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103rd annual report

Leaving home

Washington-bound Maury Horton calls on us to intensify care of soil and water resources

photo: Tom Bare

Dr. Maurice Horton
Guest Columnist

Director's comments

I wrote my first "comments" for Farm & Home Research *in 1973 just after being named associate director of the Agricultural Experiment Station. Dr. Al Musson had retired earlier that year. During his 6 years in the director's office he established a sound, productive program of agricultural research that provided numerous benefits to all of us. If you like to eat, you benefited from his programs. Al died this past July. He will be remembered—he made an impact on what we do here.*

This is our annual report issue. It provides a summary of what the Agricultural Experiment Station is, who is responsible for getting the job done, where it is done, and the resources to do the work. We do not highlight any reports to show a particular emphasis. The stories are examples of the variety of our programs.

Some familiar names are missing; some are new. We are fortunate to attract well qualified people, and some of them are introduced to you in the annual report section of this issue. Their credentials are impressive.

Dr. Maurice Horton, long-time soils professor, associate director of the Water Resources Institute, and, since 1978, head of the Plant Science Department, will continue to make significant contributions to ag research from a different setting. He is leaving us.

Dr. Horton has accepted a new position with USDA in Washington, D.C. We do appreciate the years that he has given to South Dakota. We will still see him regularly, as he explains in his guest editorial below.

-- Dr. R.A. Moore

Leaving home. . .

I welcome this opportunity to be a guest writer for *Farm & Home Research*. With nearly 27 years in South Dakota, I find the move to Washington, D.C. is like leaving home.

South Dakota has been good, and Brookings is "someplace special." My wife Betty and I raised our two children here, and their education in the Brookings schools and at SDSU prepared them well for the real world.

The South Dakota Agricultural Experiment Station is part of the Cooperative States Research Service (CSRS). My new position in Washington, D.C. with CSRS is a link between USDA and the various CSRS experiment stations across the U.S. I will serve in administering the CSRS water-quality grants program, serve on regional research committees, and evaluate soils research programs at the various land-grant institutions. The position is another challenge and one I am happy to accept.

I would like us to look together at the positive things that are happening now in South Dakota and the nation. One of the really positive factors is the attention and support being given to research on our soil and water.

continued on page 16

photo: Kevin Schmidt

Neither one nor the other

But both—farm management and farm living. Success in one is linked to success in the other

"We tend to regard agriculture as purely a business venture—or as its opposite, a pastoral way of life," says Dr. Virginia Clark, acting head of the College of Home Economics. "Either way, we miss the mark.

"We're farther ahead when we regard agriculture the same way as the people in farming themselves see it."

Clark was leader of an interdisciplinary team of Dr. Larry Janssen, Economics Department, and Dr. Ron Stover, Sociology Department. They collaborated in one of the few studies in the country to tie quality-of-life to the more commonly studied economics of family farming.

The survey found a strong connection between family life and farming. If one is positive, chances are that the other will also be positive.

"Don't jump to extremes here, either. Hugging your family every morning won't make the pigs stay in the pen or the farm books show a profit," Clark cautions. "Family life and farm management go hand in hand to create a successful farm family."

"This study proves the point: there is a connection between successful family life and economically successful farming. And it can be measured," Clark says.

"That's what made this project so successful. In the past, we had just been making assumptions that there somehow was a connection."

The team sent confidential surveys to about 6% of randomly selected farm families in each county.

". . . there is a connection between successful family life and economically successful farming."

Complete enough information came back from each member of 549 couples to use in the analysis.

For this study, a family farm was one that provided an important part of the family income. "That sounds too simplistic, but it meant we could eliminate 'hobby' farms and large-scale industrial operations," Clark says.

The families responding to the survey ranged in age from their 20s to 80s. Twice as many operators fell in the 50-64 category as in the 21-34 age group.

The majority of respondents had adult children over 18, but only 30% of this group reported that any of their adult children were engaged in farming.

