive Longevity:** Scientists are working to determine if cows with larger ovarian reserve (born with more follicles on their ovaries) also have better oocytes (eggs) and stay reproductive for a longer period of time. Researchers are hopeful that using predictors such as number of antral follicles (counted by using ultrasound technology) may aid producers in determining which heifers should remain in the herd and may have greater longevity.

*Principal Investigators: Drs. Andrea Cupp, Jennifer Wood and Robert Cushman, USMARC*

**Egg Quality and Sperm Production:** The gene Vascular endothelial growth factor (VEGF) can be alternatively processed to produce proteins that stimulate spermatogenesis (sperm production) and follicle development (the follicle contains the egg and allows for maturation of the egg) or produce inhibitory proteins that arrest both spermatogenesis and follicle development. Thus, scientists are trying to manipulate this gene to enhance fertility in cows and bulls.

*Principal Investigator: Dr. Andrea Cupp*

**Developing Markers for Egg Quality and Embryo Quality:** Scientists are determining genes that are involved in oocyte (egg) quality which may also be predictive of embryo quality and successful pregnancy outcomes. The scientists are treating cows with different levels of progesterone to develop abnormal follicles (persistent follicles) that will have an altered gene profile. Their intent is to compare this altered profile with follicles developed under “normal conditions” to obtain genes which may be good markers for competent and non-competent eggs.

*Principal Investigators: Drs. Andrea Cupp, Jennifer Wood and Robert Cushman, USMARC*

**Effects of Feeding Corn Co-Products on Reproductive Performance:** Research is also being conducted to determine the effects of feeding dried distillers grains to replacement heifers and to mature cows (prior to breeding) to determine how this may affect reproductive performance. Results from this research have demonstrated increased artificial insemination (AI) conception rates (10%) in heifers developed with dried distillers grain. Furthermore, cows supplemented with DDG 45 days prior to breeding have increased AI conception rates (10-15%) and wean a heavier calf (calf that is being nursed by the cow at breeding time). Thus, scientists are now working to determine the mechanisms for this increased conception rate and calf weaning weight after feeding DDG.

*Principal Investigators: Drs. Andrea Cupp and Rick Funston*

**Cow/Calf Teaching Herd:** The teaching herd consists of 220 heifers and mature cows, approximately 100 are purebred Angus. The remaining cows are Husker Red and Husker Black composites. The Husker composites blend Red or Black Angus genetics with Simmental or Gelbvieh to produce seedstock that meet the needs of commercial producers. Cattle from the teaching herd are transported to East Campus for use in a number of classes, including Animal Management, Animal Production Skills, Livestock Evaluation, Cow-Calf Management, Beef Cattle Merchandising and Reproductive Physiology courses. Students in these classes gain experience at the ARDC and on campus in animal handling, artificial insemination, pregnancy diagnosis, evaluation of cattle and performance records for breeding purposes, semen collection, live animal evaluation to estimate carcass traits, and gain hands-on experience managing a cow-calf operation. Cattle from this herd are also utilized in various Extension programs and youth judging contests throughout the year.

The Beef Cattle Merchandising class, under the direction of Dr. Matt Spangler, markets around 40 ARDC bulls through an annual bull sale held in April on UNL’s East Campus. The teaching herd also supplies breeding bulls and semen for the other University cow-calf operations, and includes the Physiology (research) herd at ARDC and herds at Gudmundsen Sandhills Laboratory at Whitman and Dalbey-Halleck Farm at Virginia, Nebraska. The Teaching Herd has never been static and strives to be progressive in adopting new nutritional, reproductive, and genetic research in order to stay current and better serve seedstock customers and students alike. An example of this is the participation of the teaching herd in a regional project to integrate DNA marker technology into genetic selection tools.

**Impact of Residue Removal for Biofuel Production on Soil - Renewable Energy Assessment Project (Reap):** This study seeks to determine the amount of crop residues (e.g., corn stover, cover crop) that must remain on the land to maintain soil organic carbon (SOC) and sustain production. A series of experiments with factors (including tillage and residue removal) conducted under several environments measure biomass production, grain yield, and change in soil organic carbon. From these measurements, the amount of residue needed to maintain soil organic carbon and productivity can be estimated. A second objective is to develop management strategies (such as no tillage) that support sustainable harvest of residue, modify existing practices or devise new management practices that allow harvest of stover, but maintain production level and soil organic carbon through use of cover crops, organic amendment, or other techniques.

