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Farm and Home Research

South Dakota State University Agricultural
Experiment Station

Spring 1999

Farm and Home Research: 50-2


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Farm & Home RESEARCH

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

Volume 50 • Number 2

Spring 1999



Director's comments

by Kevin Kephart

This is the second issue in our 50th year of *Farm & Home Research*. I am pleased that we can include the thoughtful comments of SDSU President Dr. Peggy Gordon Elliott. The Agricultural Experiment Station serves the state by conducting research on issues that have practical relevance to agriculture. We can effectively meet this challenge because we are part of a land-grant university, SDSU.

Here's how we connect to the university and to citizens: We provide unbiased, usable information from our research to South Dakotans through the statewide offices of the Cooperative Extension Service and to students (young people, nontraditional, and life-

long learners) through our academic programs. (Many of our scientists are also teachers, and many of our scientists employ students in hands-on, learn-by-doing research projects.) This teamwork approach to

serve agriculture is what the land-grant system is all about.

During this year-long celebration of our magazine's 50th year, we are bringing you the stories of some of our most noteworthy scientists, even if, unfortunately, we can't give credit to all the worthy people who have contributed to the prosperity and well-being of South Dakota, the region, and the world. Last time, we focused on Professor Niels E. Hansen. This issue features Edgar McFadden.

By McFadden's time, the bonanza days for spring wheat seemed gone forever, the kernels shriveled and the yields thinned by rusts in a farm crisis of truly epic proportions. Like so many other scientists, McFadden developed

an idea that everyone said would not work. The consequences of his failure would have been the loss of the wheat industry in the Northern Great Plains.

McFadden's rock-solid determination gave 'Hope' to South Dakota and to the world.

Today, although we battle other diseases such as wheat streak mosaic and head scab, this crop continues to have a huge impact on our state's economy. Yet, there are many other agricultural contributors, and Marty Beutler's analysis on the impact of agriculture to South Dakota helps to explain why agriculture is important to our state.

We are taking a few moments during this celebration of *Farm & Home Research* to reflect on our history. Our most important contributions, however, could not have occurred without guidance from you. South Dakotans are our owners and clientele combined. Please let us know about your thoughts and ideas so your children and their children can read, during the 100th anniversary celebration of *Farm & Home Research*, of more monumental research conducted at our South Dakota Ag Experiment Station. ❖



Volume 50 • Number 2 • Spring 1999

South Dakota State University

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College of Agriculture & Biological Sciences

Fred Cholick *Dean*
Larry Tidemann *Interim Director, Cooperative Extension Service*
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About the Cover

Kevin Kirby, senior ag research technician, sorting wheat kernels in SDSU's seedhouse.

The 'good partner' in the dance of life

President's comments

by Peggy Gordon Elliott
President, SDSU



Kevin Kephart, Jessica Mendelsohn, student researcher, and Peggy Gordon Elliott

- ◆ New scientific knowledge doubles every 5½ years. Medical knowledge doubles every 8.
- ◆ Approximately 7,000 new scientific articles are written every day.
- ◆ Futurists tell us today's technical knowledge will represent only 1% of what will be available in the year 2050.
- ◆ A person who reads the Sunday New York Times today is exposed to more information in one issue than was available during a lifetime to the average person living in Jefferson's day.
- ◆ "Smart" seeds are programmed to grow one season and to die the next.
- ◆ Biotechnology is redefining the meaning of life and death. DNA mapping, organ and tissue implants, and molecular computers implanted into the human body are realities.

We have no choice but to face up to this explosion of knowledge and change that bombards our daily lives and work. With each new discovery, we have to re-sort all the other information that we carry around in our heads. Sometimes that is very hard, not because we are not happy with advances in information, but because all that recalibration leaves us increasingly uncertain about what we

still think we know and who can help us straighten it all out.

On the day that we landed a man on the moon, I was visiting my mother. We had stayed up late into the night to observe the historic moment. The following day, I drove her to a nearby town. On the way, we listened to the radio replaying the event.

My usually irrepressibly chatty Mom was strangely silent. After some miles had passed, I asked why she was so quiet.

She replied, "When I was a little girl, I rode horseback behind my father to town because wagons could not get through in winter. Today, on this same road, I am hearing a man speaking to me from the moon."

I have never forgotten her comment; because it captures what each of us has to do each time we come to the brink of yet another new set of realities. I was glad I was with her that day. Most of us need someone we trust around when something profoundly challenges our old realities and our mental landscape.

Some years ago the Pew Trust published a paper in which they said to be successful today, we could not just react to all the new knowledge; we had to "dance with change."

That's probably appropriate. But as the dance becomes faster and more frenzied, we certainly don't want to dance alone. We need partners, part-

ners in whom we have trust and confidence. We need partners who understand that if we are not successful in feeding the world, this could be the last dance for everybody.

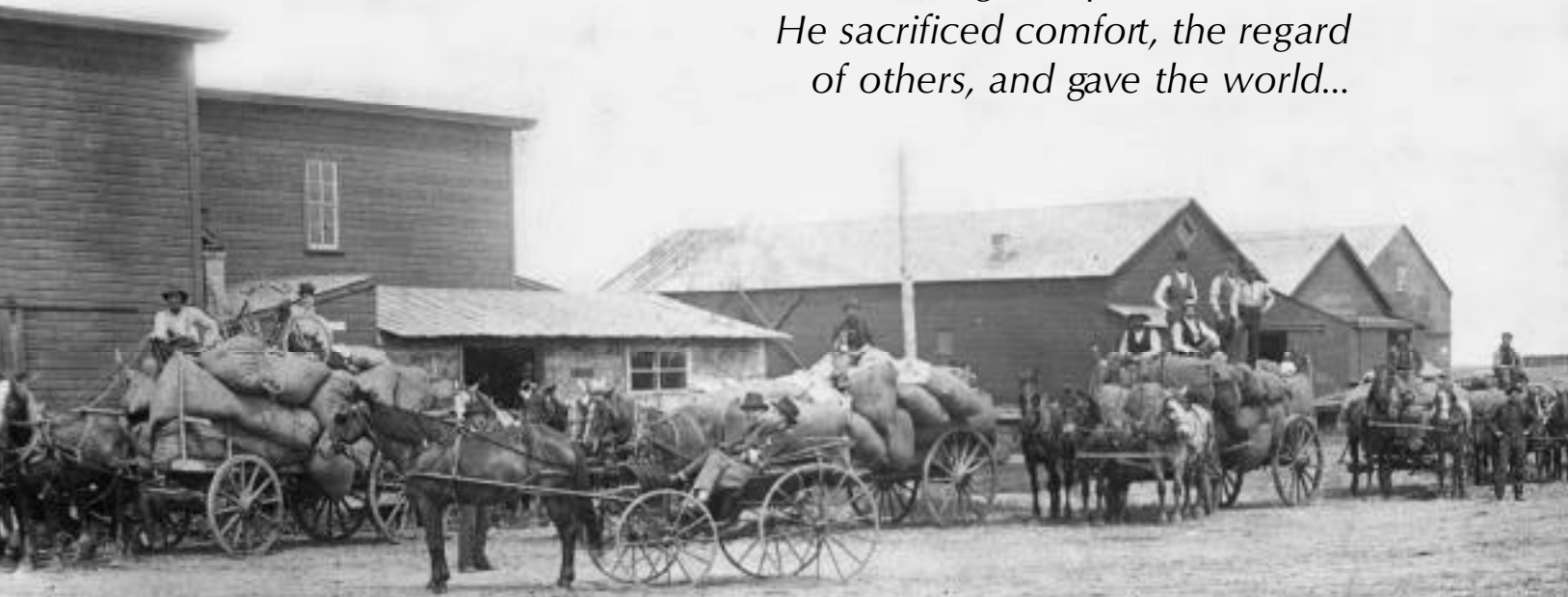
A trustworthy, loyal partner working to develop good and important information for over a century now has been our Agricultural Experiment Station. Partnering has been our strength from our early days when Professor Hansen introduced alfalfa and Professor McFadden made an "impossible" cross right up to recent days when Professor Benfield's research team "took the mystery out of 'mystery swine disease.'"

The entire mission of the AES over all these years has been to be the good partner that can find and deliver the important information that gets us through the tough times, the partner that leads us safely through the new steps of the dance.

