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SDSU Agricultural Experiment Station

Spring 1996

South Dakota Farm and Home Research

South Dakota State University

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South Dakota Farm & Home RESEARCH

Agricultural Experiment Station • South Dakota State University • Brookings, South Dakota 57007

Volume 47, Number 1, March 1996



Annual Report Issue

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South Dakota Farm & Home RESEARCH

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South Dakota State University

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About the Cover

SDSU's campus is made instantly recognizable by the lights of the Coughlin Campanile.

photo: Stuart Melby

Director's comments

Spirit and dedication to South Dakota

by Fred Cholick

Our annual report, this issue of Farm & Home Research, conveys the volume of work we do here in the South Dakota Agricultural Experiment Station but not the human spirit and dedication that accompany that work.

Although our department heads could hit only the high points, their reports give the essence of the progress we've made in the last year, all of it for your benefit.

Because that's why we're here—for your benefit. Our mission hasn't changed since the Experiment Station opened in 1887: to conduct research to enhance the quality of life in South Dakota through beneficial use and development of economic, human, and natural resources.

In 1996 terms, that means we work to increase your profitability, stabilize production, lower input costs, raise consumer acceptance, create new uses for your crop and livestock products, and increase food safety.

History shows we have done our job. You can see for yourself the new and improved crop varieties, disease resistance, feed efficiency, and increased productivity without higher production costs.

Other benefits are indicated by the many pages of publications, articles, and reports listed later in this magazine. These benefits are more indirect. Publishing our work in research journals connects us with the global scientific community. Cooperation and sharing is as essential in the wider world as it is in the labs and fields of the South Dakota Experiment Station. We can never stop learning, whether from genes, wheat plants, weeds, weight scales at the cattle chutes, or from other scientists. What we learn, we share with you.

From a physical standpoint:

- We conduct projects at seven "stations," each vital because of its

location in this diverse state and each with its own advisory board of local citizens. They are the Antelope Livestock and Range Field Station near Buffalo, the Central Crops and Soils Field Station at Highmore, Cottonwood Range and Livestock Field Station, Dakota Lakes Research Farm near Pierre, the Northeast Research Farm north of Watertown, the Southeast Research Farm near Beresford, and the West River Ag Research and Extension Center at Rapid City. The "eighth" station is on the SDSU campus. Together, they represent nearly 17,000 acres available for research.

- That's only a small fraction of the places in the state where you'll find Experiment Station scientists. Communities, small and large, are others. Cooperating farmers and ranchers give us valuable assistance when we work in their fields and among their herds.

- And we have our own livestock: approximately 500 cows with calves, 120 cows in the dairy herd, 1,500 to 1,700 cattle on feed, 120 sows, a varying number of feeder pigs, and over 850 sheep. We use these animals in both research and teaching.

- We have approximately 150 active research projects. Each deals with an agricultural issue in South Dakota, from family to farming to feedlots. Projects are supported by



Tom Cheesebrough, left, of the Department of Biology/Microbiology, shows Ag Experiment Station Director Fred Cholick how he selects genes for soybean oil with the help of bacteria. The spots show where the bacteria have successfully incorporated soybean oil genes into themselves. These genes will be extracted for further study.

photo: Tom Bare

federal and state appropriated funds, grants, dollars from commodity organizations, and gifts.

- The acres, animals, and analytical labs don't run themselves. The most important component of the Experiment Station is its people. We have 125 dedicated faculty in 12 departments in the College of Agriculture and Biological Sciences and the College of Home Economics. These are the individuals who develop the ideas and solve your problems.

So that's who we are and what we are. We are here to serve you. Get in touch with me if you have specific questions or problems. I'd be happy to hear from you. □

Dr. Fred Cholick is the Director of the South Dakota Agricultural Experiment Station at SDSU.

Bridge between research and South Dakotans

by Emery Tschetter

Ag Communications is one of many bridges between research by the Agricultural Experiment Station, information dissemination by the Cooperative Extension Service, and the people of South Dakota.

Ag Communications produces more than 130 hours of programs for commercial and public television, writes more than 500 print news stories, publishes more than 120 bulletins and other publications, and distributes nearly 750,000 publications around the world each year. Here are some of the highlights from our work in 1995.

- Today's Ag can now be seen across South Dakota and in seven other states on KELO-TV, Sioux Falls, S.D., and KOTA-TV, Rapid City, S.D. It is the most-watched ag news program on television, with more than 44,000 viewers each week. According to Nielsen ratings, Today's Ag is the 20th most watched program out of more than 300 programs on the major networks and has higher ratings than many of the prime time programs. Today's Ag won first place honors in competition among all land-grant universities that produce weekly television shows.

- When budget cuts forced South Dakota Public Television to close its Brookings studio, Ag Communications assumed production of Garden Line and Midwest Market Analysis. These are the only South Dakota-produced programs on public television that address profitability in South Dakota agriculture and horticulture issues. Garden Line is the most-watched locally produced program on South Dakota Public Television. Midwest Market Analysis has been rated by farmers and ranchers as the most-trusted source for analysis of ag markets.

- Working cooperatively with three other land-grant universities, South Dakota State University led the



photo: Emery Tschetter

Jeff Silverman of the Chicago Mercantile Exchange gives trading floor insights to Today's Ag host Michelle Rook and cameraman Brad Van Osdel. Every week, 44,000 Today's Ag viewers meet the people behind the breaking agricultural news that dominates their lives and profitability.

development and production of the Cattlemen's Satellite Shortcourse. Beef producers at over 900 viewing sites across North America participated in this program, making it the largest distance-education program ever undertaken by the land-grant system. As a result of the 15-week program, 76 percent of the participants planned to make management changes, and 92 percent said their potential profitability was increased.

- DTN & FarmDayta subscribers have up-to-the-minute access to South Dakota production and marketing information, thanks to updates from Ag Communications. Nearly 500 stories are inserted each year on both systems, reaching more than 5,000 South Dakota farmers, ranchers, and agribusinesses.

- The weekly Ag Communications news packet is used by nearly all the daily newspapers, farm publications, and radio and television stations serving South Dakota. These news stories focus on research developments and

recommendations in production agriculture and family life. Whether the story is in the Dakota Farmer or carried by the Associated Press, several of these stories each week find their way into nearly every home and business in South Dakota.

- The Extension and research publications you find at your county Extension office are produced by Ag Communications. From the 1996 crop variety recommendations to the educational materials used by 4-H members, publications produced by Ag Communications reach into every corner of the state.

There are many other services offered by Ag Communications, including construction of educational exhibits, production of videos and satellite programs, and communication training. All projects have one common element: impact on the lives and profitability of South Dakotans. □

Emery Tschetter is head of the Ag Communications Department at SDSU.

Impact on present and future agriculture

by Darrell W. DeBoer

Relevance to present and future South Dakota agriculture has been the focus of the Department of Agricultural Engineering in 1995, as it is in all years.

- To assist livestock producers, our agricultural engineers are working with a South Dakota firm to develop a new pig feeder that accommodates the movements a pig makes while eating. This will result in less feed waste. University students and faculty members comprise the development team.

- Faculty members are improving the design of post-frame and pole buildings constructed from wood and light gage metal. The new designs reduce the quantity of materials used in construction and, hence, the cost.

Our test data are currently being used nationally and are code approved in Wisconsin. The work is supported by grants from private industry.

- Indoor air quality within livestock structures is another concern of our agricultural engineers. Corn and soybean oils are being studied as possible agents to remove dust and ammonia from building air. If dust and odors can be controlled, the potential exists for reduced ventilation and energy requirements. Studies have shown that pigs also gain better in surroundings with lower ammonia levels.

- Irradiating foods significantly reduces the potential for food poisoning. Irradiation is used on chicken, fresh fruits, and vegetables in the U.S.