*Principal Investigator: Drs. Gary Varvel and Brian Weinhold*

Soybean Drought Tolerance: UNL scientists are developing a new approach that delays soybean irrigation until early pod formation in July, relying on stored soil moisture and early-season rainfalls while still producing high yields. The project builds on years of research into soybean's drought resistance and the best methods of irrigation. Typically, producers plant soybeans in early May and begin irrigating in June. In years with average or above-average early-season rainfall, irrigation can result in too much water being applied to plants. Too much moisture can result in taller and leafier soybean plants that can lodge and are more susceptible to disease. Research shows that avoiding early irrigation encourages soybean plants to develop stronger, healthier root systems that grow deeper in search of moisture. Delaying the irrigation to soybeans has produced yields equal to or higher than those achieved by starting irrigation sooner in the season.

Principal Investigator: Drs. Ken G. Cassman and James E. Specht

Remote Estimation of Crop Biophysical Characteristics: The overall goal of this research is to develop non-destructive proximal- and remote-sensing techniques for estimating of crop biophysical characteristics including vegetation cover, fraction of absorbed photosynthetically active radiation, leaf area index, biomass, chlorophyll content and gross primary production. The methods for estimating leaf pigment content (chlorophylls, carotenoids, anthocyanins) were developed and validated for different plant species, thus allowing accurate estimation of these essential biophysical parameters. Techniques were developed to estimate crop health and vigor by means of sensors positioned on airborne and space platforms.

Principal Investigators: Drs. Anatoly A. Gitelson and Donald C. Rundquist

Improved Forage and Bioenergy Plants and Technologies for the Central USA

The long-term objectives of this project are the development of improved perennial grasses and management practices and technologies for use in biomass energy production systems and grazing land in the mid-continental USA. The focus of the research will be on switchgrass for bioenergy and other warm- and cool-season grasses for grazing lands. Over the next five years, the following specific objectives will be addressed: (1) provide appropriate plant materials for use in pasture-based livestock systems; (2) improve the economic viability of forage-livestock systems for the Great Plains and North Central States with improved plant materials and management; (3) provide improved plant materials for harvested biomass used for bioenergy, bioproducts, and forage; and (4) develop sustainable production systems for harvested biomass and forage.

Principal Investigators: Drs. Ken Vogel, Rob Mitchell, and Gautam Sarath, USDA ARS
Website: www.ars.usda.gov/research/projects/projects.htm?accn_no=412518

Enhancement of Sorghum for Bioenergy, Feed, and Food Value: Long-term objectives are the development of sorghum (Sorghum bicolor) germplasm lines with improved bioenergy, feed, and food value, and the elucidation of genetic, biochemical, and biological factors impacting these characters. Over the next five years, the following specific objectives will be addressed: (1) identify and evaluate genes to improve sorghum for bioenergy, food, and feed traits; (2) develop a better understanding of genes and fundamental mechanisms controlling cell wall formation and energy availability; and (3) develop molecular and other technologies for monitoring sorghum fungal pathogens and determine the effects of sorghum genetic modification for bioenergy on pathogen populations.

Principal Investigators: Drs. Jeff Pedersen, Scott Sattler, and Deanna Funnell-Harris, USDA ARS.
Website: http://www.ars.usda.gov/research/projects/projects.htm?accn_no=412870

Genetic Improvement and Evaluation of Hard Winter and Spring Wheats: Objectives of this study are (1) to develop winter wheats adapted to the Great Plains with novel starches for use in biofuel production and food product manufacturing, as well as improved gluten strength and extractability of such wheats to produce a more economically viable package for producers and end-users. (2) A second objective is to develop hard white winter wheat germplasm with tolerance to pre-harvest sprouting and with nil levels of grain polyphenol oxidase (PPO). (3) The third objective is to coordinate the Hard Winter Wheat Regional Nursery Program to facilitate the evaluation, distribution, and exchange of high-yielding, high-quality, disease- and pest-resistant hard winter wheats for Great Plains environments.

