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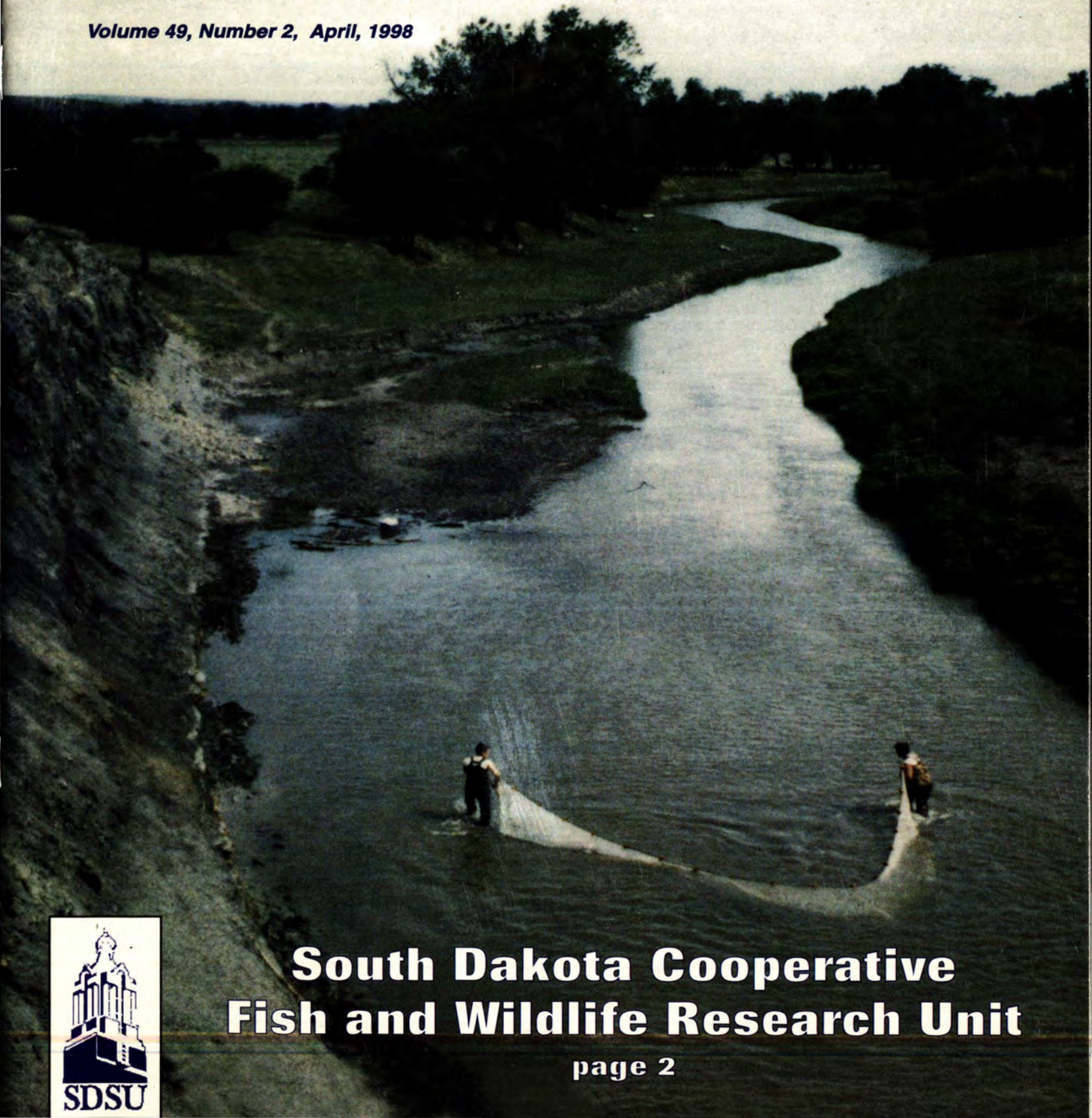
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South Dakota Farm & Home **RESEARCH** A CHRONICLE OF BIOSTRESS RESEARCH

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

Volume 49, Number 2, April, 1998



**South Dakota Cooperative
Fish and Wildlife Research Unit**

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South Dakota Farm & Home RESEARCH

A CHRONICLE OF BIOSTRESS RESEARCH

Volume 49, number 2, April 1998

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About the Cover

Researchers from the Cooperative Fish and Wildlife Research Unit drag their nets through the Belle Fourche, as part of a project updating information on fish populations for the first time in 30 years. Results showed that some fish species are not as endangered as once thought. This discovery provides proof that good ranching practices in the watersheds and healthy fish in the streams are compatible.

photo: Chuck Berry

Director's comments: the frontline conservationists

by Fred Cholick

I live on an acreage south of Brookings, but I spend most of my time in my office or traveling across the state and country—it seems there is always a meeting to attend. Many of you are in the same boat; you too love the outdoors, but it turns out that, like me, you spend more time talking and thinking about fishing, hunting, and the outdoors than you actually spend outside.

So, while we talk and send our donations to preserve our natural resources, the real frontline conservationists are the ag producers who are out there every day moving cattle or planting crops. These ag producers who take daily care of the land—so that it will take care of them and future generations—are our true conservationists. I salute them.

These people on the land have another advantage over the rest of us. They can see the big picture. “Natural resources” to them cannot be just soil, water, and air but also include plants—both domestic and native, animals—both tame and wild, and humans—young, old, men and women. And in the rare silent spaces in their busy days, producers still have a chance to consider how all these natural resources mesh together. In my youth I really enjoyed the outdoors from a tractor seat.

We who spend most of our time inside four walls have to work a little harder to see that harmony and interconnectedness. Yet, here in the Ag Experiment Station, our research projects have been trending toward that holistic approach for some time.



photo: courtesy Fred Cholick

Proof of how memorable a combined hunting-fishing trip with good friends can be is this dog-eared, pin-pricked photo that still hangs on the bulletin board of Fred Cholick (second from left). Such enjoyable experiences are only possible because of the “ag producers who take daily care of the land,” says Cholick.

We too are attempting to place each individual piece into a whole picture, searching for each component and determining its individual and synergistic values.

Our mission statement says that we shall develop the knowledge that empowers South Dakotans to work in harmony with our natural resources, to protect and use natural resources in a sustainable way to feed present and future citizens of the world. But there is more to natural resources than enhancing agricultural production, and nobody knows that better than South Dakotans.

We hunt. We fish. We feed birds. We photograph wildflowers. We recharge our personal batteries through many different outdoor

activities. We have tremendous opportunities to carry out these recreational (to create anew, restore, refresh, says the dictionary) activities. Those opportunities have been provided to us by the cooperative work of our own scientists, state agencies, and federal groups. And especially by our ag producers.

There is an axiom in game management: The best and healthiest wildlife is found on the land that is the most fertile and most productive. One complements the other and completes the “big picture” we talked about earlier. Again, I salute the ag producers who enhance our quality of life here in South Dakota.

To the rest of us: Have you taken the time to capture those special moments and truly enjoy South Dakota's natural resources? □

photo: Chuck Berry



The whole is more than the sum of
its parts when SDSU, state and
federal agencies share work in the

Cooperative Unit

by Mary Brashier

These are some of the outcomes:

- The message to farmers that there are more products from wetlands than ducks. Temporary wetlands, planted after they dry up in the spring, are superior crop producers in average to dry years. In really dry years, hay from seasonal wetlands may be the only cattle feed a farmer can find.

- Unbiased data to the South Dakota legislature concerning landowner attitudes about hunting, information that doesn't "flame" or "take sides" because it comes from straight survey data and can't be disputed.

- The discovery of thriving fish communities in some western South Dakota rivers, proof that good ranching practices in the watersheds and healthy fish in the streams are compatible.

- The counting of 75,000 individual fish of 80 different species in the Missouri River. More important: documenting the habitat niche that each species occupies so that the U.S. Army Corps of Engineers can manage the River for fisheries as well as other uses.

- The small plane dipping over Lake Oahe. The pilot is counting boats and occupants and, by formula, figuring a

workable, nonintrusive creel census, the backbone of fisheries management.

- A six-bird, eight-bat toll in a 2-year period at the 73-turbine-unit wind plant near Lake Benton, Minn. Scientists would, of course, be ready to monitor any such installations in our Central Flyway state, but, for the moment, migrating birds appear to be at low risk for collision with wind turbines.

- A picture of fish food webs in Lake Oahe—who eats whom. Now the state knows how many fish to stock to keep large trout, salmon, and walleye coming to anglers' lures.

Responsible for these research discoveries is the South Dakota Cooperative Fish and Wildlife Research Unit. At present, the Unit is composed of just two federal research biologists in the Department of Wildlife and Fisheries Sciences at SDSU.

Size is misleading. The impact of the Coop Unit blankets the state, wherever there is an "outdoors" and people who enjoy it. Its influence also stretches beyond our borders, to any state or province where there are fish-

← Students on a river ecology field trip illustrate the integration of different agencies in the Cooperative Research Unit—the professor is federally salaried and the canoes are from SDSU. The experience the students gain from field studies like this makes them more employable by state and federal agencies.

eries and wildlife biologists trained in the South Dakota unit.

