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The role of SDSU Service Labs
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Director's comments

Service labs are ‘bridges’ between researchers and South Dakotans

by Dr. Fred Cholick

Serving people is the mission of the Experiment Station, and most of us equate “research” with that mission.

And it’s true that our primary goal is to develop science-based information that enlarges knowledge, not only within South Dakota, but also regionally, nationally, and internationally.

But information “on the shelf” in completion reports is useless. It must be used. And to be used, it must be available to the citizens of South Dakota. There are two primary ways in which this happens.

The specialists and county agents of the Cooperative Extension Service are tops at transferring information from the Experiment Station to the user. Equally valuable but far less known are the chemists, technicians, and other personnel of the various Experiment Station analytical service laboratories. In those labs, science-based information is used in the diagnosis of single samples from single clients. The exchange is one to one, the best kind of interaction.

Literally hundreds of thousands of samples are received, analyzed, and identified at the various labs across the SDSU campus. Many of these are from South Dakotans, and a list describing the kinds of samples would be unending. Other samples are generated in our research activities, and since there are 154 research projects currently active in the Experiment Station, this is also a large portion of the labs’ workload.

Principal investigators in the service labs also conduct their own research, either independently or as members of a team. Almost without exception, they look for methods that enhance accuracy and efficiency in testing. An additional thrust of the research is to protect our natural resources and assist in wise management decisions on farms and ranches.

In all these activities, the labs act as a bridge. Information flows out through them and questions come back. Questions from private users of the labs often spark a research project. The labs are a way for us to identify the needs of South Dakotans.

In addition, the student connection in the service labs is very strong. Often, students provide a part of the labor force. They gain hands-on application of what they learned in the classroom. The SDSU students help us in another way they may not realize: We showcase the labs to high school and elementary students. Seeing college students much closer to their age than the perhaps graying scientists piques the interest of many a young person who will say, “Why, here’s a place for me.”

The development of knowledge is a primary goal of the Agricultural Experiment Station, not only in South Dakota but in the network of Experiment Stations within the region and nation. Analytical laboratories are a critical part of that development. They provide a service to the institution, science, and the citizens of South Dakota.

I strongly encourage you to review the various analytical service capabilities that we have and to take advantage of these services so that we can do a better job of serving your needs.

Dr. Fred Cholick is the Director of the South Dakota Agricultural Experiment Station, SDSU.
Analytical Services examine a host of plant-animal-mineral materials

by Mary Brashier

Call the manager of Analytical Services first when you’re puzzled about which lab at South Dakota State University should test your sample. “We may be the lab where the sample belongs,” says Nancy Thiex, lab supervisor. “We conduct a wide variety of tests. We also act as a clearing house, directing callers to the proper lab or person on campus.”

Analytical Services, a part of the Chemistry/Biochemistry Department at SDSU, accepts samples of feeds, fertilizers, pesticide residues, animal antibiotics and drugs, waters and waste waters, processed meats, manures and composts, and animal tissues. With such a variety of analyses to conduct, the five principal investigators and their chemists and technicians occupy a large part of the Olson Laboratories in the Animal Science Complex on the north edge of the SDSU campus.

Roughly 30,000 analyses are conducted on 10,000 samples per year. Requesting these work-ups are farmers, ranchers, agribusinesses, other small businesses, and home owners. The lab also analyzes samples for SDSU’s Animal Disease Research and Diagnostic Lab, the regulatory arm of the South Dakota Department of Agriculture’s Division of Agricultural Services and Animal Industry Board, and the Department of Environment and Natural Resources.

Many samples in the feed/forages section run by Thiex are from producers balancing feed rations and from hay marketers.

Acid detergent fiber, net energy lactation, adjusted crude protein, and other values reported by the lab “sound like technobabble only to non-producers,” Thiex says. “Many of our samples are from repeat customers, and in any case we send along a sheet that helps the client interpret results.”

Hay marketers, both buyers and sellers, usually ask for the NIRS (Near-Infrared Reflectance Spectroscopy) test, Thiex says. “This is a quick way to determine equitable prices based on nutritive values. We can have results in the mail the day we receive the sample.”

These clients are probably quickest to appreciate the multi-state collaboration and continuous internal monitoring of lab procedures in Analytical Services.

“When labs in other states report the same numbers from samples of the same hays, a farmer in South Dakota can sell in, say, Minnesota, with a lot less hassle,” Thiex says. Regional collaboration enhances our usefulness to South Dakotans.”
If concerned about pesticide contamination of plants, animals, or soil, the person to call is Dr. Duane Matthees, chief of the pesticides section of Analytical Services.

Herbicide injury is the largest part of his work, but almost always he will first advise the caller to contact the county Extension agent or Leon Wrage, Cooperative Extension Service weeds specialist at SDSU, before sending in a sample.

"Visual inspection is often the best way to diagnose injury. Chemical analysis for pesticides is expensive," says Matthees. "I don't want people to spend money for a test until they're sure they need it."

His research centers on devising more accurate testing procedures. He also teaches in the College of Arts and Sciences.

Dr. Joel Houglum, who teaches in the College of Pharmacy, handles analyses of commercial-strength pesticide formulations, antibiotics, and drugs for the regulatory officers of SDDA and individual clients.

In another section of Analytical Services, Dr. Ivan Palmer concentrates mostly on selenium, last year conducting over 4,700 analyses for individuals, the Animal Disease Research and Diagnostic Lab, industries, and other universities.

"South Dakota is unique in the world," he says. "Elsewhere, the selenium problem is deficiency. Ours is excess."

Although Palmer's lab does find excess selenium in forage and animal-hair samples sent in by some West River ranchers, he credits most long-time ranch families with the management skills to handle the problem.

"When we can, we draw them maps and give advice. There's not much they can do about sitting on top of Pierre shale and Niobrara formation geologic strata, but on the whole they handle the potential for selenium poisoning very well, mainly by not overgrazing."

The lab gained and continues to hold an international reputation for selenium work, beginning in the 1930s when workers identified "alkali disease." In following decades, Dr. Oscar Olson, now professor emeritus, devised analytical techniques that remain the "official" worldwide test for selenium. The lab also participated in the discovery that a certain amount of selenium is absolutely necessary in the diet of both animals and humans.

"So there's a great concern in the feed industry that they be allowed to supplement with selenium. We conduct a quality assurance program for the industries, and we do the same for universities. The grants and contracts help pay the bills here in our lab."

Palmer's research is related to the analytical work. He is seeking more foolproof methods that other labs can use and obtain duplicate results. He teaches students in SDSU's radioisotope lab.

Dr. Royce Emerick, also a teacher and researcher, handles analysis of minerals and metals for Analytical Services.

Because of the wide range of tests performed in Analytical Services, Thiex suggests that persons seeking help first contact their county Extension agent for assistance, fee schedules, and mailers. The relationship between Analytical Services and the county offices is a long one.

