

South Dakota State University
**Open PRAIRIE: Open Public Research Access Institutional
Repository and Information Exchange**

Farm and Home Research

South Dakota State University Agricultural
Experiment Station

1-20-2000

Farm and Home Research: 51-1

Jerry Leslie

Jaimi Lammers

Stephanie Misar

Follow this and additional works at: http://openprairie.sdstate.edu/agexperimentsta_fhr

Recommended Citation

Leslie, Jerry; Lammers, Jaimi; and Misar, Stephanie, "Farm and Home Research: 51-1" (2000). *Farm and Home Research*. Paper 5.
http://openprairie.sdstate.edu/agexperimentsta_fhr/5

This Magazine is brought to you for free and open access by the South Dakota State University Agricultural Experiment Station at Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. It has been accepted for inclusion in Farm and Home Research by an authorized administrator of Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. For more information, please contact michael.biondo@sdstate.edu.

Farm & Home **RESEARCH**

South Dakota State University • College of Agriculture & Biological Sciences • Agricultural Experiment Station

Volume 51 • Number 1

Winter 2000



**Annual Report
1999**

IN THIS ISSUE

'keep a focus, maintain balance'
Director's comments1

'the information link'
Ag Communications2

'problems relevant to production agriculture'
Agricultural & Biosystems Engineering3

'an opportunity to re-evaluate'
Animal & Range Sciences.....4

'research as varied as life itself'
Biology/Microbiology5

'supporting our agricultural community'
Chemistry/Biochemistry6

'making nature's most nearly perfect food even better'
Dairy Science7

'multidisciplinary, value-added research'
Economics8

'creating new knowledge to help improve lives'
College of Family & Consumer Sciences9

'committed to the continued pursuit of knowledge'
Horticulture, Forestry, Landscape & Parks10

'unique opportunities'
Plant Science11

'continuity and change'
Rural Sociology.....12

'improving animal health, the livestock industry, and the welfare of society'
Veterinary Science.....13

'a part of our heritage'
Wildlife and Fisheries.....14

Service Labs.....15
 Oscar E. Olson Biochemistry Labs, Analytical Services
 Animal Disease Research and Diagnostic Lab • Dairy Lab • Water Quality Lab
 Food Science Lab • Seed Testing Lab • Soil Testing Lab

Out-State Stations.....19
 Southeast Research Farm • Dakota Lakes Research Farm • West River Ag Center

112th Annual Report.....21
 People, projects and budget of the Agricultural Experiment Station for 1999

PAGE 5



PAGE 16



PAGE 7



PAGE 10



On the cover:

Tom Nelson, production supervisor at the SDSU Print Lab, removes a cover sheet from the printing press. Ag Communications and the Print Lab have collaborated in the printing of *Farm & Home Research* for 50 years.

South Dakota State University

Peggy Gordon Elliott *President*

College of Agriculture & Biological Sciences

Fred Cholick *Dean*

Kevin Kephart *Associate Dean
 Director, Agricultural Experiment Station*

Larry Tidemann *Associate Dean
 Director, Cooperative Extension Service*

Charles McMullen *Associate Dean
 Acting Director, Academic Programs*

Farm & Home Research Staff

Barbara Suhr Hartinger *Executive Editor*

Mary Brashier *Managing Editor*

Jerry Leslie *Writer*

Jaimi Lammers *Writer*

Stephanie Misar *Student Writer*

Duane Hanson *Photographer*

Tom Holmlund *Graphic Designer*

Vergene Clark *Circulation Manager*

Published quarterly by the Agricultural Experiment Station, College of Agriculture and Biological Sciences, South Dakota State University, Brookings, South Dakota. Sent free to any resident of South Dakota in response to a written request.

Articles in *Farm & Home Research* report the results of research. Because conditions will differ by locality, management skills, etc, results cannot be exactly duplicated by operators. Mention of a trademark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by the South Dakota Agricultural Experiment Station and does not imply its approval to the exclusion of other products or vendors that may also be suitable.

Material appearing in this publication may be reprinted if the meaning is not changed and credit is given to the scientist and the South Dakota Agricultural Experiment Station.

Photos in this issue were contributed by the various departments of the College of Agriculture & Biological Sciences.

Farm & Home Research is edited and designed in the Department of Ag Communications, SDSU, and printed on campus at the SDSU Printing Laboratory with AgriTek ink, containing soy, corn, and other vegetable oils.

<http://www.abs.sdstate.edu>

Published in accordance with an act passed in 1881 by the 14th Legislative Assembly, Dakota Territory, establishing the Dakota Agricultural College and with the act of re-organization passed in 1887 by the 17th Legislative Assembly, which established the Agricultural Experiment Station at South Dakota State University. South Dakota State University is an Affirmative Action/Equal Opportunity Employer (Male/Female) and offers all benefits, services, education and employment opportunities without regard for ancestry, age, race, citizenship, color, creed, religion, gender, disability, national origin, sexual preference, or Vietnam Era veteran status.

???? printed by the AES at a cost of ???¢ each.

'keep a focus, maintain balance'

Director's comments

by Kevin Kephart

The mission of the South Dakota Agricultural Experiment Station is to enhance the quality of life for all South Dakotans through the beneficial use and development of economic, human, and natural resources.

Keep a focus and maintain balance. That's the hidden message in the mission statement. Face the goal and move toward it but be responsive to unexpected opportunities; use all your available resources but don't "mine" them.

That's sound advice for state legislators, communities, businesses, and families, as well as land-grant universities like SDSU. Fortunately, we all have helpers to meet our goals—research committees, planning boards, loan officers, personal counselors. The USDA/CSREES, our federal partner, is our helper. Five goals were developed nationally through collaboration with USDA and state experiment station and extension directors:

Goal 1. An agricultural system that is highly competitive in the global economy.

This goal represents the traditional emphasis of the South Dakota Agricultural Experiment Station (SDAES). Agricultural production and management are our primary research areas; of 131 current projects, 59% fit this standard.

Goal 2. A safe and secure food and fiber system.

Work in this area by SDAES scientists is expanding; currently, 2% of the pro-

jects fit this goal. We are hiring new scientists who will emphasize food safety in their programs. This is also one area where partnering is occurring between research and extension and between departments.

Goal 3. A healthy, well-nourished population.

Approximately 5% of our research projects emphasize this goal. Key research activities include meat quality, milk composition, and calcium metabolism. Again, responsibilities cross discipline and departmental lines.

Goal 4. Greater harmony between agriculture and the environment.

This is the second-greatest area of concentration by our SDAES scientists, accounting for 22% of the projects. Some topics include wildlife issues, precision agriculture, soil resources, and management of urban landscapes.

Goal 5. Enhanced economic opportunity and quality of life for Americans.

Our work toward this goal includes value-added agriculture, economics, and horticulture. Approximately 12% of the projects fall in this category.

For this issue of *Farm & Home Research*, I have asked department heads to write summaries of their faculty's 1999 projects. I believe that reading them will give you a wider perspective on our goals and our work. The FY 2000 budget is also included in this report. I am happy to say that we received a 4.5% increase over FY 1999 in appropriated funds. This increase was primarily used to support our faculty through the South Dakota Board of Regents' salary enhancement program.

In addition to essential support from state and federal governments, the faculty also makes a huge contribution by obtaining outside grants to support their research efforts. Grant funds increased in FY 2000 by nearly 2% as compared to FY 1999. These funds represent hard work and initiative by the faculty.

The publications lists that truly show how hard our scientists work are presented on our web site rather than in this magazine. Go to <http://www.abs.sdstate.edu/abs/aes.htm> and follow the appropriate link in the annual report section.

I sincerely thank all of our supportive friends, clientele, and partners in helping us stay focused on our mission of service in challenging times. Thank you all.



Ag Communications

Agricultural communications units are unique to land-grant universities. Writers and editors in our department integrate the work of Agricultural Experiment Station (AES) scientists and extension (CES) specialists by serving as the information link to agricultural producers and the general public. To communicate effectively, it is essential that ag journalists know their audiences and be able to explain complicated agricultural and food science research accurately and clearly.

Significant Ag Communications accomplishments in 1999 that supported the agricultural college's research and extension missions include—

- *Farm & Home Research*, the magazine you are reading, the flagship publication of the AES. 1999 was the 50th year of its publication and the AES publications editor, Mary Brashier, has served as its managing editor for half of those years. The cover photo on this issue of *Farm & Home Research* documents a step in the production of Volume 50(4).
- Bulletin 566 (rev)—Grassland Plants of South Dakota and the Northern Great Plains (288 pages, 350 full-color photographs) and Bulletin 732—Plants of the Black Hills and Bear Lodge Mountains (608 pages, 750 full-color photos) came off press in September. Ag Communications facilitated the publishing of these trade-quality field guides through collaboration with the scientist-authors, the SDSU Grants Office, a commercial printer, and multiple funding partners.

Three smaller AES and CES publications are noteworthy.

- Bulletin 733—Field Guide to South Dakota Amphibians (52 pages, 45 full-color photos) was a collabora-

tion of the Cooperative Fish and Wildlife Research Unit at SDSU with multiple state and federal agencies.

- Extension fact sheets 902, Plant disease management in South Dakota—soybean cyst nematode (four pages), and
- Fact sheet 907, Economic thresholds for grasshoppers and bean leaf beetles in soybeans (eight pages), integrates research results with extension management recommendations. The fact sheets were made possible through research and extension funding and farmer check-off dollars. Barbara Hartinger was editor of these fact sheets.

A total of 498,608 print publications were distributed by Ag Communications through the ABS Bulletin Room, which has 1,593 titles available on a wide range of agricultural production, horticulture, family, consumer, and 4-H and youth development topics.

Ask for printed AES and CES publications at your county extension office or order them from the Bulletin Room by calling (605) 688-5628. All new free-distribution publications are also available via internet.

At least 100,000 subscribers to the farm, ranch, and agribusiness press were reached through 350 research and extension articles produced by Ag Communications News

Editor Jerry Leslie. Distribution to county extension educators and the commercial media is now virtually all electronic, either by e-mail or web. Leslie was also a contributing author for *Farm & Home Research*.