The magazine you are reading now is celebrating 50 years of this partnership between researcher and agricultural producer. Most of all, it is celebrating the faith of all of us at SDSU and in South Dakota: Through new knowledge and strong partnerships we can make tomorrow better than today.

I salute the many hundreds of scientists, producers, and friends who over the years have created the knowledge, distinction, and trust that so characterize the AES at SDSU. I salute their keeping us all "dancing!" ♦

*One man never gave up on his vision.
He sacrificed comfort, the regard
of others, and gave the world...*



In 1897 alone, two thirds of the world's wheat was shipped from Eureka, and wagons rolled in from as far as 75 miles away. In 1902 the railroad moved on, and in 1904 a rust epidemic struck. The wheat bonanza was over.

'HOPE'

Seven years, starting in 1879, stand out as Dakota Territory's greatest "land boom." By 1885, the population had increased from 50,000 to 415,000.

Open land without trees, a long stretch of good weather, and their own private hopes and dreams encouraged settlers to break sod and plant wheat. In the 7 years of the land boom, wheat acreage increased from just over a hundred thousand acres to well over a million acres.

In the middle of this period came a Scottish immigrant to Dakota. The New York State school teacher put up a claim shanty on a piece of land about 7 miles northwest of Webster. In 1891 during a blizzard, a son, Edgar, was born to the McFadden family in that little home which also served as a granary. The baby's bed was a grain bin filled with the next year's seed wheat.

Meanwhile, wheat had been planted at the Agricultural Experiment Station

in spring 1887, the year of the Station's establishment at the agricultural school in Brookings.

Without teams, implements, or money, the farm superintendent apparently borrowed the money to buy the seeds that first year, hoping the crop would pay off the debt. Results from this first crop were sketchy, but rust was reported in seven of the 15 varieties planted.

Out in the countryside, wheat was fast becoming responsible for the state's first "economic boom."

Wheat farmers prospered so much, in fact, that Eureka, up McPherson County just below the North Dakota line, for 15 years (1887 to 1902) was the largest inland wheat market in the world.

In 1892, 3,300 cars of grain were shipped out of Eureka; hooked together they would have been a train 30 miles long. At least 35 elevators and warehouses employed 200 men to handle

almost 4 million bushels of wheat. The harvest that year was exceptional, yielding 20 to 25 bushels per acre and bringing up to 70 cents a bushel.

But Eureka residents were living on borrowed time, and they knew it.

The railroad by 1902 moved on; another end-of-track was built up the line. Overnight, many businesses in town moved, lock, stock, and barrel, to the new terminus.

Time had run out, too, for the wheat farmers. But for a different reason.

They weren't aware of the invisible red rain falling on the filling heads of their wheat. Disease had always been around in some form or other. But they couldn't foresee that 1904 would be an epidemic year for wheat rust, one of the worst stem rust years on record, or that production across the state would be reduced by 50%.

And then, from 1904 on, though acreage stayed high, rusts and scab would take their toll and yields did not match the halcyon years of the late 1800s.

Rust was particularly bad in 1916 and 1917 and wiped out nearly the entire crop in 1920. "Marquis," the leading hard red spring wheat planted, was particularly susceptible to rust.

Back in 1904, when the good wheat years were ending, the boy McFadden turned 13. He was the family farmer that year; his father had been gored by a bull and nearly killed.

Young McFadden put in the crops and later made ready to harvest wheat that was swelling with a promise of 40 bushels per acre. But silently, the red rain fell over the farm. Just days before harvest, stalks broke over and kernels shriveled. Instead of 40 bushels per acre, he harvested 5.

The red rain was spores of the stem rust fungus. The weather was particularly good that year for the disease. From Texas, where the rust overwintered, the spores rode the winds north. It is said that in a bad rust year, as many as 600,000 spores could pour down on a single square foot of Dakota wheatland.

The boy must have brooded long about the failure of his first wheat crop, even while spending 3 teenage years in Texas.

"I returned to South Dakota just in time to witness the big drought of June 1911, followed by an epidemic of stem rust which practically wiped out everything that the drought had not taken. It is little wonder that I acquired a lasting impression of the vital importance of controlling drought and plant diseases."

Again, there would be no wheat crop to speak of from the McFadden home place that year of 1911. But nearby stood a patch of Yaroslav emmer, erect and robust, fairly bursting with health. If the spring wheats in northeastern South Dakota had succumbed to the



Edgar McFadden, memorialized for providing "a bountiful harvest for his fellow farmers while to a hungry world he gave bread."

—Day County farmers

red rain, why hadn't the emmer, another small grain?

Emmer was an enigma, not much better than a weed to some scientists and farmers but a feed grain and capable of producing twice as many bushels per acre as spring wheat. It had been grown continuously at the Highmore Experiment Station since 1903, where it was considered "probably the least valuable of small grains grown in South Dakota." Pigs wouldn't eat it, unless it was first ground or soaked.

But it stood up to rust.

So if it were crossed with a bread wheat, would it impart its rust resistance to the wheat?

"This idea filled my mind in the fall of 1911 when I started for State College to learn something about botany, field crops, and diseases," McFadden later reminisced.

His professor surely already knew that emmer and bread wheats were only distantly related, that emmer had 28 chromosomes and wheat 42, and that scientists of the day said such a mating would never take. Was it to finally silence this young man already earning his lifelong reputation as an aggressive,

tenacious, bulldog personality that the professor gave the go-ahead to such an experiment?

McFadden was boarding at a rooming house on the southwest corner of 8th Avenue and 9th Street in Brookings. He coaxed his landlady to give up a corner of her garden, and there he planted a row of emmer and a row of Marquis wheat.

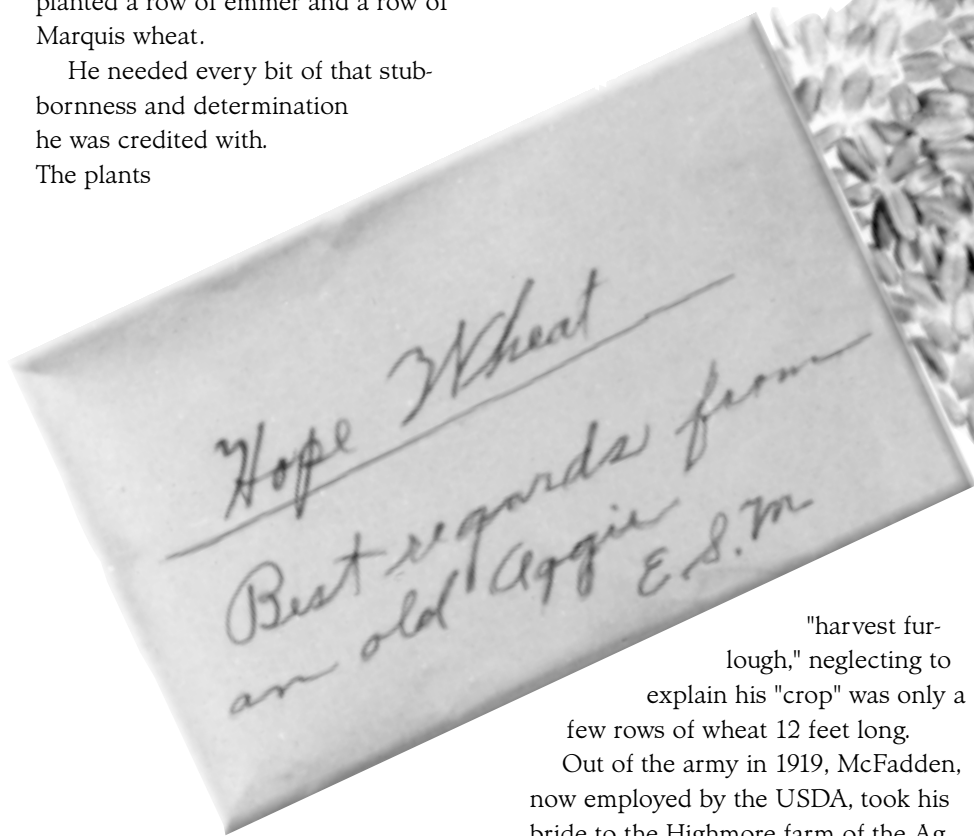
He needed every bit of that stubbornness and determination he was credited with. The plants

never exist, grew, pollinated itself, and produced 100 seeds McFadden planted in spring 1918.

But now, after graduation in 1918, he was called into the army. The story goes that he persuaded his commanding officer to give him a

plots, convinced his new wheat/emmer plants were rust resistant.