"We helped them start using hay probes about 10 years ago, and now probing is widely accepted. The samples are uniform and representative of the crop. Analyses can only be as good as the samples."

State-of-the-art technology in Analytical Services is attractive to SDSU students interested in this field. Around 10 students are hired each year, and the lab oversees the student internships and special problems projects of other students.

The lab is certified by the Environmental Protection Agency to analyze for trace elements in water. It is also certified by USDA for moisture, protein, fat, and salt in meats and by the National Forage Testing Association for moisture, protein, and acid detergent and neutral detergent fiber in forages. The lab regularly participates in self-policing exercises in which a "blind sample" arrives in the mail from an agency. The lab's analyses then are compared to known numbers back at the agency.

"We have been 'right on' in these tests," Thiex says. "That is one of the guarantees that we are giving honest and trustworthy results to our clients."
Animal Disease Research and Diagnostic Laboratory supports expansion of animal agriculture

by Dr. Larry Tennyson

The Animal Disease Research and Diagnostic Laboratory (ADRDL) at South Dakota State University is a nationally recognized center of excellence for research and diagnostics of animal diseases.

More than 85 percent of the 22,501 cases submitted to the lab during 1994 were from hogs and cattle. The remaining cases represented 43 other species of mammals and birds, according to Dr. John U. Thomson, head of Veterinary Science and director of the lab.

The 454,126 tests performed in FY 1994 is a large increase from the 157,000 tests in FY 1986.

Livestock prices are closely correlated with the demand for ADRDL services. The swine industry's pseudorabies eradication program started in 1988, and it also contributed significantly to the increased case and test numbers. A third factor is the discovery of the Porcine Reproductive and Respiratory Syndrome virus (PRRS), which has added increased interest in diagnoses since 1990.

Why is the role of the lab so economically important to the state? SDSU Economist Martin Beutler says animal production in South Dakota is about 15 percent beneath its true potential, and this is largely because of the effects of animal dis-
Connie Gates, microbiology supervisor, examines a sample sent to the Animal Disease Research and Diagnostic Lab at SDSU. The nationally recognized lab performed nearly a half million tests last year. More than 85 percent of cases sent to the lab in 1994 were from hogs and cattle.

...animal production in South Dakota is about 15 percent beneath its true potential, and this is largely because of the effects of animal diseases. The annual loss to animal disease is estimated at $344 million in direct output and $810 million in total economic activity.

—Dr. Martin Beutler
Economist, SDSU

The effort is led by a team of six veterinary pathologists. All of these veterinarians have graduate degrees in pathology. Together, they represent years of diagnostic experience.

The serology section performs tests on blood. Most are performed on specimens from live animals for regulatory purposes. With increased concern for herd health, some serological tests have become an important survey tool for veterinary practitioners.

The clinical pathology section focuses on hematology, cellular identification, parasitology, body fluid analysis, and blood chemistries.

The histopathology section is responsible for the preparation of tissue slides for the pathologists to document any characteristic structural changes in the specimens that may relate to organisms identified in tissues. This examination also is extremely critical to the disease surveillance mission of the ADRDL. Many new and evolving diseases are first observed through such evaluations.

In 1974, the ADRDL was one of the first labs in the nation to implement the use of an electron microscope in routine veterinary diagnostics. This assisted the lab in associating the rotavirus with neonate swine enteritis and the parvovirus to the canine parvovirus epidemic of the late 1970s. Most enteric cases are presented to the electron microscopy section for virus evaluation.

The bacteriology section of the ADRDL identifies types of bacteria, mycoplasma, and fungus. Some examples include E. coli, Salmonella, streptococci, clostridia, and anthrax. Following identification of the bacteria a test is usually performed to determine the most effective drug to control the organism.

The rabies section tests and reports laboratory findings on specimens suspected of being infected with the rabies virus. This section usually handles 1,000 to 2,000 of these cases per year. The routine fluorescent antibody test is 99.9 percent accurate for the rabies virus, but histological evaluation addresses the remaining .1 percent and also assists in identifying other disease causing agents.

Most incoming cases require the services of the virology section. Many diseases include a virus as the primary pathogen or as a contributing cause. This section routinely looks for viruses using fluorescent antibody staining techniques and by actually growing and isolating the virus on laboratory cells.

Larry Tennyson is a communications specialist in the Ag Communications Department, SDSU.
Center’s data essential to state’s future

by Dr. Larry Tennyson

The South Dakota State University Census Data Center works hand in glove with agriculture, business, government, and individuals across the state, according to its director, Dr. Jim Satterlee.

Located in the SDSU Department of Rural Sociology, the Center was founded in 1981 at the invitation of the U.S Census Bureau. The arrangement was that the Bureau would provide raw census data free of charge if the state would analyze and interpret it, then disseminate that information to those in government and the private sector who might benefit from it.

William Janklow, who was governor at the time, established the center at SDSU to handle the population, housing, and agriculture portions of the census data. He established a similar center at the USD School of Business to handle the portions that relate to business economics.

The SDSU Center has been an official Experiment Station research project from the start. Two years ago, the Cooperative Extension Service also became involved in helping to staff the center, and it became a joint effort of the Extension Service and the Experiment Station at that point. The role of the Department of Rural Sociology can best be described as the host of the Center.

Staffing for the Center includes a graduate student who handles the daily routine tasks.

Dr. Don Arwood is associate director of the Center and has responsibility for putting the census data into forms that can be used in classroom teaching on the campus. He also assists graduate students who use the data in research efforts relating to their theses and dissertations; and, at any given time, a dozen or more of these research projects are underway. Such assistance also is extended to SDSU administrators and faculty.

As director of the Center, Satterlee focuses his efforts on outreach to take the data to communities, organizations, businesses, agencies, county agents, and other interested individuals across the state.

Traveling 2 or 3 days each week, Satterlee presents data information to a large variety of users, in settings that might range from multi-county meetings of county commissioners looking for ways to contain rising costs of governmental services to annual meetings of a corporation considering expansion or reduction of its retail outlets in certain areas of the state.

“What I attempt to do in my work is to look at the ongoing South Dakota trends and then try to project the consequences for communities if such trends were to continue,” he said.

In some instances, this information is used by community leaders as guidance in planning for high-priority areas such as government, education, and health care areas which might be delivered at less cost through cooperation among districts, towns, and even counties.
This has led to a larger view of the word "community," Satterlee said.

The Census Data Center works with both communities and multi-county planning groups looking to encourage businesses and industries to locate in smaller communities.

The Center itself receives three or four inquiries per day, and Satterlee spends as much as three days per week consulting with individuals and groups.

"The bulk of the demand seems to be coming from the east-central part of the state in areas surrounding Aberdeen, Huron, and Mitchell," he explained. "These are the areas that are among those suffering the most from the effects of the out-migration of young people and the high loss of farms. Since 1980, we've lost 50,000 persons, and it is in the rural areas where the greatest impact is felt."