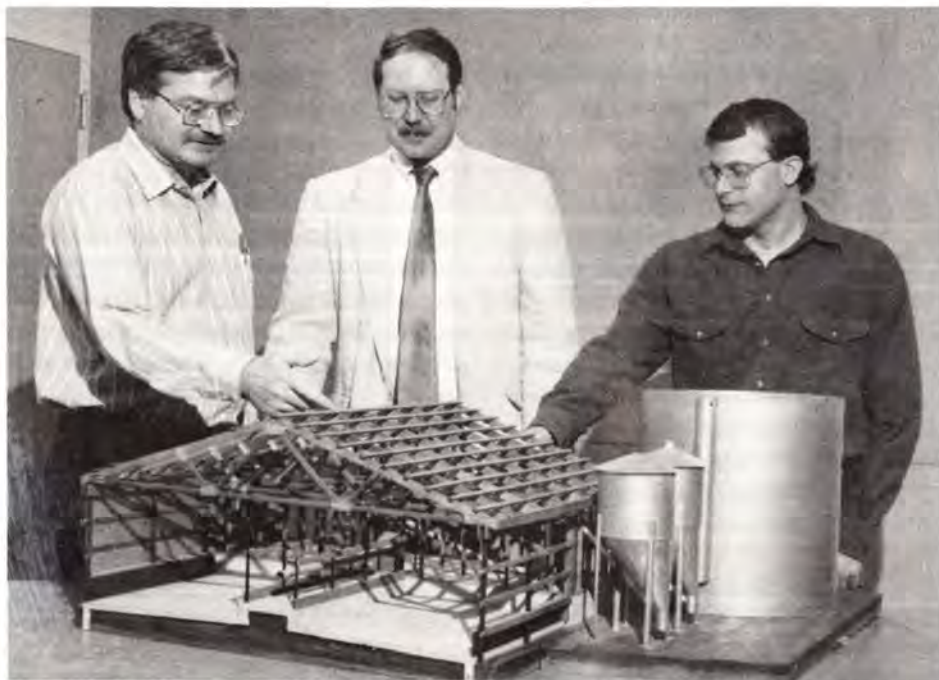
and 37 other countries. Preliminary studies of irradiated beef indicate it can be used without loss of quality and flavor. Agricultural engineers and meats researchers are investigating the use of antioxidants to reduce the rate of fat oxidation and possible off flavors in irradiated fresh ground beef.

- Computers are the heart of machine vision technology in agriculture. Our researchers are using video cameras as eyes for computers and for providing guidance for a robotic arm. Images acquired from aircraft are being used to develop maps for use in site-specific farming. Machine vision technology has potential for carcass evaluation, weed identification and spray calibration, and grain quality evaluation.

- Our agricultural engineers, in cooperation with the South Dakota Cooperative Extension Service, the Easter Seal Society of South Dakota, and McKennan Hospital of Sioux Falls, are assisting and educating individuals with physical disabilities and their families to work in agriculture. The AgrAbility Project is a national effort; locally, it helps South Dakotans rebuild their lives after mishaps and become productive, contributing members of the rural community.

- Environmental issues continue to capture the attention of South Dakotans. When soil and water researchers completed a soils analysis with grants from the Bureau of Reclamation and the USDA, they found selenium concentrations that raise concerns about potential impacts from the proposed Lake Andes-Wagner/Marty II Irrigation Project. A proposal was developed with South Dakota and federal officials to investigate the potential influence of the project on the environment.

- Extension engineers are aiding in the development and delivery of educational programs that assist producers in reducing environmental degradation from livestock waste. A computer program called Farm•A•Syst is used to identify and assess the impact of pollution sources. □



Steve Pohl, Gary Anderson, and Joel Rausch, (l to r) are structures engineers in the Department. Their chief concerns in designing livestock buildings are reasonable construction costs and indoor environments that provide economical comfort and safety to both animals and operators. Studies have shown, for example, that pigs gain more rapidly in buildings with lower ammonia levels.

Dr. Darrell DeBoer is professor and acting head of the Department of Agricultural Engineering at SDSU.

A reputation for excellence; a commitment to South Dakotans

by Jim Males

The animal science major experienced record enrollment in 1995. This record and the high interest in range science courses indicates the excellent reputation of the undergraduate program at South Dakota State University.

The academic quadrathlon team representing the Animal and Range Sciences Department (ARS) was the high team at the Midwest Section American Society of Animal Science Academic Quadrathlon. This team represented South Dakota at the National Cattlemen's convention in January 1996. Animal Science major Erin Pettigrew (Wetonka, S.D.) was recognized as the National Outstanding Senior in Block & Bridle, and Beth Rusche (Bancroft, S.D.) was third in the Outstanding Junior competition.

Traditional and new programming methods continue to extend the University to the citizens of South Dakota and the region. The Cattlemen's Satellite Shortcourse was broadcast to around 900 satellite downlinks and reached over 3,000 people nationally. The program idea and leadership originated with Don Boggs of our Department. It will serve as the model for future Extension programming.

Traditional delivery methods like the TIPS Conference for swine, Range Beef Cow Symposium for beef cattle, and Shearing Schools for sheep producers continue to be popular and excellent sources for producer continuing education. Whether through one of these programs, or at county meetings, or through individual contacts, the ARS Extension and research faculty work to get the latest information to producers and other clientele.

Research in ARS runs the gamut from fundamental investiga-



photo: Tom Bare

Don Boggs of the Animal Science Department led development of and hosted the Cattlemen's Satellite Shortcourse, aired biweekly last year. The program was the largest, longest running, continuing education program on satellite in the nation.

tions of the mechanisms that control muscle growth to implant strategies for cattle in the feedlot or from management of the range natural resource to marketing strategies for cattle.

- Much interest was shown during the last year in winter supplementation strategies for beef cows grazing native range, water infiltration rates on range that had been managed with different grazing intensities and durations, management of the flock under farm or range conditions to increase fall lambing, and supplemental zinc levels for early weaned pigs.

- The beef cattle breeding project continues to evaluate a three-breed rotation compared to a two-breed rotation with a terminal cross sire. Not only are production traits evaluated, but this project also is an important part of a national effort to evaluate selection of beef cattle to enhance beef tenderness and quality.

- In the meat science area, beef tallow was compared to soy oil for deep fat frying. Meat scientists and the

swine research team have made a major effort to reduce the effect of boar odor in hogs. The beef cattle marketing effort is a good mix of Extension, research, and cooperation between animal scientists and ag economists. The Retained Ownership Demonstration serves as an excellent demonstration project for cow/calf producers who can gather information on how their own cattle perform in the feedlot and the kind of carcasses they hang up. Data gathered in this project are also used in the beef cattle marketing research effort.

ARS faculty integrate the three-prong functions of teaching, research, and Extension that are the basis of the land grant higher education system. The faculty in ARS contribute to all of the functions regardless of their primary responsibility. This aids the Department and the college in serving the needs of all South Dakotans. □

Dr. James Males is professor and head of the Department of Animal and Range Sciences at SDSU.

Partnerships speed progress of fundamental research

by Charles McMullen

Linking resources from the Agricultural Experiment Station, commodity groups, agricultural processing consortia, and other government agencies has permitted our scientists and their students to progress on fundamental research to solve problems important to South Dakota agriculture. The Department of Biology/Microbiology greatly appreciates the partnership support provided by the South Dakota Soybean Research and Promotion Council, South Dakota Corn Utilization Council, South Dakota Pork Producers Council, and the South Dakota Wheat Commission.

- In our state, tan spot disease takes an estimated 5 to 10 percent off potential yield of both spring and winter wheats. Breeding for resistance is considered the best solution to this disease. Biology/Microbiology and Plant Science Department researchers have developed an anther culture system for rapid selection of true-breeding lines, thereby speeding up an early release of urgently needed wheat varieties.

- Scientists from the USDA Insect Laboratory and the Department have identified proteinase inhibitors that are effective in killing three species of cereal aphids. The goal is to transfer these inhibitors into wheat to create aphid resistant varieties.

- Another example of collaborative research is the teamwork of Veterinary Science and Biology/Microbiology scientists in testing the effectiveness of livestock vaccines. The new tests are scheduled to become available in 1996.

- Our scientists have also been investigating how stress affects the immune system. Controlling stress-related disease will make livestock production more profitable.

- Research to develop a noncorrosive, environmentally friendly road

deicer from corn processing byproducts has made significant headway during 1995. An anaerobic bacterium begins the process by converting corn sugar into acetic acid. To reduce the cost of the final product (calcium magnesium acetate, CMA), scientists have coaxed the bacterium to grow on stillage, a low-value byproduct of ethanol production.

Now the team is concentrating on genetically altering the bacterium to work more efficiently. Scale-up to pilot plant fermentation has begun, and contacts with potential industrial partners are also in the works to commercialize this technology.