How does such influence come about?

Probably because, while the two permanent scientists run three or four research projects each at any one time, scores of other faculty members and their research assistants have gained streamlined access to funding for additional studies from the Department of the Interior because the Coop Unit is on this campus.

"We have two advantages," said Chuck Berry, Unit leader. "One is our location in the prairie pothole region of North America where so much is happening in wildlife management. The other is our alliance with the College of Agriculture and Biological Sciences and our relationship with all of its good researchers in the various departments at SDSU."

Berry is a fisheries scientist specializing in stream fisheries, fish habitat, and fish health. Ken Higgins, specialist in wetland and waterfowl management, fire ecology, range ecology, and rare birds, is assistant leader. The other assistant leader position has just become vacant.

Berry and Higgins are faculty members in the department but receive their paychecks from the Biological Resources Division of the U.S. Geological Survey, Department of the Interior. SDSU provides laboratories, secretarial support, field equipment; in turn, Berry and Higgins teach graduate courses. The critical research dollars are provided by cooperators, the biggest chunk of change coming from the South Dakota Department of Game, Fish & Parks.

When the entire group sits down in annual review, "it's my job to select research projects that all the cooperators can get all the information from

without having to contribute all the funding," Berry said.

"Each one of our contracts must have student involvement," Berry stressed. This is a federal requirement, since coop units were originally set up at state universities in the 1930s as much to attract young people to the new field of wildlife and fisheries management as to conduct and publish university-level research on wildlife populations. Since 1963, approximately 160 SDSU graduate students have been at least partially funded by the South Dakota unit.

That student involvement now extends to the University of South Dakota. Berry is partially funding a student at USD, and two USD faculty members are on SDSU student committees.

Doug Hansen, director of the Division of Wildlife for Game, Fish & Parks (GF&P), finds the Coop Unit indispensable to his agency and to the state's outdoor enthusiasts.

"They're not off doing some academic laboratory thing that we have no need for.

"They are tied in to our long-range plans and our research needs, and we're very comfortable in providing the revenue for work that is useful and needed and that just naturally fits our program."

GF&P is stretched too thin to maintain as many research biologists as it needs to answer all the questions that come up, Hansen said. "Mostly, our

"... there would be a lot more cutting-edge, breakthrough research that would go begging if we couldn't rely on the Coop Unit and the SDSU Wildlife and Fisheries Sciences Department."

—Doug Hansen,
Department of Game, Fish & Parks,
Pierre

small staff of biologists works on practical management problems.

"What that means is that there would be a lot more cutting-edge, breakthrough research that would go begging if we couldn't rely on the Coop Unit and the SDSU Wildlife and Fisheries Sciences Department.

"What we do have is a source of funding to help this research along."

The funding originates from federal excise taxes on sporting goods and motorboat fuels, Hansen said, which is apportioned to the states by the U.S. Fish & Wildlife Service.

In the long run, Hansen emphasized, "we get better fishing, better hunting, better outdoor experiences for all South Dakotans" because of the cooperative arrangement with SDSU and the Coop Unit.



photo: Chuck Berry

When talk started about building giant turbines to harness wind energy in South Dakota, people wondered if the rotors would endanger birds during the great migrations of waterfowl and grassland and other nongame birds through the state. This concern prompted a 2-year Coop Unit study at Turkey Ridge, a 73-turbine unit just into Minnesota. Total recorded kill: six birds and two bats.

The South Dakota Coop Unit has earned that praise. It is recognized in the region as the major wetland research group in the prairie pothole area and has produced much of the information that has become the basis of wetland management.

The prairie potholes account for 10% of the continental waterfowl breeding area but produce 50% of the fall flight each year. Coop Unit research has covered nearly all aspects of wetlands—water retention, livestock forage, flood reduction, groundwater quality, esthetics, fishery potential, mapping and delineation of wetlands, waterfowl production, and wetland creation.

But there's more to wetlands than waterfowl.

"Other biologists might lynch me for saying it, and I do care about ducks, but I care more about flooding downstream," Berry said.

"Think about it: Wetlands serve as nature's sponge. We've found from our research that a watershed with 15% of its area in wetlands will have flood peaks 65% lower than one without wetlands."

Temporary and seasonal wetlands and permanent, deeper marshes can hold water and release it slowly, he continued. "They prevent washed out roads, flooded cropland, and damage to houses in towns and cities downstream."

Because of the alliance of the Unit with SDSU ag scientists who range in speciality from economics to crop production, Berry said, "We've been able to agree on the function and value of wetlands to the landowner. We can say to the farmer, 'look, your wetland has value to you.'"

As a part of Coop Unit work, Berry and his students have updated the status of fish populations in all South Dakota rivers for

the first time in 30 years. While angling hot spots like the reservoirs often steal the show, he described a study on "a river that flows through our backyards," the Big Sioux.

"We found that people used it for 25 different kinds of river related activities, with fishing the most frequent use. Every year, 20,000 people fish the Big Sioux, spending about 120,000 hours on the river.

"From that, we estimate that Big Sioux River fishing contributes a half million dollars to local economies in gas, food, licenses, bait, whatever. And all without any management costs."

For providing the Cooperative Unit with space and equipment, SDSU gets teaching faculty members who don't draw state salaries. It gets additional students drawn to campus by the caliber of research they can conduct.

For paying salaries, the U.S. Geological Survey receives back some of those graduates, ready to go to work and familiar with federal and state working practices.

Figure 1. Relationships between the Cooperative Research Unit and its partners.

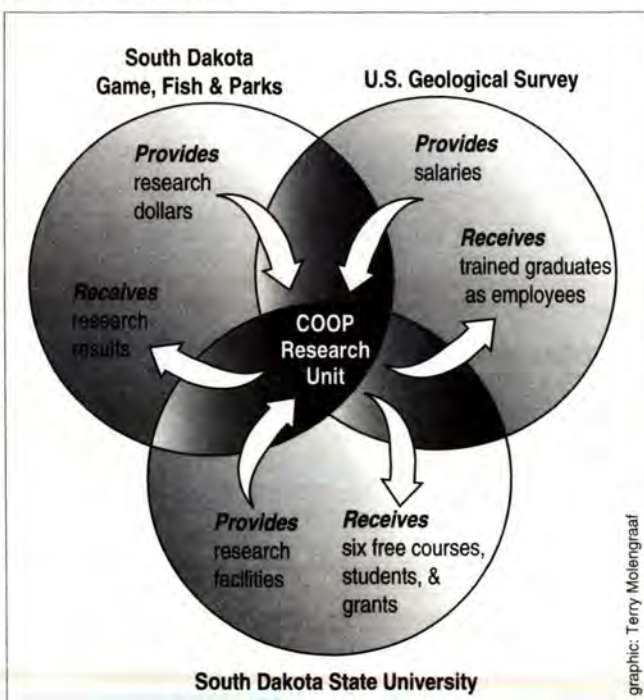


photo: Chuck Berry

The Missouri and its deepwater reservoirs may attract anglers from all parts of the country, but dollar for dollar, the Big Sioux in eastern South Dakota contributes more to the economy. And topping that, its value to kids on a summer day is beyond price.

For research dollars the Game, Fish & Parks Department receives information that will enhance the outdoor experience for South Dakota's citizens.

In fact, the Coop Unit fits the mission of the GF&P wildlife division as neatly as if the SDSU researchers were GF&P employees, Hansen said. The mission: to manage South Dakota wildlife and fisheries resources and their associated habitats for their sustained and equitable use and for the benefit, welfare, and enjoyment of the citizens of the state.

"That about says it all," he said. "Our partnership with the Unit is not a self-serving effort to keep us looking good but one that helps citizens of the state over the long term to enjoy the resources that we have."

This is one case where everybody comes out ahead. □

Biostress challenge:
an alliance of agencies to
enhance our outdoors and
reduce stress for all

USDA official: Value-added genes will change farming from an 'f' to **pharming with a 'ph'**

by Jerry Leslie

In the next 5 to 10 years, said a USDA official who regulates genetically engineered crops, farmers should expect to see:

- Pharming with a "Ph" instead of "F." Crop plants will produce pharmaceuticals, chemicals, plastics, fiber, and biologics through introduced genes.

- Doctors writing prescriptions to be taken to a green grocer. The prescription fruit or vegetable will contain a pharmaceutical derived from genes added to the plant.

- A nutritionally complete food in a single crop, such as a potato or corn.

- New biochemicals not presently in existence. They will be produced by plants containing new synthetic genes created in laboratories.

- An entirely new fiber from the cotton plant that contains a "polyester gene." The new gene will produce a natural stay-pressed cotton fabric.

- Crops worth several times what they now are per bushel by virtue of new value-added characteristics.

These revolutionary new products from biotechnology were predicted by Arnold Foudin, assistant director of Scientific Services, USDA, Animal and Plant Health Inspection Service (APHIS), Washington, D.C., to South Dakota farmers meeting earlier this year.

The products are more than dreams. Many of them are reality, he said.