Principal Investigator: Dr. Bob Graybosch
Website: http://www.ars.usda.gov/research/projects/projects.htm?accn_no=413036

Feedlot Research Continued From Front Page...

E. coli O157:H7 reduction: Research includes seven different experiments over the past eight years on determining methods to decrease the amount of E. coli O157:H7 in feedlot cattle prior to them entering the packing plants. The research focus has been on a vaccine developed in Canada that decreases shedding of E. coli O157:H7 by approximately 65%, a direct-fed microbial product that contains lactobacillus acidophilus that decreases shedding by 35%, and different diet strategies that impact shedding such as use of distillers grains.

Principal Investigators include: Drs. Galen Erickson, Terry Klopfenstein, Dave Smith and Rod Moxley

For more information, beef research is published annually in the Nebraska Beef Report at http://beef.unl.edu. Research support is provided by numerous sources, including industry grants, Nebraska Corn Board funding, the Nebraska Center for Energy Sciences Research, and other sources.
Carbon Sequestration: A state-of-the-art field research facility has been established at the ARDC to quantify carbon sequestration (storage) in agricultural systems. Agricultural crops have the potential to offset a significant amount of carbon dioxide emissions by sequestering carbon in the soil. CSP is an interdisciplinary research effort which includes faculty, students, post-doctoral researchers, and technicians from six UNL departments, focused on improving our understanding of processes controlling carbon sequestration (storage). The overall goal is to investigate the carbon sequestration potential of major rainfed and irrigated agroecosystems in the north-central USA and to understand the biophysical controls on carbon sequestration. 450 acres of corn/soybean production are dedicated to the project.

Principal Investigators: Drs. Shashi B. Verma and Ken G. Cassman

Automated Weather Data Network (AWDN): The Agrometeorology Laboratory at the ARDC is home for the longest continuously operated automated weather data network in the U.S.A. There are over 60 AWDN stations in Nebraska and another 110 in the surrounding states providing comprehensive information, on air and soil temperature, humidity, wind speed and direction, solar radiation, and precipitation for use in agricultural decision making throughout our region. This is a unique non-federal network formed by cooperation between climatologists in the various High Plains states.

Principal Investigator: Dr. Ken G. Hubbard

UV-B Monitoring and Research Program: One of the 34 USDA UV-B Monitoring and Research Program climatological UV-B (Ultraviolet-B) stations is located at the Agrometeorology Laboratory at the ARDC. Data from the monitoring program provides information important for assessing the local impact of UV-B sunlight radiation on human health, plants, the environment and materials.

Principal Investigators: Drs. Elizabeth A. Walter-Shea and Ken G. Hubbard

National Atmospheric Deposition Program/National Trends Network: The lab constitutes a field facility where precipitation chemistry is monitored year-round as part of the National Atmospheric Program/National Trends Network (NADP/NTN). The purpose of this network is to provide information on the chemistry (e.g., sulphate, nitrate, ammonium) to help monitor temporal and geographical trends. This ARDC site is one of the inaugural sites started in 1978. Now, the network consists of over 250 sites nationally. Following strict quality control, data from the ARDC and other sites are made available via the NADP website (http://nadp.sws.uiuc.edu/).

Principal Investigator: Dr. Shashi B. Verma

Husker Genetics: Crop breeding and genetics research are ongoing at UNL. Faculty develop and improve germplasm that holds potential for private and public plant breeding programs. Husker Genetics increases and maintains cultivars developed by UNL researchers and plant breeders. UNL’s research team has done an outstanding job of developing superior genetics and there is a steady increase in the demand for this germplasm. Husker Genetics is the marketing brand of the University of Nebraska-Lincoln. Foundation Seed Division merged into the Husker Genetics brand identity effective July 1, 2008. Husker Genetics is the commercialization and production entity for seed distribution.

Director: Jeff Noel  Website: http://huskergenetics.unl.edu

Corn Rootworm: Research on the biology, ecology, and management of corn rootworms has been conducted at the ARDC Insect Field Laboratory since the mid-1960’s. The main goals of ongoing research are 1) to increase understanding of the biology and behavior of rootworm species, and 2) develop and evaluate alternative corn rootworm management techniques and strategies. Many recent experiments have been conducted to evaluate new rootworm management technologies (e.g., seed treatment, and Bt corn hybrids) that are being developed by industry.

