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Farm & Home **RESEARCH**

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

Volume 52 • Number 1 • 2001



2000 Annual Report

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People, projects, and budget of the Agricultural Experiment Station for 2000



Volume 52 • Number 1 • 2001

South Dakota State University

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5,700 printed by the AES at a cost of ? each.

On the cover:

Lon Hall, research associate in Plant Science, combines his plots of hullless oats in the agronomy plots northeast of campus.

Director's Comments

Thank you for taking time to read this issue of *Farm and Home Research*, which contains our annual report for 2000. We believe it is important to present this overview of our activities so that you can have a better understanding of our people and programs.

In this issue of our magazine you will find broad descriptions of research activities being conducted in our departments, service laboratories, and off-campus research stations. Scientists in the Agricultural Experiment Station (AES) conduct research that serves the diversity of enterprises found in South Dakota. We also provide analytical services so that any citizen can obtain reliable and punctual information on their soils, seeds, water, crops, livestock, milk, and food products.

Activities at each of the nation's agricultural experiment stations are categorized among five national goals. We work within this framework:

- Goal 1** An agricultural system that is highly competitive in the global economy.
- Goal 2** A safe and secure food and fiber system.
- Goal 3** A healthy, well-nourished population.

- Goal 4** Greater harmony between agriculture and the environment.
- Goal 5** Enhanced economic opportunity and quality of life for Americans.

Scientists in our Agricultural Experiment Station are becoming increasingly successful in obtaining grants to support their research. A major source of these funds is check-off programs provided by commodity and livestock producers. To be most applicable to South Dakota farms and ranches, agricultural research needs the inputs of commodity groups, the cooperation between land-grant universities and federal and state agencies, and the assistance of individual farmers and ranchers. To all of you, for expressing your comments and for your financial support: thank you.



Additionally, AES scientists continue to make valuable contributions to scientific knowledge through publication of their work in journals, bulletins, abstracts, and books. Anonymous panels of their peers in other states review many of these. A listing of last year's publications may be obtained on the Internet at <http://www.abs.sd-state.edu/abs/aes.htm>

The strength of our research is in its purpose to serve South Dakota agriculture, rural families, and communities. Once again, thank you for opening this issue. I hope you enjoy it. □

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AgBio Communications

Agricultural communications units are unique to land-grant universities. Our writers and editors help integrate the work of the Agricultural Experiment Station (AES) and the Cooperative Extension Service (CES) 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 consumer science research accurately and clearly.

Significant changes and accomplishments in 2000 that supported the research and Extension missions of the College of Agricultural and Biological Sciences—

- A redefined and broadened mission that included adding “Bio” to the unit's name to reflect the biological sciences. AgBio Communications has combined, from a functional standpoint, with Agricultural Information Technology (Mike Adelaine, director) to ensure that the two units evolve together as advances in technology are adapted to the land-grant communications mission.
- *Farm & Home Research*, the quarterly magazine you are reading, is the flagship publication of the AES. 2000 was its 51st year of publication.
- *Biotechnology*, a tabloid-style publication funded through a legislative appropriation in support of biotech research projects, was initiated and published by AgBio Comm Editors Barbara Hartinger and Mary Brashier working with a team of scientists and CES specialists from

the Plant Science and Biology / Microbiology departments. The first issue explained the science of making a transgenic plant, answered frequently asked questions, highlighted agricultural biotechnology applications and current SDSU projects, and discussed bioethics using the Starlink® case as a point of departure. This first in a series on biotechnology will be followed by three more issues in Spring 2001.

- Two AES and CES publications are of special note: **Bulletin 734, Guidelines for Restoring and Creating Wetlands Associated with Highway Projects in South Dakota**, a collaborative publishing effort by the Cooperative Fish and Wildlife Research Unit, is a four-color, multi-agency publication intended for nationwide use. **Extension Circular 904, Shrubs for South Dakota**, a full-color, 110-page guide with photos and descriptions of a wide variety of plants for the home landscape, was a collaborative publishing effort by authors representing the horticulture, forestry, and biology disciplines in AES and CES.
- The Black Hills and grassland plant field guide bulletins published in 1999 were the subject of a display — Northern Plains Ecosystems: A Pictorial Study, A Partnering Success — accepted for the 2000 Uni-



Amy Klein, ag journalism senior from Flandreau, prepares exhibit materials for AgBio Communications. Exhibits are a growing part of the educational media arm of the College of Agriculture and Biological Sciences.

versity Agricultural Science Exhibition and Reception in Washington, D.C. The 3 x 8 foot, full-color display was designed by Barbara Hartinger.

- A total of 492,228 print publications — free and for-sale AES, CES, and 4-H — were distributed by AgBio Communications through the ABS Bulletin Room.
- At least 100,000 subscribers to the farm, ranch, and agribusiness press were reached through 350 AES and CES articles produced and distributed by AgBio Communications Ag News Editor Jerry Leslie. Leslie also was a contributing author for *Farm & Home Research*.

To receive SDSU agricultural research and Extension publications, ask at your county Extension office or order them from the ABS Bulletin Room, (605) 688-5628. All new free-distribution publications also are available via internet at <http://www.abs.sdstate.edu/abs/agpublications.htm> □

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Agricultural & Biosystems Engineering

Scientists in the Agricultural and Biosystems Engineering Department conduct livestock related research in three different areas.

At the Southeast South Dakota Research Farm near Beresford, Steve Pohl is judging the effects of environmental conditions on growing pigs. His work allows the producer to more accurately assess benefits vs. costs of spending time and money to control the environment in swine buildings.

He has also measured the response of the pig's immune system to different temperatures and ventilation rates. In some situations, high ventilation rates to cool pigs in hot weather may be counterproductive to their good

health and weight gain. He also showed that weight gain of pigs was not reduced and feed intake was not increased by allowing temperatures to fall to 50 degrees F when compared to pigs maintained at 70 degrees F.

Gary Anderson is designing a photobioreactor, a device that uses algae to control odors and dispose of livestock waste. The engineering challenge is

to design a system that is compact enough to be economically feasible for a livestock confinement operation. He will begin testing a full-sized unit this spring.

Mylo Hellickson is developing a prototype system that will reduce odors and dust in swine ventilation air. If these projects are successful, emissions from livestock housing could be substantially reduced, allowing swine production to exist in greater harmony with neighboring home dwellers.

At the other end of the food chain, James Julson and K. Muthukumarappan are using non-thermal methods to improve food safety, specifically, ex-

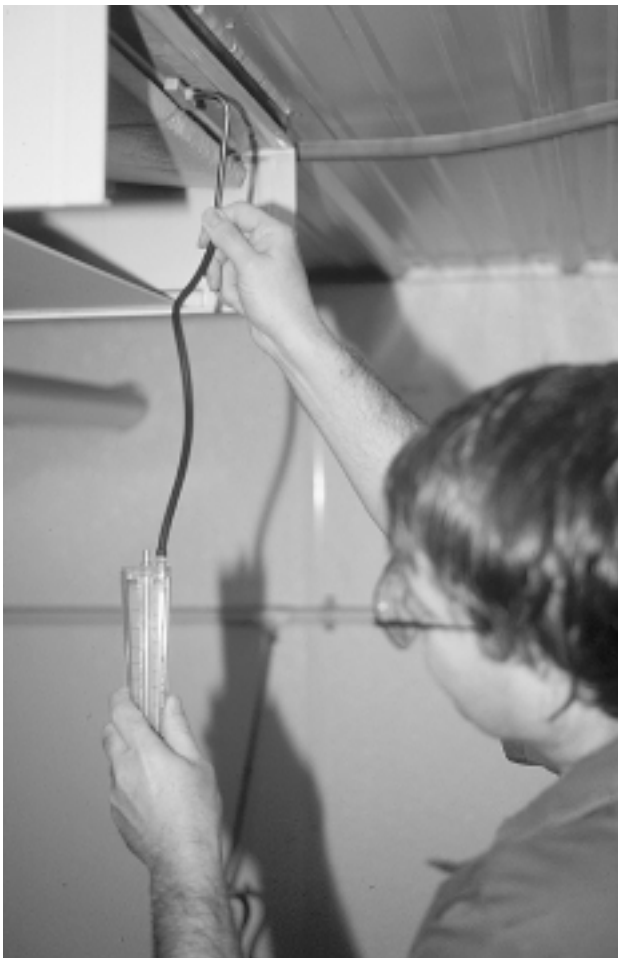
perimenting with several ways to use ozone and irradiation to reduce microbial populations in ground and packaged meat. The goal of this research is to reduce the use of chlorine and other chemicals while providing the consumer a safer meat product. They are also studying microstructure of cheeses to determine how it affects softening and melting for different end uses. Understanding the physicochemical parameters that affect the melt behavior of different cheeses at elevated temperatures is a first step in increasing the use of cheese in prepared foods.

Field research performed by the Agricultural and Biosystems Engineering Department ranges from high in the sky to deep in the ground. Dan Hamburg is using satellite images to predict sugar content in growing sugar beets, work which is now leading him to predict the amount of gluten in wheat from satellite images.