Meanwhile, the farm and the finances were failing. In 1921, his fields were burned out by drought. In 1922,



came up nicely.

But they normally self pollinated, even before the florets opened. They didn't bloom at the same time; Marquis was early, emmer was late.

For a few days that year, blooming overlapped. McFadden teased out the emmer anthers and brushed the pollen from Marquis onto the emmer stigma. He had to work at speed; scientists have now pinpointed the length of time in hot July weather such as in Brookings that wheat pollen will stay viable. After the anther opens, it is less than 5 minutes.

That fall he harvested a few shriveled seeds and planted them in the spring of 1917. One—just one—came up. This one plant, that scientists had said would

"harvest furlough," neglecting to explain his "crop" was only a few rows of wheat 12 feet long.

Out of the army in 1919, McFadden, now employed by the USDA, took his bride to the Highmore farm of the Ag Experiment Station, where they lived in the seed house while he continued his breeding work. When federal funds dried up in 1921, he never gave a second thought to desk work at another USDA location or to the offer of teaching at State College. He moved his family back to the Day County farm.

He was no farmer. He was a scientist obsessed with the idea of saving other farmers from the ravages of stem rust.

The family was described as "poor as church mice." But McFadden ignored his scoffing neighbors, neglected his growing family, and let the farm run itself while he worked day and night in his makeshift back-porch lab and his

they were hailed out. In 1923, they were rusted out; the red rain had struck again in the worst epidemic Day County had ever seen.

But only his fields withered. His test plots flourished. This terrible year was a turning point in the McFadden story.

To make relations with his neighbors worse, McFadden had tried to tell them the epidemic was coming. He had trapped the red spores of the rust on microscopic slides coated with petroleum jelly. Since he knew how long it would take for them to infect and destroy the wheat plants, he could predict failure almost to the day.

Success in the midst of devastation: his test rows of emmer/ Marquis escaped the plague totally. By the next year the new variety was reliable enough to receive a name.

'Hope.'

It was still a puny little Hope—low yielding, light weight, susceptible to spring frosts and black chaff, dark floured.

But it was resistant to stem and leaf rusts. And it had wheat's set of 42 chromosomes, meaning it could be easily crossed with high yielding wheats. He sent packets of Hope to other breeders; the germplasm that had combined in

one single seed in a Brookings backyard garden began to spread throughout the world.

Until the semidwarf wheats appeared about 20 years ago, Hope genes were in virtually all wheats the world over.

- During the war years of 1939-1945, over 15 million acres of Hope derivatives were planted in the U.S. and Canada. It was estimated that farmers in the Dakotas and Minnesota saved \$135 million in 1944 alone. Total savings during the war years: perhaps \$400 million.

- Six varieties of Texas wheats, developed from Hope by McFadden after he moved there in 1935, provided a barrier of rust-resistant wheats that would break the northward spread of the fungus spores.

- In the "Green Revolution" in less developed countries, the breeders added the rust resistance of Hope and its derivatives to local wheats.

- Popular magazines of the 1940s reported that possibly 25 million people from other countries had escaped death by starvation because they had bread derived from McFadden's Hope.

Mcfadden's personal fortunes did not profit hugely from his pioneering work. He took no royalties from his discoveries, although the family was able to live comfortably in Texas on his USDA salary.

He lived 43 years in South Dakota and 25 in Texas. His life work is perhaps best captured on a granite memorial erected by the farmers of Day County. It reads, partially, "He Provided a Bountiful Harvest For His Fellow Farmers While To A Hungry World He Gave Bread." ♦

Material for his article was gleaned from interviews with Ray Moore, former director of the Agricultural Experiment Station and with Mrs. Wanda Rufer, niece of Edgar McFadden, and from numerous Experiment Station bulletins, History of the Plant Science Department by Lyle Derscheid, and magazine and newspaper articles of the 1940s.

The Minneapolis Tribune photographer caught Edgar McFadden, left, and Gov. George Mickelson at the memorial dedicated to McFadden in 1947 in Webster. The plaque reads, in part: The farmers and farm organizations of Day County herewith seek to perpetuate the memory of and appreciation for one of Day County's farmers, agronomist and plant pathologist Edgar S. McFadden. A story describing McFadden's exploits, accompanied by several photos, appeared in the Sunday, October 26 issue of the Tribune.



His yellowed September 1946 copy...

...of the *Farm Journal* is a treasured possession for Ray Moore, plant scientist emeritus and former director of the South Dakota Agricultural Experiment Station.

"Five cents a copy. Fifty cents a year, a dollar for 5 years." To prove those prices, he shows the cover: a little girl, her teacher, an apple.

And a teaser strip running across the bottom: "The Man Who Gave Us Bread, the story of a miracle—Hope wheat—page 28"

"I never met Edgar McFadden," Moore says, "but I have talked to several who did know him. I gather he was an aggressive individual—persistent, tenacious, and someone who didn't quit until the job was done."

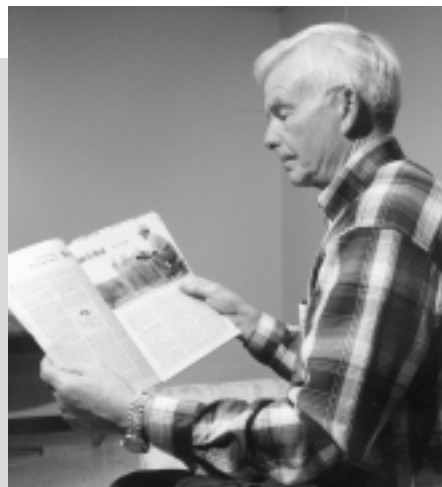
Moore admires McFadden's character and drive and is impressed by his output, but says that another person also contributed to Hope wheat. "We overlook his professor, the man who said, 'Go ahead.' He didn't quash McFadden's dreams, as he could have so easily."

Are men like McFadden and that professor around today?

"Yes, they are," Moore says, "and they will likely be found in states like South Dakota where there is a deliberate effort to buck the national trend of not listening to the determined dreamers and to go for short-term, foreseeable improvements.

"We allow our scientists a lot of freedom to pursue their own vision. We've always encouraged our folks to get out and about, to learn the needs of our ranchers and farmers, and then to design their own projects to answer those needs.

"Another McFadden will come along. Or is here now. I hope we recognize his or her talents and offer the resources to do work that, like McFadden's, will ultimately make a lasting contribution to the world's welfare."



*'Group action is something we're often not very good at.'
We must overcome that bias to...*

Break the sell-cheap, buy-high syndrome

by Mary Brashier

Marty Beutler has good news and bad news for us.

The good news, says the Extension and research economist and head of the SDSU West River Ag Center in Rapid City: "Despite everything that's happening today, agriculture is still far and away the most important industry in the state. It creates income that is nearly twice as great as the next-leading industry and nearly three times more than the third-leading industry."

More good news: "In the long run, individual farmers can minimize the effects of the next 'farm crisis' by preparing now."

The producers that can ride it out, have a secure retirement, and be able to hand the farm over to the kids are the ones with low debt, efficient operations, and marketing skills, Beutler says.

But now the bad news:

"In the short term, this farm crisis could get a lot worse, and there could be very little anybody could do to head it off.

"A lot hangs on the weather. With either a drought or too much rain, production might hit bottom. Last year, when prices were in the dumps, the weather was great. So, even with low prices, we were able to produce more and stay in place financially. We may not have that chance again."



Shipping out raw commodities means our state loses millions in value-added income, says SDSU economist

Our agricultural producers need to make decisions now that will help them ride through the ups and downs of the ag business, Beutler says.

"Many producers work year round for one day—the day they take their commodities to the market. Producers need to make themselves aware of alternative marketing strategies and shift much of the risks they face to others through cooperatives, marketing associations, and forward pricing techniques such as futures trading, options, and forward contracting."

The key to understanding how ups and downs in the ag economy affect the wallets of all South Dakotans, Beutler says, is to visualize the interrelationships that connect

farms, businesses such as the seed and machinery dealers and grocery stores in town, processing plants, and the malls in places like Rapid City and Sioux Falls. All are, to a greater or lesser extent, dependent upon "agriculture."

In 1997, the latest year with data, agriculture generated \$17 billion of economic activity in the state, up from \$15.3 billion in 1996 and \$13.5 billion in 1991.