- The genes that control the production of pullulan, a biodegradable fungal polysaccharide, have been isolated and sequenced. Pullulan, which can be produced on corn mash, has many uses in medicine, health services, and industry. Our scientists have also isolated two genes involved in soybean fatty acid synthesis. They are currently "making" a gene that they will transfer to soybeans where it will block production of polyunsaturated fatty acids and promote the formation of high monounsaturated oil.

- Another scientist has isolated bacterial "nitrate genes." Modified and inserted into soil bacteria, they could slow the loss of nitrate fertilizer from soil. In animals, certain genes regulate fat deposition and animal



photo: Duane Hanson

Bill Gibbons, microbiologist, continues his research to develop a "salt-free" road de-icer in partnership with the South Dakota Corn Utilization Council. The product has moved from laboratory experiments to pilot-plant trials to assess its commercial applications.

size. The "agouti gene" has been located in mice, and we are trying to identify a similar gene in cattle. If found and enhanced, it should lead to higher efficiency in cattle production.

- The Oak Lake Field Station, managed by the Department of Biology/Microbiology, hosted local school children studying prairie environments, history, and culture. Another Summer Science Camp for South Dakota youth was held at the station, and the facility is used by undergraduates and graduate students for field studies. The field station will be a site for new research into land-water interactions in prairie environments. □

Dr. Charles McMullen is professor and head of the Department of Biology/Microbiology at SDSU.



Duane Matthees, searching for new industrial uses of soy protein, also identifies herbicides involved in crop injury disputes. Tests are conducted for individuals and regulatory agencies.

Chemistry and Biochemistry

Increasing agricultural productivity while preserving the environment

by Laurence I. Peterson

The primary agricultural mission of the Department of Chemistry and Biochemistry is to conduct research in animal biochemistry and alternative uses of agricultural products. This work enhances agricultural productivity while preserving the environment. In addition, we offer analytical services and develop new analytical methods of economic, environmental, and regulatory importance.

In May 1995, the Cooperative States Research, Education, and Extension Service conducted its 5-year review of our overall program, lead by a team of outside reviewers representing the USDA, industry, and academia. The review team considered our current research to be "cutting edge" and the work of our Department to have

"excellent relevance to the needs of South Dakota agriculture as well as world-wide application."

- Dr. Don Evenson's work with mammalian sperm and his development of a sperm chromatin structure assay were regarded as having "tremendous implications on livestock production in South Dakota and the world" as well as having human application in areas of both fertility and toxicology.

- Dr. Royce Emerick's mineral nutrition work "has had direct application to the production of [cattle and sheep] not only in South Dakota but throughout the world." Dr. Emerick retired on December 31 after devoting his entire career (1957-1995) to animal nutrition research at South Dako-

ta State University. He established the cause of urinary calculi for both feed-lot and range livestock and has provided an understanding of calcium and phosphorus nutrition, nitrate toxicity, vitamin A nutrition, ruminant acidosis, and copper deficiency.

- Also in animal nutrition, Dr. Ivan Palmer continues the development of a universally recognized analytical method for trace quantities of selenium (now recognized as an essential micronutrient). Our state has some of the highest seleniferous soils in the world.

- Another important area is our crop utilization research. Dr. Tom West is working with fungal mutant strains to produce pullulan, a carbohydrate-based product with a wide variety of emerging commercial applications including plastics and low-calorie food products. Dr. Duane Matthees is identifying new industrial uses of soy protein. He also is continuing to identify and resolve problems relating to crop injuries from the misuse of herbicides.

- Our Analytical Services Group under the direction of Nancy Thieux runs tests for the South Dakota Department of Agriculture in support of its regulatory program and also conducts analytical work for farmers and agribusinesses throughout the state. With the increased sophistication in livestock feeding and crop protection, need and demand for these services are expected to increase in the future. To reduce the turnaround time of our services and provide a more direct link to the South Dakota agricultural community, we have developed and put online a World Wide Web site on Internet. Now our services can be directly accessed at <http://www.sdstate.edu/~cm10/http/as.html>. □

Dr. Laurence I. Peterson is professor and head of the Department of Chemistry and Biochemistry at SDSU.

Dairy Science

Benefits for students, producers, consumers, cows themselves

by John Parsons

The new Dairy Research & Training Facility was dedicated November 1, 1994, and cows were moved to the new unit one week later. This new facility has hosted numerous tours and individuals from South Dakota and the surrounding states. Several dairy farmers have returned with pen, tape measure, and notebook for help with their planned expansion or new dairy facilities.

• As part of our commitment to dairy producers, we have offered a

number of shortcourses this past year. The dairy-farm management short-course was presented in cooperation with Land O'Lakes. A milking short-course was conducted by Gene Stegeman, instructor/dairy farm supervisor, Dr. Kim Cassel, Extension specialist, and others who provided hands-on experience in the new double-8 parallel parlor. The annual Dairy/Forage Conference, organized by Dr. Cassel, was held in Sioux Falls, S.D., with 140 people attending.

• The Dairy Science Department and the Brown Swiss Cattle Breeders' Association of the USA have developed a program called "Send a Cow to College." A total of 60 Brown Swiss bred heifers will be donated to South Dakota State University to establish a herd of registered Brown Swiss and to increase the herd from 100 to 160 milking animals. To date, 23 animals have been received, representing a donation of over \$33,000 to SDSU.

• Judging activities in the Department continue to be a strong magnet for many students. High-school students in 4-H and FFA come to Little International, special judging clinics, and the state FFA contest in both dairy foods and dairy cattle judging.

Our collegiate teams participated in four contests. The dairy cattle collegiate team competed in the regional contest at Viroqua, Wis., and at the national contest, Madison, Wis. The dairy products judging

team placed third at the regional contest, Glenview, Ill., and third at the national contest, Chicago, Ill.

• The Minnesota/South Dakota Dairy Foods Research Center continues an active program of training students for the dairy industry and of conducting research to solve technical problems in the cheese, ice cream, and other dairy products areas. Dr. David Henning is studying the potential of adding cultures of *Pediococcus pentosaceus* to give higher-quality Cheddar cheese. Dr. Vikram Mistry has used electron microscopy to show that protein makes a great contribution to cheese texture in low-fat cheeses. This research led to the development of a new process which improves the body and texture of low-fat cheese. Dr. Bob Baer, Dr. Sharon Franklin, and Dr. David Schingoethe are working on projects to alter the composition of milk fat to make healthier dairy products.

Dr. David Henning and Christine Reitsma, graduate research assistant, report that *E. coli* O157:H7 can survive Cheddar cheese manufacturing processes and subsequent curing time. To eliminate potential problems with this pathogen, processing plants need to include a number of strategies in their operations that include pasteurization or heat treatment of milk for cheese manufacture, active starter cultures, and contamination prevention through good manufacturing practices.

Dr. Bob Baer is studying the effects of emulsifier in low-fat (2 percent) ice cream. Defects such as coarse and icy texture have been reduced with the use of certain emulsifiers. You can now have a low-fat ice cream that is smooth and creamy; if you doubt that, stop in at our own SDSU ice cream parlor and have a sample! □

Dr. John Parsons is professor and head of the Department of Dairy Science at SDSU.



photo: Tom Bare

"Send a Cow to College" is off to a flying start. A herd of donated Brown Swiss will allow researchers—and the producers who will use their findings—to capitalize on the high-protein milk this breed produces.

Economics

Projects contribute to increased profitability

by Ardelle Lundeen

The goal of research in the Economics Department is to increase profitability in South Dakota agriculture through providing information on alternative marketing practices, production technologies, and resource management and by describing opportunities for decreasing production and marketing costs and risks.

- Several projects combine economic and environmental analysis of sustainable agriculture. In the Big Sioux Aquifer region, a case-study approach is being used to analyze different size farms whose owners have participated in federal programs to improve water quality. Results indicate that changes in some farming practices could yield both increased farm profits and improved groundwater quality. For three of four farms studied, increased profits range from \$6 to \$30 an acre.

- An interdepartmental research project on the interactions of organic,

conventional, and transitional no-till agricultural management systems with wetlands is showing that each management system can be profitable, wildlife habitat is enhanced by vegetative diversity and residue cover, wetlands are acting as nutrient filters, and wetlands are supplying water for groundwater and soil moisture recharge. These findings are providing insights to producers, natural resource managers, and policy makers on strategies to jointly accomplish agricultural production and soil and water protection goals.