Keep track of new publications available electronically by bookmarking www.abs.sdstate.edu/abs/agpublications.htm

Contact the Bulletin Room for print copies of *Farm & Home Research*, or access it on the web at www.abs.sdstate.edu/abs/Farm&Home/

Check out weekly ag news and a timely calendar of ag events on the web at www.abs.sdstate.edu/abs/newspkt.htm □

Barbara Hartinger
605-688-4187
www.abs.sdstate.edu/abs/agnews.htm



Lowell Haag, video editor, and Tom Holmlund, graphic designer, examine the resolution of "frogs book" printout.

'problems relevant to production agriculture'

Agricultural & Biosystems Engineering

The Department of Agricultural and Biosystems Engineering addresses problems relevant to South Dakota production agriculture.

Value Added. Processes that transform agricultural commodities and residuals into value-added products are being developed. Soybean and wheat straws and a soybean-based adhesive were used in experimental fiber boards for interior construction purposes. Corn starch is being tested in a foam-based sheet packaging product. Production processes are being evaluated for soy-based snack and cereal products with enhanced anti-cancer and anti-atherosclerosis properties from soybean isoflavones. A model is being developed for predicting melt/flow characteristics of cheeses; the relationship between cheese melting and sensory properties is important to food manufacturers, processors, and consumers. James Julson and Kasi Muthukumarappan are contact persons.

Food Safety. Recently approved use of irradiation and ozone, still in the experimental stage, is being evaluated for impacts on food quality, shelf life, and microorganism survival. James Julson and Kasi Muthukumarappan are contact persons.

Farm Safety. A concerted effort is being made by our engineers to moderate the health hazards associated with one of the nation's most dangerous industries. AgrAbility, a cooperative program with Easter Seals of South Dakota and Avera McKennan Hospital of Sioux Falls, helps producers with physical handicaps remain in production agriculture. William Campbell and Daniel Robbins are contact persons.

Precision Farming. Remote sensing and GPS technologies are being used to develop methods to estimate the quality of an agricultural crop as it matures in the field. Daniel Humburg and Kenneth Stange are contact persons.

Livestock Waste Management. Research and extension personnel are collaborating on evaluating Best Management Practices that minimize adverse air and water quality impacts from the storage and utilization of livestock wastes. Educational materials and waste management meetings assist producers to be good neighbors, make wise use of waste products, and satisfy government regulations. Charles Ullery, William Campbell, Mylo Hellickson, and Steven Pohl are contact persons.

Structural Design. Studies are under way to determine the best sheet-metal skin, fastener position and type, and wood product components of post-framed buildings to minimize construction costs and increase structural integrity of these buildings in agricultural, commercial, and light-industry sectors of the economy. Gary Anderson and Van Kelley are contact persons.

Sprinkler Irrigation. Each sprinkler device has a unique drop size distribution and application pattern. Small drop sizes are of interest, especially when chemicals are applied with the irrigation water, because of potential drift from target areas. Large drops can cause soil crusting and infiltration problems. Uniformity of water application is influenced by the spacing of the sprinklers and application patterns associated with nozzle pressures. Darrell DeBoer and Hal Werner are contact persons.



Troy Small, Blaine, Minn., undergraduate research assistant, adds corn flour to an extruder in a project to find an ag product alternative to petroleum.

Climate and Weather. The State Climatologist collaborates with a network that includes the National Climatic Data Center and the regional climate centers. The climatologist also develops and disseminates climate analyses unique to the state. A partnership with FEMA, USGS, NRCS, and state and local agencies produced an analysis of the significant changes in precipitation and evaporation that caused rises in lake levels never before observed in South Dakota. Alan Bender and Hal Werner are contact persons. □

Darrell DeBoer
605-688-5141
www.abs.sdstate.edu/ae

The turn of the millennium finds the Department of Animal and Range Sciences in transition. Five talented and dedicated faculty members with a combined 135 years of service to SDSU and the citizens of South Dakota have retired in the past 2½ years. Bob Gartner, John Romans, Bill Costello, George Libal, and Dan Gee have all ended their illustrious careers at SDSU. These losses coupled with two other faculty departures have left major holes to fill, but they have also provided the opportunity to re-evaluate and make some adjustments as we continue to meet the needs of South Dakota.

Our students excel both in classroom and co-curricular activities. The Range Plant Identification team placed first at the Society for Range Management meetings this past year, and our livestock and meats teams are competitive every time out. After graduating the largest class in our history last spring, we have 262 Animal Science and 21 Range Science majors. Our graduates are in demand by agri-industries with placement in the feed and meats industries being exceptionally good. Our students continue to demonstrate their leadership



Brad Johnson, center, shows feedlot management shortcourse participants a handful of mixed rations.

'an opportunity to re-evaluate'

Animal & Range Sciences

abilities in student organizations, and Londa VanderWal from Volga was named the National Block and Bridle Club's Outstanding Senior.

Our research faculty has received excellent support from the state's livestock and grain commodity groups. These funding partnerships have allowed them to increase external funding yet remain focused on the problems and issues faced by South Dakota's livestock producers and range resource managers.

Our extension faculty is implementing the new extension vision. In addition to numerous local, regional, and statewide producer programs, our specialists have created a 3-year training curriculum for county extension livestock educators.

Our programs have become both multi-disciplinary (combining the talents and expertise of scientists from several departments and disciplines to solve problems) and multi-functional (integrating research, teaching, and extension activities). These programs target three primary focus areas: increased efficiency, enhanced natural resources, and improved products.

Increasing the efficiency of production has long been a focus area of the department. Recent efforts in the efficiency area include the evaluation of altering calving and weaning dates in beef herds, lifetime implant strategies for cattle, growth promotants for swine, low-cost swine housing, out-of-season lambing, multiple-species grazing, and the evaluation of specialty grains and alternative feeds.

Enhancing our natural resources encompasses improving the utilization and quality of range and grassland resources through the study of grazing systems, grazing patterns, and plant responses to grazing. Nutrition and management programs that minimize the output of nutrients into the environment from livestock feeding operations are also being investigated.

Improving the composition, quality, and consistency of meat is a focus of numerous projects. This area is targeted at the molecular and cellular levels, with pre-harvest treatment of market livestock and post-harvest treatment of carcasses and meat products.

Livestock continues to be a primary means for adding value to grass and grain, and the department remains dedicated to serving the needs of South Dakota. □

Don Boggs
605-688-5165
www.abs.sdstate.edu/ars

'research as varied as life itself'

Biology/Microbiology

When we are asked, "What kind of research is conducted in the Biology/Microbiology Department?" our answers are as varied as the people with the questions. The following are brief summaries of some of the work being conducted in the department:

- Research on the PRRS virus by Bob Rowland and associates has yielded a better understanding of the virus and its means of infecting pigs. This is leading to new management practices that lessen the impact of the virus on small and large operations.
- David Hurley and associates have been providing better tools to improve the survival of newborn calves. They are looking at the mechanisms involved in passing immunity from cow to calf through the colostrum.
- Bill Gibbons is identifying a pilot ethanol plant that will help define production costs while manufacturing a sufficient quantity of corn-based biodegradable deicer for use in road trials. Trials will be conducted this winter in Minnesota and Iowa. Dr. Gibbons is also producing microbial gums from ethanol plant byproducts to be used as binding agents with organic fibers and grass seed for use in re-vegetating highly erodible areas.
- Research in Bruce Bleakley's lab involves the biological control of diseases such as tanspot and head blight of wheat. Bacteria have been isolated which have demonstrated ability to antagonize these wheat diseases. The goal is to prepare these bio-control agents in a form that can be applied in the field by farmers.
- Yang Yen has been evaluating some newly introduced Chinese spring wheat lines and their parental lines



Denghui Xing, undergraduate student, works with Yang Yen in evaluating Chinese spring wheat lines and varieties derived from them for *Fusarium* head blight resistance.

for *Fusarium* head blight resistance. Three Chinese cultivars have shown some degrees of resistance. Work is continuing to further evaluate the effectiveness of new wheat varieties.

- Neil Reese's lab is examining the economic potential of native plant species to develop ecologically sound, organic gardening methods and practices that will create niche markets for regional farmers. This program ties basic botany, alternative agricultural practices, and human nutritional programs together to develop innovative agronomic strategies and strengthen rural communities.
- Mike Hildreth and associates are developing an inexpensive and easy method for cattle producers to measure production losses from internal nematodes during the grazing season. Commercial herds are being used to evaluate this technique and to determine representative losses for the various regions within the state.

- Nels Granholm and associates are conducting experiments on humans, cattle, swine, and mice designed to discover and characterize factors involved in mammalian food intake, appetite control, fat deposition, balance of fat and protein, exercise, and metabolic rate. The outcomes of this research include a heightened understanding of mammalian genes that regulate or contribute to the control of energy balance.
- Nels Troelstrup is studying the influence of lake shoreline and stream riparian zone management practices on lake water quality and biology. This involves identifying geographic patterns in prairie lake shorelines, conducting stream water quality assessment studies to identify critical watershed areas in need of better management, and identifying biological responses of aquatic life to water quality deterioration. □

Gary Peterson
605-688-6141
www.abs.sdstate.edu/bio

'supporting our agricultural community'

Chemistry/Biochemistry

The primary roles of SDSU's Department of Chemistry/Biochemistry in the Agricultural Experiment Station are to conduct research in the biochemistry of animal reproduction and fertility; develop alternative uses for the biochemical constituents of agricultural products; explore the analytical and environmental chemistry of pesticides and other organic compounds introduced into the soil; and provide state-of-the-art analytical chemistry services to South Dakota's agricultural community.

Agricultural Biochemistry. Don Evenson's work has led to the development of a method to determine the structure of sperm cell chromatin. The assay he has developed shows tremendous potential for allowing scientists to better understand the effects of exposure to chemicals and other environmental stresses on livestock reproduction and fertility.

Igor Sergeev's doctorate and prior research experience are in cellular biochemistry. The research program he is developing will explore the role of minerals and vitamins in cell function, with particular emphasis on intracellular calcium signaling and apoptosis.

Tom West is developing mutant fungal strains that can convert agricultural starches and sugars into a polymer known as pullulan. This carbohydrate-based polymer is a chemical feedstock for a variety of emerging commercial applications including plastics and low-calorie food products.