Economic activity includes the direct dollars producers pocket when selling their grain and livestock. It also includes income from the purchasing of agricultural machinery, chemicals, and other supplies by the producer. It counts value-added income generated when raw commodities are bought, sold, and processed in-state to be con-

sumer-ready. And finally, economic activity also includes the dollars spent by farm and ranch families and others employed by ag-related businesses for food, clothing, and other items.

There are other ways to interpret the results, Beutler adds.

“Production” includes the gross receipts from livestock, crops, and government payments.

“Agricultural support” includes the total value of services, machinery, supplies, food processing, and wholesale trade.

It is this latter area, agricultural support, that is now generating the extra dollars that are helping agriculture increase its prominence in the state’s economy, Beutler says. From 1991 to 1998, the economic impact from ag support industries increased \$3.5 billion. Ag production increased only \$110 million.

When adjusted for inflation, the spread becomes even greater.

“In 1991 dollars, ag production decreased in value from \$8.5 billion in 1991 to \$8.1 billion in 1997. And ag support’s total impact increased \$2.5 billion in real 1991 dollars over the same period.”

The greatest potential for growth in the agricultural economy is in the value-added part of ag support, Beutler says.

“Producing raw agricultural materials is what we do best in South Dakota. But we could add millions to the wealth of the state by increasing the percent of ag commodities processed locally.

“Then, more producers would receive higher prices for their commodities. Construction and processing jobs would be created. Tax money would be generated to operate our schools and state and local governments. And more money would be spent in non-ag businesses in the state.

“But for the present, with very few exceptions, we export raw materials

and buy back the finished product. We sell cheap and buy high.”

The morning bowl of cornflakes is a perfect illustration, Beutler says.

South Dakota exports nearly all the corn grain that is processed for human consumption. Then, among other imported products, cornflakes come back into the state.

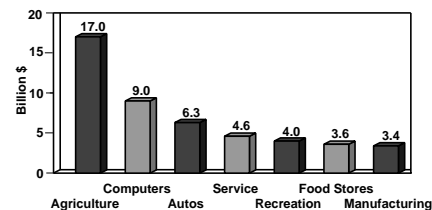
“The value of the corn in a standard box of cornflakes is less than 2%—or 3.5 cents— of the store price of a 24-ounce box of cereal which sells for \$2.60 to \$3.40.

“Somebody else is profiting from processing, packaging, and transporting the raw corn and the cereal boxes. Even if we had only completed partial processing before shipping the corn out, those added-value dollars would have meant millions to the state in wages and profits for our people.”

But adding value is difficult. “Just read the newspapers or recall the wrangles in Pierre this winter,” Beutler says. “No great benefactor with deep pockets is out there to help us.

“It’ll take homegrown cooperatives, marketing clubs, or something like

Impact of selected industries to the South Dakota economy – 1997



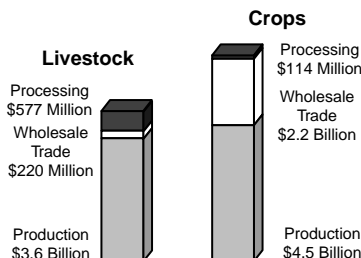
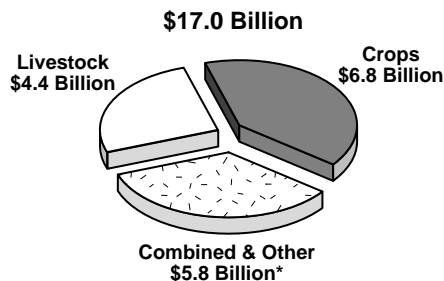
them, and it’ll take real dedication. Group action is something we’re often not very good at.

“It’ll take people getting together to put capital together. But unless they can see an economic benefit for themselves they won’t lay out the money and take the risk.”

But when the vision becomes action, Beutler says, the results far surpass expectations. He cited the soybean processing plant in Volga. “It has more than doubled the value of crops processing in the state.”

“There is great potential in South Dakota to develop industries that use locally grown agricultural commodities to produce finished or semi-finished products,” Beutler says. “We are sitting on an opportunity. When we’re comfortable with our situations we don’t see the need to change things. More progress is made when we are prodded by circumstances to look around and make new decisions. We’re not comfortable now. Is it now time to take charge and build an even stronger South Dakota agriculture for the benefit of all of our citizens?” ❖

Economic impact of agriculture in South Dakota, 1997



Biostress challenge:
growing the state’s economy
by adding value through
local processing

From work as undergraduate researchers, students achieve a jump-start on their careers

Lessons and labs

by Jami Reimer

Our SDSU faculty members have long been known for their advances in research. They don't do it alone. Many of them recruit capable and bright students from their classes to assist them.

This approach fosters teamwork in which ideas and work are shared. While the research gets a boost from the extra effort, the students are gaining valuable knowledge that will help them in their careers.

"Undergraduate research provides our students with an excellent opportunity to expand their knowledge and experience," commented William Gibbons, biology and microbiology professor at SDSU. "Our graduates are recognized for their work ethic. With lab experience behind them, they have an even better chance of landing that good job in the work world."

Ann Sperlich, daughter of Gail and Carrie Sperlich, is a junior from Parkston double-majoring in biology and agricultural education.

She just happened upon research at SDSU. "My freshman year, I answered an announcement in chemistry class and ended up working in an organic chemistry lab. I wanted to do research closely related to human biology and to work with tissue culture, so they advised me to go to the Biostress Lab and talk with some of the professors there," she said.

She was introduced to Bob Rowland, began working in his laboratory, and received credit for her work that semester.

"I really liked what I was doing, the new techniques I was learning, and the process of research was intriguing," said Sperlich.

Sperlich was an award winner at the 1998 R.A. Moore Poster Day. She presented results from her study of Porcine Reproductive and Respiratory Syndrome Virus (PRRSV). It is characterized by a persistent infection throughout the swine breeding cycle and can result in late-term abortions, still births, and respiratory distress in pigs of all ages.

Sperlich studied how PRRSV proteins interact with individual cells. She is using molecular microbiology approaches to determine how genetical-

ly engineered cells control PRRSV proteins.

"This is important for developing new therapies that can be used to block PRRSV infection in pigs," she said.

For Denise Malo, a junior environmental management and agronomy double major, coming to SDSU was natural. She is a Brookings High School graduate and is the daughter of SDSU distinguished plant science professor Doug Malo.

Malo started working in the lab right out of high school and has worked her way up the ladder. "Now, instead of doing lab work for other people, I have been given my own projects to monitor, conduct, and be responsible for," she said.

Currently, she is working on a project using remote sensing for site specific management. She defined site-specific management as targeting resources to where they are needed.

Her project goal is to characterize water and nutrient plant stresses using multi-spectral digital images from aerial, spectral, and hand-held approaches.

"To make environmentally sound decisions about resource allocations in watersheds, we must have reliable information. Remote sensing may provide that information," said Malo.

Remote sensing is the science of gathering information about an object from measurements made at a distance by using sensors in an aircraft, satellite, or on the land surface.

The quantity that is most commonly measured is spectral responses in the form of electromagnetic energy. By interpreting these responses, scientists make inferences about the physical environment.

Remote sensing is available on a variety of different scales, said Malo. Space-based (LANDSAT 7) images



Ann Sperlich, Parkston junior, with Bob Rowland, microbiologist and her "boss" and teacher. Sperlich's work is an award-winner.



Denise Malo, junior environmental management/ agronomy double major from Brookings.

are 30 meters by 30 meters, aerial multi-spectral digital images are one meter by one meter, and hand-held spectrometers are measured in centimeters.

"Research at these scales has shown that plant spectral reflection is sensitive to environmental stress," she said.

Images derived from space and aerial fly-overs came from fields under normal weather conditions during the 1998 growing season. Spectra collected using the hand-held approach will be of plants grown under controlled conditions where water and nitrogen limit growth.

"A portable fiberoptic spectrometer will be used to determine the reflectance of the leaves under different levels of stress," she said.

Part of Malo's research is funded by the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR) program. EPSCoR is a national program that supports both undergraduate and graduate research.

The South Dakota Space Grant Consortium also helped fund Malo's remote sensing research project last summer.

Jessica Mendelsohn, daughter of Robert and Susan Mendelsohn, also of Brookings, got her start in research at SDSU through Fedora Sutton, associate professor of plant science.