- Grain and livestock marketing plays a major role in Department research and Extension programs. One research project involves determining tradeoffs between average returns and year-to-year risks for different preharvest marketing strategies for corn, spring wheat, and soybeans. Major commodity groups in South Dakota have assisted with grant funds to enhance and broaden the project.

- In two research projects, the feasibility of various strategies to improve producer returns in the marketing of beef cattle is being analyzed. One study shows that feeder calf average daily gain, carcass quality grade, and dressing percentage are the major factors affecting cattle profitability. On the other hand, some factors are only loosely related to profits: initial feeder calf weight, initial fat thickness, prefeedlot arrival vaccination, calf breed, and dam milking ability.

These findings show the value of (1) cow-calf operators accumulating, over time, data on the performance of their calves going into the feedlot, and (2) feeder-cattle buyers reconsidering calf characteristics traditionally believed to be critical in determining prospective fed-cattle profits.

- Results from the various projects are used by the Extension specialists in workshops and meetings around the state and in media releases. Numerous marketing workshops have been held to inform producers and loan officers about marketing strategies to increase returns and reduce risks. Another objective is to help producers avoid "harmful" marketing strategies.

Statistics on farmland prices and rental rates are gathered and compiled annually. Survey results are made available to farmers and ranchers, landowners, and agricultural professionals (lenders, rural appraisers, professional farm managers, and policy makers) interested in agricultural land market trends.

The Department's monthly Economics Commentator provides summary research results and outlook articles on grain and livestock markets to readers. □

Dr. Ardelle Lundeen is professor and head of the Department of Economics at SDSU.



Economists Dillon Feuz and Scott Fausti compare projected returns from various marketing strategies with John Wagner, Extension beef specialist. Generally, methods with high economic risk to producers bring higher prices, low-risk strategies lead to lower returns.

College of Home Economics

Research adds value, improves diets, protects human health

by Laurie Stenberg Nichols

Food scientists in the College of Home Economics are adding value to South Dakota-grown corn and soybeans while they work to improve the diets and health of our state's people.

• Dr. Chunyang Wang, Department of Nutrition and Food Science, is discovering new ways to preserve soy isoflavones during processing. Soy isoflavones, a component of soybeans, are known to prevent heart disease and cancer. However, current soy processing destroys these isoflavones. Dr. Wang's goal is to discover new processing technologies that will preserve the isoflavones and their potential health benefits. It is believed that if isoflavones were protected during processing, human consumption of soy products would increase, creating greater demand for soybeans. Dr. Wang also has on-going research projects into new processing technologies

to improve nutritional and functional properties of soy protein products.

• Dr. Padu Krishnan, Department of Nutrition and Food Science, and colleagues are seeking new uses for corn and corn byproducts. Dr. Krishnan's most popular research has been food products containing food-grade distiller's dried grains. Distiller's spent grains are byproducts of corn processing and currently are used primarily as livestock feed. Dr. Krishnan tested various cookie recipes using up to 10 percent distiller's dried grains, and the baked products showed a 21 percent increase in insoluble fiber content. This fiber contribution is significant, as fiber has been linked to the prevention of cancer and heart disease.

Last year, Dr. Krishnan offered chocolate chip, oatmeal raisin, peanut butter, and snicker doodle cookies at nearly 20 events including the South Dakota State Fair where over 50,000

cookies were consumed by the public. Dr. Krishnan and colleagues are also analyzing whole grain to predict ethanol yield and experimenting with polystyrene foam made from corn flour for insulation and packaging purposes.

• The health hazards of pesticides are of growing concern to South Dakota producers. Dr. Linda Manikowske, Extension specialist in clothing and textiles, is experimenting with cornstarch which, when applied to protective clothing, would form a barrier protecting the applicator from skin contact with pesticides. She is working with Jim Wilson, Extension pesticide education coordinator, and with colleagues from a 10-state north-central regional research group.

Two new projects will prepare us to better help families in a busy, stress-filled world.

• Dr. Mary Kay Helling, Human Development/Family Studies, and Dr. Ron Stover, Sociology, are investigating the processes and stresses of transferring the family farm or ranch to the next generation. Through in-depth interviews with farm families, they are learning more about how families communicate during the transfer process, emotions which may be barriers or facilitators to communication, and the roles various family members play.

• Dr. Cindy Schmiede and Dr. Laurie Stenberg Nichols are interviewing families who must balance work and family responsibilities. A growing number of dual-employed couples manage both demanding jobs and busy families. The researchers are especially interested in rural employment situations, including family farms and ranches. □

Dr. Laurie Stenberg Nichols is Dean of the College of Home Economics at SDSU.



Linda Manikowske, clothing and textiles specialist, instructs pesticide applicators in the personal safety requirements of certification. She is also working with corn starch; added as a barrier on clothing, it may prevent the pesticide from coming in contact with skin.

photo: Tom Bare

Managing natural resources and beautifying homes and communities

by Peter R. Schaefer

Research and Extension activities in the Horticulture, Forestry, Landscape and Parks Department have broad influences in South Dakota that range from natural resource management to beautifying community and home environments.

- Through a grant from the USDA Forest Service, the department is studying the effects of trees on home energy use in the communities of Murdo and Eagle Butte, S.D. This research will determine the number, placement, and type of trees to maximize energy savings in these communities, and the results will be used to address similar concerns in other small communities across the state. It is anticipated that the results of this work will stimulate tree planting in these small towns.

Although the research is not completed, it has already directly influenced these communities by raising the awareness of civic leaders to the potential of trees for reducing home energy costs and by directly involving community members in the research.

- Natural resource management in forested settings is also being addressed by department faculty. A grant from the USDA Extension Service provided the means to establish a Logger Education to Advance Professionalism (LEAP) program in South Dakota. This program provides continuing education in silviculture and forest ecology that will help Black Hills loggers understand the basis for forest management decisions and will better equip them to assist forest managers in managing Black Hills tracts. Other topics that assist loggers in managing their businesses, such as accounting procedures, working with land owners, best management practices, OSHA

requirements, and first aid, were also presented.

Over 70 loggers attended spring workshops in Hill City and Spearfish, while an additional 30 attended a workshop this fall in Spearfish. The Black Hills Women in Timber and Black Hills Timbermen's Association have been, and continue to be, actively involved in the direction and promotion of this program.

- Closer to campus, the last 2 years have witnessed the establishment of new cut flower, fruit tree, and Christmas tree evaluation, demonstration, and teaching plots at the N.E. Hansen Research Center.

The cut flower plots link private industry with our research. Department faculty evaluate the quality and production potential of trial materials received from the National Association of Specialty Cut Flower Growers. These materials are then disseminated to retail and wholesale florists to inform them of the new plants that are available. In turn, these businesses tell us the public's response to these new materials. Our students also benefit from exposure to the latest in floral crops.

- The Master Gardener program, conducted through Horticulture Extension, continues to influence many South Dakotans both directly and indirectly. Seventy-five to 100 individuals participate in the training of new Mas-



photo: HFLP Department

ter Gardeners, in return for professional instruction in horticulture, donate a minimum of 80 hours of service to their communities, sharing their knowledge in beautifying and adding value to public sites and assisting Extension agents in answering horticultural questions.

ter Gardeners each year, with similar numbers receiving recertification training. These individuals multiply the impact of their training through volunteer service in their community.

The above examples highlight the active involvement of the citizens of South Dakota in the research and outreach activities conducted thorough the Horticulture, Forestry, Landscape and Parks Department. In addition, faculty conduct many other research and outreach activities that touch the daily lives of South Dakotans and the ways in which they manage rural and community landscapes across the state. □

Dr. Peter Schaefer is professor and head of the Department of Horticulture, Forestry, Landscape and Parks at SDSU.

From fields to high-tech labs, Plant Science has national impact

by Dale J. Gallenberg

Many of the Plant Science Department's research and Extension projects relate directly to production agriculture; however, basic biology, natural resource management, and other topics are also addressed. Our work ranges from applied, field-oriented studies to those emphasizing molecular biology and from immediate to long-term research. Our projects have impact not only in South Dakota but regionally and nationally as well.