Hal Werner, with the support of the Farm Bureau, South Dakota Soybean Research and Promotion Council, and South Dakota Corn Utilization Council, has developed an extensive bibliography on water management issues centered around drainage and wetlands. From this study have come several projects studying water management practices in South Dakota.

New faculty member Todd Trooien will be expanding this work when he measures lateral soil hydraulic conductivity. His results will help producers refine management practices that maximize yields while reducing the potential for leaching or runoff. □

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Steve Pohl checks inlet air velocity in a grow-finish room at the Southeast Research Farm. The engineers says that temperatures and ventilation rates affect pigs' weight gain, feed intake, and immune systems.

Animal & Range Sciences

Six scientists have joined the Department of Animal and Range Sciences this year. They are Rob Maddock, meat science, teaching and research, Ph.D., Texas A&M University; Hans Stein, swine nutrition, teaching and research, Ph.D., University of Illinois; Barry Dunn, range livestock production, teaching and Extension, Ph.D., SDSU; Emilie Campbell, molecular genetics, research and teaching, Ph.D., Texas A&M University; Cody Wright, Extension beef specialist, Ph.D., North Carolina State University; and Trey Patterson, Extension beef specialist, Rapid City, Ph.D., University of Nebraska.

These very talented individuals complement our faculty very well.

Scott Kronberg and Brad Johnson are pursuing other career opportunities.

Lowell Slyter retired January 31 after 30 years of service to SDSU and the South Dakota sheep industry. Jim Johnson has announced his plans to retire this summer after many years of working with youth, ranchers, and other resource managers. We appreciate the contributions these four men made at SDSU, and we wish them well with their future endeavors.

Two of our academic programs changed this year.

A revitalized range science major features three new emphasis areas (range livestock production, range ecology, and range resource management) which have already brought new students into the major.

The new Master of Science in Animal Sciences was also introduced this fall. This is a multi-departmental program

with emphasis areas in nutrition; genetics and reproduction; meats, muscle biology and growth; range science; and veterinary science. Our graduate student numbers are increasing, and we expect our graduate program will continue to grow with the addition of the new faculty.

Our undergraduate students continue to excel, both on and off campus.

Jeff Spark, a senior from Spencer, Iowa, is president of the SDSU Student Association. Our meats, livestock, and wool judging teams, as well as our quadrathlon, range plant ID, and undergraduate range management exam teams have all had very competitive years.

Student placement continues to be very good with excellent starting salaries for our graduates. If you know of prospective students, please let us know so we can contact them about the outstanding opportunities that SDSU can provide.

Our alumni and friends have been very supportive through gifts, participation, and other generous acts. With their help, we were able to award over \$50,000 this year in departmental scholarships. Support from our commodity groups and gifts to the program have greatly enhanced our research, teaching, and Extension efforts, and this support has been valuable in recruiting new faculty and strengthening our programs. We appreciate the generosity of all donors. □

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Biology/Microbiology

Research in the Biology / Microbiology Department ranges from characterization of DNA sequences to characterization of eastern South Dakota lakes and streams and from work that lays the groundwork for new tools to fight disease in animals, agricultural crops, and humans to best management practices that will improve the health of lakes and streams.

After inoculating wheat plants in a field disease nursery with certain bacterial strains, Martin Draper, Plant Science Department, and Bruce Bleakley have found that some of the bioagents reduced development of *Fusarium* head blight. Bleakley and a graduate student have also begun sampling semipermanent prairie pot-holes to learn more about soil microbial communities. Soil/sediment cores were sectioned by depth, and then bacterial DNA was extracted and purified from the samples.

Bill Gibbons has been developing a value-added product from condensed corn solubles. The product may be used as a soil binder in erosion control. This would enhance the value of corn solubles and improve the economics of dry mill ethanol plants.

Neil Reese has collected and evaluated the horticultural, agronomic, and pharmaceutical potential of over 100 plants native to the Northern Great Plains. Germination protocols were developed for many of the species, and about 30 species were planted in test gardens at the Oak Lake Field Station and in Brookings. The object of this work is to improve agricultural practices for the commercialization of perennial herbs.

Raymond Rowland is investigating the molecular mechanisms of viral persistence and virulence caused by porcine reproductive and respiratory syndrome (PRRS) virus, the number-one disease challenging swine producers throughout the world. The results from this research have a direct impact on the control and eradication of PRRS, as they will lead to development and application of diagnostic assays, development and use of drug and immunotherapies, and design of vaccines.

In the Environmental Biology Research Program, Nels Troelstrup and Aaron Larson have completed the Bachelor Creek Assessment Project.

They have identified critical areas in need of best management practices to protect water quality within the watershed. The Moody County Conservation District will implement these strategies.

A 3-year project identifying water quality problems and corrective strategies for the cooling pond of the Ottertail Power Plant in Milbank has been concluded by Troelstrup and Amy Gronke. Their research indicates a linkage between number of overwintering waterfowl, nutrient concentrations, and algal composition within the cooling pond.

In greenhouse trials, Yang Yen has confirmed aphid resistance in a transgenic wheat line developed by Tom Cheesbrough. He has also worked with Catherine Carter of the Plant Science Department to transfer two different transgenes into soybean tissue cultures. These experiments gave rise to several transgenic plantlets that are currently being grown to maturity for gene analysis. □

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Chemistry/Biochemistry

Agriculture in South Dakota and throughout the U.S. will feel the impacts of research conducted this past year in the Department of Chemistry / Biochemistry.

Don Evenson and Igor Sergeev explored factors leading to reduced fertility and reproductive success in cattle.

Evenson and his group recorded data that lend support to his hypothesis: that abnormal chromatin structure, as measured by the Sperm Chromatin Structure Assay which he developed, is primarily due to the presence of DNA strand breaks. There is strong support from this research that if more than an estimated 25% of sperm in a semen sample have an altered chromatin structure, the resulting embryo will not survive through a full-term pregnancy. The research also indicates that summer heat stress may produce chromatin damage above this threshold level.

Sergeev's group developed sensitive, high-resolution digital cellular imaging methods for studying calcium (Ca^{2+}) signaling and programmed cell death (referred to as apoptosis) in bovine oocytes, embryos, and sperm. Their data indicate that a sustained increase in intracellular Ca^{2+} may trigger premature termination of embryonic development.

This strongly suggests that intracellular Ca^{2+} is a critical regulator of embryonic development in cattle, particularly during the very early stages of development, a period when establishing cellular communication is crucial for embryonic survival. Optimization of Ca^{2+} signaling (e.g., with vitamin D) may help to decrease early embryonic mortality and promote

normal early development of bovine embryos.

Tom West continues to explore ways to increase corn-based production of the commercially useful microbial polysaccharides pullulan and gellan.

With corn syrup as the carbon source and hydrolyzed soybean meal as the nitrogen source, he has determined the bioreactor conditions that maximize the production of each polymer. He has also developed a spectrophotometric assay for determining the concentration of gellan in solution. This dye-binding assay measures gellan levels as accurately as the gravimetric method that is currently being used.

Ultimately, corn-based, value-added processes for the large-scale produc-

tion of these commercially useful microbial gums should increase the demand for corn processing co-products, thus increasing corn utilization and elevating the price of corn.

Duane Matthees investigates pesticide-related problems for a variety of private individuals and governmental agencies, specializing in the area of crop injury by herbicide exposure. The Pesticide Analysis Laboratory that he directs is in the process of acquiring a liquid chromatography/mass spectrometer which will give the lab capability to analyze a variety of organic compounds current instrumental techniques do not reveal. □

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Don Evenson reads the fluorescence of sperm cells passing through a counter on the attached computer which instantly plots healthy and damaged cells. He is finding that if more than about 25% of the sperm in a sample have broken DNA strands, an embryo will not survive.

Dairy Science

Our dairy science students are outstanding young people. In 2000, they earned over \$37,000 in scholarships and awards, ranging from \$300 to \$2,500 each.

Entering freshmen students also compete for seven \$500 scholarships. During this past year, discussions with our alumni who are now recruiting graduates for the dairy and food industry resulted in an offer to boost enrollment numbers by providing additional scholarship support to freshmen.

Job opportunities for dairy majors continue to be exceptionally strong with 100% placement and starting salaries of over \$38,000.

South Dakota dairy majors have also been very successful in winning national scholarships. The National Dairy Promotion and Research Board (NDPRB) each year awards 20 \$1,500 scholarships to juniors and seniors across the country who are enrolled in dairy/food science, technology, or marketing programs. It tops that by awarding a \$2,500 James H. Loper Jr. Memorial Scholarship to the single scholar deemed the most outstanding nationally among the 20.

This year, 2000-2001, a full fourth of those prestigious NDPRB scholarships were awarded to five dairy science majors from a single institution, SDSU. One of these was the \$2,500 Loper Memorial Scholarship, the first time an SDSU student has won this top award.

We have new four faculty members:

Ken Kalscheur joined us in October 2000. He is from southern Wisconsin



Of only 20 scholarships awarded by the National Dairy Promotion and Research Board this year, five were captured by SDSU undergraduates. They are, l to r, Arlo Brower, Wolsey; Jonathan Qual, Lisbon, N.D.; Brad Sharp, Bath; Hope Remiger, Wood Lake, Minn.; and Ann Harvey, Ree Heights. Sharp is winner of the top prize, given to the scholar chosen by the Board as the most outstanding among the 20.

and received his Ph.D. from the University of Maryland. His appointment is 66% research and 34% teaching in the area of dairy cattle nutrition.