Analytical and Environmental Chemistry. Duane Matthees supervises a research project seeking new analyti-

cal methods for compounds that are difficult to determine and developing new techniques for the separation and isolation of pesticides and organic contaminants from soils, waters, feeds, and foodstuffs. His research determines concentrations of these compounds in the low (ppb) ranges.

Jim Rice assumed the role of department head in July 1999. His research interests are in the environmental chemistry and geochemistry of anthropogenic organic compounds introduced into the natural environment. His current work focuses on the role of soil lipids in the binding of organic compounds like pesticides and PCBs to soil organic matter, particularly to the fraction of soil organic matter known as "humins."

As livestock breeding and nutrition, value-added product development, crop protection, and environmental monitoring become increasingly sophisticated, the need and demand for the research and services we provide will continue to grow. The Department of Chemistry/Biochemistry is committed to furnishing

to the citizens of South Dakota the access to advanced research and analysis that will be necessary to support our state's agricultural community as it moves into the next century. □

James Rice
605-688-6171
www.sdstate.edu/~wchm



Tom West and Neili Fullenkamp, lab technician, are concentrating on ag byproduct polymers that would have wide commercial applications.

'making nature's most nearly perfect food even better'

Dairy Science

Scientists discovered in the late 1980s that conjugated linoleic acid (CLA) and transvaccenic acid (TVA), which are milk fatty acids, may help reduce the incidence of cancer and aid in weight reduction. There are several different forms of CLA, but the most biologically active form is the cis-9, trans-11 isomer (referred to as c-9, t-11 C18:2).

Fortunately, this happens to be the form present in greatest abundance in ruminant products. The CLAs are produced in the cow's rumen as a result of incomplete biohydrogenation of dietary fats by bacteria.

The amount of CLA humans need to consume to prevent cancer is probably more than is normally consumed from dairy products. Thus, we are evaluating methods to increase the CLA content of milk fat so that a person could obtain the needed CLA from the equivalent of 3 to 4 glasses of milk daily.

Milk from cows fed stored feeds such as hay, silage, grains, and protein supplements typically contains 3 to 7 mg of CLA/g of fat. This amount can be boosted slightly by feeding high-concentrate diets and can be doubled by allowing cows to graze on pasture or to consume oilseeds that are high in linoleic or linolenic acid such as heated soybeans. The feeding of vegetable oils may further boost the CLA

content of milk fat but will greatly decrease milk fat percentages. We recently increased the CLA content of milk fat more than fivefold by feeding cows either fish oil or a marine algae product.

Researchers also have reported that humans and other mammals can convert TVA to CLA (a trans 18:1 fatty acid), which helps to explain the role of TVA in the prevention of cancer and obesity. Dairy products typically contain low concentrations of trans C18:1 fatty acids. The trans fatty acids in milk are mostly the trans-11 isomer, TVA. We are now finding that TVA concentration in milk can increase four- to sixfold when cows are fed fish oils. In this

case trans fatty acids from TVA and CLA are good for us in that they have no relationship to coronary artery disease.

Milk is a highly nutritious food that is better for us than we previously thought. In addition to the calcium, vitamins, and proteins that we need, milk is a very good source of nutrients—CLA and TVA—that may help us live healthier lives. We are conducting research to increase the concentrations of these fatty acids to make nature's most nearly perfect food even better for consumers. □

John Parsons
605-688-4116
www.abs.sdstate.edu/Dairysci/dairysci.htm



No fire-breathing dragon, she is merely waiting in the unheated but comfortable Dairy Unit barn for her turn at afternoon milking. She is a special pet of Pat Solsaa, dairy foreman.

‘multidisciplinary, value-added research’

Economics



Liuyi Mo, graduate research associate from China, presents a synopsis of a research topic to faculty and students in the Economics Department.

Economists design projects to integrate and synthesize findings from agricultural science and engineering disciplines and, through publication, extension, and teaching, relate their findings to a decision-making framework for clientele to use.

Economic analyses provide insight into state, national, and international issues that touch the lives of South Dakotans. These issues relate to food supply, resource use and management, and to agricultural production, marketing, and finance. Economics faculty members also are involved in multidisciplinary research projects with other scientists at SDSU and other regional universities.

Focus groups were used to determine producer reactions to the flexibility allowed by the 1996 Farm Bill (Freedom to Farm). Researchers found that due to the relative profitability of corn and soybeans, farmers are now moving to 50-50 rotations that were

not previously allowed because of base-acre limitations. Focus group participants indicate that chemical use and labor availability keep farmers in fairly narrow crop rotations. It was concluded that the 1996 Farm Bill has allowed some changes in product mix but has not necessarily encouraged more crop system diversity. Politicians and others involved in making policy decisions have been advised of the implications of these research results.

A multi-state research group assessed agricultural food system changes and the increasing importance of value-added activities. Focus groups found that stakeholders in rural development are not fully informed of economic opportunities offered by cooperatives. SDSU, the South Dakota Department of Agriculture, the South Dakota Governor's Office of Economic Development, USDA Rural Development, East River Electric Power Cooperative, and the South Dakota

Value-Added Development Center have formed an alliance to disperse complete, consistent information on rural development and cooperative opportunities and procedures. A cooperatives course has been officially approved for SDSU, and sessions on cooperative formation, management, and finance have been included in the Economics Extension Master Manager Program.

Multidisciplinary projects are evaluating production and marketing strategies to improve profitability for beef producers. A grant has been received to study health and management factors that impact beef value. A multi-state group is studying how cow/calf producers' risk preferences impact marketing decisions. In a study designed to compare grid pricing and dressed weight pricing, researchers found a) grid pricing is a riskier marketing strategy for producers relative to average pricing, and b) grid pricing will not eliminate average pricing in the cash market for slaughter cattle.

Other activities of the department include analysis of:

- long-term economic profitability of crop rotations.
- land valuation and lease rate analysis, conducted annually.
- marketing practices and profitability of South Dakota swine producers.
- structural change in the South Dakota financial industry and accompanying impacts on the availability of agricultural credit.
- rural labor availability and migration patterns.
- grain movement by market origination and destination by mode and type of market transaction. This work is done jointly with North Dakota State University and funded partially by South Dakota producer organizations.

The Economics Department disseminates summaries of research results through a monthly publication, the "Economics Commentator," and through the department web site. □

Richard Shane
605-688-4141
econnet.sdstate.edu/dept/index.asp

'creating new knowledge
to help improve lives'

College of Family & Consumer Sciences



Scott Gardner, center, listens to high-school students discuss how to build interpersonal relationship skills that will serve them long after graduation.

The diversity of disciplines within the College of Family & Consumer Sciences is reflected in our wide array of research programs. From a better understanding of how soy consumption impacts our health to discovering rural consumers' use of Internet shopping, the basic research mission of the College is to create new knowledge which will help individuals and families improve their lives.

Nutrition and Food Science. Dr. Chunyang Wang continues his research on soy isoflavones. Dr. Wang has collected soybean samples throughout South Dakota so he can measure isoflavone concentration. Because soy isoflavones are known to prevent heart disease and cancer, higher concentrations are better for consumers.

Dr. Padu Krishnan continues his research on fatty acids and oils in oats and soybeans. His research has focused on analytical techniques for measuring oils and fatty acids. He has collected 7 years of data to determine how environmental conditions impact grain quality. Dr. Krishnan has been successful in securing USDA equipment grants to purchase an LC/mass spectrometer and a GC/mass spectrometer. Check-off funds from the South Dakota Soybean Research and Promotion Council and the South

Dakota Oilseeds Council helped to finalize the purchases. These tools allow scientists to identify and measure small but economically valuable components found in our commodity crops.

Dr. Marilyn Swanson has been engaged in a regional research project evaluating factors that impact grain, fruit, and vegetable consumption. She is focusing on individuals between the ages of 19-25 and under-represented populations.

Human Development and Family Sciences. Dr. Mary Kay Helling is in the final stages of a 5-year joint project with Dr. Ron Stover to better understand the dynamics and processes used when families transfer ownership of the farm/ranch to the next generation. They have surveyed century farm/ranch families and then followed up by conducting in-depth interviews with husband/wife teams of the intergenerational families. They hope to return to the original 25 families of this study to see what steps they have taken for planning transfer. A short extension publication on this subject is available through local Cooperative Extension Service offices.

Dr. Scott Gardner has gained national attention in his research project on impacts of a high school curriculum

on preparation for marriage. He has worked with over 100 high-school teachers and has helped with instructional methods. He hopes to monitor the students for several years after high school to determine if education decreases the likelihood of divorce or marital distress. This past summer Dr. Gardner was one of several scientists quoted in a Time magazine article on marital education.

Consumerism. Professor Nancy Lyons is engaged in a regional project studying the impact of technology on rural consumer access to food and fiber products. This study is in the initial stages of obtaining information on rural consumers' use of the Internet in purchasing consumer products. A survey has been distributed to assess rural consumer shopping attitudes and practices. Items of interest include groceries, apparel and accessories, furniture and home furnishings, and general merchandise. Ultimately, this project will provide an increased understanding of rural consumer shopping patterns and attitudes toward emerging technologies and will assist rural retailers in incorporating appropriate technologies into their business operations. □

Laurie Stenberg Nichols
605-688-6181
www.abs.sdstate.edu/fcs

'committed to the continued pursuit of knowledge'

Horticulture, Forestry, Landscape & Parks

Research and extension in the department of Horticulture, Forestry, Landscape & Parks has historically had a strong home and community landscape focus. In recent years we have expanded our efforts in these areas while also developing significant research programs in forest and wetland ecology, urban and community forestry, and turfgrass management.

A grant from the USDA-CSREES allows Anne Fennell to collaborate with scientists at Oregon State University in her ongoing studies of cold acclimation and dormancy in woody plants. Dr. Fennell's research seeks to identify protein changes in grape plant buds as they respond to the shorter daylengths and cooler temperatures typical of late summer and fall which trigger cold acclimation and dormancy in woody plants. The goal of this research is to eventually identify the specific genes responsible for cold acclimation and dormancy and use this knowledge to develop woody plants better able to withstand winter in the northern Great Plains. Jim Harbage has participated in this research, primarily working with herbaceous perennials.