"On the other hand, our Indian reservation areas have somewhat more stable populations, and the same is true of communities such as Brookings, Sioux Falls, Yankton, and Rapid City."

He said other factors that have intensified demand for information from the Center over the past 2 to 3 years are the property tax problem, the rising demand for services, and the increased costs of providing such services as government and education.

"Our ability to help groups of communities in these situations is unique in that we as a state entity can come into an area and serve as a neutral, objective, third party in situations that sometimes are fueled by longstanding rivalries. This is critical in helping a group of communities or even counties to join together in the spirit of cooperation."

"This process allows communities to participate in their own destinies instead of having to accept the inevitable outcomes indicated by our census data trends."

Satterlee said the loss of smaller farms probably will continue unless ways are found to keep families on them. One of the ways is to provide opportunities for off-farm income for one or both of the spouses. This requires job opportunities generated through new or expanded business and industry, and this will happen only if numbers of small towns or even counties can join together to provide both quality and efficiency in services such as education, health care, and government that such industries desire when selecting potential locations.

"One of the greatest challenges is to overcome the effects of a continuing loss of local leaders, because each year there are fewer young persons to take their places, Satterlee said."

Accessing the services of the Center is merely a matter of telephoning (605-688-4899 or 605-688-4132). And it's all free of charge.

Larry Tennyson is a communications specialist in the Ag Communications Department, SDSU.
Extension specialists identify the tough weeds, insects, diseases

by Jerry Leslie

When South Dakota residents have weeds, insects, or plant diseases they want identified, often their first stop is their county Extension office.

Some of these samples are readily identifiable at the county office, but the real tough ones often end up on a desk in Brookings, perhaps under a viewing microscope, in the office of an Extension specialist.

Weed, insect, and disease identification are services offered by Extension specialists Leon Wrage, Murt McLeod, and Dale Gallenberg, in addition to their regular Extension adult education responsibilities.

Not “testing labs” per se, these service functions lack laboratories with highly sophisticated scientific equipment or staffing.

Yet “identification services” remain a vital resource where farmers, gardeners, and homeowners—from country and city alike—can send their samples and get an authoritative answer to a question.

Weeds to identify and crops with unknown injury end up in the office of Leon Wrage, Extension weed specialist. When an identification problem is too much for Wrage, he calls in Gary Larson, a taxonomist in the Department of Biology/Microbiology. Larson maintains an herbarium that contains pressed samples of plants identified by family, genus, and species. Larson uses his expertise and sometimes the herbarium to make comparisons of samples with plants already labeled.

Wrage estimates 150 to 200 plants per year come through his office for identification, plus another 150 samples or field evaluations that deal with suspected injury or performance problems.

"This is just part of our Extension program and helps us serve the clientele more completely. At present it isn't a separate service."

Wrage continued, "We feel it is a very important service, because a good control program starts with accurate identification of the weed."

Identification also fits well into the rest of his weed control program, because the in-flow of samples often makes Wrage aware of shifts in species or brand new weed problems slipping into the state or an area of the state. Jointed goatgrass and velvetleaf are two such examples.

The other part of this service is evaluating crop injury or poor performance. "Often producers want to know whether an herbicide may have caused an injury, if it might have been carryover, or if it was simply some kind of weather, management or soil condition factor," said Wrage.
“In an agricultural situation, the correct identification of an insect may mean the difference between saving or losing hundreds or thousands of dollars.”

—Murt McLeod
Extension entomologist, SDSU

Persons who have a plant they need to identify would best collect a sample, including parts of as many areas of the plant as possible—leaves, stems, flowers, and even a piece of root.

Then wrap it in a newspaper or paper towel, but don’t add wet material. It will arrive much better if pressed and rolled in dry paper or towel. Wetting frequently ensiles it by the time it arrives in Brookings. Plastic bags do the same. For best results, avoid mailing the last day of the week.

Mail to Extension Plant Science, Ag Hall, Box 2207 A, SDSU, Brookings, SD 57007. If you have questions, telephone (605) 688-4591.

Murt McLeod, Extension entomologist, receives 350 to 400 samples of insects or insect-related damage to identify during the course of a year.

As with weeds, the first stop for the citizen and an insect is the county Extension office. The county staff will provide identification and information in most cases. If they can’t, they forward it to McLeod. When he’s made identification he returns the information to the county office.

McLeod first conducts a visual appraisal. If he has to go beyond that, like Wrage, McLeod often draws upon the expertise of a colleague, in this case Paul Johnson, an insect taxonomist in charge of the Insect Museum at SDSU. At times Johnson will make a comparison with one of the million or so labeled insects in the SDSU collection.

Once the insect is identified, and if it is an economically important insect, control recommendations are given, McLeod said. Many times it’s not an economic problem. “The insect is just around, they noticed it, we provide identification, a little on the biology, where and why it’s found,” said McLeod. “We provide recommendations only if needed.”

Most common requests for identification are crop insects and insects from around the home, and most of these identifications are done in the interest of saving dollars.

“In an agricultural situation, the correct identification of an insect may mean the difference between saving or losing hundreds or thousands of dollars,” said McLeod.

McLeod offers directions to anyone sending in an insect for identification. He would put the insect in rubbing alcohol in a bottle or similar container. Take it to the county Extension office. If they can’t identify it, forward it to PO Box 2207A, Plant Science Department, SDSU, Brookings, SD 57007, attention Murt McLeod. Typical turn-around time is within 3 or 4 days, and that takes into account his days on the road.

McLeod does not recommend putting insects in an envelope or a plastic bag. He’s received insects in a envelope that has gone through a postal machine, and there weren’t any parts large enough to identify. He’s received worms in a plastic bag that had turned to liquid by the time he received them.

Once he opened a plastic film container and a black widow spider crawled out on his desk. This kind of a mailing needs some kind of warning for the person opening the mail.

Identification of plant diseases is a service offered by Dale Gallenberg, Extension plant pathologist at SDSU. Plant pathology by its nature encompasses aspects beyond normal crop diseases, and so do the identification services offered by Gallenberg.

Besides traditional crop diseases, Gallenberg works with horticulture problems and also general mycology or bacteriological kinds of questions. He identifies mushrooms and molds on walls and in basements. He looks at moldy grain in storage and addresses mycotoxin issues, although verification or quantification of mycotoxins would be done by Analytical Services in Olson Labs.

Although the “disease lab” or “disease identification service” is less formalized than seed testing or soil testing, a room is developing into a more formalized “disease clinic.”

Mary Thompson, a resource specialist, staffs this room or clinic and works with Gallenberg in handling the samples that come in.

Depending on the crop and the kind of problem, Gallenberg might call on other specialty researchers, such as Jim Smolik, nematologist; Tom Chase, row crop pathologist and mycologist; or Marie Langham, plant virologist.

Again, most of the samples come through county Extension offices, although some come directly from homeowners, farmers and ranchers, and private industry.