"I am interested in medicine and want to do medical research someday. Fedora had an opening in the lab and

offered it to me because she knew I was interested," said Mendelsohn.

For the last year and a half, she has been working on a research project entitled "examination of a putative phospholipaseA₂ in *Xenopus* oocytes."

"Because injected oocytes (in this case, unfertilized frog eggs) synthesize proteins encoded by injected RNA, they function as a complete system for studying protein synthesis, expression, and secretion," explained Mendelsohn.

PhospholipaseA₂ (PLA₂) is a group of enzymes that yield fatty acids and lysophospholipids. In animals these enzymes are divided into three categories. The first category is linked to many inflammatory disorders and is indirectly involved in inflammatory responses. The second group is found in the myocardium, the muscles around the heart. The third category is composed of secreted enzymes found in platelets, rheumatoid arthritis fluids, and insect and lizard venom, she said.

Although PLA₂ has been identified in plants, the functions have not been completely determined. Mendelsohn hopes to change that with her research. "We cloned a Kentucky tobacco DNA that encodes an enzyme closely related to mammalian PLA₂," she said. "In order to study the protein activity of this DNA, I inject RNA into the oocytes and then analyze them."



SDSU President Peggy Gordon Elliott with Jessica Mendelsohn, Brookings.

Mendelsohn received undergraduate research grants from the National Science Foundation and through the EPSCoR program for her research work.

She said her time in the lab has helped her in the classroom. "I have worked with Dr. Sutton since my senior year of high school. During that time, I have learned many molecular biology techniques, and everything I learn relates in some way to the classes I am taking and to what I am currently studying," she said.

For instance, she said microbiology came easier to her than for many students because of her lab experience "Many of the same concepts are used in lab and in class," she said.

Mendelsohn plans to begin medical school after graduating from SDSU in 2001 with degrees in biology and Spanish.

Students are an integral part of agricultural research at SDSU, summarizes Kevin Kephart, interim director of the Agricultural Experiment Station.

They also play other roles.

"They make us a part of the entire University. And they link us with the future.

"Through their extra effort today, student members of our research teams are preparing themselves for leadership roles in a fast-changing, high-tech world. Gaining that extra edge today will prepare them to be leaders in the the 21st century agriculture and biotechnology fields. Some of them will surely also become outstanding teachers and researchers in land-grant institutions like SDSU." ❖

Biostress challenge:

*integrating research
into students'
university education*

Our 'helping hands'

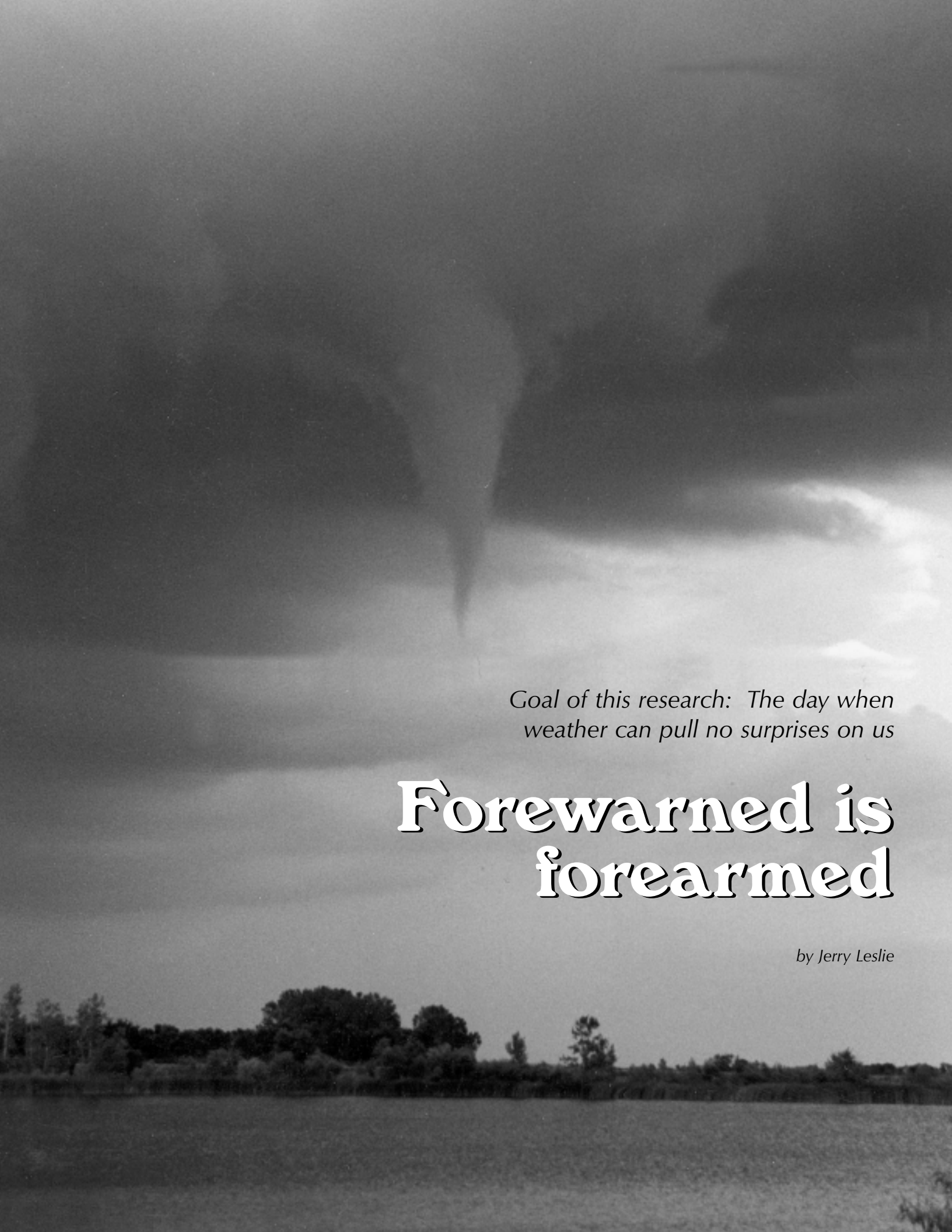
by Tom Bare





AES Research: "It wouldn't get done..."

without the assistance of the folks who milk the cows every day, clean the combines, nurse the lambs, draw the maps, type up the projects, and send out publications to Extension offices and the public. Clockwise, beginning at top, Matthew Field, Crystal Lake, Ill., undergraduate, and Patrick Solsaa, ag research technician; Marge VanderWaal, secretary; Kevin Kirby, ag research technician; Marcy Anderson, Ionia, Iowa, undergraduate student; Mike Kjellsen (standing, in center) project leader, with Pete Bergmann, Mike Broschart, and Dennis Hanson, research assistants; DeLane Doxtader, lab technician; Rud Wasson, sheep unit manager; and Bev Larson and Brenda Warborg, AgComm Bulletin Room.



*Goal of this research: The day when
weather can pull no surprises on us*

Forewarned is forearmed

by Jerry Leslie

The weather. "Everybody talks about it, but nobody does anything about it."

Not true for Al Bender of SDSU.

He and other climatologists in the region come as close as anyone in doing something about the weather. They collect information about it, and then record, probe, analyze, and try to make sense of it. They quantify weather events by duration, magnitude, and frequency of occurrence.

They serve many people from many walks of life. Climate influences the research, enterprises, livelihoods, property, and well-being of every person on the planet.

Bender, assistant professor in the Department of Agricultural and Biosystems Engineering, has served as state climatologist since 1991 when he succeeded the retiring Bill Lytle.

Bender can't serve up the "perfect" climate to suit every citizen of the state, but he works daily with individuals and organizations, public and private, to find what information people want about the climate and how they need it handled or displayed for their best use.

The SDSU climatology pages on the Internet testify to a service-oriented information base developed through cross-agency cooperation. The web address is: <http://www.abs.sdstate.edu/ae/weather/weather.htm>

Whether and climate represent dozens of variables that must be factored into field-based research.

One of three funnel clouds spotted over southeast Brookings on August 9, 1992, moved south. Moments later a tornado severely damaged the community of Chester in eastern Lake County. A relatively benign climate prevailed over the U.S. for several decades until about 1976, when records kept at SDSU began to show a change to one producing more extreme weather conditions. (SDSU photo by Jerry Leslie)

These factors include temperature, precipitation, wind velocity, barometric pressure, solar radiation, heat exchange, evapotranspiration, and the combinations of each.