Carter Johnson recently received a grant through the U.S. Geological Survey to continue his investigation of the potential impacts of global climate change on prairie wetlands. This 5-year study involves scientists from Patuxent Wildlife Research Center (USDA, Maryland), Biology and Plant Science departments (SDSU), Desert Research Institute (University of Nevada, Reno), and the Nature Conservancy (Cornell University, Ithaca, N.Y.). The research includes field measurements of the water budgets and vegetation dynamics of wetlands in South Dakota, mathematical

modeling of surface and ground water, and study of land uses and farming practices that could offset possible negative consequences of climate change on wetlands and waterfowl.

Dr. Johnson also recently received McIntire-Stennis funding for a project to characterize existing riparian zone vegetation and its function along the Big Sioux River. It is proposed that this project be included in eight-state regional research addressing critical needs in riparian zone management. In related work, Dr. Johnson also assisted FEMA this past year in determining the frequency of high-water events in northeastern South Dakota. FEMA will use this information along with that from other scientists to determine how best to address the natural disaster that region has experienced.

With the hiring of Leo Schleicher, we moved away from research on vegetable production and greatly increased our emphasis in turfgrass research. With about 120 golf courses, thousands of acres of maintained turf, and increased homeowner emphasis on home landscapes in South Dakota, we felt turfgrass research deserved greater attention. Dr. Schleicher has developed a strong relationship with the South Dakota Turf Research Foundation, which provides support for turfgrass research at SDSU. He is

participating in national studies of turfgrass varieties and in Hatch-funded research to determine appropriate cultural practices and industry supported herbicide and cold hardiness research. In just 2 years the research has progressed to the point where we will be hosting the first SDSU turfgrass research field day in July 2000.

We continue to pursue research in park management, agroforestry, urban forestry, fruit production, and landscape practices. Much of what we study has value for almost all South Dakotans, and we are committed to the continued pursuit of knowledge which will improve the quality of life in South Dakota and the Northern Great Plains. □

Pete Schaefer
605-688-5136
www.abs.sdstate.edu/hort/hflp/hflp.htm



Collecting wetland data are Rick Voldseth, graduate student, Glenn Guntenspergen, USGS, and Susan Boettcher, research associate.

'unique opportunities'

Plant Science

The Plant Science Department houses faculty and staff specializing in agronomy, crop science, soil and water science, weed science, entomology, and plant pathology. Programs within the department encompass a broad array of research, extension, teaching, and technical service. This mix of disciplines and activities provides for some unique opportunities for faculty, staff, and students within the land-grant system at SDSU.

Many of the research and extension programs are directed at production agriculture; however, other areas such as ecology, natural resource management, and molecular biology are also addressed. Some projects are applied or field oriented, while others are more basic or fundamental. Some have immediate impact, while others are long-term. Collectively, the importance of research and extension programs in the department is not restricted to South Dakota alone, but is also regional and national.

One strength of the department's research and extension programs is its excellent working relationship with various crop commodity groups. In addition to financial support, these groups help maintain a close association between faculty and clientele, ensuring that current or developing problems in production agriculture are addressed.

Another strength of the research and extension programs is their cooperative nature. Projects are often multidisciplinary. Frequently there are multiple project leaders, including departments in addition to Plant Science and institutions in addition to

SDSU. Personnel from various state and federal government agencies are often involved, along with producers and private industry.

The department benefits greatly from external funding support from competitive granting agencies such as USDA, NSF, NASA, and private industry. Faculty are actively involved in writing and submitting grant proposals to obtain funding to support their programs. The department continues to be very successful in terms of external grant funds obtained.

While there are many on-going programs in the department, two in particular are highlighted here.

Crop variety development continues to be a major emphasis. Major breeding and genetics programs are in place for spring wheat, winter wheat, soybeans, corn, oats, forages, sunflowers, and other oilseeds. In addition to new varieties, emphasis is also placed on inbred lines and other germplasm development for some of these crops. Techniques range from conventional plant breeding to molecular biology. The Crop Performance Testing Program generates data on the performance of potential South Dakota varieties along with those from other states. The Foundation Seed Stocks

Division and the Seed Certification Program play vital, fundamental roles in the propagation and distribution of seed stocks to producers.

The Plant Science Department, along with faculty and personnel from other departments, institutions, agencies, and the private sector, has developed a nationally recognized program in precision farming. Increased profitability and natural resource conservation are but two of the factors behind this effort. Faculty and staff from the department took the leadership in developing a national precision farming manual, already recognized as a high-quality and informative document, and in the organization of regional conferences on precision farming. □

Dale Gallenberg
605-688-4600
www.sdstate.edu/~wpls/http/psihome.html



Screening for susceptibility, Cynthia Bergman, graduate research assistant, assists Marie Langham in inoculating plants with wheat streak mosaic virus.

'continuity and change'

Rural Sociology

Significant changes are under way in the Census Data Center, located in the Rural Sociology Department on the SDSU campus. James L. Satterlee retired on July 1, 1999, as head of Rural Sociology and director of the Data Center. During his 32 years of service to the department, university, and South Dakota, Dr. Satterlee was actively involved in research projects resulting in the publication of 70 documents of direct value to rural people and communities and the state as a whole. Dr. Satterlee's outreach activities involved numerous community service programs in the areas of demography, community development, and multicultural topics.

In recognition of his service, the South Dakota Board of Regents awarded Dr. Satterlee the title of Professor Emeritus of Rural Sociology.

Although retired, Dr. Satterlee continues to be active with the department in research and outreach services to our rural communities and the state. He and Carol Cumber of the SDSU Economics Department recently completed two case studies addressing alternatives for supplementing traditional farm income through value added processing and direct marketing of agricultural products. The two case studies focused on the innovative ventures of the Dakota Style Company of Clark and the Goosemobile project of Canistota.

More recently, Dr. Satterlee and Donna Hess, acting head of the Rural Sociology Department, met with a clinical pastoral education group from Revillo to share data from the Census Data Center reflecting the changing demographics of that area and to discuss ideas supportive of changing rural communities such as Revillo.

The work begun by Dr. Satterlee continues as the Census Data Center broadens its focus from providing demographic data to clientele throughout the state to more specifically addressing issues related to farm families and rural communities in times of crisis and change.

Two new short-duration projects this year are by Robert Mendelsohn and Donald Arwood and their graduate students. Their projects address issues of rural domestic violence, quality of life in rural South Dakota, and sustainable farm families and communities, complementing another on-going project of Ronald Stover also of our department and Dr. Mary Kay Helling of the Department of Human Development, Child, and Family Studies on the intergenerational transfer of family farms.

Professor Emeritus James Satterlee's work and that of the Census Data Center that he directed for so many



Jim Satterlee devoted 32 years of service to department, university, and South Dakota and, officially retired, continues research and outreach in community development.

years continue to provide data and service to the people on South Dakota's farms and ranches and in its urban and rural communities. □

Donna Hess
605-688-4132
web.sdstate.edu/departments/soc/

'improving animal health, the livestock industry, and the welfare of society'

Veterinary Science

Mission: to protect and improve the health of animals, the viability of the South Dakota livestock industry, and the welfare of society through high-quality diagnostic, research, extension, and teaching activities.

The SDSU Veterinary Science Department is a diverse group of faculty and staff working together to fulfill that mission. The department's 16 faculty members specialize in a variety of disciplines including pathology, virology, bacteriology, epidemiology, toxicology, immunology, serology, clinical pathology, physiology, and production economics. This is complemented by career-service staff with similar specialties as well as skills in office management, business accounting, word

processing, computer support, animal care, physical facility maintenance, and grounds keeping. The overall result is an efficient team of animal health experts dedicated to monitoring, discovering, and conducting research on diseases of animals. As always, our strongest effort is toward food animal infectious diseases.

Staying abreast of new animal disease syndromes is a team effort. It first involves animal owners that discover problems on their farms and ranches. It next involves the hometown veterinarian called in to consult on the issue. If warranted, the local veterinarian will initiate a series of laboratory tests to provide clarification. The

laboratory veterinarians and staff conduct specific diagnostic tests to obtain a precise disease diagnosis. These activities result in the discovery of new disease problems in our region. Many of our diagnostic faculty and staff have small research appointments to facilitate this process. Diagnostic activity is often referred to as "grassroots research" since it represents the everyday ebb and flow of animal health issues. On occasion, the extension veterinarian and other laboratory personnel will visit the farm and ranch to gather more data.

When serious problems are identified, faculty and staff that are appointed to a higher level of research responsibility conduct research that allows for clarification of the problem for the purpose of eventual solutions. Sig-

nificant problems usually require extended and in-depth research. Therefore, researchers spend a significant amount of their time writing grant proposals for additional research funding from state, regional, and national agencies.

Distributing the information is another key part of the research process.

Thirteen refereed articles were printed in national publications, and 170 other publications and presentations were offered across the state, region, and nation. Research was conducted on:

- the epithelial cell receptors for the scours causing *E. coli*
- the spread of PRRS virus in boar semen
- the toxic effects of ensiled leafy spurge in cattle
- the causes of spontaneous livestock abortion
- the effect of dust on the health of pigs
- the epidemiology of PRRS virus (how it spreads within a herd)
- a new neurovirulent strain of PRRS virus
- the effects of selenium toxicosis on pregnant beef cattle
- the virulence factors of bovine herpesvirus
- the immunological effects of BVD virus vaccinations
- cattle production records analyses
- new tests for a new strain of swine influenza virus
- new methods to sort different strains of PRRS virus
- a new brain disease in South Dakota farm-raised elk (CWD).

These are just some examples of the research activities of the SDSU Veterinary Science Department during 1999. □

David Zeman
605-688-5171
www.vetsci.sdstate.edu



Chris Chase, left, makes a farm visit to share results of a herd health survey.

'a part of our heritage'

Wildlife and Fisheries

Wildlife and fisheries resources hold a special place in the hearts and minds of most South Dakotans. These resources are an integral part of our heritage and represent a significant determining factor in why many of our citizens choose to live in the state.