Plant disease problems that can’t be identified by the county ag agent can be forwarded to Extension Plant Pathologist, Box 2108, Plant Science Building, SDSU, Brookings, SD 57007.

Jerry Leslie is a communications specialist in the Ag Communications Department, SDSU.
More and more of South Dakota's raw agricultural products are being processed into food products in state. This adds value to the product and profit to the producers' bottom line.

Dr. Padu Krishnan is one of the people helping these food entrepreneurs through the maze of federal regulations before products can reach the grocery shelf. Krishnan is an associate professor in the Department of Nutrition and Food Science at South Dakota State University.

Give Krishnan the recipe for a new food formulation, and he can have a nutrient analysis ready for Food and Drug Administration (FDA) labeling within a minute or two. His "assistant" is a computer loaded with sophisticated software.

Give him the product itself—pasta, barbecue sauce, bread, tacos and chips, meat, candies—and it takes a little longer; he and his lab assistants grind, dry, pulverize, extract, and reduce the product to ashes in a furnace at 650 F overnight. About 2 weeks later, they have the nutrient analysis giving water content, crude protein, total fats, dietary fiber, cholesterol, minerals, vitamins, and a host of other information.

Some food processing firms are referred to Krishnan's lab by the Governor's Office of Economic Development, the South Dakota Department of Agriculture, or the FDA. Others call or come on their own initiative. Fees depend upon the type of testing requested.

"Nutrient analysis is part of our service to South Dakota citizens, although we are essentially a research laboratory," Krishnan said. The staff, headed by senior microbiologist Mary Gengler, is well versed in sample handling, assays, and data reporting.

Nutrient analysis is required by the FDA's "truth in labeling" provision. But even Krishnan has been brought up short when he reads package labels in the store. He and Carol Pitts, Cooperative Extension Service foods and nutrition specialist, often get together to puzzle over the difficulties of label reading.

"If it's confusing to us, what must it be for other consumers? Labels are intended for the average person to interpret."

Krishnan stands by the nutrient analyses that come out of SDSU. The product leaves his lab accompanied by factual, verifiable information. "We are obliged to be accurate and honest. "You can have any label that you want on your product, but the nutritional portion of the label must be accurate. If you make a claim, that your product is low-fat or enriched or high in vitamins, for example, the analysis part of the label has got to back up that claim."

The lab is also ready to help when a consumer doubts a label claim, suspects food spoilage, or simply wants...
an answer to a question. He recalls the response of other diners at a trendy restaurant to the behavior of a couple at a nearby table:

"One had a regular meal. The other a meal claimed to be low in fat. They each cleaned their plates right down to the shine. Then they ordered dinner all over again, the exact same meals. These—soup, salad, dessert, and main course together—were dumped into two separate doggie bags."

Krishnan pureed and then freeze-dried the two mixes, turning them into powders. The nutrient analyses that followed verified parts of the low-fat claims of the restaurant. The food editor of a regional newspaper and a dietitian accomplice had eaten the first meal for a palatability check.

Other requests for help are not so humorous, Krishnan added. Hospitals also turn to the lab. One request concerned possible toxins in raw underground stems of yucca plants. The plant portions had been eaten by a person because they resembled edible roots commonly consumed in his home country.

Krishnan knew that yucca plants contain glucosides, natural herbicides in the plant that protect it from grazing animals. The same compounds are found in potatoes and yams, he says, "but we cook these chemicals out before we eat the food."

He tracked down the glucoside content in the literature and found that the toxin levels were not a cause for alarm. "You'd have to eat tons of raw yucca before anything happened."

When not performing nutrient analyses on new food products, assessing the nutrient content of recipes entered in a 4-H foods contest, or preparing dietary analyses for the elderly, the cereal grains chemist works with commodity groups on research and analyses. He teaches food science and nutrition classes, and conducts research.

For example, he provided a scientific opinion on the role of oat beta glucans in reduction of plasma or blood cholesterol to the American Oat Association. The commodity group, in turn, filed a comment on oat fiber and human health issues in the Federal Register. Says Krishnan, "We are sought out for expert opinion in the formulation of food policy, another role we play."

One research project is the updating of methodology and testing. Techniques that have been used since the 1800s may employ chemicals hazardous to environment and humans. Krishnan is validating several new tests in research funded by the South Dakota Wheat Commission.

"In one of these new tests, everything takes place in a reaction tube so we are not exposed to dangerous chemicals, we use less of them, and the results are more accurate. That's good news for our technicians and students. It also means speed, efficiency, and reduced analytical costs for the consumer."

Mary Brashier is a communications specialist in the Ag Communications Department, SDSU.
Samples come to SDSU service labs from all corners of South Dakota

photos by Tom Bare

Kyle Elenkiwich (left), rural Brookings, S.D., collects a water sample for the Water Quality Lab. Instructions for sample collection are available from the county Extension office. Although salt and chemical concentrations in water may not be readily noticeable to the livestock producer, they can adversely affect rate of gain and general animal health. Above, Extension agent Leo Orme demonstrates a sampling probe for Spearfish, S.D., rancher Sandra Hood. Hundreds of thousands of samples of all types are collected by farmers, ranchers, Extension agents, businesses, and government agencies and examined at the appropriate labs at SDSU. The result is safer products for South Dakota consumers and more profits for producers.
Leon Wrage (above, right) discusses herbicide recommendations with Gary Egeberg (above, left), an aerial applicator from Brookings, S.D. Chemical applicators see SDSU and Extension specialists as a source of unbiased, up-to-date information. Extension specialists take their 'labs' out on the road, working with individuals and groups on problems specific to their area, and participating in workshops and training sessions around the state.

State dairy inspectors such as Arden Peterson (above) collect random samples of milk from stores, farms, and processors for testing at the State Dairy Lab at SDSU. Their vigilance is responsible for South Dakota's safe and wholesome milk supply. Chuck Friedrich, Aurora, S.D. (left), is one of the more than 2,000 South Dakota farmers who use the services of the Seed Testing Lab at SDSU every year. Lab tests assure them that their seed is pure, weed-free, and ready to germinate.
Seed Testing Lab assures seed is pure and weed-free

For growers and seed dealers who want to be sure their seed is pure, weed-free, and ready to germinate, the Seed Testing Laboratory at South Dakota State University is the place to go.

The lab is located on the second floor of Ag Hall. It serves a variety of clients across the state and region.

The lab processes an average of 8,500 samples a year and, during the busiest season, up to 2,000 samples a month.

More than 2,000 farmers and about 200 companies make use of the laboratory’s services, according to Brent Turnipseed, manager.

When a farmer or a seed company wants to have seed tested, they usually stop at the local county Extension Office and pick up a mailer and instructions for sampling, plus a rate card. Some also telephone the seed lab for mailers. Then they send the sample to the lab for the tests. Results come back in the mail.