UNL Department of Entomology faculty are also actively working with grower, industry, and regulatory organizations to develop effective but practical resistance management strategies that are required by the U.S. Environmental Protection Agency (EPA) when new transgenic corn hybrids are registered. Experiments are being conducted at the ARDC to increase understanding of rootworm age specific mortality, mating behavior, late season ecology, and female ability to reproduce after feeding on various Bt transgenic events.

The long-term goal is to work with industry and the EPA to provide growers with a suite of viable rootworm management tactics (growers can then adopt the tactics that best fit their needs) and to facilitate their use within an Integrated Pest Management (IPM) framework in combinations that are sustainable over time.

Principal Investigator: Dr. Lance J. Meinke

Switchgrass: On-going entomological research efforts at the ARDC are working to identify the insects and mites associated with switchgrass, investigate their biology, seasonal abundance, and injury potential, and develop management alternatives for potential pests. Special attention is being directed at identifying natural enemies, which may play an important role in regulating pest populations, and on locating insect-resistant germplasm.

Principal Investigator: Dr. Fred Baxendale

Stable Flies: The USDA-Agricultural Research Service (ARS) Agroecosystem Management Research Unit, in collaboration with the Department of Entomology, has been conducting research on stable flies at the ARDC for nearly 30 years. This facility offers unique opportunities to study stable fly development, migration and feeding in a diverse agricultural environment. Current research focuses on characterizing winter hay feeding sites in the pastures, quantifying stable fly development in those sites and developing cultural, physical and chemical control technologies to eliminate stable fly larvae. Researchers have estimated that as many as a million stable flies can develop and emerge from a winter hay feeding circle.

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Principal Investigator: Dr. Shashi B. Verma
at the ARDC in collaboration with the sites and participating farmers. Biological
tors for the Healthy Farm Index, a new farm assessment tool, are being developed
include: berseem clover, field peas, cow peas, hairy vetch, and soybeans. Indica-
projects currently use part of the organic land at the ARDC. Current cover crops
soybean harvest. Wheat breeding, biodiversity monitoring, and cover crop
crop, followed by corn and then soybean with wheat planted immediately follow-
At the ARDC site, the primary rotation is wheat, followed by manure or cover
break systems and is home to the longest running study on crop response to wind protection. Long-term yield averages indicate
that wind protection provides an increase in yield of 15% for winter wheat, 12% for corn, and 16% for soybeans.
While yields in individual years may vary considerably due to
growing conditions, primarily rainfall, economic analysis indi-
cates that an investment in windbreaks pays for itself in 7 to 10
years and results in long-term returns in the range of 4 to 6%.
These long-term averages include the yield losses associated
with the land planted to the windbreak and yield losses due to
competition immediately adjacent to the windbreak. Long-
term yield trials continue and indicate very positive impacts of
well-designed field windbreaks.
Principal Investigator: Dr. Jim Brandle with technical support
from Bruce Bolander and Mike Cieslik

Long-Term Windbreak Studies: Long-term studies on the
ecological role of windbreaks and other woody components of the agroecosystem
in maintaining biological biodiversity, their impact on predatory species (both
birds and insects) and their role in biological control of crop pests have indicated
the value of the ecosystem services provided to all as a result of well managed ag-
icultural ecosystems. In order to capture these values we have been developing a
Healthy Farm Index. The Healthy Farm Index is a tool that integrates ecological,
economic, and social parameters to assess how land-use and land-cover patterns
influence biodiversity, production, and other ecosystem services.
Principal Investigators: Dr. Jim Brandle and John Quinn, Ph.D. candidate