Darrel Rennie, manager of the dairy research and training facility, started in December 2000. He is from Harrisburg and received his B.S. from SDSU in dairy production in 1990. He had been owner/manager of Rennie Dairy, Harrisburg.

Alvaro Garcia, Extension specialist, started in January 2001. He is from Montevideo, Uruguay, and earned his DVM in Uruguay and Ph.D. from the University of Minnesota in 1997.

Garrett Meyer, dairy plant superintendent, started in September 2000. He is from Pollock and received his B.S. from SDSU in dairy manufacturing in 2000.

Most of the processing equipment and all of the utilities in our dairy plant date from 1961 when the facility

opened. It is becoming increasingly difficult to obtain replacement parts and maintain this equipment. After 40 years of training hundreds of students in dairy processing operations, it is time to upgrade the dairy plant to a state-of-the-art facility.

Banner & Associates of Brookings will prepare cost estimates of the remodeling project. John Linneman, W.M. Sprinkman Corp., has provided cost estimates for the dairy processing equipment. Once the study is completed (early 2001), a fundraising plan will be developed by dairy science faculty and the SDSU Foundation to raise the funds needed.

The residence at the dairy unit north of campus is being remodeled with new windows, floor coverings, and kitchen cabinets. After 35 years the house was in need of updating. □

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Economics

Economic issues in agriculture in the year 2000 were headlined by farm policy changes, value-added enterprises, and transgenic crops. Traditional studies of marketing, finance, labor, profitability, and their impacts on agricultural policy were also continued in the Economics Department.

Tom Dobbs is examining ways to improve the ecological sustainability of South Dakota and U.S. crop systems through public policy initiatives. He recently returned from sabbatical leave at the University of Essex in England where he studied European Union and English farm policy and compared their "stewardship" payments to U.S. policy alternatives.

Evert Van der Sluis has worked on a multi-state project documenting the critical social and economic conditions needed for the successful establishment of value-added new-generation cooperatives. He has established two web sites: One shows how to conduct feasibility studies and write business plans. The second contains

a review of literature on transgenic (biotech) crops. Both can be reached by accessing <http://learn.sdstate.edu/vandersluis/index.htm>

A 10-year crop rotation study evaluating agronomics and economics of two-, three-, and four-crop rotations was completed by Douglas Franklin, who now turns to transgenics and their impact on profitability. Gary Taylor and Nicole Klein will add the economic impacts of transgenics on the production and marketing systems of the food chain.

In commodity research, Klein reports that swine producers leave the industry for reasons other than price, and Scott Fausti documents that the monetary incentive to price fed cattle on the grid has been declining over the past 3 years.

Tonya Hansen has a grant from the South Dakota Department of Revenue for a pilot study assessing agricultural land based on its agricultural income-producing value. Larry Janssen and Martin Beutler have reported the im-

pacts of land values and rental rates on South Dakota farm decision makers and on the economy of the state. Janssen and Matt Diersen described the major structural changes in South Dakota's farm sector during the past 30-40 years and discussed future trends and their implications for farmers, agribusinesses, and state policymakers. Janssen, in conjunction with Diane Rickerl, Plant Science Department, studied the agro-economic impacts of wetlands policy and management on South Dakota agriculture.

Dwight Adamson has compared metro and nonmetro wage structures and the role that wages, amenities, and governmental differences play in migration of labor. Early results indicate that 75% of the 27% wage differential between metro and nonmetro can be explained by more favorable amenities.

Charles Lamberton analyzed the impacts of changes in structure of South Dakota's financial industry on availability of credit to agriculture. Concentration in the banking industry has led to an increase in rural availability of banking services due to branch banks. He found that bank costs would increase with expansion of ag real estate loans, non-interest leasing deposits, and the number of branch banks operated.

Food product trade under NAFTA was investigated by Bashir Qasmi. As a result of NAFTA, the U.S. intra-industry trade with Canada has increased while the U.S. intra-industry trade with the rest of the world has decreased. □

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This is the first year that AES research appointments in the College of Family and Consumer Sciences have spanned all three departments within the College.

Marilyn Swanson, nutrition and food sciences, is a member of a north-central regional project in which scientists from 10 states are investigating young adults' (18 to 24 years) readiness to change their food habits in regard to consumption of vegetables and fruits, targeted because of their health benefits in reducing the risk of heart disease and cancer.

Many young adults said inconvenience was one of the major reasons they did not consume fruits and vegetables. This may be specific to the age group; reasons for not eating produce may be different for older adults.

Preliminary results from Chunyang Wang, foods scientist, indicate that soybeans grown in northern states have higher isoflavone concentrations than those grown in the south. This may be significant marketing information for producers in northern states including South Dakota; it is also useful knowledge for soybean and soy food processors.

College of Family & Consumer Sciences

Several partnerships have been formed to study the potential benefit of soy. Wang is currently cooperating with Augustana College to study the effects of soy on cardiac health, skeletal health, and aerobic fitness. He is also part of the soy and bone health project lead by Sioux Valley Hospital. With Dr. Chris Chase of the SDSU Veterinary Science Department, Wang is exploring possible anti-viral effects of soy phytochemicals. Another study is beginning with SDSU pharmaceutical scientists; this will look at the impacts of soy phytochemicals on brain aging.

Oats represent an underused but extremely nutritious cereal grain. This grain has oils that exhibit unique nutritional properties and food-additive

potential. Dr. Padu Krishnan, food science, is developing a rapid and accurate method of measuring fatty acids and oil concentration in oats.

Nancy Lyons, apparel merchandising, is participating in a north-central regional project, the impact of technology on rural consumer's access to food and fiber products. One specific study area is the effect of e-commerce on rural consumer purchases.

Scott Gardner, human development and family studies, is in the fourth year of a project in which high-school students prepare themselves to resolve adult conflicts and for healthy, lasting marriages. Dr. Gardner contacts former students who have completed marriage education classes to find if they have changed their attitudes. He has also secured funding from the Dibble Fund to gather data from students in other states and compare them with South Dakota students to assess the impact of taking a marriage education curriculum.

Mary Kay Helling, human development, has completed an AES project which examined intergenerational transfer of family farms and ranches. She also studied family inheritance processes as a reflection of family culture. Most families realize the importance of planning for the farm or ranch transfer, yet many lack the resources or delay planning. □

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Horticulture, Forestry, Landscape & Parks

Research in the Horticulture, Forestry, Landscape and Parks Department ranges from the shortest grasses to the tallest trees and from golf courses and gardens to river banks:

Trends in forest production and recreation, examining the economic and environmental factors and trends that have impact on production and recreation in the Black Hills National Forest. Initial work suggests a need to identify and understand the relationship between the increasing development of forest recreation and its impact on forest hydrology. Research findings will provide direction to land managers in efforts to lower the economic and environmental risks to humans and the forest in the face of ever higher demands on this resource.

Growth of native and introduced trees and shrubs in urban landscapes. Urban soils, specifically their influence on tree performance, have received little attention from the tree care profession. The objectives of this new project are to evaluate trees from a variety of sources for superiority in growth, hardiness, habit, and pest resistance; to demonstrate the importance of the soil environment with respect to tree growth; and to identify ways that urban soils can be modified to support maximum tree performance.

Restoring riparian woodlands, a goal of an increasing number of private landowners and land management agencies in the Great Plains. Many of these original woodlands have been



degraded or destroyed by a combination of human actions. Management prescriptions are being developed to restore health to woody riparian zones in western South Dakota rangeland. Research on basic riparian zone structure and function on eastern South Dakota rivers is being expanded. Field experiments along the Big Sioux river will lead to cost-effective methods to restore riparian health. By restoring trees and associated vegetation to formerly wooded areas, landowners and society in general can regain the ecological services provided by healthy riparian areas while maintaining profitable farming and ranching operations.

Cold acclimation, dormancy induction, and winter survival. The timing of dormancy induction and release is important for winter survival and economic production of woody plants. Identification of genes controlling different mechanisms involved in cold acclimation and dormancy induction, maintenance, and release will provide tools for marker assisted plant breeding and testing and selecting for optimal adaptation to climatic conditions of the Northern Plains.

Turfgrasses for South Dakota. Regional differences in stress resistance among turfgrass species and cultivars across the state can be expected, based on past climatological data. Improved buffalograss turf-type cultivars may be an ideal low-input turfgrass for much of South Dakota. Perennial ryegrass also provides an excellent turf, but historical temperature extremes indicate the potential for winterkill, particularly in winters with no snow cover. Species and cultivar response are being studied through the establishment of test plots of cultivars of buffalograss, perennial ryegrass, fineleaf fescue, Kentucky bluegrass, and creeping bentgrass at several locations across the state.