Wildlife and fisheries users can be classed into two groups, consumptive and nonconsumptive users. Consumptive users are primarily those who hunt, fish, or trap. Nonconsumptive users include wildlife watchers and feeders, photographers, and others. All of these people represent a cross-section of urban and rural residents of all ages. In addition, many nonresidents visit specifically because of our wildlife and fisheries resources.

To obtain a better perspective of the importance of wildlife and fish to our citizens, consider some of the following facts gathered in 1996:

- 38% of South Dakotans 16 years of age or older hunt **or** fish. Only one state has a higher participation rate.
- 14% of South Dakotans 16 years of age and older hunt **and** fish. Only one state has a higher participation rate.
- 60% of South Dakotans age 6 to 15 hunt or fish. Only one state has a higher participation rate.
- 30% of South Dakotans participate in wildlife watching activities.

What is readily apparent is that wildlife and fisheries resources are significant to the people of the state. Our department's research program is primarily directed at addressing natural resource issues of importance to a wide array of citizens. The depart-

ment has three primary research thrusts: wildlife-fisheries-agriculture interactions, biostress, and wetlands.

In 1997, the South Dakota Agricultural Experiment Station (SDAES) reviewed and revised its mission and future directions. The Wildlife and Fisheries Sciences Department directly addresses the SDAES mission of "conducting research to enhance the quality of life in South Dakota through the beneficial use and development of human, economic, and natural resources." Six future SDAES directions were identified. The three directions to which our department primarily contributes are: 1) "to insure an adequate quantity of acceptable quality water for agricultural, industrial, municipal, and recreational use;" 2) "to conduct research that will contribute to rural revitalization through development of human and natural resources to enhance economic and social conditions;" and 3) "to acquire the technology to maintain a safe environment and improved quality of life."

The department's faculty is very active in obtaining the research funding needed to help the SDAES address its objectives. For every research dollar received from the SDAES over \$6 are received from other sources. Such leveraging enhances the overall utility of our program to state citizens.



Department biologists, highway engineers, and landowners are collaborating in mitigating and banking wetlands affected by road development.

There are approximately 50 current research projects in the department. They range over the whole state in both terrestrial and aquatic environments. Included are such high-profile animals as mountain lions, walleyes, ring-necked pheasants, largemouth bass, and elk. Also included are lower-profile organisms such as songbirds, minnows, frogs, and mice. Habitat management research spans all types of land forms in the state including the Black Hills, grasslands, small ponds, wetlands, croplands, the Missouri River, and others. All of these organisms and habitats that are present in the state add to its diversity and citizen quality of life—that is why we conduct research in wildlife and fisheries. □

Chuck Scalet
605-688-6121
wfs.sdstate.edu

Oscar E. Olson Biochemistry Labs, Analytical Services

The Analytical Services Laboratory is housed in the Olson Biochemistry Laboratories area of the Animal Science Complex on North Campus Drive. The mission of the Analytical Services Laboratory is to provide quality analysis in support of the University and the state agricultural effort, to provide educational opportunities for SDSU students, and to provide research in areas consistent with services we perform.

The laboratory is managed as two sections. One section accepts samples for pesticide analysis and is managed by Dr. Duane Matthees. The second accepts animal feed, forage, fertilizer, manure, compost, meat, and water samples and is managed by Nancy Thiex. Ten full-time chemists and a dozen part-time students support the functions of the laboratory.

In 1999, approximately 13,000 samples were received and about 80,000 results were reported. The most commonly requested service provided by the pesticide laboratory is the analysis of traces of herbicides in conjunction with suspected plant injury. For the other section, the most commonly requested analyses include selenium, crude protein, fiber, and minerals such as calcium, phosphorus, potassium, and magnesium.

Both laboratories provide a wide variety of services that are not commonly available. These less frequently requested analyses, such as for amino acids or drugs, are no less important in our mission to serve our agricultural clientele. Interpretation of results is routinely provided and is as important as the actual test results.

The laboratories provide toxicological analyses to the Animal Disease Research and Veterinary Diagnostic Laboratory, analytical services in support of the South Dakota Department of Agriculture's Division of Agricultural Services and Animal Industry Board programs, and analyses to several SDSU scientists in support of their research. The laboratories also serve the general public (farmers, ranchers, hay buyers and sellers, etc.) as well as the extension educators in the counties. The NIRS Mobile Laboratory was taken to several events in 1999, including DakotaFest '99, Mitchell; USDA Ag Tour, Wanblee; Bennett County and Haaken-Jackson Forage Production Days, Kadoka; and the South Dakota Cattlemen's annual meeting, Pierre.

Quality is an important component of the services provided by the laboratories. The labs participate in a number of proficiency testing programs



Lab Manager Nancy Thiex keeps phone lines busy as she interprets test results and confers with associates across the country.

and certifications, including USDA, EPA, and the National Forage Testing Association.

An important new acquisition for the laboratory in 1999 was the purchase of an ICP spectrophotometer. This instrument expands the capabilities of the laboratory in the area of elemental (or mineral) analysis. □

Nancy Thiex
supervisor
605-688-5466
www.sdstate.edu/~cm10/http/as.html

Animal Disease Research and Diagnostic Lab

Since 1887, the South Dakota Animal Disease Research and Diagnostic Laboratory (ADRDL) has maintained a proud tradition of providing quality veterinary diagnostic services to the state and region.

The ADRDL serves animal owners by acting as a reference laboratory for animal health professionals and state/federal regulatory officials. As a reference laboratory, we provide the precise, detailed animal disease information that is needed for those in charge of managing, treating, and preventing diseases in animals. When the world population reached 6 billion people in October 1999, we were reminded that we are an integral part of the animal health infrastructure that works to feed the state, region, nation, and world.

The animals that come our way are large and small and come with hooves, paws, feathers, or fins. Many of the diseases we deal with are also potential human diseases, and there-

fore we play a role in public health as well. Two tests are now on-line to support the state's meat inspection program.

The ADRDL continues to adapt new technology to the routine business of veterinary diagnostic investigation. This year molecular tests for *Mycoplasma hyopneumoniae* and *Clostridium perfringens* were added. The *Clostridium* test has great potential to help us understand intestinal disease syndromes in cattle, sheep, and swine.

In June 1999, we received notification of re-accreditation by the American Association of Veterinary Laboratory Diagnosticians. We are one of only 36 accredited labs in the U.S. Meeting the many challenges of the future will require a stable budget and the on-going support of all sectors of the animal industry.

We are proud to be considered an essential infrastructure of the ani-



Dale Miskimmins and Keith Koistinen, undergraduate from Lake Norden, examine a set of lungs to determine extent of damage.

mal/livestock industry and count it a privilege to serve the citizens of South Dakota through the ADRDL. □

David Zeman
Director, ADRDL
605-688-5171
www.vetsci.sdstate.edu

Dairy Lab

The primary mission of the State Dairy Laboratory is to supply results from analysis of raw and finished milks and other dairy products to the South Dakota Department of Agriculture's Office of Dairy and Egg Inspection. The lab also offers a statewide service program to farmers and dairy processors.

The laboratory, housed in the Dairy-Micro building and under the administration of the Dairy Science Department, is an FDA-accredited facility,

and all analyses are performed by FDA-certified analysts using the standard methodology of all milk laboratories throughout the U.S. All state milk laboratories in South Dakota and their analysts are accredited and certified by the Milk Laboratory Evaluation Officer for the state, who is the director of the SDSU lab.

The lab's sample load has been very consistent over the past several years. This past year, 1,524 samples were examined. Analyses performed on these samples totaled 4,554: 732 were regulatory milk (raw and fin-

ished) products, 415 were official raw milks for antibiotic (AB) residue screening, 125 were SDSU dairy unit samples tested for AB contamination, and 252 were submitted to the laboratory's statewide service program.

The state has 15 laboratories that must be re-accredited every 2 years and 65 analysts who must also be re-certified at the same time. □

Arnold W. Appelt
Director
605-688-4116
www.abs.sdstate.edu/Dairysci/dairysci.htm

Water Quality Lab

Intended use of water is important when determining water quality. It identifies the analysis that needs to be performed. A packet of interpretative information is included with each report of analysis.

Over 600 service samples with 1 to 10 parameters each were analyzed in 1999. Analysis for boron in irrigation water accounted for over 400 samples. Another 71 samples were for livestock and farmstead water analyses. These analyses determine whether mineral concentrations are suitable for livestock production and household use.

During 1999, another type of livestock production (fish culture) increased the use of the Water Quality Lab services. Eight samples were analyzed for fish culture.

Seventy-five samples were analyzed for irrigation, household use, and nutrient analysis. Many samples require individual attention to identify and solve water quality problems for lab customers.

A second major function of the Water Quality Lab is to support water research. One research project to document and quantify the water quality benefits of installing animal waste management systems on feedlots contributes 10-40 samples annually.

Two projects will identify pollutants and their sources, set water quality goals, and determine measures needed to meet those goals. Nearly 300 samples, mostly for nutrients and sediments, were analyzed for these projects in 1999. Lake and pond research projects accounted for nearly 100 samples in 1999.

The Water Quality Lab is located in the Agricultural Engineering Building at SDSU. □

David German
supervisor
605-688-4910
www.abs.sdstate.edu/labs_services/wql



Arnie Appelt readies broth tubes for raw milk samples due to arrive the next day.

Food Science Lab

The Food Science Laboratory provides services in product development, nutrient analysis, and food safety. Research scientists have a special knowledge and interest in cereal grains and oilseed processing.

Value-addition efforts can enhance the market value, nutritional efficacy, and health-promoting properties of traditional cash crops. The lab has a track record for providing assistance to entrepreneurs in various activities associated with getting processed foods to market. We have conducted chemical analyses of ingredients or finished food products such as mixed grains, an award-winning gourmet mustard, Indian fry bread mix, buffalo meat, and numerous varieties of meat jerky.

The support of commodity agencies such as the South Dakota Soybean

Research and Promotion Council and the South Dakota Corn Utilization Council have contributed to the Test Kitchen and Product Testing facility. Funded projects have allowed for the testing of speciality recipes and publication of a soy cook book.

The laboratory has a computerized sensory evaluation facility used in taste testing. Computer software is also used for rapid analysis of food based on existing nutrient data banks.