ARDC Organic Farm Systems Research: Building on 30 years of windbreak
research, 45 acres of protected land were certified organic in 2008 in the shelter-
belt area. The ARDC organic farm is part of a new network of University organic
research sites across Nebraska and is supported by a USDA grant. Other organic
sites are located at: the Haskell Ag Lab (HAL) near Concord, the South Central
Ag Lab (SCAL) near Clay Center and the High Plains Ag Lab (HPAL) at Sidney.
These four sites represent a statewide effort in interdisciplinary research.
The land at each organic research site is intended to support further organic
research and outreach. The project provides opportunities for ongoing research
in cover crop management for providing organic sources of nitrogen and weed
control and development of wheat varieties for organic producers.
At the ARDC site, the primary rotation is wheat, followed by manure or cover
crop, followed by corn and then soybean with wheat planted immediately following
soybean harvest. Wheat breeding, biodiversity monitoring, and cover crop projects currently use part of the organic land at the ARDC. Current cover crops include: berseem clover, field peas, cow peas, hairy vetch, and soybeans. Indica-
tors for the Healthy Farm Index, a new farm assessment tool, are being developed
at the ARDC in collaboration with the sites and participating farmers. Biological
monitoring has identified 63 bird species at the ARDC. Local organic farming groups have been an integral part of our research efforts and
are frequent visitors to the site.
Principal Investigators: Dr. Charles Shapiro, Agronomy - HAL; Dr. Jim Brandle, Natural Resources - ARDC; Dr. Steven Knezevic, Weed Science
- HAL; Dr. Bob Wright, Entomology – SCAL; Dr. Chuck Francis, Agronomy; Dr. Steve Baenziger, Agronomy; Dr. Drew Lyon, Agronomy – HPAL;
Liz Sarno, Extension Educator; and John Quinn, Ph.D. Candidate
Website: http://organic.unl.edu
Notable Visits...

25x’25 Tour - 25x’25 is a renewable energy initiative backed by organizations and individuals united by a common interest in making America’s energy future more secure, affordable and environmentally sustainable.

EU Parliament Ag Committee - Neil Parish, chairman of the European Parliament’s agriculture committee, learned about UNL research and extension efforts at the ARDC. The tour was part of a two-day visit to Nebraska sponsored by the Nebraska Department of Agriculture.

Governor’s Reverse Trade Mission - The Governor’s office hosted the state’s first reverse trade mission tour in the fall. More than 125 guests from eight nations visited Nebraska. The event was devised to encourage international companies to explore opportunities for investment in Nebraska. Nearly 40 people from the group visited the ARDC.

Schools & Government
- Nebraska Federal Women’s Council
- Saunders County FSA Meeting
- Saunders County Extension Board Meetings
- Wahoo High School ASSET & PSAT Testing
- Youth Election Seminar

UNL Departments and Classes
- Animal Science Field Labs
- Irrigation and Precision Ag Lab Classes
- Various UNL departments and classes met at the ARDC throughout the year for meetings, tours and classes

Environment, Horticulture & Entomology
- Beginning & Master Beekeeping Workshops
- Carbon Climate Change Meeting
- Carbon Credit & Wind Energy Meeting
- Nebraska Forestry Service Tree Care Workshop
- Onsite Wastewater Training
- Turf Grass Field Day

Tours
- Chinese Trade Delegation Tour
- Several Canadian groups, including Innovative Farmers Association of Ontario
- University of Nebraska Medical Center Family Medicine Residents Farm Safety Visit

Livestock and Animals
- Co-Product Storage and Utilization
- DAIReXNET Webinar: Surviving High Feed Costs
- Dairy Research Facility Open House
- Eastern Nebraska Goat Workshop
- Husker Nutrition Conference
- Nebraska Companion Animal Satellite Conference
- Quality Assurance Training

Ag Trade & Commodities
- Nebraska Cattlemen Board
- Nebraska Grain Sorghum Board
- Nebraska Seed Trade Association & Nebraska Crop Improvement
- Saunders County Livestock Association Directors
- Saunders County Corn Growers Association
- Saunders County Soybean Grower Directors

Crops & Natural Resources
Field days at the ARDC include several Crop Management Diagnostic Clinics which, on average, impact the management of over 3.7 million Nebraska crop acres annually.

Other programs include:
- Alfalfa Management for Producers
- Corn Disease Management
- Farmland Lease Arrangements for Tenants and Landlords
- Field Scout Training for Pest Managers
- Grain Marketing Programs
- Nebraska No-Till Conference
- Nitrogen Management Training
- Nebraska Soybean and Feed Grains Profitability Project Consultations and Annual Programs
- Organic Winter Wheat Varieties Tour
- Organic Working Group/Nebraska Sustainable Ag Society
- Private Pesticide Applicator Training
- Sprayer Technology for Growers
- Vo-Ag/Extension Educator In-Service CMDC Training
- Wheat Production/Pest Management Field Training