In addition, our scientists participate in regional and externally funded research. Our varied projects underscore our continued commitment to the pursuit of knowledge that will improve the quality of life in South Dakota and the northern Great Plains. □

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Plant Science

During the past year, the Plant Science Department continued its strong record of providing quality teaching, research, Extension, and technical service programs to the citizens of South Dakota, the region, and the nation. We have an excellent balance between long-term, core programs and the capacity to adapt and address new and emerging issues.

Our soybean breeding program made history this year by releasing, through the AES, a variety containing the Roundup Ready® trait. This concluded several years of work to incorporate the trait into a public variety and marked the successful completion of a marketing agreement by which the variety can be produced and distributed through the Foundation Seed Stocks and Certified Seed programs. South Dakota soybean producers in the northern part of the state now have a high-quality, Roundup Ready® variety specifically adapted to their area.

Several faculty members in the department and throughout the ABS College are working on combined research, Extension, and education programs to answer questions and concerns about biotechnology and its role in agriculture today. The group is examining issues of human food and animal feed safety and potential “gene migration” from producer fields. This work has impacts on many fronts, from consumer acceptance to international markets.

Efficient and economical production of crops continues to drive much of our research. How can we achieve greater yields and reduce input costs for producers?

In response, we are studying fertility, pest management, varieties, and other aspects of production. We are

placing more emphasis on crop quality and on niche characteristics such as oil in soybeans and protein in wheat. This is an initial step toward adding value for producers.

We are growing new crops and examining new uses of old crops. An example is the multi-state, multi-agency biomass energy project for switchgrass. This has tremendous potential to provide a revenue source on marginal land in the upper Midwest, and it addresses some very fundamental issues of natural resource management.

The precision farming team highlights important agricultural issues such as production efficiency and natural resource management. From fundamental questions about soil characteristics to specific recommendations on inputs, these scientists are recognized regionally and nationally.

Many faculty in the department are becoming increasingly involved in international agriculture. With their help, students and others at SDSU are becoming more fully aware of the global society in which we live and work. International opportunities often result in personal contacts that lead to exchange agreements and/or market opportunities in the future.

The Plant Science Department, through its faculty, staff, and students, will continue to provide excellent information and programs to producers and other clientele. Critical to that mission is your input. We need to know that we are, in fact, addressing your needs. □

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Lon Hall, research associate in Plant Science, combines his plots of hulled oats in the agronomy plots northeast of campus.

Rural Sociology

Rural Sociology faculty and graduate students initiated three projects during the past year addressing issues of deep concern to rural communities. They are domestic violence; sustainability of farm families and rural communities; and agricultural biotechnology.

Robert Mendelsohn and Anna Netterville, graduate student, began the first phase of a project on domestic violence in rural areas, identifying 27 domestic violence shelters in the state and conducting telephone interviews with the directors on their needs in prevention and intervention programs. A follow-up survey will address four areas: (1) problems facing rural shelters; (2) rural programs; (3) intervention strategies; and (4) community involvement and participation. The goal is to develop, pilot test, and evaluate a model for the reduction of rural domestic violence.

Don Arwood, with the assistance of Susan Meendering, Terry Nelson, and Forrest Sanner, graduate students, is examining the sustainability of rural communities and farm families. The team has conducted surveys and follow-up interviews with farm families from three eastern South Dakota counties. Meendering and Arwood presented preliminary findings at the Great Plains Sociological Association meeting in Bismarck.

Their findings reveal a strong commitment to the farming way of life by the families interviewed. Many spoke about growing up on a farm and their love for the that way of life. They believed the farm is a good place to

raise a family and to teach family values.

On the other hand, they spoke of social changes, a tight financial situation, the need to reduce expenses, deferring medical treatment, discontinuing health insurance, reducing cash outlays, and securing employment off the farm. They lamented declining "neighborliness" and attachment to community. Many perceived that people are too busy, working harder and for longer hours, to spend as much time as they would like with neighbors and friends. Off-farm employment added to the strain of time management but contributed income and employee benefits such as health insurance.

Census data analysis continues. Policy implications will be identified. Summaries of findings will be posted on the Census Data Rural Life Center home page at <http://web.sdstate.edu/departments/soc/socweb7.htm>

A multi-state project was initiated late last year that addresses social, cultural, economic, and ethical issues associated with agricultural biotechnology. A consortium of five land-grant universities and four tribal colleges was funded by USDA's Initiative for Future Agriculture and Food Systems Program (IFAFS) for \$3.7 million over a 4-year period. SDSU is the lead institution, and the department head of Rural Sociology is the



Marcey Moss and Dave Olson, graduate students in the Census Data Center, prepare interpretations of census data for clients from across the state and region.

principal investigator. Others involved from SDSU are Ronald Stover and Kim Mordal, graduate assistant; Catherine Carter and Dianne Rickerl, plant science; Nels Granholm, biology; Carol Pitts, Extension foods and nutrition; and Evert Van der Sluis, economics.

Consortium activities will integrate research, education, and outreach. Scientists will examine determinants of product adoption, consumer behavior, industry response, product regulation, intellectual property rights, and values and ethical considerations in decision-making, diverse cultural perspectives, and producer and consumer attitudes. Findings will be used in developing educational and informational materials for diverse audiences to help them understand benefits and risks.

An annual Bioethics Institute is planned. Annual K-12 teacher workshops will take place at participating institutions. Web pages will be developed across the institutions to deliver materials and information to educators, policy makers, and the general public. □

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Veterinary Science

Our 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 composed of 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. They are complemented by career-service staff with similar specialties and skills in office management, business accounting, word processing and computer programs, animal care, physical facility maintenance, and grounds keeping. Overall, we have an efficient team of animal health experts dedicated to monitoring, discovering, and conducting research on diseases of animals. As always, our strongest effort is directed toward food animal infectious diseases.

Members of our animal health team are also found on farms and ranches. Animal owners who discover problems and hometown veterinarians called in to consult are our partners in staying abreast of new animal disease syndromes. Diagnostic activity of this type can be viewed as "grass-roots research" since it is a sampling of the everyday ebb and flow of animal health issues.

The Extension veterinarian and other laboratory personnel may visit farms and ranches to gather more data. And when serious new problems are identified, they usually require extensive ongoing research. Therefore, our scientists spend a significant amount of their time writing grant proposals for additional research funding from state, regional, and national agencies.

Sharing what we learn is another key part of the research process. Fourteen refereed articles in national publications and 165 other publications

and presentations were offered across the state, region, and nation.

As always, the vast majority of our research is centered on identifying and curing or alleviating natural infectious diseases of animals, especially livestock. Controlling natural disease provides a better life for the animals, enhances the economic viability of the producer, and assures the nation a safe and abundant food supply.

Some examples of research in the SDSU Veterinary Science Department during 2000:

- fetal effects of BVD virus in cattle
- antibody development in fetal and neonatal pigs
- Porcine Reproductive and Respiratory Syndrome (PRRS or the old Mystery Swine Disease) virus infection in boars
- understanding the basic components of the PRRS virus

- identifying cell receptors for *E. coli* that causes scours in pigs and calves
- studies with bovine herpes virus, the cause of IBR
- studies on the neonatal immune system of calves and pigs
- impact of internal parasites in South Dakota beef cattle
- improved diagnostic tests for fetal wastage in livestock
- control of enteric diseases in swine and cattle
- studies on Johne's disease in cattle and bison
- aflatoxin poisoning in mallard ducks
- effects of soybean isoflavones in preventing respiratory disease in cattle. □

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Truston Gilger, animal science major from Boyes, Mont., I, and Mark Braunschmidt, prevet major from Lennox, assist Jane Christopher-Hennings who is designing a diagnostic test that will detect Johne's disease in its early stages.



Wildlife & Fisheries Sciences

A fishery or wildlife system is composed of three interactive components: the biota, the habitat, and the human users.

The biota are the fishes, birds, mammals, reptiles, amphibians, insects, and other animals that are present. Habitat is where the organism lives and includes a nonliving portion (soil, wind, oxygen, water, humidity, etc.) and a living portion (plants). A habitat sometimes is not natural — humans create habitats by activities such as agriculture.

The human component of a fishery or wildlife system is direct, indirect, consumptive, and/or nonconsumptive. Whatever the category, everyone on the planet is a user of fish and wildlife in some form or manner.

For any wildlife and fisheries research program to be effective, research breadth across these three interactive components is a necessity. The SDSU wildlife and fisheries research program addresses issues of most importance to South Dakota. At times, we may concentrate on game or commercially important species; on nongame species; on habitat, either natural or human produced; or on user issues.