The germination test is most in demand. It tells the percentage of normal seedlings that develop under ideal growing conditions.

The purity analysis also is widely used. It determines the percentage of pure seed, inert matter, and other crop and weed seed present in a seed lot. Other crop and weed seeds found in the sample are identified and reported, as well.

Another often-requested test is the noxious weed seed exam. It detects any prohibited or restricted noxious weed seeds present in the sample. The weed species reported will depend on where the seed will be sold. If the seed is to be sold or grown in South Dakota, the test is for weeds considered noxious in South Dakota. If to be sold out of state, the USA noxious test will be run.

Dennis Ruhlman, germination supervisor at the SDSU Seed Testing Lab, counts germination of seeds in a test chamber. This reveals the percent of normal seedlings that will develop under ideal conditions.
These three tests are the most widely used and are used together, because all three are required by state law for anyone who intends to sell seed in the state, Turnipseed explained.

Using the germination, purity analysis, and a seed count per pound information, the grower can calculate how many pounds per acre of seed to plant to achieve a desired plant population, Turnipseed said.

The largest single customer is the South Dakota Crop Improvement Association, an organization dedicated to providing the public with high quality seeds and superior varieties to insure genetic purity.

The Crop Improvement Association has special objectives. "They want to be sure they sell top quality seed, that it's going to be very clean—because their standards are higher—and they also want to be sure of genetic purity. Genetic purity is one reason for buying certified seed through the Crop Improvement Association," said Turnipseed.

"The [seed testing] lab is very up-to-date, very respected... They can conduct any type of testing we need done."
—Bob Pollmann
Executive Director,
Crop Improvement Association

Bob Pollmann is the executive secretary of the Crop Improvement Association. He believes that having access to the SDSU Seed Testing Lab saves the Association from having to maintain its own testing lab, as is done in some other states like Minnesota, Nebraska, and Kansas.

For seed to be certified, it must be tested for purity, noxious weeds, and germination, Pollmann said. The Crop Improvement Association "has enjoyed an excellent working relationship with the laboratory over the years."

He added, "it is a very beneficial operation for both parties. We get services of expert technicians and at the same time don't have to expend those resources maintaining a lab in the summer when not much testing is done."

Said Pollmann, "The lab is very up-to-date, very respected within the state, region, and to some extent nationally. They can conduct any type of testing we need done. If seed is going overseas where we need to follow international rules or within the United States, they can run the appropriate tests."

Other customers include seed companies from both in and out of state, cooperatives, elevators, individual farmers, and the South Dakota Department of Agriculture which uses the lab for regulatory testing.

The laboratory runs several other tests for special purposes. They include:

- Accelerated aging test for soybeans. It is a high humidity, high temperature stress test that is a good indicator of vigor in soybean seed. It is used in conjunction with a standard germination test for a more complete picture of seed quality.
- The corn cold test also is a high humidity, low temperature stress test that has proven useful to determining the vigor level of seed corn.
- The tetrazolium test is a rapid chemical viability test that can be used to tell a grower potential germination capability of a seed lot. This test is used by those who need to know right away if a seed lot is worth purchasing and don't want to wait for the time involved in a typical germination test. The tetrazolium test can give results within 24 hours.
- Electrophoresis is a test used to identify wheat, oats, and millet varieties. This test looks at the protein in a seed and, like "fingerprinting," compares it to known protein in specific varieties for an accurate identification. This test is useful for people who have forgotten which bin which varieties were stored in. It's also routinely used by the Crop Improvement Association which must guarantee varietal purity.
- Moisture tests, test weight per bushel, and seed counts are other services provided by the laboratory.

The fee generating laboratory is financially self-supporting, funding all salaries from its user fees, except for part of Turnipseed's faculty appointment dedicated to teaching and research. Grants from the Crop Improvement Association help out with equipment purchases.

Using part-time student help—up to 18 in a year—"works out great" for the laboratory, according to Turnipseed. "We train them to be analysts. We teach them skills a lot of them have used to go on and become registered seed technologists."

"It also helps us, because during the busy season we have our labor force, beginning in September and running through the end of April," said Turnipseed. 

Jerry Leslie is a communications specialist in the Ag Communications Department, SDSU.
Ron Gelderman is one of few people who hope they can one day put themselves out of business. Gelderman is manager of the Soil and Plant Analysis Lab at South Dakota State University.

Farmers and fertilizer dealers send their soil samples here to be analyzed for deficiencies so they know how much or how little fertilizer to apply.

Gelderman hopes advancing technology will one day allow on-site soil testing so farmers can get their answers while still out in their fields, quickly and inexpensively.

That way more farmers would use soil testing more often and reap its benefits, and that, Gelderman believes, would justify putting his lab out of business.

But until quick, on-site tests are devised, this laboratory, located in the basement of Ag Hall on the SDSU campus, will continue conducting 15,000 to 20,000 soil tests per year.

The lab is capable of evaluating soil fertility in two ways, one through soil analysis, the other through plant analysis. About 95 percent of the testing done here is on soils, Gelderman said.

For soil testing, the laboratory offers a routine package consisting of a nitrate-nitrogen test, phosphorus, potassium, pH, and soluble salts. Those tests will address most of the fertility problems a farmer can expect to encounter.

However, a whole range of tests is offered for micronutrient and secondary elements, if someone has a specific problem to solve. Those secondary and minor elements include zinc, sulfur, chloride, calcium and magnesium, iron, manganese, copper, and boron.

The laboratory also offers special soils tests useful to greenhouses, irrigators, or farmers who need to know the suitability of their soils for certain soil-applied herbicides.
The laboratory also conducts plant analysis to determine if a plant is deficient in nutrients. This test is usually conducted when a farmer sees a problem with a growing crop and wants to know if that problem is fertility, Gelderman said.

Plant analysis is useful when an area of a field is showing symptoms. If the plant analysis shows a nutrient deficiency, that part of the field can be fertilized separately from the rest, said Gelderman.

A disadvantage of plant analysis is that by the time the plant has shown a problem, it's usually too late to fertilize to make it pay for the current growing season, Gelderman said.

The typical soil fertility test that goes through this lab begins in the field with a soil sample, often from a fertilizer dealer or consultant working with or for a farmer. The soil sampler will typically take a number of core samples in a field, then mix them together and draw a composite sample amounting to one pint and send it to the lab in a paper mailer.

Mailers are available from county Extension offices across the state. Testing services and a fee schedule are also available, along with recommendations for taking representative soil samples. "We usually recommend 15 to 20 samples in a field or area you want fertilized separately."

The soil, once in the lab, is dried, ground, processed, and analyzed. The results go back to the sender by mail within 3 to 5 days, said Gelderman. "Many people ask us to fax the results to them."

Included with the soil test results is a recommendation for how much fertilizer to apply to meet specific yield goals.