Foudin's agency regulates and permits all new bioengineered crops. He



photo: Tom Bare

Introducing desirable genes into crop-plant cells and then regenerating entire new plants from those tissues is the business of Tom Cheesbrough, molecular biologist at SDSU. This university must "choose its battles carefully," he says, and focus on crops and problems specific to South Dakota.

sees applications for bioengineered plants 3 to 5 years before they are released. Many of the developments he discussed are already under review by his department.

Genetically altered crops will be produced this year on an estimated 60 or 65 million acres in the U.S., twice that of 1997, and ten times that of 1996, Foudin predicted.

Farmers this year will see the introduction of crops with "stacked genes," genes added for herbicide, insect, and disease resistance.

"I think within the calendar year we'll see approval of a potato that will have 5 to 8 different genetic characteristics in one crop," Foudin said.

And, he said, look for crops with multiple disease resistance, especially viral resistance. "Nature has been very good to us. We are seeing the fact that

a crop can be made resistant to more than one disease, and the outcome is that they seem to be synergistic. So putting in three different genes for viral resistance seems to work better than having one gene in alone."

Foudin said even new "Bt's" are being developed. "There are estimates that . . . somewhere in the neighborhood of 3,000 and 11,000 different Bt's (can be found) in nature, and they are probably effective against a whole group of insects, arthropods, and nematodes," Foudin said.

Bt refers to *Bacillus thuringiensis*, a soil bacterium from which an insect-resistant gene has been transplanted into corn, cotton, and other crops.

The University of Florida has placed genes for pesticide resistance into predatory mites used in biocontrol for citrus crops. "Normal" mites help con-

SDSU carving its own niche in plant biotechnology

SDSU is capitalizing on its own strengths in biotechnology research. In the works at SDSU's Northern Plains Biostress Laboratory:

- Wheat with genes for a protein that kills at least three kinds of aphids. The wheat will also stop them from reproducing.

- Soybeans with modified genes that will allow them to produce only mono-unsaturated oil. This should add dollars to the value of a bushel of soybeans.

- Winter wheat with genes added for cold tolerance. This wheat would be more able than current varieties to survive South Dakota's extreme winters.

- Soybean varieties with a gene added that reduces flower abortion. Seed set would be four or five times that of present varieties.

- Soybean varieties with special tolerance to floods and with increased disease resistance after a flood.

"In the works" and not field-ready for years, said Tom Cheesbrough, molecular biologist at SDSU.

A land-grant university like SDSU, working with a limited budget, must "choose its battles carefully," and SDSU does that by focusing on problems specific to South Dakota farmers, rather than national or international problems, Cheesbrough said.

When the recovery rate of cells in tissue culture successfully altered with new genes is one in 10,000, a large private corporation is at a decided advantage; 60 full-time researchers

can be assigned to this one project, Cheesbrough said. In contrast, the SDSU team will be Cheesbrough and one part-time graduate research assistant.

The toughest part of genetically altering plants, not just for SDSU scientists, but for private industry as well, has been to get an entire plant back from a single, genetically altered cell. When such a plant is recovered from tissue culture with a desired trait, the next move is to turn it over to the plant breeder to put the new trait in with the other traits that a variety must have to compete, Cheesbrough said.

"Most of the private sector now has very good programs for ... (regeneration). We in the public sector are developing programs for doing this, and we've got programs going now (that work) in soybean, wheat, and sunflower. And we're also working with some horticultural varieties," Cheesbrough said.

One spin-off from this regeneration process, known as tissue culture, has been selection for specific traits, used at SDSU to produce a line of wheat with resistance to tan spot.

The array of research projects cited by Cheesbrough receives support from one or more of the following producer organizations: South Dakota Soybean Research and Promotion Council, North Central Soybean Group, United Soybean Board, the South Dakota Corn Utilization Council, South Dakota Wheat Commission, and South Dakota Crop Improvement Association. □

Roundup™-ready cotton, Roundup™-ready corn, Liberty-Link™ ready corn, insect-resistant corn, and Roundup™-ready soybeans and canola.

In the last 24 months, Monsanto has spent in the neighborhood of \$2 billion in acquiring smaller companies, particularly seed companies that are the basis of the agricultural revolution. Novartis has done the same, and so has AgrEvo.

"It wouldn't be any extravagance to say that the worldwide biotech, biochemical, and pharmaceutical industry has probably spent in the neighborhood of \$8 to \$10 billion dollars" in the acquisition of these smaller companies, Foudin said.

Foudin predicted farmers of the near future will be using entirely different intercropping and rotations designs, due to the new genetically altered crops.

"No longer will you be limited by the fact that a crop is biologically sensitive or not sensitive to a herbicide."

Rotations "can be custom designed. Through the use of computers and systems analysis you'll be able to develop custom rotations using crops with the appropriate chemical, insect, and disease resistance for your specific environment and crop production situation."

The beauty of this revolution is "that it is one technology that America is out front in all the way," said Foudin. "The regulatory systems and the technology in the U.S. are moving, to quote Captain Kirk, at 'warp speed' and pulling away farther and farther.

"And the prediction is American agriculture and the American economy will be the force way out into the next millennium."

Foudin's visit to South Dakota was arranged by Bob Pollmann of Brookings, executive director, and Laird Larson of Clark, president, of the South Dakota Crop Improvement Association. □

tol citrus pests but are killed whenever growers spray their citrus crop. The new mites survive the spray.

The University of California has introduced lethal genes into a serious insect pest in California. The genes cause the insect to die when the temperature drops to a certain point.

"This temperature-lethal mutation would collapse the majority of the population, close enough to zero, that the insect probably would be eradicated in the area where the gene is introduced," said Foudin.

Transgenic crops already available include insect-resistant cotton,

Biostress challenge:
crops with wider uses, and higher profits; new tools and ways to combat stressors

Farming is a chess game with Nature. Thinking out your crop rotations far ahead of this year's move will be **well worth the effort**

by Larry Tennyson



photo: Tom Bare

Crop rotations are one way for a farmer to play chess with Mother Nature—the assessment of Dwayne Beck, manager of the Dakota Lakes Research Farm near Pierre. Planning them out is “well worth the effort.”

He and Clair Stymiest, Extension crops specialist at the West River Ag Center at Rapid City, are involved in the long-term evaluation of farming methods to increase cropping intensity, diversity, and economic return from semiarid central and western farm lands.

Beck's involvement dates back to studies at the former Redfield agricultural research station.

“Most of those studies were of short rotations. We didn't realize the value of the longer rotations of 4 years or more with at least three crop types.”

Beck says when the Dakota Lakes research facility first started, most area farmers were conventional tillers. Now, most associated with the station are no-tillers.

The proof is in the number of acres put to corn in the area. In terms of bushels, the volume has tripled in the past 6 years—and it's all because of no-till farming methods, according to Beck.

“Before, there was barely enough corn produced to bother buying. Now they are piling it on the ground at the Pierre elevator.”

The key to it all is to reduce tillage, Beck said. “The only way we can have a more diverse rotation in this area is with no-till, because, otherwise, we don't have enough moisture to do it.”

True, the past growing season was an exceptional year, Beck admits. Even so, the average for dryland corn was in the 130-bu range, and the 6-year average is well over 100 bu.

There is no “typical rotation,” because every producer has different priorities.

One is workload. Operators with cattle may not have the time for cer-

No one rotation is “magical,” says Clair Stymiest, Extension agronomist in West River. “Success depends on good science and overall management.”



Producers touring Dakota Lakes Research Farm (DLRF) learn that longer rotations—at least 4 years and three crop types—are critical for long-term economic stability in low-rainfall areas of the state. Successful long rotations require no-till for moisture management, says Dwayne Beck, DLRF supervisor.

tain types of rotations. Another is risk. Putting sunflowers behind corn can make a lot of money for the operator in some years. “Take this year, for example,” Beck said. “Corn following sunflowers was one of our biggest money-makers. Last year it wasn’t because it was so dry. Some operators can afford to take that risk, and others with a lot of debt can’t.

“Here, we push the principles of no-till systems. The entire no-till system relies on following three equally important cultural practices: rotation, sanitation, and competition.”

These principles include having a minimum of three crop types in a rotation. “We also like to see a 2-year interval between crops of the same type—although the wheat-wheat-corn-flower rotation does break that rule.”

With various rotations, an operator can control, to some degree, soil moisture conditions, seed bed conditions, and even soil temperature.

Rotations, competition, and sanitation are key factors in pest control. “Our primary pest control is this same set of cultural practices, and they also control weeds. Herbicides, if they’re used, are only there to give our crops a head start so they’re more competitive.

“When I have a weed problem, the first thing I think of is: what kind of crop can I plant to take those weeds out—not what kind of herbicide can I use. Herbicides are expensive and are becoming more so every year.”

With freedom to farm being the cornerstone of the new farm act, there’s going to be a lot of pressure to take advantage of market shifts, Beck continued. But to do this successfully, the producer needs to understand the concepts of how to change a rotation without it costing him more than the market gain.

“Actually, we’re just using the same principles as Mother Nature. These are old ways, really. We just find ways to apply and adapt them in a modern world. During the so-called ‘Green Revolution,’ we thought we could overpower Mother Nature with chemicals. We avoided her for awhile, but she eventually figured us out.”