To become aware of developing problems in production agriculture and to pass on solutions and recommendations, our faculty maintains close associations with clientele. Our work is well supported financially by commodity groups. We also receive significant external competitive grant funding and private industry contributions.

- Variety and germplasm development is a major activity; we emphasize characteristics that ensure stable, profitable crop production—yield, quality, pest resistance, stress tolerance, and others. Recent variety releases from SDSU include 'Russ' spring wheat, 'Nekota' winter wheat (joint release with Nebraska), and 'Hendricks' soybeans (joint release with Minnesota).

Variety development is not limited to conventional methods. Molecular techniques are used to study oil content and quality, freeze resistance, pest biology, and other factors. Near-Infrared Reflectance Spectroscopy (NIRS), usually associated with forages, is used to measure various crop quality parameters.

- The Crop Performance Testing program generates data to assist producers in making variety and hybrid planting choices. Basic seed stocks are made available through Foundation

Seed Stocks and Seed Certification programs.

- The potential of alternative crops and the economics of rotation/tillage systems are being examined. Management of CRP acres coming back into production and the best utilization of wetlands are being studied as well. Winter wheat producers are benefiting from work on conservation compliance, specifically "credit" for wheat growth in the fall.

- Several soil science projects are involved in the development and implementation of precision or site-specific farming. Department faculty helped host a recent precision farming conference.

- Basic crop fertility requirements, the use of soil testing, and fertilizer/pesticide application technology are important facets of our work. Studies have shown that certain chemical application techniques need to be critically evaluated to reduce the risk of herbicide movement in areas vulnerable to groundwater contamination.

- Various biological control agents have been evaluated for control of insects and weeds. Promising results have been obtained using a fungus on grasshoppers and flea beetles on leafy spurge.

- Studies on reduced corn rootworm insecticide rates and on cereal aphid management have influenced recommendations made to farmers in South Dakota and the region.



Variety development, a major activity in the Department, encompasses both tried-and-true conventional breeding and the newest in molecular technology. To meet the goals of more stable and more profitable production, two new wheat varieties have been recently released.

- The soybean cyst nematode was discovered in Union County in 1995. We will continue to develop educational and control programs. Phytophthora root rot of soybeans is an increasing problem, and research emphases include race identification, population dynamics, and resistance screening.

- Field evaluations of pesticides on a variety of crops generate data which aid producers in making control decisions. In the W.E.E.D. Project, programs have been developed for unique problems, such as managing ALS-resistant kochia.

- Pesticide applicator training, container recycling, and waste pesticide disposal are successful programs involving inter-agency cooperation. □

Dr. Dale Gallenberg is an associate professor and head of the Department of Plant Science at SDSU.



One of three persons leaves rural South Dakota in a decade. Results are fewer—and aging—farm families and small communities. The Rural Sociology department combats this decline by providing a forum for community rebirth and revitalization.

Rural Sociology

Taking the pulse of South Dakota's farms and communities

by James L. Satterlee

While the U.S. Census Bureau reported a slight (.8 percent) increase in population for the state of South Dakota during the decade 1980-90, "natural increase" (births minus deaths) for the same period reflected an out-migration of over 50,000 persons during the decade. Over half of the out-migrants were young adults aged 20-34 years.

One of every three persons living in the rural farm sector of the state in 1980 had left by 1990.

The impacts of that loss have spread outward from farms and ranches. Most small South Dakota communities of the 1990s have boarded-up businesses on mostly empty mainstreets.

Census numbers mask these realities, however. The raw numbers show that the total population of towns under 2,500 (the rural non-farm sector) increased slightly. These gains,

however, can be accounted for by the large increases in just a few communities within commuting distance of our larger urban centers. The smaller communities in the state have been seriously affected by the loss of farms and ranches and, more specifically, the families who operated them.

The survival of many of our smaller family farms and their nearby towns is linked and is dependent upon opportunities for off-farm employment of one or both family members. The question then is: How do we help revitalize communities to serve as logical sites for economic development (business sitings and/or expansions) that will provide the quality of life necessary for such activity to occur?

- The Census Data Center (CDC) at South Dakota State University is a repository of all census data available through the Bureau's State Data Cen-

ter Program. By themselves, these numbers are not very meaningful to local decision makers. We sift through and sort the information into reports and publications that provide current data and trends for use by individuals and groups working to improve their communities or start or enlarge businesses. The joint support of the Agricultural Experiment Station and the Cooperative Extension Service allows our staff to work directly with community leaders in translating the census data into alternative routes to development.

- Four regions in South Dakota have already set up frameworks to empower local communities to set goals, share resources, and provide opportunities for farm and town residents. The CDC has played a critical role in providing a forum for discussing common interests and concerns. At the present, at least 26 (40 percent) of the 66 counties in the state have been involved in some aspect of regional planning. Staff of the CDC make 30 to 40 formal presentations annually, conduct workshops, and develop numerous special reports to support these regional efforts.

The CDC is supported through funding by the Agricultural Experiment Station, Cooperative Extension Service, and SDSU instructional programs. In addition the U.S. Department of Commerce-Bureau of Census provides the census data free of charge to the CDC.

For population, agricultural, and economic information pertaining to your locality, contact the Census Data Center, Box 504, SDSU, Brookings, SD 57007-1296, or phone 605-688-4132. □

Dr. James Satterlee is professor and head of the Department of Rural Sociology at SDSU.

Veterinary Science

Benefits of animal health improvements stretch from producer to consumer

by John U. Thomson

All citizens of South Dakota benefit from the efforts of the Veterinary Science Department (VS)/Animal Disease Research and Diagnostic Laboratory (ADRDL) at South Dakota State University. The animal disease research, diagnostic, Extension, and teaching efforts are all focused to address health concerns of livestock and poultry operations in South Dakota. Improvements in animal health promote animal welfare, assure safe and wholesome food, and provide improved profitability, efficiency, and savings that are shared from the producer to the consumer.

- The ADRDL received over 27,000 submissions of animal specimens from regional veterinarians representing every South Dakota county during the past 1.5 years. The laboratory conducted over 650,000 tests on specimens from 31 mammalian and 14 avian species, with 85 percent coming from cattle and swine. Diagnoses involving rabies, anthrax, *Salmonella*, cryptosporidiosis, and other zoonotic pathogens that may be transmitted from animal to humans were provided. These frequently highlight the importance of the ADRDL service in assisting in the prevention, control, and treatment of diseases.

- Veterinary Science researchers have preliminary data that there are wide variations in the virulence of isolates of 0157:H7 *E. coli*. The 0157:H7 *E. coli* isolates from cattle appear to be significantly less virulent than those associated with human illness. These findings will assist future efforts to provide a safer food supply.

- Bovine respiratory syndrome has plagued the beef industry for decades. The lack of knowledge about the bovine immune system has been a limiting factor in controlling and pre-



photo: Tom Bare

The volume of specimens coming into the Animal Disease Research and Diagnostic Laboratory is staggering. Tests conducted are vital to the prevention, control, and treatment of diseases in animals. Because many pathogens may be transmitted from animals to humans, work in the Lab also has impact on human health.

venting this syndrome. SDSU researchers have the technology to evaluate mucosal cell immunity. This new technology allows research to add valuable scientific information about the efficacy of prevention and control protocols.

- Veterinary Extension is focusing on improved utilization of records and information. After Extension assisted the owner and attending veterinarians in the analyses of records for an 800-head feedlot, they realized that the home-raised calves were the highest contributors to health problems. This information stimulated management to reevaluate the herd health plan and feedlot entry policies. This will improve the profitability for this operation and serve as an example for many other producers and veterinarians.

- SDSU researchers continue to provide valuable scientific information about the Porcine Reproductive

and Respiratory Syndrome. Efforts to evaluate the role of semen in the transmission of the disease have led to the development and implementation of a polymerase chain reaction (PCR) testing procedure to identify semen containing the virus. The significance of this contribution has been magnified by the swine industry's rapid adoption of artificial insemination.

- Many researchers in the Department are utilizing flow cytometry technology, a sophisticated cell sorter. These efforts are producing protocols for the evaluation of semen, milk, and blood that will eventually be incorporated into the ADRDL diagnostic offerings to further the health and well-being of animals. □

Dr. John U. Thomson is professor and head of the Department of Veterinary Science and Director of the Animal Disease Research and Diagnostic Laboratory at SDSU.