Numerous questions pertaining to ingredient substitution, microbiological safety, product formulation, and food labeling are directed to this laboratory through Cooperative Extension Service staff throughout the year. □

Padmanaban Krishnan
605-688-5161
<http://www.abs.sdstate.edu/fcs/nfs/fsban.htm>

Seed Testing Lab

The SDSU Seed Testing Lab provides fast, reliable, and unbiased seed testing to all clients. In 1999 the lab tested over 9,000 seed samples, conducting over 21,000 tests (such as for purity analysis, germination, etc.) for a large and varied clientele. Approximately 6,300 service samples, 1,675 Crop Improvement Association samples, 228 regulatory, and 1,241 electrophoresis samples were received from clientele.

The laboratory also tested over 500 research samples. Two other gratis services offered to current clientele were the "rough percent seed fill check" (for unharvested fuzzy grasses) and seed/plant identification, with approximately 400 samples received.

Lab personnel presented talks, papers, and workshops at national and regional meetings, including the national AOSA convention, the Seed Analysts of the Midwest meeting, and the South Dakota Ag Horizons conference. We also participated on departmental, regional, and national association committees.

Research work in breaking seed dormancy of cereals and native grasses to improve and implement new germination procedures continues. Electrophoresis research focuses on developing better methodologies for current species testing and on developing methodologies for barley, switchgrass, and some of the wheatgrasses. Other cooperative graduate student research work uses NIRS to predict seed germination and vigor.

Seed testing staff are five permanent staff members, one temporary (part-time) analyst, one graduate student, and 10 to 20 student

employees who receive training and experience as well as a stipend. Facilities, equipment, and expertise are made available (whenever possible) to University faculty and graduate students. The lab provided 15 tours from individuals and groups ranging from elementary school classes to farmer groups. □

Brent Turnipseed
manager
605-688-4589
Brent_Turnipseed@sdstate.edu



Brent Turnipseed and Jason Langland, student teacher, describe seed sampling to Brookings fourth-graders.

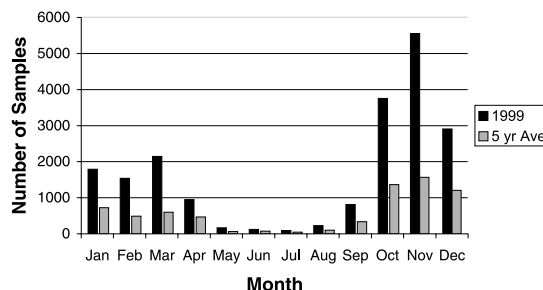
Soil Testing Lab

The SDSU Soil Testing Laboratory's purpose is to evaluate the fertility status of South Dakota soils. It provides unbiased analysis and nutrient recommendations for South Dakota producers and homeowners. Typical clients are farmers, ranchers, homeowners, and private and government organizations.

The laboratory processed and analyzed 20,028 producer samples representing about 12,000 fields during 1999. Over 77,000 separate analyses were made from these samples. The month of November had

the single highest sample number (5,550) of any month ever. A routine analysis package that includes nitrate-N, P, K, pH, and salts is run on most field samples. Many samples also include organic matter, zinc, and sulfur analyses.

SDSU Soil Testing Laboratory—
Number of samples by month.



The lab also processed and analyzed 1,936 soil samples for research personnel and 1,125 plant samples during the year.

In September the laboratory changed to a database program to print results, perform calculations, and summarize results. In addition, the program can print out lab forms used to record results. The program will soon allow e-mail transfer of producer results along with automated invoicing and billing. □

Ron Gelderman
manager
605-688-4766
www.abs.sdstate.edu/plantsci/service/soiltest

Southeast Research Farm

Nearly 30 scientists conducted a wide variety of crop and livestock research and demonstration projects at the Southeast Research Farm during 1999.

- Beef cattle projects evaluated the use of yeast and high-oil corn (HOC) in calf-fed feedlot receiving or finishing rations.
- Feedlot performance associated with different calving and weaning strategies continued.
- Swine research showed that HOC should be carefully substituted for normal corn in grow-finish rations.
- Reduced dust levels when feeding swine HOC were documented.
- Performance and economics of raising pigs in a hoop barn vs. a conventional confinement building were compared throughout the year.

Crop production was moderate to poor this season. Our rainfall was 5 inches above normal during the first half of the growing season, but the last half was 4.5 inches below normal. Some fields in our area were too wet to plant or drowned out after planting. Soil moisture was excessive in the spring and early summer, but the soil was quite dry by harvest. Strong wind and hail caused moderate to severe crop damage on July 2. Approximately 20% of our cropland was completely lost to hail and water damage.

- Small grain and soybean yields of 10 to 15 bu/A, corn yields of 90 to 100 bu/A, and hay yields of 3 T/A were common in places, although some fields did better.
- Crop variety test results for alfalfa, corn, and soybean (including Roundup Ready germplasm for row crops) were conducted.
- The tillage and crop rotation project completed its ninth year.

- The use of specialty crops like high-oil, Bt, and white corns and soybeans that provide protection against Phytophthora root rot were examined.
- Soil fertility research and site-specific farming using global positioning technology were conducted.
- Much of our weed control research and demonstration work suffered because of the wet weather during the spring.

A large part of our crop and livestock research was supported by check-off dollars from corn and soybean growers. □

Robert Berg
associate professor & farm manager
Southeast Research Farm
29974 University Road
Beresford SD 57004
605-563-2989
FAX: 605-563-2941



Investment and feeding costs are being compared at the SE Farm between a hoop barn and a conventional confinement unit.



Dwayne Beck leads a tour at Dakota Lakes where research is primarily on no-till crop production.

Dakota Lakes Research Farm

in July and August challenged some of the warm-season crops, but (with the exception of a few varieties) they held on and performed quite well.

Dormant seeding practices accounted for almost all spring wheat and some canola acres in 1999.

Please visit our web page for complete results and analysis, new publications, and some downloadable presentations. This information can be found by entering our page from the College of Agriculture and Biological Sciences home page (www.abs.sdstate.edu) or directly at www.dakotalakes.com. Or contact your local extension educator to obtain this same information. □

The Dakota Lakes Research Farm continued long-term research programs focused on developing techniques and components needed for efficient and sustainable no-till crop production. The staff at Dakota Lakes also provided assistance to scientists from SDSU and the USDA-ARS wishing to work at the farm.

Rotations again played a major role in determining crop performance and cost of production. In fact, long-term cost of production for winter wheat in the poor rotations is nearly double that achieved in the best rotations.

The 1999 growing season was moist and cool during the early part of the season and hot and dry later. This resulted in good yields of the cool-season crops. The hot and dry weather

Work continues on the concept seeder that we have been developing for several years. The 1999 season was the first time we have used multiple openers and active hydraulic down-pressure on all of the parallel links.

Dwayne Beck
professor & farm manager
Dakota Lakes Research Farm
P.O. Box 2, Pierre SD 57501
605-224-6357
FAX: 605-224-0845
www.dakotalakes.com

West River Ag Center

There are nine staff members located at the West River Ag Center working in the areas of agronomy, range science, animal science, economics, and 4-H.

Agronomy. The Plant Science Department, the Wheat Commission and the Oil Seeds Council partnered to perform needed research in western South Dakota. Grants totaling \$24,000 were used by the staff to support research on oilseed crops in crop rotations, winter wheat yields from delayed plantings, and effects of crop rotations on diseases.

Range Science. 1999 saw the culmination of 9 years work on two photo

field guides for plants of the region. One book for the Black Hills and Bear Lodge Mountains and the other for the grasslands have received high praise and acclaim. Combined, they have 900 pages, 1,100 photographs, and 850 plants described. This effort was made possible as a result of a large cooperative effort among 5 SDSU departments and 24 external financial partners.

Economics. A study of 1998 South Dakota agriculture showed a large decline in the economic impacts of ag and ag related industries. Total economic value fell \$2 billion from \$17 in 1997 to \$15 in 1998. Most of the declines can be attributed to double

digit percentage drops in livestock and crop prices.

4-H. 4-H has been working hard to incorporate technology into the 4-H program through increased communication using e-mail and the "web." 4-H staff at the Center arrange field trips for youth out of state and coordinate 25 youth projects statewide. □

Martin Beutler
Director, SDSU West River Ag Center, and ranch economist
1905 Plaza Blvd
Rapid City, SD 5702-9302
605-394-2236
beutler.martin@ces.sdstate.edu

112th Annual Report

South Dakota Agricultural Experiment Station

January 1, 1999 to December 31, 1999

Board of Regents

David Gienapp, Madison
James Hansen, Pierre
Harvey Jewett, IV, Aberdeen
Curtis Jones, Britton
Pat Lebrun, Rapid City
Rudolph Nef, Milbank
Shane Penfield, Lemmon
Robert T. Tad Perry, Executive Director, Pierre
Jack Rentschler, Sioux Falls

Executive

P. G. Elliott, PhD, President
F. A. Cholick, PhD, Dean
K. D. Kephart, PhD, Director/Associate Dean

Planning/Special Projects

E. Tschetter

Fiscal Officer

D. G. Longioliere

Advisory Groups

Antelope Livestock & Range Field Station (Buffalo)

Bill Clarkson, Buffalo
Dave Fischbach, Faith
Gary Gilbert, Ludlow
Casey Hunter, Belle Fourche
Mark Keffeler, Sturgis
Merle Kopren, Prairie City
Ken Nelson, Buffalo
Leonard Nygaard, Gascoyne, N.D.
Larry Vroman, Buffalo

Central Crops & Soils Field Station (Highmore)

Dennis Beckman, Wessington Springs
Brad Bonhorst, Pierre
Marcia Deneke,* Wessington Springs
Kristi Effling,* Gettysburg
Becky Fortune,* Miller
Randy Hague, Highmore
Phil Hamburger, Seneca
Scott Ingel, Cavour
Randy Johnson, Harrod
Keith Melius, Miranda (alternate)

Larry Nagel, Gettysburg
Dave Otto,* Huron
Lyle Stewart, Pierre (alternate)
Gerald Syring, Faulkton
Jake Vilhauer, Highmore (alternate)
Paul Weeldreyer,* Onida
Ken Wonnemberg,* Highmore
Todd Yackley, Onida
Greg Yapp, Huron
Mike Volek (ag tech),** Highmore
Brad Farber (manager),** Brookings
Dale Gallenberg (dept head),** Brookings
Bob Davis (dist ext supervisor),** Brookings
Nilo Reber (dist conserv),** Highmore