Clair Stymiest has been working with rotations since 1980, including locations at Winner in 1980-86, at Hayes in 1988-96, and at Wall from 1994 to the present.

“We’ve seen a lot of changes, including extremes in farming practices,” said the specialist. “We’ve seen farmers who’ve gone from a 50-50 wheat-fallow rotation on large acreages to as little as 10% fallow, increasing cropping intensities. Typically, we’ve seen fallowing drop to 20-25%, with 70-80% of the land being cropped each season. Farmers are evaluating stored soil moisture, trying to forecast crop potentials.”

Research results from the Wall crop rotation study indicate that adding a

broadleaf such as sunflower or safflower to a 3-year crop rotation significantly increases winter and spring wheat yields. Winter wheat yields were increased by an average of 11 bu/A in 1997 and by 6.5 bu/A in 1996 by going to a 3-year rotation.

Prior research plots established at Hayes in 1988 indicated a 6-year average of 4 bu/A yield increase for winter wheat in rotations that had corn-fallow-winter wheat when compared to one of winter wheat-fallow.

More information is available in the West River Annual Progress Report at local Extension offices, Stymiest said.

“We’ve seen a lot more diversity in cropping, and a lot more sunflowers and corn here in the western part of the state,” he continued. “There’s no particular type of rotation that is magical, however. It all goes back to good science and overall management.

“For instance the operator needs to know how deep the crop roots, how it takes its moisture, what time during the growing season it needs moisture, and how all this fits into a cropping sequence. It’s the same with herbicides. The producer can’t use a herbicide on his wheat that will carry over and kill his sunflowers the following year.

“The more he learns about his crop and chemicals, the better he’s going to be at developing rotations that will work for him.

“Our goal has been to find ways to rotate these crops and see what the various combinations will do to a farmer’s profit line. We’re also interested in the possible economic advantages of more frequent cropping, and what effect it might have in West River South Dakota.”

One of the problems has been that there simply isn’t enough moisture for really high corn yields, Stymiest indicated. Even with no-till farming to conserve moisture, yields rarely surpass about 60 bu/A. And with inputs driving overhead to about \$135 per acre, a farmer can’t afford to raise 60-bu corn.

“Because a farmer can’t manufacture rain, the only reasonable approach to raising corn is to cut overhead. Corn is

worth adding to our rotation if only we can get that input cost down," he said.

Somewhat better results have been achieved with sunflowers and safflowers, the specialist continued. "Both are drought resistant—particularly the safflower. It hardly ever wilts. In fact, dry weather is rather good for a safflower crop, because it reduces disease and insect problems as well as improves overall quality.

"So, we're looking at using these two crops in rotation behind wheat and following that with a low-moisture crop like millet when moisture conditions are normal—and just following when it's really dry. We've had excellent results, and many farmers have had success planting winter wheat back into millet stubble in the fall."

Stymiest said his immediate goal is to help farmers look at stored soil mois-

ture and rotating high- and low-moisture use crops and cool-season and warm-season crops. His secondary goal, particularly with operators who raise livestock, is to have at least two ways to go with a given crop.

"For instance, suppose there's a crop of grain sorghum, and weather conditions dry up. There's always a need for forage, so the sorghum could be used as a forage crop.

"The same is true for other crops. We have to look at two possible uses for them. Millet, for instance, makes excellent hay, so if price isn't too good for millet—and hay price is high, the operator could use this crop as hay.

"Without a crystal ball to know what moisture conditions will be, farmers have to evaluate each spring as it comes and determine what kind of rotation to use," he advised. "Farmers have to be

flexible, but they also have to do a lot of risk-management assessment."

Stymiest's work has been funded by two checkoff groups: the South Dakota Wheat Commission and the South Dakota Oilseeds Council. Beck's work is funded by the Wheat Commission with substantial additional amounts from the Corn, Oilseeds, and Soybean Councils. □

Biostress challenge:
management as a key
factor in reducing stress
on crops and
enhancing profits

China and South Dakota exchange crop information

A delegation of ag officials from the province of Heilongjiang in northeastern China visited the Northern Plains Biostress Lab this winter to exchange crop information with SDSU research scientists.

All eight members of the delegation are members of the provincial department of agriculture there, and last year they invited Fred Cholick, director of the Ag Experiment Station, to observe cropping practices in their region.

"Their primary interest in South Dakota lies in our winter wheat," Cholick explained.

Their province shares many similarities with South Dakota in biostress and other weather related factors, although it receives more annual rainfall, according to Jiang Huailian, interpreter for the group and Section Chief of International Cooperation for the Heilongjiang Department of Agriculture.

Farmers there now grow spring wheat, but that crop is too slow to mature to

allow a following crop of vegetables.

"And so, they need to go to winter wheat with a high level of winter hardiness like those varieties we are developing here at SDSU," Cholick said.

After visiting with research scientists at SDSU, the group continued on to central South Dakota, where they visited several producers, toured the Dakota Lakes Research Farm, and attended a meeting on no-till farming techniques.

Other stops for the group before returning to China included a visit to the Chicago Board of Trade and the USDA in Washington, D.C.

The delegation presented South Dakota with a collection of their soybean vari-



Fred Cholick (right) recently hosted a delegation of ag officials paying a return visit from Heilongjiang Province in northeastern China. Growing conditions there are similar to those in South Dakota, Cholick said, but they "need to go to winter wheat." Spring wheat does not mature fast enough to permit planting a following crop in the same year, and no piece of land can afford to remain idle for a lengthy period.

photo: Tom Bare

eties for use in the SDSU breeding program. In exchange, Cholick presented them a group of experimental lines in the SDSU wheat breeding program.

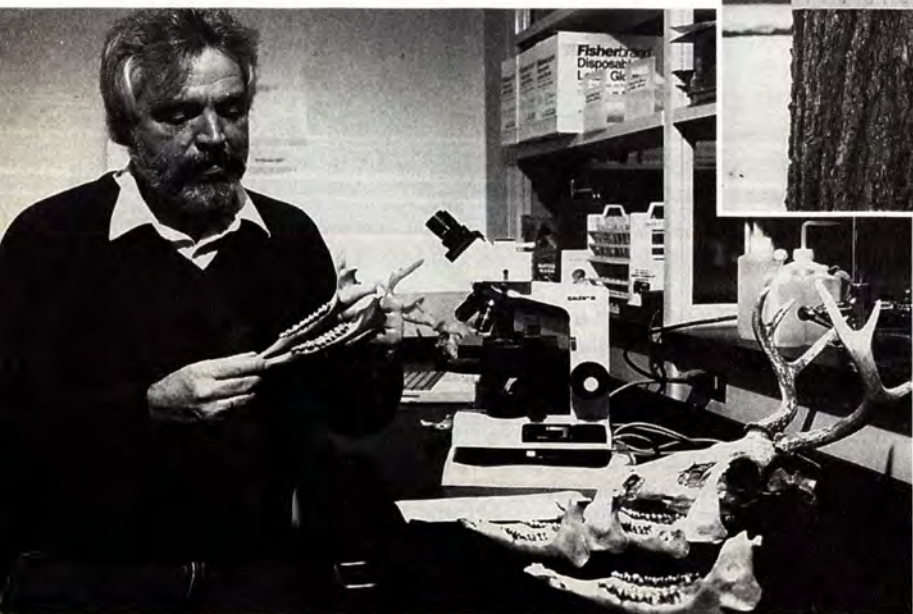
"As collaboration grows between their province and our state, it may be expanded to include an exchange of graduate students," Cholick said. □

They come from a vast range of scientific disciplines, and they use a wide variety of methods and tools, but they are all...

waging war on biostress

photos by Tom Bare

Measurements of a tree's diameter, says Carter Johnson, Horticulture, Forestry, Landscape and Parks Department (right), can be used to estimate many important ecological and forestry variables such as lumber volume, biomass, leaf area, and crown area. Jon Jenks, Wildlife and Fisheries Sciences Department (below), examines bone fragments from white-tailed deer, an important economic resource in South Dakota. His research will help managers improve the quality of big-game herds for hunters while minimizing depredation on croplands.