Over 50 research studies were conducted within the department during 2000. A representative sample:

Biota dominated studies

- flathead and channel catfish in the James River
- small mammal survey in Wind Cave National Park
- Topeka shiner status
- biology of yellow perch
- disease incidence in deer and elk populations
- ecology of wild turkeys in the Black Hills
- largemouth bass population dynamics
- nongame bird abundance in sagebrush habitats
- larval fish abundance in the Missouri River
- wetland bird abundance
- panfish population quality in small lakes
- monitoring martens and mountain lions in the Black Hills

Habitat dominated studies

- habitat selection by white-tailed and mule deer
- status of fish and habitat in the White River
- energy flow in forested and non-forested floodplain wetlands
- biodiversity in natural and created wetlands
- nutrient availability in Black Hills reservoirs
- waterfowl and nongame bird abundance in wetlands
- biotic integrity of the James River
- plant communities of Missouri River floodplain wetlands

- relationships of habitat and fish communities in small impoundments
- nongame bird and ring-necked pheasant abundance in CRP

User dominated studies

- characterization of Black Hills deer hunters
- impacts of sediment overburden in wetlands
- maintenance and supplemental stocking success of largemouth bass
- winter depredation by white-tailed deer
- entrainment of rainbow smelt through Oahe Dam

It is important to describe the funding sources for the research conducted in the department. South Dakota Agricultural Experiment Station support is important and essential to our research program; it provided 10% of our total research funding in FY 2000. The other 90% was generated by individual faculty members through outside grants and contracts. As is always the case, success revolves around the activities of people — the faculty in wildlife and fisheries sciences continues to excel in serving South Dakota. □

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Oscar E. Olson Biochemistry Labs, Analytical Services

The mission of the Analytical Services Laboratory is to provide unbiased, quality-grade analysis in support of SDSU and South Dakota agriculture; educational opportunities for SDSU students; and research in areas consistent with our analytical services. The laboratory, administratively a part of both the Agricultural Experiment Station and the Chemistry and Biochemistry Department, is managed as two sections. One accepts samples for pesticide analysis and is managed by Duane Matthees. The second accepts animal feed, forage, fertilizer, manure, compost, meat, and water samples and is managed by Nancy Thiex.

In year 2000, a total of 62,169 results were reported by the Analytical Services Laboratory on 12,466 samples:

- state-wide and University non-NIRS, 20,061 tests and 18,89 calculated results on 7,876 laboratory samples
- in-house NIRS, 16,574 constituent and 14,001 calculated results reported on 2051 samples

- Animal Disease Research and Diagnostic Laboratory, 2,122 on 1,049 samples
- State Meat Inspection, 1,137 on 325 samples
- State Feed Inspection, 1,727 on 468 samples
- State Fertilizer Inspection, 567 on 238 samples
- State Remedy Inspection, 87 on 77 samples.

In addition, 2,464 constituent and 1,540 energy calculations were reported on 306 laboratory samples with the NIRS at three remote locations: Miller, Sioux Falls at the National Forage Testing Association Sampling Workshop, and DakotaFest at Mitchell.

Projects related to analytical methodology in 2000 focused on six areas:

- An AOAC collaborative study on a Karl Fischer method for the determination of water in animal feed.
- Method validation and a collaborative study protocol for a Kjeldahl method for N determination using a copper catalyst, boric acid trapping

agent, block digestion, and steam distillation.

- Method validation for the extension of the Randall extraction technique for fat extractions from animal feeds and forage.
- A collaborative study protocol that will include hexane as well as diethyl ether as a solvent for fat extraction.
- A manual, Guidelines for Preparing Laboratory Samples, co-authored for the Association of American Feed Control Officials.
- Extensive, week-long workshops and seminars for chemists from agricultural analytical laboratories, held in Sioux Falls. Attendees were 71 participants representing 22 state labs, USDA, EPA, and Agriculture Canada, 34 participants from industry laboratories, and 24 participants from other laboratories (veterinary diagnostic, university, Canadian Grain Commission, etc). □

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The State Dairy Laboratory at SDSU provides data to the South Dakota Department of Agriculture for possible regulatory action. Finished products, cultured products, single-service containers, plant waters, raw milks from plant silos, and milks for antibiotic residue screening made up the 1,500 samples run during fiscal year 2000.

Standard plant counts, coliform counts, water analysis for MPN values, pasteurization verification, solid and butterfat determinations, and antibiotic residue screening accounted

Dairy Lab

for the 4,600 analyses conducted during the past year.

The Charm II apparatus was upgraded to meet pending changes in the pasteurized milk ordinance. The Charm 6600 uses luminescence as well as scintillation technology. Therefore, we will be able to incorpo-

rate pesticide screening into our test methodologies. In addition, the 6600 is computer linked for upcoming FDA and ISO compliance. □

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As data from the 2000 U.S. Census begin to be released, activity in SDSU's Census Data Center will increase. The Center, located in the Rural Sociology Department, responds to requests for information from constituents across the state. During the past year, requests came from 16 counties in South Dakota, as well as from out of state. The clients who made use of the services:

Requests for data during 2000

| <u>Type of client</u> | <u>Number of requests</u> |
|-----------------------|---------------------------|
| Government | 16 |
| Business | 24 |
| Academic/research | 53 |
| Public/not for profit | 3 |
| Media | 9 |
| Private citizens | 18 |

Marcey Moss, graduate assistant in Rural Sociology, prepared 11 techni-

cal reports, including estimates of population and sub-populations. David Olson, new graduate assistant, adds community development and leadership experience to the Center.

A change is in progress. The Center's function is expanding to provide broader information and services. Other units on campus will participate in the Census Data/Rural Life Center.

Initially, it will be a "virtual center" providing information and services

to clientele who may be at a distance. A home page is being created that will post brief reports on Census data, abstracts of research reports, and brief papers addressing topics of concern to rural South Dakota. Links to other web pages of interest to our rural constituents are also planned. □

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Census Data/ Rural Life Center

Animal Disease Research & 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, animal health professionals, and state/federal regulatory officials. We provide the precise, detailed animal disease information needed by those in charge of managing, treating, and preventing diseases in animals. We are an integral part of the animal health infrastructure working to feed the state, region, nation, and world.

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

tial human diseases, and therefore we play a role in public health as well. During FY 00, the ADRDL received 22,135 requests for laboratory testing and conducted over 462,000 test procedures. Three tests are now on-line to support the state's meat inspection program.

The ADRDL continues to adapt new technology. This year molecular tests for serotyping *E. coli* isolates were added. An automated immunohistochemistry machine was added to identify disease organisms in tissues. Other new molecular tests are in development stages. Continuing to

meet 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 one of only 36 accredited labs in the U.S., and we are proud to be part of the essential infrastructure of the animal/livestock industry. We count it a privilege to serve the citizens of South Dakota through the ADRDL. □

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Food Science Lab

Activities of the Nutrition and Food Science Laboratories in 2000 included considerable effort in food product development and testing for the South Dakota Soybean and Research and Promotion Council (SDRPC). The test kitchen and sensory analysis facilities were used extensively.

A revised cookbook, "Favorites from the Heartland, Second Edition," was published by the SDRPC and featured soy-based recipes. A rapid protein analyzer was used to determine the protein contribution of soy ingredients in the recipes. Food labeling using claims of heart-healthy soy proteins were authorized by the Food and Drug Administration in 1999. Development and testing of confectionary products using soynuts have resulted in shelf-stable candies.

Numerous other analyses for state and regional entrepreneurs were conducted as a service. Products included gourmet mustards, variety honey, gourmet vinegars, foods from Bolivia, and a high-oil oat variety used in livestock feed. □

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Padu Krishnan and Tobin Hoffman, graduate research assistant, examine the unique signature of folic acid on the screen of a mass spectrometer. The instrument identifies compounds in foods by their fingerprints.

Seed Testing Lab

The SDSU Seed Testing Lab provides fast, reliable, and unbiased seed testing. In 2000 we tested over 10,000 seed samples, conducting over 21,000 tests (purity analysis, germination, etc.) for a large and varied clientele.

Approximately 6,600 service samples, 1,540 South Dakota Crop Improvement Association samples, 251 regulatory, and 944 electrophoresis samples were received from clientele. Over 800 research samples for in-house and graduate student research also were tested. Over 200 samples from clients were received for identification only.

Lab personnel participated in national and regional meetings, presenting

talks and workshops at such gatherings as the national Association of Official Seed Analysts convention, Seed Analysts of the Midwest meeting, and Ag Horizons Conference. The lab hosted the May "Seed Analysts of the Midwest" workshop and the 2000 Upper Midwest Regional Collegiate Crops Judging contest. For the fifth year in a row, we prepared and provided 900 seed analysis samples for the Collegiate National Crops Judging Contests held annually in Chicago and Kansas City.

We continue our research into breaking seed dormancy of cereals and native grasses. Electrophoresis research has led to better methodologies for barley variety identification/verifica-

tion, and work continues on switchgrass and wheatgrasses. A student completed her M.S. degree by using the NIRS to determine seed germination, vigor, and other quality indices.

Seed testing staff includes five permanent staff members, one temporary (part-time) analyst, one graduate student, and 10 - 20 student employees who receive training and increase their experience. The lab provided 22 tours to individuals and groups, ranging from elementary school classes to farmers. □

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Soil Testing Lab

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

The laboratory processed and analyzed 11,443 samples representing about 7,200 fields during 2000. Over 40,000 separate analyses were made on these samples. 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 analysis. The lab also processed and analyzed 3,667 soil samples for scientists and 2,132 plant samples during the year.