What about cost? One composite soil sample will cost $10. If this came from an 80-acre field, the cost would amount to 12.5 cents an acre. The potential earnings from fertilizing deficient soil, or the savings from not over-fertilizing, is enormous, compared to the cost of a soil test, Gelderman said. By properly fertilizing a farmer can realize $40 to $50 an acre in added crop yield, Gelderman said. Then the 12.5-cents-per-acre cost of a soil test pales by comparison.

Yet Gelderman estimates that perhaps only 10 to 15 percent of South Dakota's farm land is sampled every year. Most of the state's tilled land is probably sampled every 6 or 7 years, Gelderman believes. "Nitrogen should be sampled every year for non-legume crops," he said.

Gelderman sees exciting things ahead in soil fertility, among them site-specific farming, grid sampling, remote soil testing, and field fertility maps.

He predicts that, one day, technology will allow for rapid remote testing of plant tissue, possibly as the grain goes past a sensor on a combine. If a combine is equipped with the global positioning system (GPS) receivers and computer, plus remote plant nutrient analysis equipment, it could conceivably map the fertility of the field as it harvests the crop, Gelderman reasoned.

Although scientists haven't yet developed remote soil testing or plant analysis techniques, Gelderman thinks it's only a matter of time. Industry, SDSU, and other universities across the country "have just started looking at these things," Gelderman said. "I think a lot of things will be coming in a few years we haven't even thought of yet."

Gelderman said currently soil sampling and testing is a time consuming operation. "If it could be combined with another field operation and made quicker, more people would use it and more money would be earned or saved."

The summaries of test results from any year figure extensively into Extension information provided farmers by Jim Gerwing, Extension soils specialist. This lab also is heavily involved in soil testing research, results of which find their way into the soil testing problem. The laboratory also is used for educational tours and in graduate and undergraduate instruction in soil testing. Several students are hired by the laboratory every year, and graduate students have research assignments in the lab.

The laboratory is financially self-sustaining from the user fees it generates. Fees pay the salaries of four full-time and three to six part-time persons and part of Gelderman's salary except for the portion he devotes to teaching and research.

Jerry Leslie is a communications specialist in the Ag Communications Department, SDSU.
State Dairy Lab fights the clock to assure safe milk supply

by Mary Brashier

It's a race," says Bill Northeimer of activity in the State Dairy Lab at South Dakota State University which he supervises. A race against the clock: more samples arrive tomorrow. And a race against contamination: Depending on the source, if a sample shows "hot" for drug residues, either the raw milk from which it came needs to be dumped by the processing plant or milk products need to be taken off the shelves before they get into shoppers' carts.

"We look for 'hot' ones, tests that are positive and indicating a problem with the milk quality. We hardly ever find them. But we can't let our guard down," says Northeimer. "Nationwide, 99.9+ percent of raw milk samples test 'clean' for beta-lactam drug residues, for example, and South Dakota's milk supply fits right in with those figures."

The State Dairy Lab, located in the Dairy-Microbiology Building at SDSU, provides private analytical services for both dairy farmers and processors. A larger part of the lab's responsibilities is analytical support for the dairy inspection arm of the South Dakota Department of Agriculture (SDDA). Tests are run on both raw milk and milk products.

"A lot of the credit for our low number of positives goes to the state milk inspectors," Northeimer says. "Inspectors work with farmers and dairy plants and keep track of what's going on out there, what drugs are being used, and the sanitation practices. The inspectors can head off a lot of troubles before they develop."

Tom Kludt, supervisor of inspectors in the SDDA dairy inspection program, says the State Dairy Lab should share in the credit for South Dakota's excellent milk supply.

"The turnaround and the vigilance at the lab are high. We can be pulling products from the shelves or from the processor's stock room the next day if tests start running positive."

An individual dairy farmer or plant operator may request any test the lab performs. Most often, Northeimer says, these people are concerned about high somatic cell counts or drug residues in the milk. Other times they want help with production problems or in-house testing, or they want to qualify for component pricing and premium payments. Test results are confidential.

"Basically, we're looking at the quality indicators of the raw milk and milk products," Northeimer says. He summarizes several of the more common tests:

- High bacterial counts in pasteurized milk may indicate poor handling and sanitation practices or improper pasteurization.
- The presence of coliform bacteria suggests raw milk contamination during processing after pasteurization.
- If a phosphatase test shows positive (residual), the milk used to make the product was not pasteurized properly or it was contaminated with raw milk after pasteurization.
- High somatic cell or bacterial counts in raw milk usually indicate an infection such as mastitis in one or more cows in a herd.
- A positive drug finding usually indicates that the cow's milk was not
withheld long enough after treatment.

No matter how "hot" the sample, if the sample comes from a private source, confidentiality is maintained, Northeimer says. If the sample was obtained by a state dairy inspector, the alert goes out to the regulatory agency.

As of July 1, 1995, 1,048 Grade A and 667 Grade B dairy farmers operated in the state, according to Kludt. Grade A milk qualifies to be bottled or used for Grade A products such as cottage cheese, yogurt, and creams. Grade B is mostly processed into cheese. State inspectors must visit each Grade A farm at least twice a year and Grade B producers once a year.

The State Dairy Lab at SDSU will become involved if the inspector wants a specific test run, usually for antibiotic residues.

Milk processing plants in South Dakota range from the very small to the very large, Kludt says. Inspectors visit each one once a month to collect samples of products and raw milk. These samples come to the SDSU lab for examination.

"The turnaround and the vigilance at the lab are high. We can be pulling products from the shelves or from the processor's stock room the next day if tests start running positive."
—Tom Kludt
Supervisor of dairy inspectors, S.D. Department of Agriculture

The State Dairy Lab is accredited by the U.S. Food and Drug Administration Laboratory Quality Assurance Branch (FDA/LQAB). This accreditation assures that all laboratory results are obtained by uniform approved methodology and that the results will back up any enforcement action taken by the state.

Once a year, unknown milk samples will arrive in the SDSU lab from the FDA/LQAB in a nationwide evaluation of all official state dairy labs. Northeimer and Arnie Appelt, chemist in the lab, must come up with results that the FDA/LQAB evaluates as correct. This, plus on-site visits from the agency, allows the State Dairy Lab to keep its accreditation for another year. Northeimer must meet additional requirements to maintain his certification as the state's laboratory evaluation officer. Additional state regulations also apply.

“We have guidelines for about every move we make,” Northeimer says. “And we have to keep our work quality up. Our record keeping borders on excessive. We keep logs on everything—test results of course, sample history including temperatures through to the lab testing, who collected the samples, brands, code dates, size of containers, and more, much more.”

Just as the FDA/LWAB checks him out, Northeimer does the same with state certified laboratories. He also publishes a newsletter to keep the labs informed of federal actions, changes in guidelines, and interpretations of analytical requirements.

The chemists teach their methodology to SDSU students and analyze samples for researchers in the Dairy Science Department. They conduct workshops and short courses on testing methods for dairy plant personnel.