*County extension educator
**SDSU representative

Range & Livestock Field Station (Cottonwood)

Ron Christensen, Kadoka
Jerald Cook, Quinn
Ingebert Fauske, Wall
Clifford Fees, Philip
Larry Gabriel, Cottonwood
Bill Headlee, Kadoka
Richard Horton, Wall
Scott Kennedy, Philip
Richard Kjerstad, Quinn

Dakota Lakes Research Farm (Pierre)

Mike Arnoldy, Kennebec
Wilbert Blumhardt, Bowdle
Ralph Holzwarth, Gettysburg
William Huber, Parnamelee
Chris Huse, Onida
Bryan Jorgensen, Ideal
Kent Kinkler, Onida
Dave Nelson, St. Lawrence
Marvin Schlomer, Glenham
Steve Taylor, Presho
Maurice Trautman, Pierre
Paul Weeldreyer, Pierre

Northeast Research Farm (South Shore)

Hal Clemensen, Conde
Thad Duerre, Bristol
Lynn Eberhart, Britton
Gary Erickson,* Aberdeen
Sandra Gregg,* Sisseton
Donald Guthmiller,* Hayti
Jennie Johnson,* Clear Lake
Leon Koeppel, Clair City
Orrin Korth, Watertown,
Laron Krause, Clear Lake

Lyle Kriesel, Summit
Chuck Langner,* Watertown
Laird Larson, Clark
Paul Leiseth, Hazel
Gordon Little, Watertown
Tracey Renelt,* Milbank
Mark Rosenberg,* Redfield
Inel Rychman, Warner
Lorne Tilberg,* Britton
Gary Troester*, Webster
Allen Heuer (manager),** South Shore
James Smolik (research coordinator),** Brookings
Dale Gallenberg (dept head),** Brookings
Bob Davis (dist Ext supervisor),** Brookings
E. Kim Cassel (ag program leader),** Brookings

*County extension educator
**SDSU representatives

SESD Research Farm (Beresford)

Craig Anthony, Yankton
Duane Auch, Centerville
Kevin Edelman, Menno
John Fahlberg, Beresford
Robert B. Hansen, Irene
Kirk Jensen, Beresford
Ron Johnson, Alcester
Dean Knutson, Centerville
Leroy Larson, Vermillion
Wayne Larson, Crooks
Don Lerseth, Beresford
Alvin Novak, Yankton
Brian Smit, Davis
David Ulrickson, Canton
Dean Weber, Wagner

Staff

Agricultural Communications

B.S. Hartinger, MA, interim department head
M.R. Brashier, MS, communications specialist-
publications
J.R. Leslie, MS, communications specialist-ag
news and features

Agricultural & Biosystems Engineering

D.W. DeBoer, PhD, professor and acting head
G.A. Anderson, PhD, associate professor
A.R. Bender, MS, assistant professor
M.A. Helleickson, PhD, professor
D.S. Humburg, PhD, associate professor
J.L. Julson, PhD, associate professor
V.C. Kelley, PhD, assistant professor

K. Muthukumarappan, PhD, assistant professor
M.A. Schipull, MS, assistant professor
K.W. Stange, MS, assistant professor
J.D. Stout, MS, research associate
H.D. Werner, PhD, professor

Animal & Range Sciences

D.L. Boggs, PhD, professor and head
J.A. Clapper, PhD, assistant professor
T.M. Clark, BS, research associate
J. ElBarhamtoshi, MS, research assistant
D.H. Gee, PhD, professor
R.H. Haigh, BS, supt, Range & Livestock Research Station, Philip
B.J. Johnson, PhD, assistant professor
J.R. Johnson, PhD, professor
P.S. Johnson, PhD, professor
S.L. Kronberg, PhD, associate professor
Xu Lan, PhD, research associate
D.M. Marshall, PhD, professor
D.C. McFarland, PhD, professor
H.L. Miller, PhD, professor
R.H. Pritchard, PhD, professor
R.J. Pruitt, PhD, professor
P.J. Schlobohm, BS, research assistant
A.L. Slyter, PhD, professor
R.K. Swan, BS, supt. Antelope Range Livestock Station, Buffalo
R.C. Wasson, Jr., MS, research associate/sheep research unit supervisor
D.M. Wulf, PhD, assistant professor

Biology/Microbiology

C.R. McMullen, PhD, professor and head
B.H. Bleakley, PhD, associate professor
T.M. Cheesbrough, PhD, associate professor
W.R. Gibbons, PhD, professor
N.H. Granholm, PhD, professor
M.B. Hildreth, PhD, professor
D. Hurley, PhD, associate professor
R.N. Reese, PhD, professor
R.R.R. Rowland, PhD, associate professor
N.H. Troelstrup, Jr., PhD, associate professor
C.A. Westby, PhD, professor
Y. Yen, PhD, assistant professor

Chemistry/Biochemistry

J.A. Rice, PhD, professor and head
N.A. Anderson, BA, research assistant II
D.P. Evenson, PhD, professor
L.K. Jost, MS, research assistant II
H. Kayongo-Male, PhD, professor (joint appt with Bio/Micro)
D.P. Matthees, PhD, professor
D.C. McFarland, PhD, adjunct professor
I.N. Sergeev, PhD, assistant professor
N.J. Thiex, MS, associate professor
T.P. West, PhD, professor

Dairy Science

J.G. Parsons, PhD, professor and head
R.J. Baer, PhD, professor
H.H. Bonnemann, MS, instructor/dairy plant manager
R.I. Dave, PhD, assistant professor
D.R. Henning, PhD, associate professor/Alfred Chair

A.R. Hippen, PhD, assistant professor/David H. Henry Sustained Professorship
K.M. Kasperon, BS, research assistant II
V.V. Mistry, PhD, professor
D.J. Schingoethe, PhD, professor
G.A. Stegeman, MS, instructor/dairy farm supervisor

Economics

R.C. Shane, PhD, professor and head
D.W. Adamson, PhD, associate professor
M.K. Beutler, PhD, professor
T.L. Dobbs, PhD, professor
W.D. Ellingson, BS, instructor
S.W. Fausti, PhD, associate professor
D.R. Franklin, PhD, associate professor
L.L. Janssen, PhD, professor
N.L. Klein, PhD, assistant professor
C.E. Lamberton, PhD, professor
B.A. Qasmi, PhD, assistant professor
E. Van der Sluis, PhD, assistant professor

Family & Consumer Sciences

L.S. Nichols, PhD, professor and dean
S. Gardner, PhD, assistant professor
M.K. Helling, PhD, associate professor and head
P.G. Krishnan, PhD, associate professor
N.N. Lyons, MS, assistant professor
M.A. Swanson, PhD, professor and head
C.Y. Wang, PhD, associate professor

Horticulture, Forestry, Landscape & Parks

P.R. Schaefer, PhD, professor and head
S.E. Boettcher, MS, research associate
M.E. Enevoldsen, MS, research associate
N.P. Evers, BS, instructor
A.Y. Fennell, PhD, associate professor
W.C. Johnson, PhD, professor
K. L. Mathiason, MS, research assistant
L.C. Schleicher, PhD, assistant professor
R.L. Stubbles, PhD, professor

Plant Science

D.J. Gallenberg, PhD, professor and head
P.B. Beauzay, MS, research associate I
D.L. Beck, PhD, professor/Dakota Lakes Research Farm manager
R.K. Berg, Jr., PhD, associate professor/SESD Research Farm manager
B.H. Bleakley, PhD, associate professor
A.G. Bly, MS, research associate II
A.A. Boe, PhD, professor
R.R. Bortnem, MS, research associate II
E.T. Butler III, PhD, adjunct associate professor
C.G. Carlson, PhD, professor
C.D. Carter, PhD, associate professor
T.E. Chase, PhD, associate professor
S.M. Christopherson, BS, research assistant II
D.E. Clay, PhD, associate professor
S.A. Clay, PhD, professor
J.J. Doolittle, PhD, associate professor
M.M. Ellsburly, PhD, adjunct associate professor (USDA/ARS)
B.G. Farber, MS, research associate III/Central Research Station manager
P.E. Fixen, PhD, adjunct associate professor
B.W. Fuller, PhD, associate professor

R.H. Gelderman, PhD, professor/Soil and Plant Analytical Lab manager
K.A. Grady, MS, assistant professor
L.A. Hall, MS, research associate II
R.G. Hall, PhD, professor
T.L. Hall, BS, research assistant II
L. Hammack, PhD, adjunct assistant professor (USDA/ARS)
S.A. Hansen, MS, research associate I
L.S. Hesler, PhD, adjunct associate professor (USDA/ARS)
J.A. Ingemansen, MS, manager, Foundation Seed Stocks
Y. Jin, PhD, assistant professor
P.J. Johnson, PhD, associate professor
A.L. Kahler, PhD, adjunct professor
S.A. Kalsbeck, MS, research associate I
R.W. Kieckhefer, PhD, adjunct professor (USDA/ARS)
J.A. Koepke, MS, research assistant II
R.A. Kohl, PhD, professor
M.A. Langham, PhD, associate professor
M.J. Lindstrom, PhD, adjunct associate professor (USDA/ARS)
Z. Liu, MS, research associate II
R.S. Little, M S, research assistant II
D.D. Malo, PhD, distinguished professor/Biostress Center of Excellence director
W.C. Moldenhauer, PhD, adjunct professor (USDA/ARS)
A.E. Olness, PhD, adjunct associate professor (USDA/ARS)
D.T. Olson, MS, assistant manager, Seed Certification Service
J.L. Pikul, Jr., PhD, adjunct professor (USDA/ARS)
R.J. Pollmann, MEd, associate professor, manager, Seed Certification Service
C.L. Reese, MS, research associate I
D.L. Reeves, PhD, professor
D.H. Rickerl, PhD, professor
J.R. Rickertsen, MS, research associate II
W.E. Riedell, PhD, adjunct associate professor (USDA/ARS)
J.C. Rudd, PhD, associate professor
R.G. Rudd, BS, research assistant I
J.A. Schumacher, MS, research engineer
T.E. Schumacher, PhD, professor
R.A. Scott, PhD, associate professor
K.L. Skroch, BS, research assistant I
J.D. Smolik, PhD, professor/Northeast Research Farm manager
C.E. Stymiest, MS, associate professor
F. Sutton, PhD, associate professor
M.E. Thompson, BS, extension/research assistant I
E.B. Turnipseed, PhD, associate professor/Seed Testing Lab manager
Z.W. Wicks III, PhD, professor
H.J. Woodard, PhD, associate professor
X. Zhang, MS, research associate I