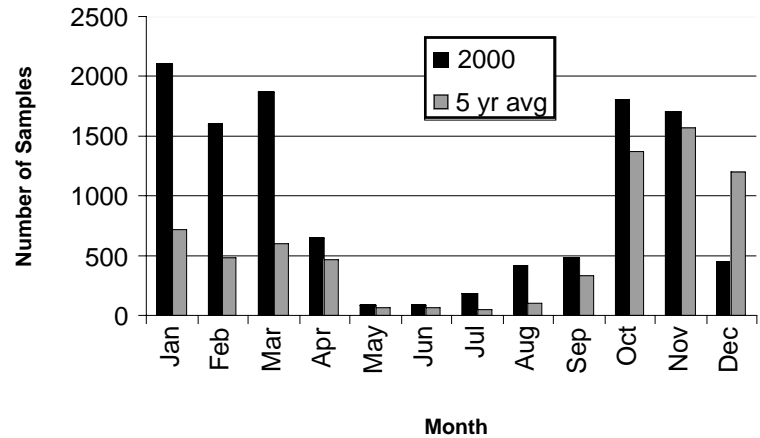
Research in the Soil Testing program centers on developing soil and plant tests that correctly correlate response of field crops to applied nutrients. In 2000, studies were conducted with phosphorus, potassium, and sulfur on corn and soybean, nitrogen and manure on grass, and phosphorus on spring wheat. Several lab studies are done each year to improve accuracy, precision, and efficiency of the lab tests.

Numerous tours of the lab are conducted each year by laboratory staff. Lab personnel present papers, talks, and field topics at state, regional, and national meetings each year. The laboratory participates in the North American Proficiency Testing Program (NAPT) to ensure that test results are accurate.

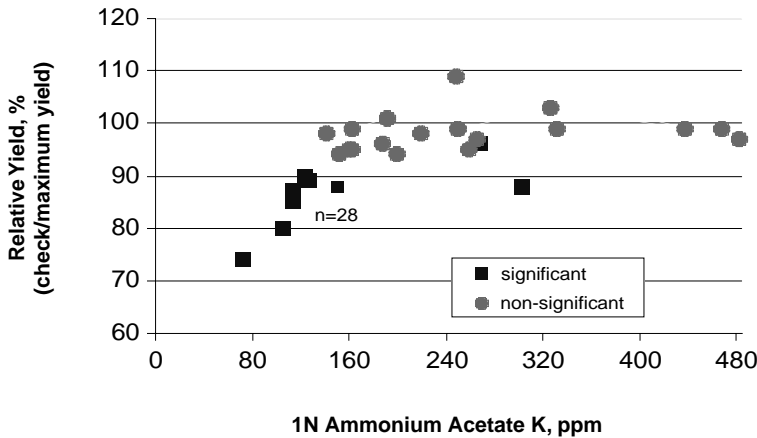
Four issues of the lab's newsletter 'Dakota Dirt' were mailed out to almost 500 agronomy managers and consultants in 2000. □

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SDSU Soil Testing Laboratory—
 Number of samples by month.



Corngrain yield response to added K as influenced by soil test K, South Dakota, 1996-2000.



Water Quality Lab

The Water Resources Institute's Water Quality Lab assisted a greater-than-normal number of livestock producers in 2000 to identify water quality problems. Scant snowfalls in the winter of 1998-99 resulted in little snowmelt in spring 1999. This, combined with a dry summer in 1999, resulted in little dilution of the high salt content in many dams. In several areas, poor livestock health and even deaths were reported.

Problems arising from salty water were not restricted to western South Dakota. Samples with total dissolved solids (TDS) concentrations in excess of 10,000 ppm were found in the eastern part of the state. Waters with TDS concentrations that high are not recommended for any use. Other samples from both eastern and western South Dakota indicated very good quality water.

The Water Quality Lab supports research. Pat Johnson, SDSU range scientist, is examining how a marginal water source affects herd health and production. The Water Quality Lab will provide testing services for this project for the next 3 years.

The Institute also provides educational hands-on opportunities to SDSU students. This year, Mary Grosland conducted phosphorus analysis in support of two Total Maximum Daily Load (TMDL) projects quantifying pollutant loads in parts of the Big Sioux River. These studies are supported by the East Dakota Water Development District as part of a statewide TMDL effort identifying sources of pollutants that restrict beneficial uses of water bodies in South Dakota.

In 2000, the Water Quality Lab also provided analytical services to other

research projects, homeowners, irrigators, feed suppliers, fish producers, nurseries, and heat pump dealers. Producers with questions about the quality of their livestock waters should contact their local county Extension educator or the Water Quality Lab at 688-4211. □

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Dakota Lakes Research Farm

Long-term research programs at the Dakota Lakes Research Farm focus on efficient and sustainable no-till crop production. The staff at Dakota Lakes also assisted scientists from SDSU and the USDA-ARS working at the farm.

The 2000 growing season was one of the driest in history with only 9.47 inches of total precipitation from October 1, 1999, to October 1, 2000. Growing season precipitation was nearly 2 inches less than that in 1988. Temperatures were also warmer than normal, especially in July and August. These conditions provided the opportunity to study no-till systems under unusually high levels of water and heat stress.

The water-conserving characteristics of no-till benefited both dryland and irrigated fields. Winter wheat yields were excellent (some over 80 bu/A) where it was grown in good rotations. This performance can be traced to conserved water from late summer (August 1999) rainfall.

Spring wheat and other cool-season crops (peas, canola, etc) did much better than expected, in light of the fact that they followed high water-use crops and had little rain during their growth cycle. Summer crops varied in yield depending on previous crop, soil type, and no-till history.

Dormant seeding of spring wheat worked well again this year. Wheat

keeps its growing point below ground level until late spring and so did not freeze. Dormant-seeded canola was only successful in heavy residue. Canola in other situations emerged early in the spring and was killed by a late April freeze.

Please visit our web page for complete results and analysis, new publications, and some downloadable presentations. Or contact your local Extension educator. □

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Southeast South Dakota Research Farm

Low soil moisture after the 1999 crop and below normal spring and early summer precipitation resulted in moderate to poor production this season for many crops. Annual rainfall was only 2 inches below (92% of) normal, but growing season precipitation was 4.7 inches below (75% of) normal. Cool-season small grains, the first cutting of alfalfa, and some row crops were poor in some tests.

Nearly 30 scientists conducted a wide variety of crop and livestock research and demonstration projects at the farm during 2000.

Weed control research and demonstration studies and crop variety tests for alfalfa, corn, and soybeans (including Roundup Ready® germplasm for row crops) were established. We completed the 10th year of production and economic performance of our tillage and crop rotation project. Specialty crops (high-oil, *Bt*, and white corn and soybeans that provide protection against phytophthora root rot), soil fertility research, and site-specific farming using global positioning technology were examined. The

relative amount of soybean defoliation was measured through aerial imagery.

Soybean cyst nematode was confirmed on the station for the first time this year. Possible bean pod mottle virus symptoms were commonly seen in our soybean fields again this season. We measured impact of potato leafhopper on newly established alfalfa and the effects of gray leaf spot, Stuart's wilt, and other diseases on corn. The effectiveness of Rhizobium inoculants and several seed treatments on soybean were also investigated.

Beef cattle scientists evaluated possible interactions between high-oil corn (HOC) and implants in calf-fed feedlot finishing rations. Feedlot performance associated with different calving and weaning strategies continued.



Reduced dust levels associated with HOC might help delay the spread of respiratory diseases in grow-finish swine operations. Performance and economics of raising pigs in a hoop barn during the winter and early spring were also measured. □

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West River Ag Center, Rapid City, noteworthy projects for the year 2000 included:

- response of western wheatgrass tillers to grazing (three studies)
- effects of water quality on cattle production
- economic impacts of agriculture on the state's economy. In 1999, impact increased \$1.6 billion from the previous year to \$16.3 billion.
- continued assistance to the retail distribution network of two AES plant field guides
- CES educator training — three field days and seven multiple site video conferences
- preparation for a SARE-funded program for CES and NRCS staff in-

volving two states and 10 days of field and classroom sessions that will be offered in 2001 and 2002. The purpose of these sessions is to upgrade the professional skills of ag advisors in forage-based management for sustained livestock production.

- research on crop rotations, adaptation of new crops, and testing of small grains to provide data for recommendations to producers. This work was completed on 13 private cooperator fields in western South Dakota. The 1994-present crop rotation study located at Wall has provided an opportunity for county

West River Ag Center

Extension educators to receive training in developing crop rotations for the area.