Neither of those figures is a healthy forecast for the future of South Dakota agriculture, the researchers believe.

Over three fourths of the farms generated more than $40,000 of farm-product sales, compared to 47% for all South Dakota operations. The difference here lay in the way the survey was conducted. The mailing list was complete for medium and larger farmers but not for the smallest. Otherwise, respondent characteristics were typical of all South Dakota farmers.

The key indicators used to determine economic success were net farm income and total debt-to-asset ratio. Half of the farm families were in excellent shape (Fig 1).

Marginal income operations (Couple Two in the accompanying story) accounted for 17% of respondents; 22% were in a marginal solvency position (the Threes), and 11% were vulnerable (the Fours).

There are connections between average age of operator and amount of leverage but not between average age and net income. Younger families are

Figure 1. Categories of family farm success[1]: Net farm income by total debt/asset ratio.

Total Debt/Asset Ratio	Net Farm Income[2]	
	At least $10,000 per yr.	Less than $10,00 per yr.
0.00--0.39	**Favorable** (210 farms/ranches) Total Assets.....$437 Net Worth.....375 Net Farm Income.....40 Fed. Payments[3].....20	**Marginal Income** (70 farms/ranches) Total Assets.....$231 Net Worth.....201 Net Farm Income.....0.6 Fed. Payments[3].....10
0.40+	**Marginal Solvency** (92 farms/ranches) Total Assets.....$424 Net Worth.....152 Net Farm Income.....34 Fed. Payments[3].....28	**Vulnerable** (48 farms/ranches) Total Assets.....$234 Net Worth.....81 Net Farm Income.....-2 Fed. Payments[3].....11

[1] Only 420 farming operations provided the necessary information for this classification. Dollar averages are reported for each category.

[2] The dollar figures have been rounded to the nearest 1,000 dollars. Net farm income equals net cash farm income minus depreciation. It is not adjusted for inventory changes.

[3] Federal farm program payments.

more likely to be expanding the operation, acquiring debt in the process. Management practices may be more important than other factors in explaining differences in net farm income levels.

Family success was also measured by two indicators: (1) satisfaction with the family and farm life, and (2) extent that a family operates as a cohesive social unit (coherence). Husband and wife filled out different questionnaires, with some questions overlapping to determine their shared (or divergent) viewpoints.

Clark says that 14% of the couples fell into the "divergent" group.

"In one couple, for example, the wife is extremely satisfied, a rating of 1. The husband is extremely dissatisfied, a rating of 5. In the second couple, both individuals fall in the middle, at 3. If we average the scores for each couple, we'd believe that since both couples had combined scores of 3, both couples were equally satisfied. Not likely. The first couple is 'divergent.'

"On the brighter side, 24% of the couples were highly and 34% were moderately successful from a family satisfaction-coherence viewpoint," Clark says.

Lower stress levels were positively associated with financial viability and with family life success (Fig 2).

"Couples reported stress, and we expected that. Other studies across the nation show that farm familes have more stress symptoms than urban families. Farm families have machinery breakdowns during harvest, rain on the hay, a multitude of daily stresses. Yet the national studies also show that farm families report greater satisfaction than do urban people. They are able to handle their stress."

If the wife works off the farm (more common in families that were younger, on smaller farms, and more highly leveraged), stress was higher, but not anywhere the level reported nationally.

Which farm couple would you choose?

Pick the farm couple that's most successful and happiest:

Hint: They're all close in age; they're all active farmers.

Couple One has a net income that's high to even luxurious by most standards. Few or no farm debts. No worries about what the lender thinks.

The farm of Couple Two is also debt free or close to it. Their net income, however, is low, at $10,000 or less. They couldn't put in major improvements without convincing the bank they'd have increased income; one of them might have to take an off-farm job.

Couple Three has an income as high as that of Couple 1. But Couple 3 is highly leveraged; the farm's debt load is high. Income is high enough to pay off the principal.

Across the road is Couple Four. They have both a low income and high debt.