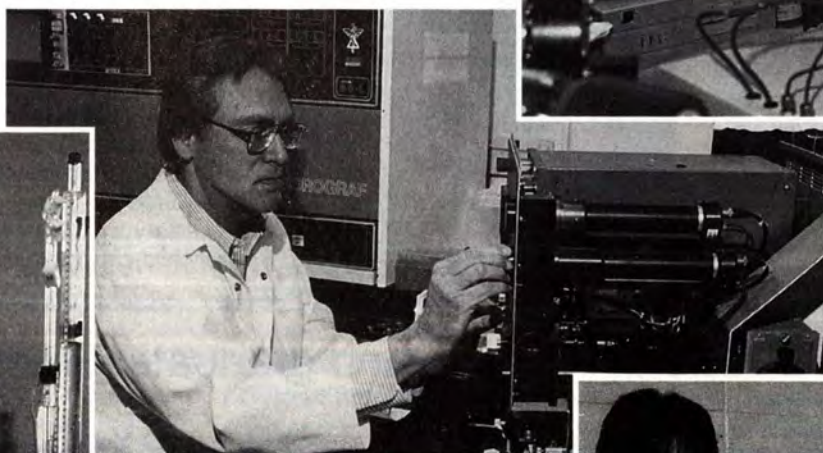
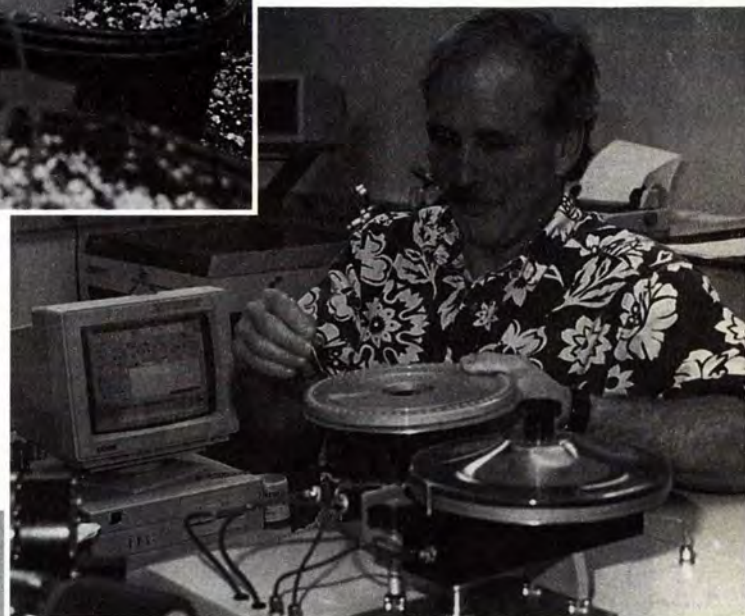


Sharon Clay, Plant Science Department (right), designs basic biological and ecological criteria for weed management decisions in conventional and alternative farming systems, with a goal of reduced herbicide use. Tom Schumacher, Plant Science Department (photo to right of Clay), is determining management practices for CRP acres returning to crop production which would have the greatest beneficial impact on soil quality and long-term production. This total acreage could reach over one million in the next 4 years.





Neil Reese, Biology/Microbiology, is working to prevent flower abortion in soybeans. If more flowers form pods, yield will increase without increases in costs. David Clay, Plant Science Department (right), concentrates on protecting water resources while maintaining profitability through judicious use of fertilizers in different cropping systems.



An assay developed by Don Evenson, Biochemistry (above), is considered nationally to be a valuable tool in both fertility and reproductive toxicology studies. Nancy Thiex and Ivan Palmer, Analytical Services (right), have received national honors for their work in sample analyses. The citation comments, "Precise and accurate analysis of selenium has proven difficult to achieve, but this well organized, smartly executed and clearly written study has now provided two excellent methods."





photos: Deanna Gilkerson

Early childhood education students at SDSU gain practical, hands-on experience in classes that allow them to work in the Helen Young Pre-school Laboratory. Children enrolled in the Pre-school benefit from a variety of stimulating age-appropriate learning and development activities planned by student teachers. SDSU early childhood education graduates go on to enrich the lives of South Dakota's children as pre-school teachers and directors, Extension agents, elementary teachers, Head Start leaders, and other child-care professionals.

The golden thread—research and graduates from SDSU bringing professionalism to child care

by Jerry Leslie

Thousands of children across South Dakota are benefiting from an evolving effort to improve the professionalism of child care.

SDSU, through its teaching, research, and Extension, is one of the leaders in that movement.

Research-based information about child development is making its way into the hands of child care providers, pre-school teachers, and parents, thanks to graduates of SDSU's College of Family and Consumer Sciences (FCS).

These graduates can be found around the state in a variety of roles. They often are directors or head teachers in pre-schools, Head Start programs, or child care facilities. They are in county Extension offices as FCS agents, in the Child Services Division

of the Department of Social Services in Pierre, in the Family Resource Network, and in public schools as counselors and elementary teachers.

Judy Branum is director of the SDSU Helen Young Pre-School Laboratory which provides hands-on practical experience to about 100 early childhood education majors each year in the FCS College.

"We've put enough students through (the pre-school) that many communities in South Dakota will have one of our graduates playing a major role in educating children under 5 or in the early elementary years," she said.

The FCS connection is a gold thread running through the partnering agencies and organizations that bring professionalism to the field of child care. These groups take child care beyond baby-sitting, making full use of a child's formative years.

Since its beginning in 1914, the Cooperative Extension Service "home economics" education component served families. The CES current mission to strengthen families is more important today than ever before, says Darlene Moss, CES FCS program leader at SDSU.

The CES employs 43 FCS county Extension agents across the state, all of whom have at least a bachelor's degree in family and consumer sciences. Many have either a major at or at least some courses in early childhood education from SDSU or other universities.

The farm crisis of the 1980s forced both parents of many families to earn an income. Rural women went out of the home to work, creating a shortage of child care, not just for toddlers but also for school-aged children, said Moss.

At present, around 80% of South Dakota mothers with children under age 6 are in the work place, a percentage higher than the national average and well above the state's 50% in 1980.

"A majority of our (FCS) agents are doing some form of child care provider training," said Moss. Agents taught more than 650 persons from 27 counties during fiscal year 1997.

Four FCS Extension agents also are trained in the infant and toddler initiative of the Statewide Early Childhood Enrichment Program. This program is funded by a \$2.1 million Bush Foundation grant and has created a statewide resource network for child care providers.

The CES has "partnered" with the South Dakota Department of Social Services for a long time, said Moss. "They are a social program, but they do not have the educational network that we have."

"By being able to form coalitions with everyone, building on the strengths we have, we can all do a better job," said Moss.

"We are not duplicating services," she emphasized.

South Dakota's child care providers and pre-school teachers "are the most responsive audience I've ever worked with," said Judy Johnson, a county Extension agent of 25 years now from Sioux Falls, formerly of Yankton.

"Child care providers are interested in providing positive re-enforcement for children, physically, educationally, and emotionally. They're asking for the educational services that help them do this.

"The child care provider is definitely the person in a young child's life—infant through pre-school—with whom the child or infant spends more time with than anyone else outside of the parents.

"These providers feel a strong sense of responsibility for being a positive role model. In too many cases, they practically are the parents," said Johnson.

Johnson is one of several Southeast South Dakota FCS agents who help organize the annual Dakotaland Child Care Conference in Yankton for child care providers from five counties. She has also assisted at the Tri-State Child Care Conference held in South Sioux City, Nebr., each year. These conferences and others like them across South Dakota provide in-service credits to day-care providers, helping them meet a state requirement for 20 hours of in-service training per year.

"I have definitely benefited, and my business has benefited from having the Yankton County Extension office in town here.... We are really fortunate to have SDSU to help us."

—Lynnette Erickson, Yankton,
owner-manager of Kolor Me Kids
Learning Center/Day Care

SDSU's interest in the well-being of the child has always been based on research findings.

Mary Kay Helling, associate professor and head of the Department of Human Development, Consumer and Family Science (HDCFS) at SDSU, said that early childhood education "borrows from many fields."

From developmental psychology comes information about the changing needs and characteristics of young children. From family studies, the importance of family life on child development. From language development research, the knowledge of how the brain develops.

The department also has its own on-going research program, with eight faculty members with doctoral degrees contributing to advancement of the profession.

"People are finally recognizing that early childhood education is a profession," said Helling. "We are still battling the notion you just have to be nice, female, and have raised your own children to care for and educate young children."

The department has an advisory committee of field workers, including staff of the Department of Social Services involved in licensing child care providers.

"We provide a service to the early childhood community out in the state. It's bi-directional. We don't have all the answers. We have information we can share, but we learn as much from the people we have contact with.

"We all have a common goal out there—to increase the quality and availability of child care. It's such a massive task that no one can do it alone. It takes individuals, families, organizations, and businesses," said Helling.

The feedback to CES agents is positive, like this tribute from Lynnette Erickson, Yankton, who with 40 employees cares for 200 Yankton area children as owner-manager of Kolor Me Kids Learning Center/Day Care.

"I have definitely benefited, and my business has benefited from having the Yankton County Extension office in town here. Just weeks ago, Sharon Guthmiller (FCS agent in Yankton) put on an in-service food safety workshop for us and used Joan Hegerfeld (Extension food safety associate from SDSU) as a speaker.

"The next day someone took bleach and cleaned the countertop. I've been in day care a long time and I learned something, too. We all benefited, and our children at day care will benefit," said Erickson.

Erickson also cited the usefulness of the Extension-sponsored Dakota-land Day Care Conference that helps about 175 providers from five counties stay updated in their in-service training.

The Family Resource Network, a private grant-funded resource and referral agency, is located on the SDSU campus and supervised through the FCS College.

This center, managed by Pam Henning, an FCS College graduate, has a storeroom full of children's toys and play equipment suitable to specific developmental levels for loan to child care providers. The center offered technical support and training to more than 300 child care providers last year.