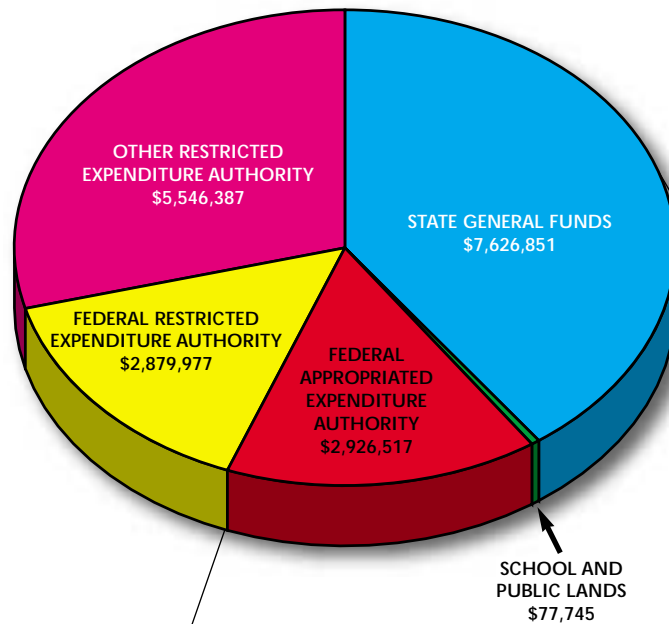
Veterinary Science

D.H. Zeman, DVM, PhD, professor and head
D.R. Baker, BS, research assistant
D.A. Benfield, PhD, professor
C. Chase, DVM, PhD, associate professor
J. Christopher-Hennings, DVM, MS, assistant professor
W.B. Epperson, DVM, MS, associate professor
D.H. Francis, PhD, professor
M.B. Hildreth, PhD, professor
L.D. Holler, DVM, PhD, assistant professor
D.J. Hurley, PhD, associate professor
D.D. Johnson, DVM, PhD, professor

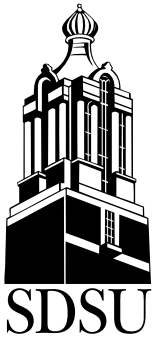
| | | | | | |
|--|--|-------|---|--|---|
| R-238 | Impact of technology on rural consumer access to food and fiber products; Lyons | H-078 | Genetics of fungal pathogens of row crops; Chase | S-991 | Gallenberg |
| R-306 | Stages-of-change model to promote consumption of grains, vegetables, and fruits by young adults; Swanson | H-079 | Sunflower breeding and testing | S-992 | Seed certification; Pollmann |
| | | H-086 | Alternative oilseed crops; Grady | S-993 | Seed testing; Turnipseed |
| | | | Site specific farming to increase farm profitability and to enhance environmental quality; Carlson | S-994 | Variety testing; Hall |
| | | H-094 | Winter wheat breeding and genetics; Haley | S-995 | Survey entomologist; Fuller |
| | | | Correlation, calibration, and interpretation of soil and plant tests; Gelderman | | Foundation Seed Stock; Ingemansen |
| Horticulture, Forestry, Landscape & Parks | | | | Rural Sociology | |
| MS-028 | Trends impacting forest production and forest recreation: 2010; Stubbles | H-095 | Soybean breeding, genetics, and production; Scott | H-097 | SDSU Census Data Center; Satterlee |
| MS-048 | Restoring riparian woodland in agroecosystems of the Northern Great Plains; Johnson | H-108 | Breeding perennial grasses and legumes for forage, wildlife habitat, and tolerance to stresses; Boe | Station Biochemistry | |
| H-137 | Dormancy and stress response of deciduous fruit crops; Fennell | H-117 | Forage production, quality, and persistence; Kephart | H-049 | Analysis of pesticides and related substances; Matthees |
| R-177 | Rootstock and interstem effects on pome and stone fruit trees; Fennell | H-118 | Weed management in conventional and alternative cropping systems; S. Clay | H-067 | Production of value-added, corn based microbial gums; West |
| H-198 | Evaluation, selection, and management of turfgrass species/cultivars by geographical region in South Dakota; Schleicher | H-126 | Prediction of economic return from mechanical treatment of rangeland natriborolls; Kohl, Kronberg, Humburg, Beutler | H-074 | Enzymatically mediated organic reactions; Matthees |
| H-216 | Root and crown hardiness of ornamental herbaceous perennials; Harbage | R-128 | Supplemental information support for pesticide use in minor crops; S. Clay | H-179 | Calcium and vitamin D regulation of cellular processes in domestic livestock and poultry species; Sergeev |
| MS-239 | Evaluation of native and introduced trees and shrubs for South Dakota in relation to their growth on varied soils in urban landscapes; Evers | H-138 | Wireworms of the Northern Great Plains; Johnson | H-225 | Automated cytometry of sperm quality; Evenson |
| R-258 | Freeze damage and protection of horticultural species; Fennell | H-146 | Precision farming: managing N stress to reduce environmental impacts and maintain profitability; D. Clay | S-996 | Analytical services; Thiox |
| | | H-156 | Pedology information transfer from South Dakota agriculture and environment; Malo | Veterinary Science | |
| Plant Science | | | | SD-9602270 | Envelope proteins of PRRSV and their role in antigenic variation; Nelson, Hennings |
| SD-9603834 | Agroeconomic impacts of wetlands in the prairie pothole region; Rickerl, Janssen, Johnson | H-159 | Soil management for improved soil quality and reduced biostress; T. Schumacher | AH-175 | Development and evaluation of new diagnostic methods; Holler, Johnson |
| SD-9603940 | Integrated systems management of watersheds for economic and environmental integrity; D. Clay, S. Clay, Helder, Woodson | H-169 | Etiology and epidemiology of plant viruses in South Dakota; Langham | AH-176 | Effect of dietary supplementation on colonization by enteropathogenic bacteria; Francis |
| G-017 | Site specific integrated pest management; S. Clay | H-178 | Corn genetics, physiology, and breeding; Wicks | AH-206 | Improved diagnostic methods for bovine respiratory and enteric viral diseases; Benfield, Chase |
| H-038 | Nutrient recycling in crop rotations; Woodard | H-188 | Fate and transport of waste components when land-treated; Doolittle | H-256 | Reproductive wastage in livestock and zoonotic risk assessment; Holler, Epperson, Thomson |
| H-045 | Tillage and crop rotations for eastern South Dakota; Berg | H-195 | Molecular genetics and transformation of oilseed crops; Carter | R-296 | Bovine respiratory disease: risk factors, pathogens, diagnosis, and management; Chase, Epperson |
| R-055 | Characterizing nitrogen mineralization and availability in crop systems to protect water resources; D. Clay | H-197 | Biological control of foliar and head diseases of wheat; Bleakley | R-357 | Enteric diseases of swine and cattle: prevention, control, and food safety; Francis, Benfield, Hildreth |
| R-057 | Forage crop genetics and breeding to improve yield and quality; Boe | R-199 | Persistence of Heterodera glycines and other regionally important nematodes; Smolik | Wildlife and Fisheries Sciences | |
| H-058 | Ecological and alternative management considerations for corn rootworms in the Northern Great Plains; Fuller, Boetel | H-218 | Management of eroded soils for enhancement of productivity and environmental quality; T. Schumacher, Lindstrom | H-016 | Management alternatives for South Dakota ponds and small lakes; Brown, Scalet |
| H-066 | Studies of host-parasite interactions between wheat and its fungal pathogens; Jin | H-227 | Nondestructive freeze test using thermoelectric cooling; Sutton | MS-046 | Wild turkeys in South Dakota's prairie woodlands; Flake |
| H-068 | Spring wheat breeding and genetics; Rudd, Jin | R-236 | Plant germplasm and information management and utilization; Boe | H-157 | Strategies for minimizing winter depredation by white-tailed deer; developing lure forages; Jenks |
| R-075 | Biological and ecological basis for weed management decision support systems to reduce herbicide use; S. Clay | G-247 | SD NAPIAP 1998 pesticide database maintenance and current application methodologies; S. Clay | H-158 | Human, habitat, and biotic influences on panfish populations; Willis |
| H-077 | Development and utilization of oats and rye adapted in South Dakota; Reeves | H-248 | Diversifying crop rotations; Beck | S-963 | South Dakota Cooperative Fish and Wildlife Research Unit; Berry, Higgins |
| | | H-257 | Agricultural wetland management; Rickerl, Janssen, R. Johnson | | |
| | | H-276 | Alternative methods of meeting conservation compliance; Stymiest | | |
| | | S-957 | Plant Science farm; Kohl | | |
| | | S-958 | Plant Science greenhouse and seedhouse maintenance; | | |

Operating Budget

South Dakota Agricultural Experiment Station Fiscal Year 2000



| | | |
|--------------------|---------------------|--------|
| Salary & Benefits | \$9,262,143 | 87.12% |
| Operating Expenses | \$1,368,970 | 12.88% |
| TOTAL | \$10,631,113 | |



SOUTH DAKOTA STATE UNIVERSITY

College of Agriculture and Biological Sciences
Agricultural Experiment Station
Brookings, SD 57007
Kevin Kephart, Director

Non-Profit Org.
US Postage
PAID
Brookings, SD
Permit 24

Publication

Change Service Requested

Popular publications from the
ABS BULLETIN ROOM

1-800-301-9293
sdsu_bulletinroom@sdsu.edu



FS 905, FREE



B 732, \$34⁹⁵



B 566 (rev.), \$17⁹⁵



B 733, FREE



FS 902-A, FREE