The answer is not so obvious. If you said Couple One, you're using economic standards of success. If you said Couple Two, you're using the same standards the farm couples themselves use; these standards include both economics and family perceptions of well-being.

Couples in the Two category in the farm family survey were half again more successful than the Couple Ones, almost twice as successful as the Couple Threes, and three times as successful as the Couple Fours.

"It's not that they've done what they planned to do in life and are now just 'coasting,'" says Dr. Virginia Clark, project leader of the survey (see accompanying story).

"There are young people in this group with their lives ahead of them. They puzzle us."

The team is probing the data for more clues.

"That's good news. South Dakota families handle two careers or both spouses working better than families in other states, despite the fact that we in South Dakota are more likely to retain strict gender roles on the farm," Clark says.

By that she means that men do the farm tasks (and women help, depending on their off-farm employment), and women do the housework. "There's less reported disagreement over work roles than you'd expect."

When it comes to making decisions that affect the farm and the family, most of the farm couples (75-84%) make them together when they relate to family or household decisions. A majority use that approach when the decision involves farmland rental or purchase. Otherwise, the man usually makes the principal farm decisions.

And the more the couple agrees on basic issues, the more likely the operation is to be financially successful. The level of agreement was the highest for those in a favorable financial position (Couple One) and lowest for those in a vulnerable financial position (Couple Four).

Figure 2. Percentage of families experiencing different levels of stress, by family success.

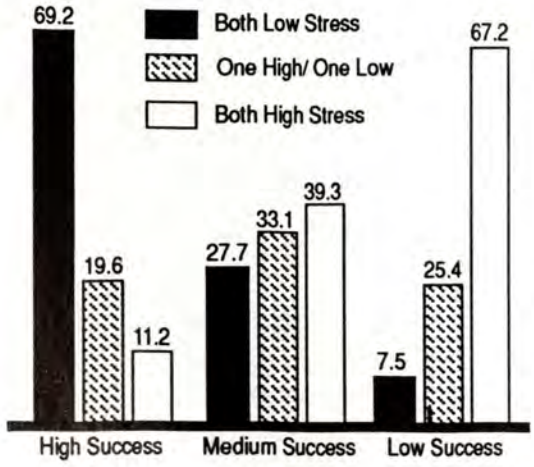


photo: Kevin Schmidt

The man and woman in a "successful" farm family keep their work roles separate, agree on family issues, and make their major decisions together. They overwhelmingly agree that the farm " is a good place to bring up the kids," and while they're hardly immune to stress, they have shared resources that will carry them through. As much as any farm couple can be, they are in control.

The results of the survey are useful to a variety of groups, Clark says. Almost all of the variables examined (farm management, extent of couple agreement, amount of stress, decision making style, work roles) are controllable, or mostly controllable, by farm couples in the short run or over a several year period.

"These findings can be used by farm couples themselves, and by those who provide education and training to them," Clark says.

The project was funded in part by a $75,000 grant from Farm Enterprise Partnership of the Midwest Technology Development Institute in St. Paul, Minn. The South Dakota Agricultural Statistical Service distributed the surveys. Also working in the project was Peggy Schlechter, now lecturer in the Department of Consumer Affairs in the College of Home Economics. Writer: Mary Brashier.

The 'treasured exception'

Genetic 'oddities' give us clues to growth, cancer, fertility in humans and livestock

When this SDSU scientist opens his lab door in the morning, he's greeted by his 500 —more or less— research subjects. They squeak.

Nels Granholm has an infectious enthusiasm for his charges. "Yellow mice have a direct connection to production agriculture," says the biologist.

"Fertility and reproductive efficiency, lean-to-fat ratio, health and vigor, gene therapy. The secrets to advances in all these areas are locked inside these mice. They've got a lot to teach us.

"They are our stand-ins for pens of livestock. They're a lot cheaper to raise. And we already know a lot about how their systems work that will transfer to large animals."

"We" are the scientists at six labs scattered throughout the world. Of them, Granholm is probably the only one working on most of the primary hereditary problems this particular strain of mouse must face.