In addition, the center functions as headquarters for one of five regions in the South Dakota Early Childhood Enrichment Programs funded by the Department of Social Service's Office of Child Care Services. The center also coordinates the statewide infant-



photo: Tom Bare

From small home daycares to corporate sponsored pre-schools, child care facilities in South Dakota are in great demand. With 80% of mothers of children under 6 in the workplace, South Dakota ranks well above the national average. SDSU research, Extension, and teaching combine to provide a base for efforts to ensure a quality level of care for South Dakota's children.

toddler training funded by the Bush Foundation Grant.

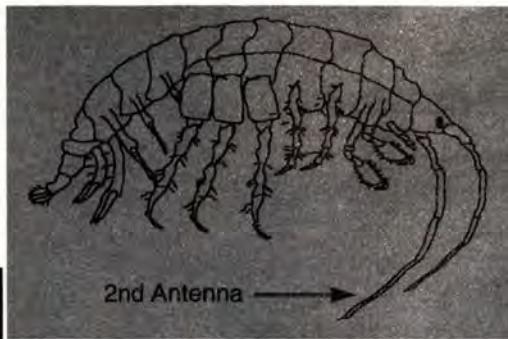
More and more businesses are coming to recognize the value of professional child care. The First National Bank of Brookings has built and equipped a Kid's World Learning Center which employs FCS graduates in its pre-school. The facility provides developmentally appropriate child care/pre-school on the bank premises so that bank employees can drop in and visit their children during the day.

This pre-school arrangement was held up as a model by Loila Hunking, Sioux Falls. Hunking was named coordinator of child care services for the State of South Dakota by Governor Bill Janklow.

Hunking's goal is "to bring attention to the need for quality care, early in a child's life when the abilities for feeling and learning are developed.

"If we don't do it right now, everything that happens after that—and much of what happens in the public school system—is either enrichment or remedial. We've got to do better by our very youngest. If we don't, we'll pay for it in the long run." □

Biostress challenge:
research-based,
professional child care
impacts human stress



Normally, male freshwater scuds, no bigger than your fingernail, and important food for young game fish and for ducks, wave their second antennae to attract and then hold females. But SDSU scientists have found that these appendages become deformed in water with heavy nutrient overloads. Physical and chemical testing of water will be augmented with biomonitoring to identify "hot spots."



photo: Nels Troelstrup, Jr.

A little critter may tell us more about environmental disturbances than chemical and physical tests when

the scud's deformities are linked to water quality

by Mary Brashier

In the animal world, if push comes to shove, survival is more important than reproduction.

SDSU scientists are counting on this biological maxim and a small crustacean called a scud to help them identify polluted lakes and rivers.

When survival is not an issue, animals can use their energy to defend

territories and attract partners. Birds display spring plumages and songs, gorillas flash canine teeth, and the lowly scud waves his appendages to attract and then clasp a female.

These are "ornamental traits," said Nels Troelstrup, Jr., Department of Biology/Microbiology. "And they are very susceptible to environmental disturbances."

In other words, animals will give up reproduction before they give up life. When animals are stressed, "the energy that they would have used to develop red wing patches or other sexual features is redirected into maintaining the body."

Studies have shown that certain atmospheric pollutants alter or eliminate breeding plumage in birds. Stress produces asymmetric or nonexistent gorilla canines (gorillas are vegetarians and use these teeth primarily for display).

"The idea here is that because ornamental traits exhibit sensitivity to environmental changes, their form—or their absence altogether—might be good indicators of what's going on in the environment," Troelstrup said.

Troelstrup and Eric Miller, graduate student from Chamberlain finishing his Master's degree this spring, set out to find if this pattern fit scuds living under eutrophic conditions—nutrient overloads in rivers or lakes.

Question 2: If they could produce abnormalities in controlled lab experiments, could they count on finding the same abnormalities in natural bodies of water? If not, the experiment would be an interesting exercise but useless in the real world.

Scuds are crustaceans, related to crayfish, lobsters, and shrimp. Different species vary tremendously in size and are found worldwide; two or three species, about the size of a person's little fingernail, are common in South Dakota lakes, rivers, streams, and wetlands.

Fishermen know them as the shrimp-like "wiggles" in vegetation along the shore line. Young game fish and ducks use them for food, and biologists use them in toxicity testing.

"We know something about how scuds respond physiologically to a lot of different contaminants," Troelstrup said.

Those responses, however, have been measured in the artificial environment

of the laboratory, he added. "No one's used these traits as indicators of what's going on in a stream or lake."

Nutrient enrichment—eutrophication—is a common cause of reduced water quality in South Dakota surface waters. Troelstrup and Miller chose ammonium nitrate, component of a common fertilizer, as the stress agent in their experiments. They set up aquaria in the lab, scooped up scuds from nearby ponds, mixed and stirred the animals up to get homogenous populations, and dropped them into the tanks. They fed them a standard ration of rabbit chow.

One set of tanks received no fertilizer; two other sets were dosed with two levels of ammonium nitrate. Miller watched growth and reproduction throughout the experiment, measuring total body length, appendages and antennae, and recording number of eggs produced.

The second antennae—an ornamental trait—turned out to be the one body feature consistently most sensitive to ammonia stress and nutrient enrichment; they were significantly shorter than the same organs on scuds in control tanks.

While scud populations soared in the control tanks—all that good chow, no doubt—survival and reproduction dropped in the treated aquaria.

"In fact, we had to end the experiment ahead of schedule because the high treatment tanks experienced such mortality," Troelstrup said.

That was half the battle. "The lab work established causation. Since we were controlling everything else and only varying the ammonium nitrate, we could safely infer that the changes we saw were caused by the ammonia," Troelstrup said.

"But is that what happens in the field? The outdoors is not a controlled experiment."

Miller collected scuds from a series of lakes in eastern South Dakota along a nutrient gradient from low to very high nutrient concentrations (mesotrophic to hypereutrophic lakes). Generally, measurements from the lakes supported what he'd seen in

the lab: Second antennae were the scuds' most sensitive organs to nutrient enrichment, more dependable in response than any other trait.

"Combining lab and field is what's neat about this project," Troelstrup said. "A lot of studies do one or the other but not both. If Eric just saw the change in the antennae in the field, he'd only know that something was wrong."

Perhaps such biological monitoring can be refined in the future, Troelstrup suggested. "What may be a good trait to look at for high ammonia levels might not be a good trait to look at for organic enrichment or for a pesticide spill. Different traits might respond to different contaminants."

Biomonitoring is valuable because traditional water quality assessment is "hit and miss," Troelstrup said.

Commonly, a management agency maps out a network of sites across the state and sends someone out to each site once a month or so to collect water samples for chemical and physical lab testing.

"So he scoops up his monthly sample. Half an hour after he leaves there's a thunderstorm that washes a bunch of contaminants into the stream.

"By the time he gets back a month later, that water's flushed downstream and things appear to be back to normal. He has missed any changes.

"But if we sample resident 'critters' and if we're measuring the right thing, on Date B a month later we should be able to detect what happened any time after Date A because the animals have been there throughout the whole period."

Scuds serve these purposes well, Troelstrup said.

"Fish leave if the environment turns sour. Even though scuds can swim very well, they don't normally move long distances. They'll be there the next time we come testing. If they're not, their absence might indicate that a major event had occurred."

He adds that he will continue to use physical and chemical monitoring, "but adding biological responses helps the interpretation of physical and chemical data and helps identify hot spots."



Eric Miller (right) made the connection between the scud's short appendages and water pollution; his lab work verified ammonium nitrate as the cause of the deformities that he was seeing in the field. Working with him here is Eric Fairley, also a graduate student in the Biology/Microbiology Department.

photo: Nels Troelstrup, Jr.

Down the road, Troelstrup envisions cooperation with state agencies to map watersheds from satellites. He would be looking for correlations between the changes exhibited by his scuds and other small organisms and any changes in lake and river photos from space. Perhaps, he hopes, "we will be able to integrate GIS and biomonitoring to help us identify disturbances in the land-water interface with less effort." □

Biostress challenge:
biomonitoring to more
accurately assess
water quality



photo: Tom Bare

SDSU and Case™ work out deal where one-time internship leads to prototype machinery and **real-world work for engineering students**

By Larry Tennyson

A unique partnership between the SDSU Department of Ag Engineering and Case™ Corporation's Concord™ operation is unfolding, with the potential to produce farm equipment better suited to the biostresses of South Dakota and other north-central states.

The partnership began when Dan Humburg, associate professor of ag engineering at SDSU, met Noel Anderson in a committee meeting on preci-

sion agriculture. Anderson, a former North Dakota State University faculty member, was an engineering manager for Concord™ in Fargo, N.D.

"It was in 1996, and I needed a summer internship for one of my students, so I contacted Noel, who agreed to arrange it with his company," Humburg said.