Wildlife and Fisheries Sciences

Needs of citizens, producers, and wildlife are combined in research

by Charles Scalet

Some 347,000 citizens of South Dakota over the age of 16 either hunted, fished, or in some other way participated in outdoor activities that involved wildlife and fisheries resources in 1991, according to the latest figures from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Most of that activity occurred on private land.

Our research activities address both the needs of resource users and the needs of people upon whose land the majority of the state's wildlife and fishery resources are found.

Approximately 15 percent of our Department's research budget originates directly from the Agricultural Experiment Station, while the other 85 percent is obtained from outside grants

and contracts. Regardless of the source of funds, a large proportion of our research effort is directed at wildlife-fisheries-agriculture interactions.

All of our approximately 50 research projects have positive impacts on state citizens. The three research areas described here are typical examples of how our projects contribute to the ongoing mission of the Agricultural Experiment Station, which is to improve the quality of life for South Dakotans as producers, consumers, and citizens.

- One project involves white-tailed deer in the Sand Lake National Wildlife Refuge in Brown County. Because of deer depredation on crops, primarily corn, in surrounding private fields, we investigated by tracking and

Farm and ranch ponds serve multiple uses, including fishing and recreation, in South Dakota. Research-based stocking can be customized to support species from largemouth bass to trout.

counting deer in the area and mapping their patterns of movement onto and off the refuge. Resulting management suggestions may reduce crop damage. Modifications in hunting seasons may help to further reduce damage. This project obviously affects both landowners and deer hunters.

- Farm and ranch ponds represent a major economic resource to state landowners. These same ponds are also a significant recreational resource for a large number of South Dakota citizens. Ponds range from those having warmwater fishes, such as largemouth bass, to coldwater ponds that are best suited for rainbow trout. Current research is focusing on coolwater species such as yellow perch and northern pike. Ongoing projects are directed at determining management strategies that work best in various types of waters. By giving landowners options concerning what strategies are feasible for their ponds, we hope to increase the quality and utility of these multipurpose water bodies.

- Another project involves problems associated with the Black Hills deer herd. This issue concerns decreasing population quality and harvest since the 1970s. We are currently determining habitat needs for deer reproduction and growth. The majority of deer in the Black Hills reside on U.S. Forest Service land, and the deer population is dependent on how that land is managed. Deer population quality can be enhanced by modifying forest management practices. This region is a major public lands area, and therefore, affects many consumptive and nonconsumptive deer users.

Our outreach and service activities are centered in three areas: how to improve habitat for game species, songbird information, and aquaculture questions. □

Dr. Charles Scalet is professor and head of the Department of Wildlife and Fisheries Sciences at SDSU.

108th Annual Report

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I.J. Stotz, MS, instructor
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D.H. Zeman, DVM, PhD, professor

Wildlife and Fisheries Sciences

C.R. Scalet, PhD, professor and head
C.R. Berry, PhD, adjunct professor
M.L. Brown, PhD, assistant professor
W.G. Duffy, PhD, adjunct associate professor
L.D. Flake, PhD, professor
K.F. Higgins, PhD, adjunct associate professor
D.E. Hubbard, PhD, associate professor
J.A. Jenks, PhD, assistant professor
D.W. Willis, PhD, professor

Projects

Agricultural Engineering

G-043, Application of machine vision to selective mechanical harvest of mushrooms; Humburg
H-053, Environmental factors that affect pig health; Anderson
H-063, Design and analysis of agricultural structures; Anderson
H-133, Influence of irrigation and drainage design on discharge water quality and corn profitability; DeBoer, Chu
H-163, Extrusion processing as a value enhancing technique for agricultural materials; Julson, Krishnan
R-184, Climate and agricultural landscape productivity analysis and assessment in the North Central Region; Bender
H-192, Root growth and soil impedance; Alcock, Myers
H-204, Machine vision as a sensor for automation and quality enhancement in agriculture; Humburg
H-243, Modeling groundwater recharge from vadose zone to aquifer; Chu
H-354, Rheological, thermodynamic, and transport properties of hydrogels and films made from biopolymers; Tang, Julson, Wang, Krishnan, Costello, Komath

Animal and Range Sciences

- R-079, Genetics of body composition in beef cattle; Marshall
H-203, Use of quality grade prediction and implant strategy as marketing tools for feedlot cattle; Wagner
H-213, Effects of melengestrol acetate and prostaglandin on postpartum reproduction in beef cows; Miller
H-223, Patterns of utilization on season-long and spring-deferred pastures; P. Johnson
G-224, Molecular markers associated with production efficiency of beef cattle; Marshall
H-232, Metabolizable protein requirements of cattle during rapid growth; Pritchard
H-245, Genetic improvement of beef cattle production efficiency; Marshall
H-253, Nutritional management to minimize costs and improve reproductive performance of beef cows; Pruitt
R-255, Molecular mechanisms regulating skeletal muscle growth and differentiation; McFarland
H-274, Water intake, runoff, and vegetation characteristics of soils with various histories of land treatment; Gartner, Johnson, Kronberg, Tusler, Kohl, Beutler
H-284, Understanding and manipulating the diet selection of ruminant livestock; Kronberg
H-290, Effects of balance and level of indispensable amino acid on daily feed intake by swine; Hamilton, Libal
H-292, Development of a field guide to the vascular plants of the Black Hills; J. Johnson
H-301, Nutrition and management influencing reproductive efficiency of swine; Libal, Hamilton
H-314, Protein deposition in 20- to 113-kg pigs as affected by diet and gender; Hamilton, Libal
H-333, Lean gain in pigs: prediction of lean growth and identification on factors affecting lean growth; Libal, Hamilton
H-334, Improving the production and utilization efficiency of animal products and byproducts; Romans
R-342, Increased efficiency of sheep production; Slyter
H-344, Development of small portion, convenient, meat food products; Costello, Romans, Tang
H-374, Ammoniated oat hulls as a feed for growing beef cattle; Birkelo
R-390, Factors regulating protein synthesis, degradation, and growth in skeletal muscle; McFarland
H-433, Leafy spurge interactions with livestock and rats; Kronberg, Phelps
SD-9303587, Heterogeneity in growth factor response of myogenic satellite cell populations; McFarland
SD-9404543, Effects of stocking rate and grazing system on patterns of tiller utilization; P. Johnson

Biology/Microbiology

- H-115, Genetic modification to enhance crop quality and insect resistance; Cheesbrough
H-135, Molecular analysis of a gene which regulates growth, fertility, and carcass size; Westby
H-143, Bioconversion of ethanol production byproducts into acetate (CMA); Gibbons
H-162, Enhanced growth and reproductive efficiency; Granholm
H-194, Echinacea: identification and development of the agronomic and horticultural potential of this genus; Reese, Matthees
H-221, Rapid fixation and selection for agronomic characters through anther culture of spring wheat hybrids; Chen, Rudd
H-222, Nitrite reductase gene of *Azospirillum brasilense* and nitrite assimilation; Westby
H-231, Molecular biology of a mammalian gene which regulates carcass size, fertility, and obesity; Westby
G-233, Developmental regulation of soybean fatty acid synthesis; Cheesbrough

Chemistry and Biochemistry

- H-054, Mineral nutrition and metabolism in animals; Emerick, Kayongo-Male
H-074, Enzymatically mediated organic reactions; Matthees
H-084, Bioreactor production of a corn-based fungal polysaccharide; West
H-110, Flow cytometry; Evenson
H-225, Automated cytometry of sperm quality; Evenson
H-254, Biochemistry of selenium; Palmer
S-407, Analytical services; Thies
SD-9404175, Acquisition of a flow cytometer; Evenson, Benfield, Hurley

Dairy Science

- H-083, Improving quality and microbial safety of dairy products; Henning
H-093, Composition, quality, and consumer acceptance of milk and dairy products; Baer
H-103, Improvement of the quality of lowfat cheese; Mistry
R-105, Modifying milk fat composition for improved manufacturing qualities and consumer acceptability; Schingoethe, Baer
H-113, Analysis of dairy products; Parsons, Northeimer
R-172, Dairy herd management strategies for improved decision making and profitability; Brouk
R-202, Metabolic relationships in supply of nutrients for lactating cows; Schingoethe
H-212, Whey utilization by dairy cattle; Schingoethe
G-235, Omega-3 fatty acids in dairy rations: changes in milk composition and immunity; Franklin
H-413, Reduction of reliance on antibiotics in dairy cattle through nutritional immunoenhancement; Franklin