4-H & Youth
- Ag Awareness Festival - Over 650 fourth-graders learn about agriculture at the annual Ag Awareness Festival.
- 4-H Council
- 4-H Leadership Programs and Training
- 4-H Clinics and Workshops focusing on:
  - Childcare, GPS, Modeling, Photography, Rockets, Robotics, and Sewing/Clothing
  - 4-H Portfolio Workshop
  - 4-H Project Fair
  - 4-H Public Speaking Contest
  - 4-H Shooting Sports Training

Other
- Sustainable Leadership Workshop
- National Multiple Sclerosis Society Bike Rest Stop
- KTIC Great Nebraska Tractor Ride Rest Stop
The ARDC consists of approximately 9,663 acres (3,865 hectares)

- 34% Pasture
- 14% Other
- 23% Irrigated Cropland
- 29% Dry Cropland

Over 7,700 domestic farm animals used for research and teaching reside on the ARDC

- Cattle = 3,993
  Beef Feedlot, Cow/Calf, Dairy, and Veterinary Science

- Swine = 3,800
  Farrow-to-Finish Operation

Livestock information based on 2007 Census data.

To learn more about the ARDC, visit our website at www.ardc.unl.edu.

Interested in learning more about the projects or programs in this publication? Visit ardc.unl.edu and search for the key words of the project or the principal investigator. This publication is also available in electronic format online to download and print. You may also contact ARDC Marketing and Promotions Manager, Deloris Pittman, at (402)472-3293 or dpittman1@unl.edu.
The UNL Dairy Research herd includes 130 Holstein cows. The herd’s average annual milk production (rolling herd average) is 21,000 lbs. The average fat and protein content is 3.6 and 3.1%, respectively. Somatic cell count SCC averages 324. Goals of the unit are to investigate and demonstrate: 1) modern dairy production practices to UNL undergraduate, graduate, and veterinary students; 2) how forages and fiber by-products can best supply the nutrients required for lactation; and 3) evaluate relationships that exist between productivity, genetics, and reproductive efficiency.

Current research sponsored by the Nebraska Corn Board includes evaluation of different storage methods for wet distillers grains plus solubles. A second project involves evaluating the effects of feeding low lignin BMR corn silage in combination with dried distillers grains plus solubles (DDGS). Additional experiments evaluate the effects of different corn silage hybrids on milk production and composition.

Distillers Grains Study: A common concern surrounding the inclusion of distillers grains into dairy diets is the negative effect on milk fat synthesis. Research is showing that the concern is not justified. Abnormal rumen conditions are the most significant cause.

Feeding ingredients that contain high levels of unsaturated fats are known to contribute to milk fat synthesis depression. Among unsaturated fatty acids, linoleic acid in particular, can cause milk fat depression. Distillers grains are a rich source of linoleic acid, but usually only cause milk fat depression when combined with other ingredients that are also rich in unsaturated fat.

It is possible to formulate rations high in distillers grains without high levels of linoleic acid. Practically, this may mean that the inclusion of feeds such as whole cottonseed and roasted soybeans are not included or fed in low amounts if feeding DDGS. If these ingredients are expected to supply protein, alternative sources that are lower in fat should be considered.

It is well known that diets that are either (1) high in starch containing grains, or (2) deficient in coarse roughages result in a decline in the concentration of fat in milk. Because both of these diet factors result in lower rumen pH, it is believed that cows experiencing rumen acidosis produce milk with lower concentrations of fat.

Why would rumen pH affect milk fat production? It is believed, at least in part, that this effect is due to some activity of rumen microbes. Rumen microorganisms hydrogenate unsaturated fatty acids in a process called biohydrogenation. During the process, partially saturated fatty acids may pass out of the rumen and be absorbed by the small intestine. Some of these acids negatively influence milk fat formation. Furthermore, the formation of these fatty acids are believed to be the direct result of rumen microbes operating in a low pH environment.

Given the understanding of rumen fermentation, several considerations should be taken into account when adding DDGS to lactating cow diets. First, ensure the ration has adequate effective fiber. Rations should not be too high in grain and contain not more than 40% non-fiber carbohydrates. The concentration of starch in the ration should range 21% to 27%.

Principal Investigators: Drs. Jeff Keown and Paul Kononoff