- selection by the Kauffman Foundation as a pilot site, providing \$20,000 to teach entrepreneurial skills to 8- to 12-year-olds in southwestern South Dakota □

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113th Annual Report

South Dakota Agricultural Experiment Station

January 1, 2000 to December 31, 2000

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Clifford Fees, Philip
Larry Gabriel, Cottonwood
Bill Headlee, Kadoka
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Dakota Lakes Research Farm

Mike Arnoldy, Kennebec
Wilbert Blumhardt, Bowdle
Ralph Holzwarth, Gettysburg
William Huber, Paramelee
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

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Gary Erickson,* Aberdeen
Donald Guthmiller,* Hayti
Lester Hansen, Sisseton
Jennie Johnson, Clear Lake
Kelly Johnson, Pierpont
Lynn Johnson, Ortley
Darren Kilker, Britton
Leon Koeppel, Clair City
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AES Research Portfolio

Agricultural and Biosystems Engineering

H-018, Effects of process parameters on melt/flow/structure characteristics of cheeses at high temperatures; Muthukumarappan, Mistry, Julson
H-020, Synergistic effects of bacteriocins combined with ozone or irradiation; Julson, Muthukumarappan, Henning, Dave, Pitts, Wulf
H-119, Swine and dairy facility design for odor reduction; Hellickson, Pohl, Thaler
R-130, Improvement of thermal and alternative processes for foods; Muthukumarappan, Julson, Krishnan, Wang
H-229, Impact of climate and soils on crop selection and management; Bender
H-266, Improved design of post-frame buildings and enhanced indoor air quality of swine unit; Anderson, Kelley, Schipull
H-297, Value enhancement of South Dakota agricultural materials; Julson, Wang
H-307, Management of irrigation technology and water to minimize negative environmental impacts; DeBoer
H-317, Adaptation of emerging technologies to agriculture of the upper Great Plains; Humburg

Animal and Range Sciences

H-027, Relationships among hormonal influences on growth, reproduction, and carcass characteristics in swine; Clapper
H-037, Increasing efficiency of sheep production; Slyter
H-047, Improving reproductive efficiency of beef cattle; Miller
H-050, Water quality and beef production; P. Johnson, J. Johnson, Walker, Beutler, Oedekoven, Epperson
H-087, Production systems to reduce the cost of production and improve reproductive performance of beef cows; Pruitt

H-149, Genetic and environmental factors affecting meat quality; Wulf
R-170, Molecular mechanisms regulating skeletal muscle growth and differentiation; McFarland
H-226, Nutritional and management factors affecting swine reproductive performance and economic return; Libal
H-246, Manipulation of diet components to maximize efficiency of retention by feedlot cattle; Pritchard
H-277, Optimizing feed resource use in beef cattle production: "alternative" feeds as energy sources; B. Johnson
H-286, Patterns of utilization and plant response to grazing; P. Johnson
H-287, Improving the sustainable use by livestock of leafy spurge-infested and other pastures in the Northern Great Plains; Kronberg
G-327, Effects of grazing, competition, and climate on tiller survival and production; P. Johnson
R-347, Genetic improvement of cattle using molecular genetic information; Marshall

Biology/Microbiology

SD-9702751, Virological, immunological, and molecular components of reproductive PRRS; Rowland, Benfield, Cafrun
H-059, Genes important in livestock health; Westby
H-060, Analysis of factors that regulate energy balance in humans, livestock, and mice; Granholm, Marshall, Specker, Westby, Kattlemann, Pitts
H-076, Pullulan, a commercially valuable polymer: gene identification and creation of fungal overproducers; Westby
H-088, Mechanisms of viral persistence and pathogenesis; Rowland
H-089, Use of native plants and a permacultural approach for development of niche markets crops for the Northern Great Plains; Reese
H-110, Genetic modification to enhance crop quality and insect resistance; Cheesbrough
H-136, Developing novel fermentation products from condensed corn solubles; Gibbons
H-168, Ecological analysis of land-water interactions in prairie environments; Troelstrup
H-186, Analysis of a gene that regulates traits of interest to animal productivity; Granholm
H-208, Understanding the role of transferred maternal immunity in the development of the neonatal immune system; Hurley
H-228, Control of cattle parasites in South Dakota: profitability assessment; Hildreth, Epperson
H-237, Utilizing biotechniques to enhance wheat germplasm; Yen

Chemistry/Biochemistry

H-049, Analysis of pesticides and related substances; Matthees
H-067, Production of value-added, corn based microbial gums; West
G-080, Purchase of a fluorescence light microscope; Evenson
H-090, Characterization of livestock sperm that demonstrate susceptibility to DNA denaturation in situ; Evenson
G-140, A rationally designed vaccine for rotaviruses using hyperbranched and dendrimeric materials; Majerle, Hurley

H-179, Calcium and vitamin D regulation of cellular processes in domestic livestock and poultry species; Sergeev
G-210, Molecular probes of bull sperm nuclei producing abnormal embryos; Evenson
G-240, Acquisition of a scintillation counter with solids capability; Rice
S-891, Potential effects of genetically modified corn and soybeans on mammalian fetal, breast-fed postnatal, pubertal, and adult development; Evenson
S-996, Analytical services; Thix

Dairy Science

H-036, Yield of cheese and improvement of quality of nonfat and low fat and process cheese; Mistry
H-096, Composition, quality, and consumer acceptance of dairy products; Baer
H-100, Expanding use of whey in food products; Dave
H-116, Reduction of reliance on antibiotics in livestock production; Hippen
R-167, Management systems for improved decision making and profitability of dairy herds; Hippen
R-207, Metabolic relationships in supply of nutrients for lactating cows; Schingoethe
R-209, Modifying milk fat composition for enhanced manufacturing qualities and consumer acceptability; Schingoethe, Baer, Hippen

Economics

R-019, Financing agriculture and rural America: issues of policy, structure, and technical change; Lamberton
H-056, Implication of "risk" and other factors for diversified and sustainable farming systems; Dobbs
H-069, Changes in global patterns of food products trade: implication for the U.S. and South Dakota; Qasmi
H-107, Changes in agricultural food systems: the increasing importance of value-added activities; Van der Sluis
G-109, Health and management factors affecting beef value; Fausti, Epperson
H-127, Economic analysis of agricultural and land markets and land management practices in South Dakota; Janssen, Beutler
H-148, Rural labor markets and factors influencing rural/urban and metro/nonmetro migration; Adamson
H-160, Value-added agriculture in South Dakota: its impact on structure, efficiency, prices, and agricultural policy; Taylor, Klein
H-200, Perception of biotechnology and biotech produced agricultural products and implications for risk management; Franklin
R-337, Enhancing the global competitiveness of U.S. red meat; Fausti
S-983, Agricultural biotechnology: economic implications for Midwest agriculture; Van der Sluis, Qasmi

Family and Consumer Sciences

- SD0001, Liquid chromatograph mass spectroscopic measurement of folic acid and natural folates in food; Krishnan
H-098, Promoting healthy families and communities through high school relationship education; Gardner
H-147, Phytochemicals in soybeans; Wang, Krishnan, Julson, Scott, Matthees, Woodard
H-166, Investigation of oil and oil constituents of oats and soybeans; Krishnan, Reeves, Kephart, Wang, Thies, Scott
R-238, Impact of technology on rural consumer access to food and fiber products; Lyons
R-306, Using a stages-of-change model to promote consumption of grains, vegetables, and fruits by young adults; Swanson

Horticulture, Forestry, Landscape and Parks

- MS-028, Trends impacting forest production and forest recreation: 2010; Stubbles
MS-048, Restoring riparian woodland in agroecosystems of the Northern Great Plains; Johnson
H-137, Dormancy and stress response of deciduous fruit crops; Fennell
G-139, Molecular and genetic mechanisms involved in bud dormancy in woody plants; Fennell
R-177, Rootstock and interstem effects on pome and stone fruit trees; Fennell
H-198, Evaluation, selection, and management of turfgrass species/cultivars by geographical region in South Dakota; Schleicher
H-216, Root and crown hardness of ornamental herbaceous perennials; Harbage
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
R-258, Freeze damage and protection of horticultural species; Fennell
R-270, Integrating biophysical functions of riparian systems with management practices and policies; Schaefer, Johnson, Boettcher

Plant Science

- SD-9603940, Integrated systems management of watershed for economic and environmental integrity; D. Clay, S. Clay, Helder, Woodson
H-038, Nutrient recycling in crop rotations; Woodard
R-055, Nitrogen mineralization and availability in crop systems to protect water resources; D. Clay
R-057, Forage crop genetics and breeding to improve yield and quality; Boe
H-058, Ecological and alternative management considerations for corn rootworms in the Northern Great Plains; Fuller, McManus
H-066, Studies of host-parasite interactions between wheat and its fungal pathogens; Jin
H-068, Spring wheat breeding and genetics; Rudd, Jin
H-077, Development and utilization of oats and rye adapted in South Dakota; Reeves
H-078, Genetics of fungal pathogens of row crops; Chase
H-079, Sunflower breeding and testing alternative oilseed crops; Grady