"When a yellow-furred mouse is born, we know exactly what its genes are. Right now we're only interested in one—the 'yellow gene'."

Granholm can guarantee that the yellow mouse will put on excess weight, with more of it running to fat than to protein. It will have fewer offspring than a normal mouse. It will have a depressed immune system and a greater susceptibility to cancer.

Mice and humans have about 100,000 genes each. That's a lot of places where things must go right but sometimes go wrong.

"The key is to understand how genes work," Granholm says. "Mice, just like humans, can have abnormal genes. The same gene that controls the 'wrong' coat color in this mouse strain just happens to control fertility and fat and a lot of other things too. That's fortunate for those of us studying genetic defects, if not so lucky for the mouse."

The yellow mouse's problems are related to its weight. Its metabolic pathways and their controlling enzymes are similar to those in livestock and humans.

"We're at the point where we think the mouse's enzymes go awry when they're formed. When enzymes are first made, they go through a maturation process something like going down a conveyor belt

photos: Duane Hanson

Nels Granholm knows a lot more than the "science" and the expert and gentle care of the yellow mouse. "Mice were in style once," he says. People kept them as curiosities, and mice even played a role in ancient Chinese literature and were painted by great dynastic artists. The first scientific paper on yellow mice appeared in 1886, and by 1905 researchers already knew that this mouse's yellow fur, obesity, and cancer were all linked together by one mutation.

"[mice] are our stand-ins for pens of livestock. They're a lot cheaper to raise."

during a manufacturing process. If all the right things get put on at the right time, the enzyme comes out the end fully prepared and functional.

"We think that for the mouse enzyme that controls obesity, the problem comes at the point sugar units are added onto the enzyme."

What results is that the mouse has no governor on its growth.

"Let's be positive. The mouse has a 'growth promoting effect'." suggests Granholm. "Yellow mice are not only fatter. They also have a greater long-bone length and carcass size. They're just bigger animals."

Granholm sees impacts on feed efficiency in livestock.

"First, we have to figure out what the growth promoting factor is. Then we may be able to redirect the calorie flow from fat to protein. These same methods just might pass over to large-animal research.

"We could enhance feed efficiency and encourage greater growth in livestock without the side effects of artificial growth additives."

The yellow mouse has another problem that also is genetically linked to the color of its coat and its obesity—lowered fertility.

Sows have the same problem. One major factor that limits efficient swine production in the U.S. is less-than-optimum reproductive performance.

"We know the female's capable of more than the 7-10 pigs per litter on average that she produces," Granholm says. "What we can only guess is the economic impact of just one more pig farrowed and weaned per litter on a national average."

Granholm eliminated a lot of possibilities before he zeroed in on the cause of the yellow mouse's smaller-than-average litters.

The yellow gene seems to selectively block or prevent implantation—when the early embryo burrows into the uterine lining to exchange blood and accept nutrients from the mother.

He knows there is a similar block that also occurs in swine and other

livestock. "Messages essential for reproduction don't flow back and forth between the brain and the pituitary and the ovary."

There are parallels in human endocrinology. "Extremely obese or extremely thin people have difficulty bearing children. There is a delicate balance between nutritional level and degree of fertility."

Granholm is also working with the mouse's immune system. The yellows are more susceptible to cancer, for one thing.

"One of the prevailing theories now is that the immune system senses when a cell becomes pre-cancerous and then destroys it. It recognizes that cell by some odd difference in the molecules on the surface of the cell.

"We think now that the yellow mouse can't make these so-called recognition molecules."

"Stress comes in all shapes and forms," Granholm says. "We most often think about environmental stress—it's too cold, it's too hot. This mouse inherits his stress. It comes in a yellow coat."

He recalls an old adage in the genetics business: "Treasure your exceptions."

"The yellow mouse, because of its potential to help us understand growth, cell metabolism, fertility, and cancer, is one of those 'treasured exceptions,'" Granholm says.