"Bill and Arnie also routinely test milk and milk products from our own SDSU dairy farm, milk plant, and ice cream parlor," says Dr. John Parsons, head of the department.

“Our State Dairy Lab plays a critical and vital role in assuring consumers that South Dakota milk is safe and wholesome,” Parsons says.

Mary Brashier is a communications specialist in the Ag Communications Department, SDSU.
Lab determines if water is safe for humans, livestock, plants

by Dr. Larry Tennyson

A single drop of pesticide in 26,420 gallons of water is equivalent to one part per billion, but analysis of water samples at that level of accuracy is routine in the SDSU Water Pesticide and Water Quality Lab located on the second floor of the Ag Engineering Building at South Dakota State University.

Simply put, the lab exists to determine if water is suitable for its intended use, according to Research Associate David German.

A simple, low-cost test can help prevent expensive if not irreparable loss to equipment, soils, livestock, and even human health, he explained.

German has a background in chemistry and biology and has been associated with the labs since 1986. He has served as lab supervisor for the past 4 years. His earlier duties included conducting lake studies for the Oakwood Lakes Project. In addition to his present duties, he also conducts research in nonpoint source pollution in ground water and surface water and in monitoring the quality of 21 of the deeper lakes in the state.

The lab serves two functions for two distinct sets of users. It does service work for individual farmers, homeowners, irrigators, corporations, feed stores, and other users. Water tests range from pesticide analysis to inorganic nutrient analysis. The lab also supports ongoing research projects at SDSU with both pesticide and inorganic analysis.

Within the general water quality service area there are several categories, German said.

Livestock water analysis is one of the more frequently requested services, and it involves determining whether the levels of substances such as salts and nitrates are conducive to efficient livestock production. The lab has found some instances where salt levels exceed 10,000 parts per million, a condition that can be fatal to cattle. Even conditions much less severe than these can affect the rate of gain and overall health of the animals, according to German. Information also is used to balance feed rations.

Nitrates can't be seen, tasted, or smelled, so what conditions indicate a need for testing of water used for animals or household use?

"Location of the well and the type of construction offer one kind of tip," he said. "If you have a shallow well of 20 feet or less that has a cribbing unit that is made of wood or stacked concrete pipe installed in sections—and especially if it isn't sealed on the surface, you should have that water tested for both nitrates and bacteria on an annual basis. Deeper wells have less likelihood of contamination, although the water often does have more minerals." Water used to irrigate crops, gardens, and trees also is tested in the lab. The lab has identified water so laden with salts and sodium that it actually has killed trees. The lab also sometimes conducts a
"If you have a shallow well of 20 feet or less ... you should have that water tested for both nitrates and bacteria on an annual basis. Deeper wells have less likelihood of contamination, although the water often does have more minerals."

—Dr. David German
Water Quality Lab, SDSU

Wide spectrum investigation just to determine whatever abnormalities that might be present. One example was a water sample sent in by a tree nursery that was eventually found to contain a carryover herbicide.

Farmstead analysis is another testing category, and it involves testing water that is used for both household and agricultural use. Tests on such samples also include determining iron and manganese levels which affect laundry and other household uses. The lab does not test for harmful bacteria in these instances, however. Such samples are referred to the State Health Lab in Pierre.

Another important testing category is irrigation water analysis. The lab assays the positive and negative ions produced by the salts in the water. This information then is compared with a soil map of the irrigated fields to determine if the type of water is suitable for use on all, part, or none of the soil types depicted. Long-term use of unsuitable water types for irrigation can, of course, ruin the soil, German commented.

Heat pump water analysis and interpretation is a relatively new kind of testing category intended to determine the suitability of groundwater or other types of water for use in heat pump systems. Unsuitable water includes that which contains high amounts of substances such as iron that eventually will clog up or corrode the pipes leading to and from the heat pump.

Detailed instruction for accessing general water quality analysis services is available at local offices of county Extension agents across the state, German said. Pesticide sampling is a bit more complicated, however, and users are advised to contact German (605-688-5611) to discuss sampling procedures.

A
other entire array of tests can best be described as "customized," according to German. These are tests that are essential to research projects in various SDSU departments, and there are specific, often unique sets of parameters for each one. In fact, even assay methods are often one-of-a-kind for certain research projects.

An example of such a research study was one that investigated wetland characteristics as they relate to precipitation across the state. This required a specific assay of total phosphorus and nitrogen to help answer the question of whether the nutrient levels differ in various wetlands in areas of diminishing rainfall as one travels westward across the state.

The lab even uses special polycarbonate bottles for the samples in projects involving phosphorus in order to produce assay results of the required level of accuracy.

Another example was one in which the death of livestock prompted an investigation in which the water source was eventually found to contain a toxic strain of algae.

Research is the primary focus of the pesticide component of the lab, German said. Projects include cooperative efforts with the South Dakota Department of Agriculture, the City of Sioux Falls, and the East Dakota Water Development District—all to determine pesticide concentrations at both peak and low flows in the major rivers of South Dakota. This includes test sites on the James, Missouri, Vermillion, and Big Sioux rivers.

The lab handles thousands of tests annually, German said, but the demand often varies. During the summer, the lab might be overwhelmed by the sheer number of test requests it receives. Wintertime demand can be slack at times. Overall, requests for water quality tests actually have declined somewhat as more farms access their water supply from rural water systems. During wetter periods, the number of irrigation tests decline, but the opposite is true during dry periods.

Jing Ning, lab technician, conducts a water analysis. Testing for South Dakota farmers and ranchers is only one aspect of the work at the Water Lab. The lab is also active in research. The pesticide component of the lab, for example, is involved with a number of cooperative research projects to determine pesticide levels in South Dakota rivers and lakes.
Most people know that a great deal of faculty research goes on in South Dakota State University laboratories, but fewer probably realize how much student learning takes place there.

Whether for education or for employment, students use the labs in a variety of ways. Some perform or assist in research; others help provide services to lab patrons.

Students can benefit in many ways from studying or working in the labs, said Ron Gelderman, associate professor and manager of the Soil Testing Laboratory. For instance, they gain exposure to new techniques and information.

"In the soil lab, they get to see the diversity in soils we have in this state and how different they are in analysis and properties," he said. "That knowledge is a great advantage to them."

Gelderman enjoys seeing students increase their skills and confidence as they learn to perform more complicated procedures. "For some, it's their first regular job, and it gives them a sense of responsibility and accomplishment."

Gelderman enjoys seeing students increase their skills and confidence as they learn to perform more complicated procedures. "They may start out as very timid, but they grow and expand their knowledge," he said. "I'd like to think the lab has something to do with that."

Lab work can also give students an edge in their future careers, said Brent Turnipseed, assistant professor and manager of the Seed Testing Laboratory. "They get experience here that they're not going to get anywhere else," he said. "It's a lot different from what I'm studying, so I'm learning even more."