"The student was Brad Meyer of Pol-lack, and his internship was extremely

Dan Humburg, SDSU ag engineer (second from right), explains a fluted wheel metering unit from a Case-Concord tank to students Joe St. Aubin, Marshall, Minn., Jonathan Roehrl, Redwood Falls, Minn., and David Hunsley, Pierre. At right is Tim Murray, who earned an M.S. degree in ag engineering and is now a research and design engineer with Case-Concord. The students are Case-Pro interns.

successful. He developed an innovation for Case™ that allowed them to consider a brand-new type of planting option on their air-till drill—one of the main products in the Concord™ line.

"When fall rolled around, Concord™ was interested in having Brad stay up there and continue to work on the project. Brad, however, wanted to get his senior year out of the way here, so Concord™ sent the prototype machine back here with him.

"Brad found a work area where development could continue over the winter, and Concord™ hired a graduate student and several of our undergraduates to help Brad with the work part-time."

In the spring of 1997, Meyer used the prototype to plant crops and evaluate strengths and weaknesses of the machine in the Brookings area. Case™ then hired Meyer, the grad student Tim Muray, and an undergraduate, Doug Prairie, full-time. Over the past year, this team has worked to improve the seeder, and Concord™ has built additional copies of the prototype machine.

The need for wide and thorough testing of these machines now has created yet another hands-on learning opportunity for three more SDSU ag engineering students, who will work for Concord™ this summer to collect the test data that the company will use for further equipment refinements.

While all this was been going on, Anderson suggested to engineering management officials at Case™ that there are fewer young people from farm backgrounds with strong farm machinery experience who are going into ag engineering, Humburg said. That would likely produce a shortage of engineers with that kind of grassroots experience who would be potential employees of firms like Case™.

"Dr. Anderson suggested that it might be wise for the company to start a program that would give them a chance to work with some of those students earlier—before they graduate. He also suggested that the engineering staff of a farm equipment developer is always going to be stretched to the limit in the spring when they want to test equipment and the time is most limited. He asked them to consider that these two factors, coupled with SDSU's interest in having a stronger internship program for their ag engineering students, were a natural basis for developing a program called Case™ Agricultural Systems Engineering PRO-gram, or 'Case™Pro'."

Case™Pro will take students who are part way through their junior year and give them real-life experience in an engineering environment doing testing and evaluation of new equipment.

"Case™ was enthusiastic about the concept and decided to put some

resources into the program. We expect a formal agreement fairly soon."

Case™ also is providing some funding that will enable SDSU to make slight modifications in its curriculum to enhance the overall internship program. Two courses that ordinarily would be taught in a 16-week time frame will now be accelerated into an 8-week time frame so that students can complete them before spring break. One of the courses is new to the curriculum: "Evaluating Agricultural Equipment" and is an extension of the power machines course that Humburg teaches in the fall semester.

The other innovative aspect of the program is the course in technical communications. It will feature 8 weeks on campus and the remaining 8 weeks in the field—with the student keeping in contact by Internet. Technical writing could then be taught in a real-life setting, on the job, rather than in simulated situations. Instruction will be given by Dr. Mary Ryder of the SDSU Department of English.

According to Ryder, "Technical writing focuses on workplace documents that are efficient, reader-oriented, and designed to convey information. The ideal way to teach these skills is to put a student on the job where theory translates into practice.

"While classroom instructors can insist that the communications skills are imperative to success in business and industry, that message only becomes clear when a student has to express ideas in a variety of situations to a variety of audiences. This internship provides just that opportunity. I am excited about this program. All of us should benefit greatly—the stu-



Humburg joins Douglas Prairie, another SDSU ag engineering graduate who now works as a product engineer for Case-Concord™, and Noel Anderson, Case-Concord™ manager of advanced technology engineering, in looking over a tower distribution system on another piece of equipment. Anderson coordinates the Case Pro internship program.

photo: Tom Bare

dent, the instructors, the industry, and the consumer."

This approach may become a model that will be adopted by other schools, and Humburg, Ryder, and Anderson are preparing a grant for a project that would help provide computers and administrative support for the field experience.

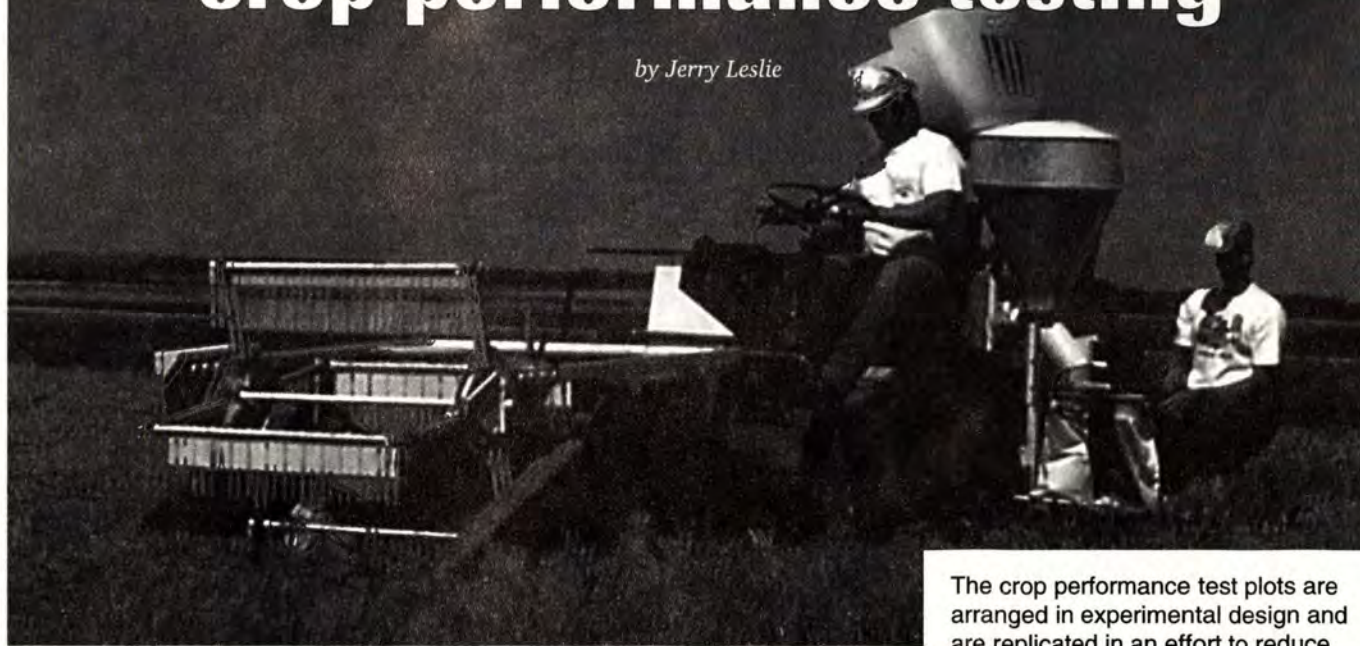
"This partnership with industry seems to be a win-win situation all the way around," said Humburg. "But the bottom line in all of this is that it may result in equipment being designed for use in this region by engineers who have background experience and have a first-hand understanding of the needs of South Dakota farmers and ranchers." □

Biostress challenge:
South Dakota-fitted farm
machinery designed by
South Dakota engineers for
South Dakota conditions

It takes just as much effort and money to grow an average variety as a superior one. Yields and profits increase by careful attention to SDSU's...

crop performance testing

by Jerry Leslie



Unbiased information is worth its weight in gold. No place in agriculture is that easier to document than in crop performance testing.

A 5-bushel yield advantage in 300 acres of soybeans priced at \$6.50 is worth \$9,750.

A soybean farmer in 1997 could have reaped almost \$10,000 more from 300 acres simply by planting a better-yielding variety.

Over the years, 5 more bushels per acre is the historical yield advantage of top-yielding soybean varieties over average yielders in SDSU's Crop Performance Testing Program (CPT). Bob Hall of the Plant Science Department is project leader for the CPT.

"Unless a different seed source costs more, it takes just as much money in inputs to grow and harvest an average variety as a superior variety," he said.

"In many cases a superior variety doesn't cost any more for the seed than an average variety."

Objective, unbiased information like that from CPT is an example of what land-grant universities are all about.

Hall functions almost like a "Consumer Reports" for seed buyers. His work is principally data accumulation, analysis, and summarizing. Then he releases his information in publications, news releases, and on the web...and lets the chips fall where they may.

Laird Larson, Clark farmer and president of the South Dakota Crop Improvement Association, said, "Many producers, myself included, anxiously wait for these results to come out, and we spend a lot of time studying the results when they do."

Larson continued, "If there is any complaint, it's that they might not come out quickly enough, because we are anxiously waiting to start making our variety choices and purchase our seed for the coming year....It's not just the yield; it's the characteristics information, too."

Crop performance testing results and variety recommendations "are widely accepted by the producers of South Dakota," Larson said.

The information about variety performance in South Dakota is renewed each year through planting,

The crop performance test plots are arranged in experimental design and are replicated in an effort to reduce error. They are planted with specially designed planters and are harvested with combines electronically equipped to test for yield, moisture, and test weight in the field. Further testing is carried out later in the laboratory.

harvesting, and record keeping on more than 8,400 test plots scattered over 19 counties in South Dakota.