Bob Berg, manager of the SDSU Southeast Experiment Farm near Beresford, summarizes weather data for research projects at the farm from two automated stations at the farm, one used by Bender and the other by the National Weather Service. Other SDSU research stations collect and record similar data.

Besides Berg, many other SDSU scientists use weather and climate data. Bob Hall, Extension crops specialist and leader of SDSU's Crop Performance Testing Program, said yield trials on crop varieties tested around the state come out a little different each year. "We often rely on Bender's climate data to explain variations in crop performance, good or bad. It can be very valuable to us to have that kind of climate history."

Data gathered by SDSU's climatology program is used in combination with information from the Ag Statistics Service by agribusinesses. Climatological data play important roles in crop insurance underwriting and settlements.

They also are used in recommending planting dates, Hall said. The average last frost date and average first killing frost bracket a locality's growing season. And the length of the growing season dictates which varieties to plant.

Dick Pruitt, cow-calf animal scientist at SDSU, said he uses climate data when forage availability is a factor in research projects. Climatic variations, particularly seasonal rainfall amounts, sometimes explain why benefits of supplementation vary from year to year.

Forage production data and climate records go hand in hand in range management research, Pruitt added.

Sometimes climate variations are a major part of the study objectives, such as an undergraduate project now under way analyzing the effects of weather on when cows calve.

"It seems there is some evidence when a front comes through, cows are more likely to calve as the weather is changing," Pruitt said.

Plant breeders like Roy Scott (soybeans) and Jackie Rudd (spring and winter wheat) also depend on weather data, because new varieties must be adapted to South Dakota conditions.

Bashir Qasmi in Economics uses climate data in analysis of crop yield relationships. Padu Krishnan in Nutrition, Food Science, and Hospitality factored in climate when evaluating quality and nutrients in small grains.

Plant physiologist Anne Fennell is looking at chilling of grapes and other fruits and the transformation of starches into sugar, an area of study needing climate records.

Others accessing climate data are Don Kenefick and Fedora Sutton, on cold acclimation of cereal grains; Sharon Clay, using soil temperatures and soil moisture in her weeds research; David Clay, working with nitrate leaching in soils; and Tom Schumacher, studying the effects of weathering on soil physical properties. Ag Engineer Steve Pohl uses weather records in his studies on swine buildings, pig environment, and efficiency.

Technological advances are happening in climatology, said Bender. Sensors to measure an increasing number of weather variables now are becoming more reliable and less costly.

The SDSU automated weather stations have sensors and dataloggers. Funneling into SDSU's Climatology Office at SDSU is a network of 12 Ag Experiment Station weather stations—near Aurora, Beresford, Brookings, Caputa, Cottonwood, Gettysburg, Nisland, Oacama, Redfield, South Shore, and Pierre—plus another 16 airports stations around the state.

Once a day—more often if necessary—Bender interrogates stations and downloads their automated responses for later analysis.

And he gathers from the Internet, logging onto various web sites around the country and pulling data from the National Oceanic and Aerospace Administration (NOAA), Federal Aviation Agency (FAA), the Department of Defense (DOD), and others.

"The challenge now," he says, "is to roll all that data together into one set. That's where we are right now in stage of development."

We're in the process—and we'll make it this year—to develop a 25-mile South Dakota grid," Bender said. "We will have the data every 25 miles to include temperature, humidity, wind direction, atmospheric pressure, solar radiation, soil temperature, and precipitation.

"We've done a couple of research projects on how to spatially interpret the data. NOAA and the National Weather Service have developed a mesoscale model which is used as a short-term weather forecast model."

By combining all the data now available, South Dakota will have its own cli-

mate grid almost identical to the one that the National Weather Service uses in its weather forecasting.

"When this is complete, the model will be able to describe the climatic conditions for any time or place in the state (within 25 miles of accuracy) without having to rely directly on any one reporting station," Bender said.

This more detailed record of climate for any place will be used by commercial applicators, builders, insurance people farmers, and the public. It will be useful in damage claims and insurance settlements, he added.

When it's in place, the South Dakota grid will become a frequently updated map on a web page. Bender foresees the user putting the computer's cursor at a point on the map, clicking, and then filling out a form for the day and information desired. The output likely will be a complete table of figures.

Bender's work differs from that of the National Weather Service meteorologists who focus on prediction for the next 5 days or a week. "I'm interested in what has happened in the

past and relating that to what happens in the next year or longer. We have a different time focus."

Meteorologists are coming to rely more on the science of climatology, Bender said. "When extending forecasts beyond a couple of weeks, then climate becomes more important."

Advances in climatology are improving long-lead forecasting, and probabilities of occurrence are now available. El Nino and La Nina, unheard of 25 years ago, have become household words, as their impact on weather continues to be better understood.

"The 1997-98 El Nino was one of the two strongest in the last 100 years and is the first one that was observed from beginning to end," Bender said.

Another application of Bender's work is crop modeling. Computer-based biological simulation models will one day take into account most of the environmental variables that impact yield.

Driven in part by precision farming and the need for better risk management, computer models will provide long-lead crop-yield outlooks based on the future climate, after what is known about weeds, insects, diseases, and soil fertility are plugged into the models.

Computer models will one day help select appropriate crops and varieties and prescribe their planting dates and other management strategies. As the growing season progresses, models will support management decisions on irrigation, fertilizer and pesticide applications. During the growing season, models will predict final yield and harvest date. ❖

Join us in the centennial celebration of the...

Highmore Research Farm (Central Crops and Soils Research Station)

Wednesday, June 30, 1999

Hear...

Centennial speakers describe projects at the very first research farm established in the north-central U.S.

Visit...

with your neighbors, friends, scientists, and Extension educators over a special, free Centennial supper

Take...

a guided evening tour of the research plots on the station.



Highmore Station, 1908



Highmore Station, today

June 30, 1999, 1 p.m. to dark
(The station is on Highway 14 on the outskirts of Highmore, S.D.)

Biostress challenge:

using computer modeling to understand climatic effects on South Dakota agriculture

Wheat streak mosaic virus

*This disease is fully armored.
Our best weapon: resistant varieties*

by Larry Tennyson

Marie Langham has a \$10 million problem.

Langham, plant virologist at SDSU, is deeply involved in the effort to provide farmers a winter wheat variety that can resist wheat streak mosaic virus and other viral diseases.

Wheat streak mosaic costs winter wheat producers a minimum 5% of the crop each and every year in South Dakota, according to Langham, adding up to a loss of at least \$10 million per year. The virus is "one of the greatest threats to wheat production today and in the future," the scientist says.

Like all plant-pathogenic viruses, the wheat streak mosaic virus must have a living plant host at all

times. "Plant debris on the field surface won't keep a virus going as it does for other pathogens," Langham says. "So when I go into a field, I am always looking for the 'green bridge,' some living green plant that is harboring the virus for a while."

The virus, which causes sterility, stunting, reduced secondary tillering, and reduced grain fill, moves into winter wheat in the fall, transferring in the spring to spring wheat, corn, or field-side grasses where it will live during summer. In the fall, it's back to winter wheat.

"It also overwinters in winter wheat during its vernalization period, and it may be a contributing factor to winter kill of wheat," she added.

The virus is transmitted by the wheat curl mite, riding along in the mite's saliva and entering the plant where the mite has fed. "It doesn't make much difference where this happens,"

Langham says, "because the virus goes systemic, meaning it will work its way to every cell of the plant."

"And like a pirate, it just takes over, instructing the cells to make more viruses instead of more wheat."

Because the virus has become an integral part of the plant's cells, it is about as invincible as the viruses that cause human colds, Langham says. "You can't go to a doctor and get a shot to get rid of your cold. And there's no way to eliminate the wheat streak virus with a chemical treatment."

Nor is the mite a weak point in the virus life cycle.

"If a farmer notices a portion of his field has wheat streak symptoms, he might be tempted to spray for the mite, but there's a problem. The mite is gone. It has taken 2 weeks for the wheat streak symptoms to develop."

Mite populations are fairly high in South Dakota, Langham adds. "So the vector is not a weak point in the disease cycle."

There is a possibility that wheat breeders could fashion a wheat plant the mite didn't care to munch on.

"TAM 107 has some mite resistance," Langham says. "However, varieties with mite resistance can still be virus susceptible, so in years with heavy mite populations, all wheats are vulnerable."