Economics

- H-011, Sustainability of "organic" versus "conventional" beef production in South Dakota; Taylor, Feuz
H-024, Economic implications of the current marketing arrangements for slaughter cattle; Fausti
R-064, Economic and environmental implications of expiring conservation reserve contracts; Janssen, Beutler
H-081, Analysis of seasonal patterns in grain prices and evaluation of alternative grain marketing strategies; Qasmi
H-134, Economic analysis of farmland markets in South Dakota; Janssen
H-145, Economic assessment of grain marketing patterns, practices, and strategies in South Dakota; Qasmi
H-152, Crop production functions: economic implications for South Dakota; Franklin
H-155, Feasibility of a new value based cash marketing system for fed cattle; Fausti
H-165, Assessing long term economic profitability and risk of crop production in Southeast South Dakota; Franklin
H-181, Economic and environmental implications of conservation reserve program contract expiration in South Dakota; Janssen
H-191, Policy and economic aspects of sustainable cropping systems; Dobbs
H-215, Economic linkages between agriculture and other sectors of South Dakota; Ellingson
R-291, Regulator, efficiency, and management issues affecting rural financial markets; Lamberton
H-302, Acreage supply response for major crops for South Dakota; Ellingson
R-303, Domestic and international marketing strategies for U.S. beef; Feuz
H-370, Economics of rangeland improvement; Beutler

Home Economics

- H-025, Intergenerational transfer of the family farm/ranch: family challenges, strategies, and community response; Helling, Stover
R-123, Enhancing health and safety through personal protective equipment; Manikowske
R-185, Family and work linkages; Nichols, Schmiede
H-273, Use of near infrared reflectance technology in the measurement of fatty acids and amino acids in oats and soybeans; Krishnan, Kephart
H-364, Preservation of soy isoflavones during processing; Wang, Krishnan, Julson

Horticulture, Forestry, Landscape and Parks

- MS-022, Strategies of resolving forest production versus forest recreation conflicts in the Black Hills of South Dakota and Wyoming; Stubbles
R-042, Rootstock and interstem effects on pome and stone fruit trees; Fennell
MS-044, Carbon budgets, agroforestry ecosystems, and global climate change in the Northern Great Plains; Johnson
H-052, Environmental stress and fruit production in South Dakota; Fennell
H-069, Vegetable breeding, evaluation, production, and cultural practices to increase yield; Prasher
MS-125, Selecting best management strategies for resolving forest production versus forest recreation conflicts; Stubbles
MS-173, Genetic diversity in native and planted population of *Juniperus virginiana* L.; Schaefer
MS-263, Genetic improvement of agroforestry tree species; Schaefer
MS-324, Evaluation and propagation of superior selections of native and introduced trees, shrubs, and vines; Evers
H-403, Micropropagation of *Echinacea augustifolia*, *E. pallida*, and *E. pupurea*; Harbage

Plant Science

- G-015, SDAES participation in NAPIAP; S. Clay
H-014, Elateridae of the Northern Great Plains; P.J. Johnson
H-023, Agricultural management: a systems approach; D. Clay
R-033, Forage protein characterization and utilization for cattle; Kephart
R-034, Overwinter survival of *Heterodera*, *Pratylenchus*, and associated nematodes in the North Central Region; Smolik
G-041, Tillage induced microrelief impacts on NO_3^- and atrazine movement in soils; D. Clay, T. Schumacher, S. Clay, Bischoff
H-045, Tillage and crop rotations for eastern South Dakota; Berg
R-055, Characterizing nitrogen mineralization and availability in crop systems to protect water resources; D. Clay
H-060, Molecular genetics of lipid and protein biosynthesis in oilseed crops; Carter
G-061, Mapping quantitative trait loci (QTL) using molecular markers in cultivated oats; Reeves, Kahler, Butler
H-062, Phosphate buffering capacity in select South Dakota soils; Doolittle, Gelderman
H-065, Ecology and behavior of economically important arthropods in the Northern Great Plains; Collins
H-073, Water flow through weathered glacial till: description and measurement; Kohl, J. Schumacher, Carlson, DeBoer, Doolittle
R-075, Biological and ecological basis for weed management to reduce herbicide use; S. Clay
H-085, Bioavailability of nutrients and contaminants in soil; Doolittle
H-091, Soybean in vitro; Carter
H-092, Development and utilization of oats and rye adapted in South Dakota; Reeves
H-094, Winter wheat breeding and genetics; Haley

H-095, Correlation, calibration, and interpretation of soil and plant tests; Gelderman
H-102, Correlation, calibration, and interpretation of soil and plant tests; Gelderman
H-104, Soybean breeding, genetics, and production; Scott, Stein
H-111, Agricultural management impacts on wetlands; Rickerl, Bleakley, Hubbard
H-114, Oilseed breeding and genetics; Grady
H-132, Management of northern and western corn rootworms in South Dakota; Fuller, Sutter, Boetel
H-144, Alternative crop production systems for northeastern South Dakota; Smolik
H-153, Metabolic and genetic consequences on inverted solute regulation resulting from freeze selection; Kenefick, Sutton, Haley
H-154, Soil management to reduce biostress; T. Schumacher
R-161, Introduction, multiplication, evaluation, preservation, documentation, enhancement, distribution, and utilization of plant germplasm; Wicks
H-164, Weed ecology and control in conventional and alternative management systems; S. Clay
H-174, Biological control of tan spot of wheat on wheat residue; Bleakley
H-195, Molecular genetics and transformation of oilseed crops; Carter
H-201, Abscissic acid regulated genes in freeze resistance of barley; Kenefick, Sutton, Cheesbrough
H-229, Expert systems for scheduling fungicide applications for wheat disease control; Gallenberg
H-230, Tillage and crop rotations for eastern South Dakota; Berg
G-234, Integrated farming system management utilizing nested databases on the watershed level; S. Clay, Ellsbury, Forcella
H-264, Etiology and epidemiology of plant viruses in South Dakota; Langham
H-265, Improved rootworm management practices in South Dakota; Fuller, Chandler, Boetel
H-283, Breeding perennial grasses and legumes for forage, wildlife habitat, and resistance to insect-related stresses; Boe, Kephart
H-293, Technology transfer of applied/basic soils information for the agriculture and environment of South Dakota; Malo
R-312, Forage crop genetics and breeding to improve yield and quality; Boe
H-313, Genetics of fungal pathogens of row crops; Chase
H-323, Corn genetics, physiology, and breeding; Wicks
H-343, Spring wheat breeding and genetics; Rudd
H-353, Soil specific fertilizer, pesticide, salinity, and sediment management; Carlson, J. Schumacher
H-363, Alfalfa forage yield, quality, and establishment; Kephart
R-373, Impact of accelerated erosion on soil properties and productivity; T. Schumacher, Lindstrom
H-383, Fertilizer management and nutrient use efficiency in field crops; Woodard
H-393, Conservation compliance in western South Dakota; Strymiest
R-400, Biological and ecological basis for weed model to reduce herbicide use in corn; S. Clay
R-410, Nutrient management to sustain productivity while protecting surface and groundwater quality; Gelderman
R-423, Thifensulfuron-methyl magnitude of residue on flax; S. Clay, Wrage
H-443, Management factors required to utilize cool-season crops as replacements for summer fallow in no-till winter wheat systems; Beck
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
SD-9304149, Strategy to identify genes linked directly to freeze resistance; Sutton
SD-9400965, Transformation techniques in sunflowers; Carter

Rural Sociology

H-112, Census Data Center; Satterlee
S-214, Human stress and the intergenerational transfer of family farms and ranches; Stover, Helling