This makes Bob Hall, his two technicians, and other cooperators some of the busiest small gardeners in South Dakota during the growing season.

Hall and associates plant 2,700 small grain plots, 2,200 corn hybrid plots, and 3,500 soybean plots, working mostly with new public and commercial varieties and a few experimental and unreleased lines.

Each year for the past several years, Hall has tested 30 spring wheat varieties, 6 durums, 35 winter wheats, 15 oats, 10 barleys, 250 to 280 corn hybrids, and 380 to 410 soybean varieties.

On average, dryland yields from those varieties tested over the 5 years Hall has been in charge of CPT are soybeans, 50 bu/A; spring wheat, 42; oats, 99; and corn, 133.

"Many producers, myself included, anxiously wait for these results to come out, and we spend a lot of time studying them when they do."

—Laird Larson, Clark farmer and president of the S.D. Crop Improvement Association.

A new test will be initiated in 1998 of Roundup-ready varieties of soybeans.

Commercial seed companies pay to have some of their varieties and hybrids tested here, and SDSU crop breeders also test their experimental lines alongside the proven varieties they will have to beat to one day become released.

Fees for testing of commercial varieties and hybrids help pay the operating and maintenance expenses of the program which is otherwise funded through the Agricultural Experiment Station.

"We exist to furnish the crop producer of the state an unbiased comparison of varieties and hybrids available for production in South Dakota," said Hall. "If you can figure out what variety yields the best on your land, in your area, you can maximize your profit."

The data from the Crop Performance Testing Program gets lots of use. Besides giving farmers a side-by-side comparison, it also helps a Plant Science variety recommendations committee decide recommendations each year for small grains and soybeans, and it helps another committee decide whether experimental lines should be released as new public varieties.

Bob Pollmann, executive director of the South Dakota Crop Improvement Association (SDCIA), said he

takes the information from CPT out across the state each fall to a series of educational meetings.

Pollmann, who also serves on the Plant Science variety release committee, said the committee deliberates on an experimental line for potential release it looks at 3-year averages from the testing program, keeping in mind the areas of the state where performance would be the best.

CPT "certainly is very important in that you have scientifically conducted and replicated trials that attempt to reduce as much experimental error as possible and give a true test to a variety's ability to perform. And it's done without showing favoritism to a particular variety," Pollmann said.

Certain efficiencies reduce cost of the CPT operation. Hall gets help in the western end of the state from Clair Stymiest, West River Extension agronomist, and John Rickertsen, research associate, both in the West River Ag Center, Rapid City.

Also, SDSU crop breeders and their crews will assist with planting and harvesting when they have plots in the same areas as the CPT program. They include Roy Scott, soybeans; Jackie Rudd, spring wheat; Dale Reeves, oats; and Scott Haley, winter wheat.

Results of the CPT trials are ready for producers about the turn of the year, Hall said. County Extension offices have free copies of C 253 for corn, EC 775 for soybeans, or EC 774 for small grains. The information is also on the web at <www.sdstate.edu/~wpls/http/var/vartrial.html> and in news articles and from the Crop Improvement Association. □

Biostress challenge:
identify the varieties that
produce under harsh
South Dakota conditions

Hands on experiences inreal-life jobs boost graduates' appeal to future employers as

"We have seen from employers a real desire to have students graduate not just with the book smarts and what they've learned in the classroom but also with some out-of-class, professional experience."

This is according to Tim Nichols, assistant to the Director of Academic Programs in the College of Agriculture and Biological Sciences at SDSU.

Not all departments require students to complete an internship to graduate, but the valuable experience is one reason students who do choose to do an internship can receive credit for it.

Marty Michalek, senior ag business major from Oacoma, didn't have to do an internship, but he thought the experience would be beneficial.

"I'd been looking at a possible job with Farm Credit Services (Farm Credit Services of the Midlands, FCSM) for a number of years. The internship opening came available and I thought it would be a good way to get some practical experience to see if it would be something that I was interested in, to see if I liked the company, to see if I'd be good at it."

After putting in his application, Michalek went through two telephone interviews and two interviews in person at the FCSM office in Huron before he was given one of only two internship positions that were available.

Michalek got a good taste of the agricultural lending business while at FCSM. He says the FCSM internship is designed to be a feeder program into their credit officers development program.

"My big job there was to get an overview of the company. Find out what they did, what services they provide, how they go about doing it. Try to learn as much as I could about what a loan officer at Farm Credit is required to do."

Don Warrington, Omaha, manager of staffing and employee relations for FCSM,

students check out job market

by Jody Heemstra

feels internships are a valuable experience for students.

"You really don't get the feel for what that job is until you've had a chance to do it," Warrington says.

Doug Malo, distinguished professor of plant science, says agronomy students are required to do an internship because the industry wants employees that they do not have to train.

"Internships give industry and government agencies a chance to look at and evaluate future employees. Employers do not have to take as much time to train new employees when they permanently hire students with internships. This results in less time and money lost."

Malo goes on to say that not only do internships give students beneficial experience, but they can increase annual salaries.

"When we started the required internship, the average annual salary of Bachelor of Science agronomy graduates jumped about \$5 thousand."

Warrington agrees that providing internships for students is a win-win situation for the company as well. The company gets to see what students are learning in school and how well they can apply the information to "real world" situations. Internships provide the company a chance to preview possible future employees before actually hiring them.

"Students not only get their own perceptions of a job, but they also have an opportunity during our summer internship program to talk to our staff and other professionals in that career."

Professor of Wildlife and Fisheries Sciences David Willis says wildlife and fisheries majors aren't required to do a formal internship in order to graduate, but they can receive credit toward graduation for their experiences.

"The students who are going to be successful in wildlife and fisheries, absolutely have to have the summer work experience and/or experience at other times of the year. We try to help them find volunteer and paid positions during the school year and paid experiences during the summer."

Willis goes on to say that although they only have about 10 students per semester on formal internships, about 90% of their students do get hands-on work experience.

Nichols says, "An internship helps students by giving them a taste of what it's like to work in that profession. Students have an opportunity to try on a career, try on a company, try on a certain job and get a feel for whether or not that organization is one they want to work for."

*"You really don't get the feel
for what that job is
until you've had a chance
to do it."*

—Don Warrington, Omaha, Farm
Credit Services of the Midlands

Michalek says his classes at SDSU taught him some of the major things but it's the little things he got from his internship that he thinks will make a difference.

"There were some things from class that didn't make sense at the time, but while working at FCSM I got to see some of them applied. I saw macroeconomic trends happening right here in South Dakota."

Malo says after students have done an internship, they must take a cooperative

Ag business major Marty Michalek, Oacoma, found his internship experience in the ag lending business beneficial. "There were things in class that didn't make sense at the time but while working ... I got to see some of them applied."

education/seminar class which requires them to give a presentation of their internship experience to an audience of classmates and plant science staff members. Then, they must answer questions from the audience.

"We ask questions to see how well prepared our students are at this particular point in their professional career. This helps us to determine where we should go with our courses and how we can improve our teaching to better prepare our students to meet future needs in the field of agronomy."

Nichols says future employers also benefit from students doing internships.

"They get a student who has a better idea of what they want. If they've had the internship experience, they'll know whether or not they like it. So, potentially, you reduce turnover within the organization."

Michalek says no matter what he decides to do, his internship experience will benefit him.

"If I go into lending or if I do personal tax returns, or if I go into management, the financial analysis portion of what I learned this summer is going to be valuable." □

Biostress challenge:
on-the-job training
while developing
the human resource



photo: Tom Bare

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Calendar of Events

Date Event

MAY

23 State Feeder Pig Show, Mitchell
29 Ag Unity, Pierre
31-June 3 Stockgrower/Cattlemen Annual Convention, Aberdeen

JUNE

2-4 Character Counts! Training, Winner
2-5 SD Youth Range Camp, Sturgis
9-12 State 4-H Conference, SDSU, Brookings
20 SD Beef Industry Council Meeting, Pierre
26-27 SD 4-H Foundation Summer Meeting, Chamberlain
30-July 1 Rangeland Days, Burke

JULY

1 SE Experiment Farm Crops Tour, Beresford
3-13 Citizenship Washington Focus, Chevy Chase, MD
8 NE Experiment Farm Crops Tour, Watertown
5-11 4-H Performing Arts Camp, Aberdeen
15-17 State 4-H Horse Show, Huron
27-31 American Society of Animal Science & American Dairy Science Association Joint Meeting, Denver, CO

AUGUST

16-19 SD Veterinary Medicine Association Annual Meeting, Sioux Falls
18-20 DakotaFest, Mitchell
25 - Sept. 7 State Fair, Huron

SEPTEMBER

9 Antelope Range Livestock Station Field Day, Buffalo
10 Cottonwood Range Station Field Day, Philip
18 SD Beef Industry Council Meet/Prime Promoters Banquet
19 Beef Bowl, SDSU, Brookings
23-24 SD Eminent Farmer/Homemaker Events SDSU, Brookings
23-24 SD State Dairy Convention/Dairy Fieldmen, Watertown

OCTOBER

4-10 National 4-H Week
31 Food Safety Seminar, SDSU, Brookings