- H-086, Site specific farming to increase farm profitability and to enhance environmental quality; Carlson
H-099, Soybean breeding, genetics, and production; Scott
H-108, Breeding perennial grasses and legumes for forage, wildlife habitat, and tolerance to stresses; Boe
H-117, Forage production, quality, and persistence; Kephart
H-118, Weed management in conventional and alternative cropping systems; S. Clay
H-126, Prediction of economic return from mechanical treatment of rangeland natriborolls; Kohl, Kronberg, Humburg, Beutler
R-128, Supplemental information support for pesticide use in minor crops; S. Clay
H-138, Wireworms of the Northern Great Plains; Johnson
H-146, Precision farming: managing N stress to reduce environmental impacts and maintain profitability; D. Clay
H-150, Influence of potassium (K) rate, placement, in-season treatment, hybrid, and tillage on K deficiency in corn; Gelderman
H-156, Pedology information transfer; Malo
H-159, Soil management for improved soil quality and reduced biostress; T. Schumacher
H-169, Etiology and epidemiology of plant viruses in South Dakota; Langham
H-178, Corn genetics, physiology, and breeding; Wicks
H-180, Plant biotechnology methods and applications in agriculture; Carter
H-188, Fate and transport of land-treated waste components; Doolittle
H-197, Biological control of foliar and head diseases of wheat; Bleakley
R-199, Persistence of Heterodera glycines and other regionally important nematodes; Smolik
H-218, Management of eroded soils for enhancement of productivity and environmental quality; T. Schumacher, Lindstrom
H-220, Tillage and crop rotations for eastern South Dakota; Berg
H-227, Nondestructive freeze test using thermoelectric cooling; Sutton
R-230, Characterizing weed population variability for improved weed management decision support systems to reduce herbicide use; S. Clay
R-236, Plant germplasm and information management and utilization; Boe
G-247, SD NAPIAP 1998 pesticide database maintenance and current application methodologies, S. Clay
H-248, Diversifying crop rotations; Beck
G-250, SDSU soil chemistry project – atomic absorption spectrophotometer; Doolittle
H-257, Agricultural wetland management; Rickerl, Janssen, R. Johnson
R-260, Reducing the potential for environmental contamination by pesticides and other organic chemicals; S. Clay
H-276, Alternative methods of meeting conservation compliance; Stymiest
S-892, Roundup Ready soybeans: transgene dispersal and transgenic soybeans as feed and as food; Carter, Cheesbrough, Scott, Wrage, Turnipseed, Thaler
S-957, Plant Science farm; Kohl
S-958, Plant Science greenhouse and seedhouse maintenance; Gallenberg
S-991, Seed certification; Pollmann

- S-992, Seed testing; Turnipseed
S-993, Variety testing; Hall
S-994, Survey entomologist; Fuller
S-995, Foundation Seed Stock; Ingemansen

Rural Sociology

- H-030, Sustainable farm families and agricultural communities in South Dakota; Arwood
H-040, Rural domestic violence and quality of rural life; Mendelsohn
H-097, South Dakota State University Census Data Center; Satterlee
G-190, Consortium to address social, economic, and ethical aspects of biotechnology; Hess

Veterinary Science

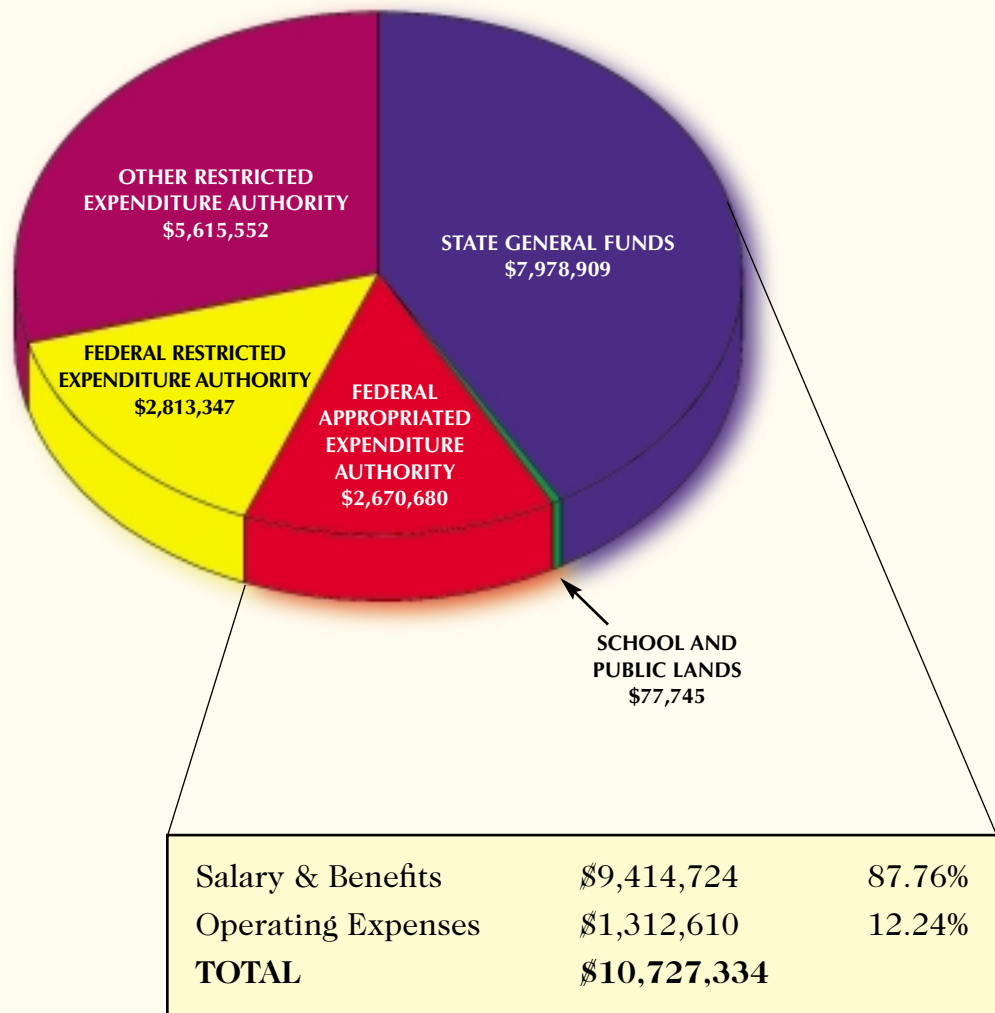
- SD-9602270, Envelope protein of PRRSV and their role in antigenic variation; Nelson, Hennings
SD-9902298, Receptor binding specificity of the K88 fimbriae of E. coli; Francis, Rowland
H-010, John's Disease in cattle and buffalo (bison): a South Dakota concern; Christopher-Hennings, Nelson, Epperson, C. Chase, Henning
G-070, Biochemical basis for genetic resistance to K88 Escherichia coli infections; Erickson
G-120, Genomic quaspecies associated with the persistence and pathogenesis or porcine reproductive and respiratory syndrome virus (PRRSV); Benfield, Rowland
AH-175, Development and evaluation of new diagnostic methods; Holler, Johnson
AH-176, Effect of dietary supplementation on colonization by enteropathogenic bacteria; Francis
AH-206, Improved diagnostic methods for bovine respiratory and enteric viral diseases; Benfield, Chase
H-256, Reproductive wastage in livestock and zoonotic risk assessment; Holler, Epperson, Thomson
R-296, Bovine respiratory disease: risk factors, pathogens, diagnosis, and management; Chase, Epperson
R-357, Enteric diseases of swine and cattle: prevention, control and food safety, Francis, Benfield, Hildreth

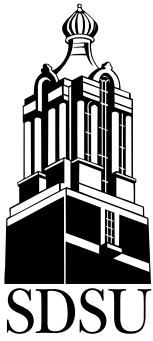
Wildlife and Fisheries Sciences

- H-016, Management alternatives for South Dakota ponds and small lakes; Brown, Scalet
MS-046, Wild turkeys in South Dakota's prairie woodlands; Flake
H-157, Strategies for minimizing winter depredation by white-tailed deer I. developing lure forages; Jenks
H-158, Human, habitat, and biotic influences on panfish populations; Willis
S-963, South Dakota Cooperative Fish and Wildlife Research Unit; Berry, Higgins

Operating Budget

South Dakota Agricultural Experiment Station
Fiscal Year 2001





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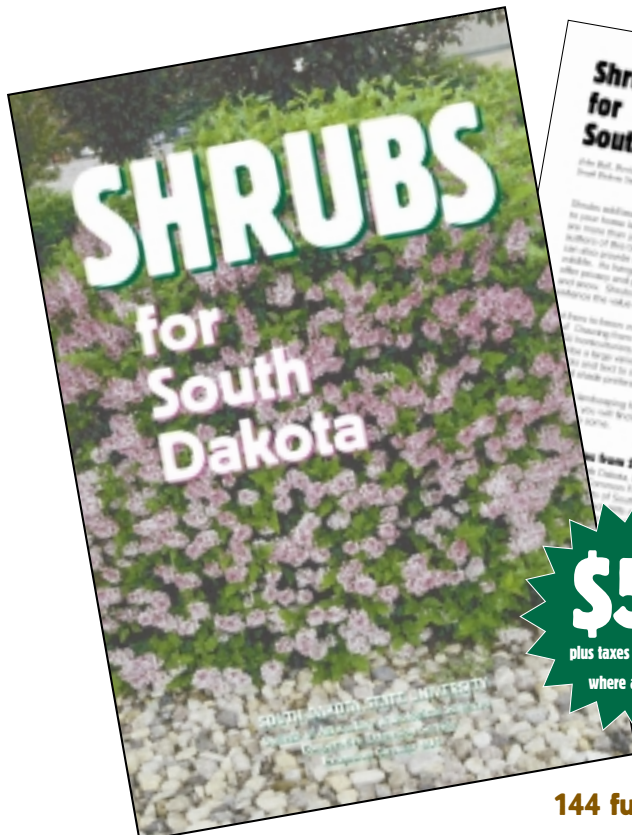
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