When virus and vector can't be cracked, the best bet is host-plant resistance.

That's why Langham became involved in the winter wheat breeding program. Her role is to screen each new variety for resistance by inoculating it with the virus in test plots.

Langham, Delane Doxtader, technician, and Cynthia Bergman, graduate research assistant, perform these field evaluations for resistance on over 600



In search for resistance, Cynthia Bergman and Marie Langham inoculate over 600 test plots of winter wheats with wheat streak mosaic virus each year.

test plots spread over 2½ acres in the wheat streak nursery planted in the winter wheat breeding program.

"When we first started resistance testing, we didn't have anything better than 'Dawn,' which is an older variety but is still in use by farmers in the state. It is our yardstick for assessing the resistance in each new variety."

Dawn is an interesting case. "We just don't see anything in its pedigree that says it should be a better variety, but year after year the farmers have found it's a good one to plant in areas that have wheat streak. And when we test it against a scale that runs from 0 to 5, from absolutely no symptoms to a dead plant, it typically gets an upper-2 rating.

"That's excellent. We hardly ever see anything in the 1s. Unfortunately, Dawn doesn't have as much yield capacity as some newer varieties, even though it is still a very good yielder."

When Scott Haley released 'Tandem' last summer, the scientists found it was at least as good as Dawn. Some varieties coming out of the breeding program promise to be significantly better.

Langham drove many back roads before she came up with the annual \$10 million loss figure. She sampled from over 60 fields in 25 counties, taking 50 plants at each stop every fall and every spring, and including plants from other wheat growers who learned of her study.

As familiar with wheat streak as she was, she couldn't rely on field observations to assess infestations. Only an immunological assay in the lab would pin down the virus.

"Viruses are the great imposters," Langham says. "They can imitate the symptoms of other problems such as nitrogen deficiency, herbicide damage,

or other viruses, or they can reveal no symptoms at all. Only testing will tell."

Besides support from the Agricultural Experiment Station, major sources of funding for Langham's work have been the South Dakota Wheat Commission and the South Dakota Crop Improvement Association, which has purchased several pieces of equipment for her use and also has funded Bergman's work. ❖

Biostress challenge:

*overcoming 'one of
greatest threats to wheat
production today'*

*By using only
'traditional' crops
are you limiting
your options?*

Different crops have come into the agricultural news in South Dakota lately. Some folks have billed them as unusual or exotic "specialty" crops. Are they?

Ask that of Dwayne Beck, manager of the Dakota Lakes Research Farm for the South Dakota Agricultural Experiment Station, and he'll say, "Definitely not. They are better called 'rotational crops.'

"Any type of crop that can be complementary instead of competitive to other crop types in your rotation quali-

The challenge in selecting the 'right' rotation

by Larry Tennyson

fies as a rotational crop. For example, wheat needs to be in the eastern part of the state because it is complementary to corn and soybeans in keeping diseases at bay. It keeps us more efficient, even though our annual gross return may suffer a bit," said the agronomist.

The study of rotational crops is wide open. With all the possible choices to pick from, is there a "best one?"

Beck responded that it is indeed hard to select the right category of crop—commodity, cover, or pulse (which are legumes such as lentils, field peas, chickpeas, or edible beans grown for human consumption). And there are types within types, he added. There are peas that are designed only for livestock consumption and others that are grown strictly for forage. There are also many different kinds of lentils.

In each and every one of these types of crops there are differences—differences in marketability, in use, and in plant physiology.

According to Beck, the challenge to crop producers is to become familiar enough with these differences to adapt and build superior crop rotations that accommodate the ever-changing financial and growth conditions faced each year in a state like ours.

Chickpeas, for example, thrive in dry conditions.

"We grew chickpeas at the Redfield Experiment Station several years ago, and they belong in the Pierre area. The reason is that chickpeas only want water twice—once when you plant them and once when you eat them," he said. "They don't like rain during the growing season, so they are ideal for a dry area like Pierre and the southern and western parts of the state."

Chickpeas for the salad bar (kabuli types) are difficult to raise, and if they have poor color, the price can drop from around 30 cents per pound to about 6 cents. "But this year at Pierre, we raised 2,000 pounds of chickpeas per acre at 30 cents per pound. That sure beats summer fallow."

A smaller chickpea (desi types) is ground into flour, so color isn't as important. "We haven't done much with this one yet, but it's a good producer, it can go into livestock feed, and it also grows well in hot and dry conditions. So, this one may be better adapted to southwestern South Dakota," he said.

Meanwhile, the field pea seems to be better adapted to north-central and northwestern South Dakota, because it is best adapted to cooler weather.

Lentils prefer "cool and dry," conditions in the far western part of South Dakota. "We've grown them at Pierre, but it just got too hot for them too often—so we switched over to chickpeas," Beck said.

"Then there are the oilseed crops, which include sunflower, soybeans, canola, flax, rape, and safflower. And within these, they differ greatly in terms of optimum environmental conditions."

The mix of potential rotational crops grows ever more complex with the addition of forage crops and cover crops that can be grazed, or hayed, or used for nitrogen; the warm-season grasses such as corn, sorghum, the forage sorghums, the millets, and proso millet; and the cool-season grasses that include the wheats.

"A rotational crop that we're looking at is soft red winter wheat, which ordinarily is grown much farther east and south of here. This may prove to be a better fit in eastern South Dakota no-till situations than the hard red wheat that has been bred for areas like Wall or Pierre.

"So, the secret in picking the right crop is this: Produce specific commodities for specific markets. And we do that by having a rotation that is diverse and by picking our crops for our rotation and our own personalities.



Dwayne Beck, manager of the Experiment Station's Dakota Lakes Research Farm near Pierre, defines "rotational crops" for the author during a break in a farm show.

"Here's what I mean. I pay \$60 per acre for my chickpea seed, which gets my attention in a hurry. But it can gross me \$600 if it doesn't go off quality, in which case I might barely recover my seed cost. I have to be a very high-risk type of individual to grow them.

"The crops you pick also have to fit with your work load—that's another consideration.

"It's up to each of us to find our own answers. You pick a group of crops that fit what you're trying to do, and you study these to learn their special characteristics. Join the commodity groups that relate to those crops. Talk to guys who are growing them. Go to the field days.

"Consider all the facts you can gather about risk and return in the conditions you are apt to face in a given year, and then it's decision time." ♦

Biostress challenge:

selecting complementary crops for diverse rotations

When the tables are turned

by Mary Brashier

In reversal of roles, 'food insecure' families give educators workable food buying tips

"Hunger? Do we have hunger in this state?"

If that had been asked by almost anybody else, Carol Pitts, Helen Chipman, and Mary Peterson of the South Dakota Cooperative Extension Service at SDSU wouldn't have turned a hair.

But the question came from professionals who should have known better, from other South Dakota nutrition educators.

Chipman answered.

"Yes, there is hunger, for about 20% of South Dakota children under 18."

Children with inadequate diets lag in growth and in school. They have more frequent, more severe, and longer-lasting infectious diseases.

Often—not always—they come from poor households.

As research conducted in South Dakota this last year shows, poorer families—food stamp eligible parents of children under 18—often are unable to feed their families "good" meals from paycheck to paycheck. The bright spot is that these families have much more nutrition-savvy than the researchers expected.

"When the family does not have access to enough food to keep active and healthy, it's called 'food insecurity,'" said Pitts. "Merely knowing what to prepare and eat can't put adequate food on the table for 75% of the participants in our research. They are food insecure."

The research Pitts referred to was conducted with two sets of parents—teen parents and adult family heads—from each of four areas of the state—urban, suburban, rural, and reservation. They met in small groups last winter to talk about their concerns in feeding their families. All were parents of children under 18 and all had limited financial resources.

Organizations serving limited-resource families helped identify potential participants who were invited to join the focused discussions after brief telephone interviews assessed their interest in sharing their experiences. "This was not a random survey," Peterson stressed. "But they were representative, and they did feel that their neighbors and friends



Cooking skills are rarely learned at home anymore, so children who can bring home a time- and money-saving recipe from school or youth club gain self esteem and confidence in the kitchen their busy parents are bound to appreciate. Nearly all focus group parents knew it was valuable to shop for groceries and prepare food as a family group.

were pretty much in the same boat."