Veterinary Science

R-082, Prevention and control of enteric diseases of swine; Francis, Benfield
AH-131, Epidemiology and control of Johne's disease in South Dakota livestock; Johnson, Fawcett, Bjordahl
AH-175, Development and evaluation of new diagnostic method; Holler, Johnson
H-183, Objective measure of stress and its physiological effects of stress on the immune response of cattle and swine; Hurley, Walker
AH-193, Early events (binding and entry) in the pathogenesis of porcine rotaviruses; Benfield, Erickson
G-205, Identification of the cell receptor(s) for group a porcine rotaviruses; Garduno
AH-242, The identification of the respiratory epithelial cell receptor for bovine herpesvirus 1; Chase
H-244, Virulence determinants of *E. coli* 0157:H7 food-borne disease strains; Francis
G-252, Analysis of porcine intestinal receptors in which *E. coli* K88 bind; Francis, Bosworth, Erickson
R-281, Bovine respiratory disease: risk factors, pathogens, diagnosis, and management; Miskimins, Thomson, Leslie-Stein
AH-294, Effect of excessive selenium on pregnancy outcome and the immune system in cattle; Holler, Yeager
H-304, Diagnosis and pathogenesis of porcine reproductive and respiratory syndrome virus in the fetus and sow; Holler, Christopher-Hennings
SD-9304186, Consequences of interaction of bovine herpesviruses with mononuclear leukocytes; Chase, Hurley

Wildlife and Fisheries Sciences

H-012, Assessment of movements, density, and depredation patterns of white-tailed deer at Sand Lake National Wildlife Refuge, South Dakota; Jenks
H-035, Factors influencing recruitment of panfish in South Dakota waters; Willis
MS-051, Wood ducks and prairie woodlands: artificial nesting structures, brood survival, and habitat in South Dakota; Flake
H-071, Northern pike management in South Dakota ponds and small lakes; Scalet
H-072, Assessment of fisheries management options for South Dakota ponds; Willis
S-963, South Dakota Cooperative Fish and Wildlife Research Unit; Berry, Higgins

Publications

If you are interested in any of these articles or publications and cannot reach the author listed, contact the department under which the reference appears. Some of the authors may be graduate students who have completed their studies and left SDSU. The department will be able to assist you.

Agricultural Engineering

Refereed journal articles

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Chu, S.T. 1994. Capillary tube infiltration model with Brooks and Corey parameters. *Trans ASAE* 37(4):1205.
Chu, S.T. 1995. Effect of initial water content on green-ampt parameters. *Trans ASAE* 38(3):839.

Gao, Y.C., J. Leleivre, J. Tang. 1995. Theoretical analysis of stress concentrations in gels containing spherical fillers. *Trans ASAE* 38(6):1813.
Li, Y., S.T. Chu. 1995. Field evaluation of aquifer-recharge model. *J Irrig & Drain, ASCE* 121(6):385.
Tang, J., M. A. Tung, Y. Zeng. 1995. Mechanical properties of gellan gels in relation to divalent cations. *J Food Science* 60(4):748.
Tung, M.A., I.J. Britt, J. Tang. 1994. Mechanical properties and strength of food polymer gels. *Tezukayama College Food Sci* 16:5.

Other reports, publications

Anderson, G.A. 1995. Designing diaphragms to carry applied loads. *ASAE paper SD95-120*.
Chu, S.T. 1995. Groundwater recharge and water table rise under equilibrium conditions. *Intl ASAE-CSAE Conf*.
DeBoer, D.W., S.T. Chu. 1994. Application-rate-dependent soil infiltration and center-pivot irrigation runoff. *Rpt N 94-A-015, Ag Eng*.
DeBoer, D.W., J.J. Doolittle, R.A. Kohl. 1995. Spatial variability of selenium, salinity and water retention in a potentially irrigable soil. *Final rpt, SDSU*.
DeBoer, D.W., A. Warrick. 1994. Selenium concentrations in subsurface drainage water. *ASAE paper 942625*.
DeBoer, D.W., H.D. Werner, J.Y.T. Hung. 1995. Irrigation technologies and management for water conservation. *Proc Intl Conf on Water Res Mgt in Arid Countries*:61.
Humburg, D.S., J. Srinivasan. 1994. Structured light and camera system for scanning mushroom strays. *ASAE paper 943509*.
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Manjegowda, R. 1995. Simulation of drainage discharge and analysis of soil selenium concentrations for the Lake Andes-Wagner project. *MS thesis, SDSU*.
Salem, S. 1995. Implementation of a modified Hough transform for singularization of mushrooms using the TMS 320C30 digital signal processor. *MS thesis, SDSU*.
Tang, J., M.A. Tung, Y. Zeng. 1994. Mechanical properties of gellan gums in relation to polymer and cation concentrations. *Abstrs, 2nd Intl Workshop on Gellan and Related Polysaccharides*.
Tang, J., M.A. Tung, Y. Zeng. 1995. Gelling temperature of gellan solutions. *Paper 93D-14, IFT*.
Warrick, A.W., G. Fennemore, D.W. DeBoer. 1995. Predictions of readily-leached solutes in subsurface drains. *Agr Water Mgmt (submitted)*.

Animal and Range Sciences

Referred journal articles

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Boettcher, S.E., W.J. Johnson, F.R. Gartner. 1995. Case study in woodland restoration. *Rangelands* 17(1):15.
Dodson, M., D. McFarland, E. Bandman, W. Dayton, Z. Yablonska-Reuveni, E. Greene, M. Doumit, W. Bergen, R. Merkel, J. Vierck, S. Velleman, J. Koumans. 1995. Status of satellite cell research in agriculture. *Basic and Applied Myology* 5(1):5.
Dritz, S., K.L. Clark, G. Nemecek, N. Williams, B. Thaler, R. Vinson. 1995. Swine nutrition, roundtable discussion. *Agri-Practice* 16(18):10.
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Feuz, D.M., S.W. Fausti, J.J. Wagner. 1995. Risk and market participant behavior in the U.S. slaughter cattle market. *J Agr and Resource Econ* 20(1):1.

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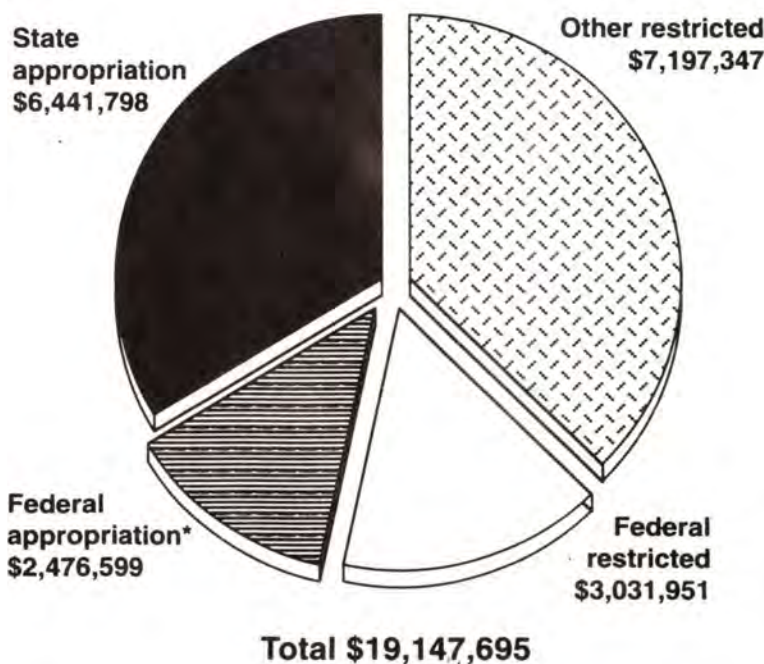
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Budget

Agricultural Experiment Station
For July 1, 1995, to June 30, 1996



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Calendar of Events

Date	Event	Person to Contact
March 1996		
22-24	Black Hills Jr. Leader Retreat, Rapid City	Kim Mehl, Pennington County Agent
22-24	Lawn and Garden Expo, Sioux Falls	Steven Munk, Minnehaha County Agent
30	SD Horse Fair, Sioux Falls	Larry Insley, Animal & Range Sciences, SDSU
April 1996		
18	Food Safety Training, RDTN sites	Carol Pitts, Extension Home Economics, SDSU
May 1996		
13-14	Wyo-Mon-Dak Community Development Conference, Miles City, Montana	Linda Smith, Meade County Agent
June 1996		
4-7	SD Stockgrowers Assn/CattleWomen/Junior Annual Convention, Hot Springs	Jim Males, Animal & Range Sciences, SDSU