Kramer also appreciates the hands-on nature of her work in the lab. "It's easier to learn because it's right there in front of you," she said.

Renae Ford, senior agronomy and environmental management major, feels the same about her work with Malo in the Pedology Laboratory. "If I can see and do something, I understand it better," she said.

She also likes the fact that Malo teaches her the procedures through demonstration. "I could have learned some of this through a booklet," she said, "but when I observe something and know I'll be doing it next, I don't forget it."

Close interaction with faculty is another benefit, Ford said. "I learn more about the whole field of agronomy from seeing what other professors..."
Renae Ford (above, left), senior agronomy and environmental management major, assists Doug Malo, professor of plant science, in performing a soil particle size analysis. Kris Kappenman (right), graduate biology and environmental management major, works in the Water Quality Laboratory. He uses a spectrophotometer to measure the transparency of lake water samples.

"Working in a lab gives students practical experience and on-the-job training. That gives them a broader view and makes them capable of doing future projects."

—Dr. David German
Water Quality Laboratory, SDSU

Faculty members also have a responsibility when teaching or training students in the labs, Malo said. “Science is always just a generation away from extinction, so we must make sure our students have the skills to carry it on.”

Jennifer Widman is an information specialist with University Relations, SDSU.
The service labs in the College of Agriculture and Biological Sciences and the College of Home Economics conduct a wide range of analyses for South Dakotans. Fees are based only on tests performed.

Contact your county Extension office first for assistance. If the county staff is unable to pinpoint the source of your problem, they can provide sampling instructions, fee schedules, special mailing tubes or envelopes, addresses, and help in sending in your sample to South Dakota State University.

Unless yours is a routine sample, it is best to call the lab before mailing the sample. You will be advised on appropriate tests to request or may be directed to another service lab. Be as specific as possible in requesting tests. In the case of livestock losses, work with your veterinarian in sending in samples.

### Testing/Information Service

- Agricultural statistics, trends, South Dakota .......Census Data Center
- Amino acid analysis, feeds ...Analytical Services
- Animal disease diagnosis ..........Animal Disease Research & Diagnostic Lab
- Animal feeds analysis ..........Analytical Services
- Dietary analysis *(human diets)* ..........Nutrition & Food Science Lab
- Drug analysis *(animal feeds, animal tissues)* ......Analytical Services
- Economic statistics, *(trends, South Dakota)* ......Census Data Center
- Education statistics, *(trends, South Dakota)* ......Census Data Center
- Fertilizer testing ..........Analytical Services
- Food nutrient analysis *(human diets)* ..........Nutrition & Food Science Lab
- Food product labeling ..........Nutrition & Food Science Lab
- Food spoilage *(human diets)* ..........Nutrition & Food Science Lab
- Forage analysis *(including NIRS)* ..........Analytical Services
- Insect identification *(and control recommendations)* ..........Murt McLeod
- Health care statistics, *(trends, South Dakota)* ......Census Data Center
- Housing statistics, *(trends, South Dakota)* ......Census Data Center
- Manures, composts ..........Analytical Services
  *for nitrogen, phosphorus, potassium*
- Meats *(processed)* ..........Analytical Services
  *fat, moisture, added water, nitrites*
- Milk *(raw or manufactured)* and milk products ......State Dairy Lab
  *drug residues, somatic cell counts, bacteria counts, milk components, dairy water*

### SDSU Laboratory/Specialist

- Analytical Services
  Olson Biochemistry Labs ASC
  SDSU Box 2170
  Brookings SD 57007-1217
  ph: (605) 688-6172
  FAX: (605) 688-6295

- Animal Disease Research & Diagnostic Lab
  Department of Veterinary Science
  Rm 105
  SDSU Box 2175
  Brookings SD 57007
  ph: (605) 688-5171
  FAX: (605) 688-6003

- Census Data Center
  Department of Rural Sociology
  Scokey Rm 202
  SDSU Box 504
  Brookings SD 57007
  ph: (605) 688-4899
  FAX: (605) 688-6354

- Gallenberg, Dale
  Plant Science Building
  SDSU Box 2108
  Brookings SD 57007
  ph: (605) 688-4603
  FAX: (605) 688-4602
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**Nutrition & Food Science Lab**
SDSU Box 2275A
Brookings SD 57007
ph: (605) 688-4040
(605) 688-4048
FAX: (605) 688-4439

**Seed Testing Lab**
Ag Hall Rm 240
SDSU Box 2207A
Brookings SD 57007-1096
ph: (605) 688-4589
FAX: (605) 688-4602

**Soil & Plant Analysis Lab**
Ag Hall Rm 07
SDSU Box 2207A
Brookings SD 57007-1096
ph: (605) 688-4770
FAX: (605) 688-4602

**State Dairy Lab**
Dairy-Microbiology Rm 118
SDSU Box 2104
Brookings SD 57007-0647
ph: (605) 688-5491
FAX: (605) 688-6276

**Water Resources Institute**
Agricultural Engineering Rm 204
SDSU Box 2120
Brookings SD 57007
ph: (605) 688-4211 (water quality)
(605) 688-5612 (water pesticides)
FAX: (605) 688-4917

**Wrage, Leon**
Extension Plant Science
SDSU Box 2207A
Brookings SD 57007
ph: (605) 688-4591
FAX: (605) 688-4602
## Calendar of Events

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<td>Region 8 Headstart Conference, Rapid City</td>
<td>Carol Pitts, Nutrition &amp; Food Science, SDSU</td>
</tr>
<tr>
<td>22-26</td>
<td>NAE4-HA Convention, Billings, Montana</td>
<td>Gary Heusel, 4-H Program Leader, SDSU</td>
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<tr>
<td>27-28</td>
<td>SD Sheep Growers Association Annual Meeting, Spearfish</td>
<td>Jeff Held, Animal Science, SDSU</td>
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<td>30-Nov 3</td>
<td>Extension Annual Conference, Brookings</td>
<td>Larry Tidemann, Ext Program Leader, SDSU</td>
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<td><strong>November</strong></td>
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<tr>
<td>6-9</td>
<td>District Weed Meetings</td>
<td>Leon Wrage, Plant Science, SDSU</td>
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<tr>
<td>13-22</td>
<td>District Crop Improvement Meetings</td>
<td>Robert Pollman, Plant Science, SDSU</td>
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<td>13 Ipswich</td>
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<td>17 Wessington Springs</td>
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<td>20 Webster</td>
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<td>21 Freeman</td>
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<td>22 Madison</td>
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<tr>
<td>28-29</td>
<td>SD Cattlemen's Association Annual Meeting, Sioux Falls</td>
<td>James Males, Animal Science, SDSU</td>
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<tr>
<td><strong>December</strong></td>
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<tr>
<td>5-7</td>
<td>Range Beef Cow Symposium, Gering, Nebraska</td>
<td>Doug Zalesky, Animal Science, SDSU</td>
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