Of the 65 participants, 58 were women and 7 were men; 52% were employed; 22% had less than a high school education, 43% had a high school diploma or GED, 29% had some advanced schooling, 6% had a college degree; and

69% had a family income of \$15,000 or less.

Nearly all of them (91%) worried more about feeding their families than about housing, employment, heating their homes, paying medical bills, or other household expenses.

They chose the correct answers 75% of the time in a pre-discussion questionnaire of their basic foods knowledge.

An exception was "Which package of chicken is the best buy?" The answers could be a) \$1.09/lb, for a total price of \$3.15, or b) \$1.29/lb, for a total price of \$3.01.

At more than a two-to-one spread, they chose "b," the one that was more per pound. "But that spoke to their need," Peterson explained. "The \$3.15 chicken may have been a better buy per pound, but they needed to buy the chicken that cost 14 cents less total.



To avoid the "it's 5:30 and what in the world are we going to have for supper" syndrome, some mothers "cooked big" on Saturday and packaged and cooled meal portions for weekdays.

One chicken was going to feed them, no matter the price per pound. And then they could use that 14 cents for something else."

"... there is so little money So I try to buy staples first and then meat, and sometimes I will have some left to buy fruit. But most of the time I don't ..."

—suburban working adult mother

Participants made lists, used coupons, compared prices, stocked up on sale items, and purchased food in their least expensive form, such as chunk cheese and family packs of meat—if they could afford them, Chipman said.

And the parents remarked on the perils and the values of bringing their children along when shopping.

"One mother would send her 10-year-old son to pick out the cereal, but it needed to be a certain size box for a certain amount of money," Peterson said. "That taught him some shopping skills while keeping him occupied for a while."

But other parents left children at home if they thought they would beg for expensive or non-nutritive foods. One mother had a succinct slogan:

"Can't talk, can come."

—adult suburban mother with three preschool children

Another mother, a careful buyer home from work one evening, discovered her family had raided her cupboard after school and seriously wrecked her menu plans:

"[They took] my can of soup I planned for a day or two down the road"

—adult urban mother with three school-aged children

"Many of these people were very careful shoppers," Peterson said. "They had extremely creative money-saving strategies to share with us and each other. Almost unanimously, they want to break this cycle in which the paycheck runs out before the end of the month, and they want to do it without financial help from an agency. They want to stand up on their own.

"I see their faces," said Peterson.



Among the "Meal Solutions" handout cards, prepared in response to focus group needs, are kid-easy and economical ways to win the end-of-the-month-stretch of the food budget.

"They're permanently with me and heavy in my heart."

Food shopping decisions tie into other issues, as national food-trend surveys reveal.

"Quite simply, people from all economic levels are not in the kitchen and, because of the way society is, they're



Focus group parents shared their shopping savvy with the nutritionists, telling how they shopped for the best bargains, read labels, looked for store brands, bought in bulk when possible, and resisted temptations to stray from their shopping lists.



Most dads in the focus groups had even fewer cooking skills than the mothers. Some organizations and agencies serving limited-resource families offer cooking classes especially for them, and these young fathers are learning basic skills of economic and nutritional value to their families.

not going back there," Pitts said. "Our South Dakota research definitely reflects the national trend of less emphasis on cooking skills and home-prepared meals.

"People are just busy, for one thing. We know that 75% of the decisions about what to have for supper are made after 4:30 in the afternoon.

"That may mean stopping at the convenience store on the way home and picking up something easy—but pricey," she added. "Or throwing something in the microwave. Or stirring a box of seasoned macaroni into hamburger," Pitts said. "Some of our teenage parents admitted these were the only things they knew how to make."

"[The home ec teacher] spends more time trying to teach ... nutrition ... because she feels that's more helpful than actually learning to cook because she ... [at least] wants them to be able to make good food choices ..."

—rural adult mother

The research identified the challenges facing families with limited resources. What is the next step?

"Meal solutions," Pitts said.

"Obviously, time is of the essence, and people want ideas on how to implement nutrition information in a cost-effective, time-effective way. It's important, for all families, to get a nutritious meal on the table in a timely manner. But this is more difficult for limited-resource families, due to the cost of convenience foods.

"National food-trend surveys also show that more and more limited-resource families are looking to supermarkets for meal solutions. We have tended to associate all people in a hurry with fast food restaurants. Not anymore. Those who want only convenience stay with fast food. Those who want quality and more traditional meals are going to the supermarkets."

Grocery stores are answering the

trend by offering a wider variety of partially prepared foods, Pitts said.

"Partially prepared foods can be expensive if they're all you rely on," she admitted. "But with careful planning and combining with other foods, we can prepare nutritious and relatively economical meals."

Pitts would not rule out careful buying at fast food places.

"Our focus group participants have these places scoped out," she said. "They know exactly when the cheaper specials appear. There's no reason not to use these specials if they are combined with a fruit or fresh vegetables and milk."

Such menu combinations appear on the "meal solution" cards beginning to appear in grocery stores, WIC locations, food pantries, medical clinics, and other places "where people go to get food or information," Pitts said.

The cards are offered by the South Dakota Nutrition Network, a statewide coalition of public and private agencies, which also sponsored the focus group research. ❖

Biostress challenge:

empowering people to adopt nutrition-wise actions



Food safety practices are as important as the nutritional or budgeting information distributed by the Cooperative Extension Service.

Nutrition education programs...

...offered by South Dakota Cooperative Extension Service and its allies.

• EFNEP (Expanded Food and Nutrition Education Program)...

...is celebrating its 30th year in South Dakota. EFNEP is available in seven urban, rural, and reservation areas. Its success can be traced directly to paraprofessionals in these counties.

These Extension Nutrition Assistants work directly with families with limited financial resources. The quality of the staff is reflected in the example of Ruth Rens, Minnehaha County, who was chosen National Paraprofessional of the Year by the National Extension Association of Family and Consumer Sciences.

EFNEP consists of basic, hands-on learning, with 10 to 12 lessons for adult participants and 6 to 10 subjects for youth. Youth only have to show "improvement" in specific skills and behaviors. Adults, however, need to reach a certain competency level. When 25 to 30% of adults reach this level, the program is considered a success. In 1998:

of 583 adults

90% improved diets
30% improved food management
26% improved food selection and preparation
29% improved food safety practices

of 1,959 youth

83% increased variety in diets
72% increased knowledge of nutrition essentials
67% increased ability to select low-cost nutritious foods
71% improved food preparation and safety practices

Helen Chipman, Program Coordinator

• FNP (Family Nutrition Program)...

...in its third year is now offered in 10 counties as a partnership of the Cooperative Extension Service, the State Department of Social Services Food Stamp Program, and the USDA Food and Nutrition Service. WIC, Head Start, Healthy Start, low-income day care centers, school districts, after-school programs, adjustment training centers, food pantries, grocery stores, low-income housing complexes, hospitals, clinics, and tribal health agencies also cooperate. FNP differs from EFNEP in that reaching as many people as possible is more important than providing comprehensive nutrition education. Consequently, no long-term classes are offered in FNP.

In 1998, 30,455 one-time contacts were made with the target audience of individuals and families with limited resources through small group classes, walk-by demonstrations, newsletters, and handouts of materials.

Extension Nutrition Assistants provide demonstrations, displays, and taste testing at sites throughout the counties. They lead small groups through grocery stores and explain labels, unit pricing, and comparison shopping.

In 1998, 532 participants improved their food safety practices, 1,724 increased the nutritional quality of their diets, 208 improved their food purchasing and budgeting skills, and 60 extended their ability to provide food for their families for the entire month.

Helen Chipman, Program Coordinator

• South Dakota Nutrition Network...

... recognizes the needs for greater uniformity of nutrition education and for food security among people with limited financial resources across the entire state, not just in pockets reached by smaller coalitions of agencies.

Funded by a federal grant in 1996, the Nutrition Network is composed of the South Dakota Food and Nutrition Coordinating Committee—representatives from the state departments of agriculture, education and cultural affairs, health, social services, the USD Medical School, SDSU's colleges of Family and Consumer Sciences and Agriculture and Biological Sciences, and South Dakota commodity groups—and a host of private, non-profit, and profit agencies that work with limited-resource audiences. The South Dakota Cooperative Extension Service was selected as lead agency in the Network—it already has nutrition educators in place in counties across the state and it has strong local network connections.

The survey described in the accompanying article was conducted under the auspices of the Network as a first step in social marketing.

Mary M. Peterson, Nutrition Network Coordinator





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