Dr. Nels Granholm, biologist in the Biology/Microbiology Department, has spent the larger part of 15 years at SDSU working with the strain of mice that carry the lethal yellow gene. Writer: Mary Brashier.

research notes capsule updates on Experiment Station research

New sunflower variants show genetic resistance to beetle

Sunflowers rank second (behind soybeans) in world production for edible oil. The major problem in growing sunflowers in the U.S., however, is the excessive cost of chemicals. Without chemicals, insect pests can cause yield losses of 60% or more.

Researchers at SDSU, conducting one of only two sunflower research projects in the U.S., have found new sources of genetic variability to improve sunflower resistance to pests. There is some evidence that feeding by *Heliothis virescens* was deterred by the genetic code from these plant sources. The work is a cooperative project with the Entomology Department of North Dakota State University. *Principal investigator in South Dakota: Dr. A. Espinasse-Gellner, Plant Science, SDSU.*

N recs for corn can be lowered

Refinement of nitrate soil tests shows, in preliminary data from 26 field studies, that nitrogen recommendations for corn, based on the nitrate-N soil test, can be lowered by an average 15 to 25 lb/A. Producers will have to buy less fertilizer nitrogen while still maintaining yields, and there will be less potential to contaminate ground water with excess fertilizer. *Principal investigator: Dr. Ron Gelderman, director of Soil Testing Program, SDSU.*

Revamped marketing could add millions in beef industry profits

If beef cattle producers put new marketing knowledge to work, increasing cash receipts by 5% isn't an unreasonable goal. Across the beef industry, such an additional 5% would raise returns by $72.8 million.

New management and marketing practices are being incorporated into farm and ranch operations in a comprehensive Integrated Resource Managment Plan. Short-term profits are one goal. Another is long-term sustainability of rangeland, pasture, and cropland resources. *Principal investigator: Dr. Dillon Feuz, Economics Department, SDSU.*

LIFE IN THE OLD TREE YET

Most windbreaks are past their prime but cleaning up the weeds gives them more years

A lot of attention has been given to the destruction of the rain forest in the Amazon and to the damage to trees caused by acid rain in Europe, Canada, and other areas. Closer to home we also have a tree resource that is in trouble. Our windbreaks right here in South Dakota are in a state of decline, and many trees are dying.

In the late 30s and early 40s, over 200 million trees and shrubs were planted on 30,000 farms in 18,600 miles of windbreaks in the prairie states. Those trees are 50 or so years old now. They are dying as surely as leaves drop in the fall.

Fifty is a grand old age for some trees, particularly Siberian elms and cottonwoods. But other trees common in windbreaks could still have years of growth and usefulness left.

Many of them won't have that time. A survey, already several years old, showed that 61% of South Dakota windbreaks could muster only a fair or a poor condition rating, or they were so bad they couldn't be rated at all. ("Fair" indicates that about 30 to 40% of the canopy is missing.)

Over 80% were infested with grass or weeds; 14% were grazed, and only 12% had received any form of renovation.

Cleaning up the windbreak floor is the quickest and cheapest form of renovation. Most South Dakota windbreaks aren't thick enough to have closed canopies. Grass and weeds receive enough sun to thrive. They use a surprising amount of moisture and nutrients which they deny to the trees.

A total of 20 windbreaks of different ages were selected in 1986 for a weed-control study. Part of each windbreak was treated with glyphosate, a post-emergence, non-

selective, translocated herbicide which has no soil residual, the first year at 2 lb active ingredient per acre. The following spring, we used simazine, a pre-emergence soil residual herbicide, at 4 lb active per acre to keep out invading vegetation.

The trees responded. They increased the diameter growth of stems by 1 inch (2.46 cm) in 3 years in the treated plots, compared to .8 inch (1.99 cm) in the sections receiving no treatment.

They bushed out more. Average crown density increased by 9% in the treated plots, compared to 4% in the control. Trees in the treated plots also ended up slightly taller.

Half of the windbreaks were on a fairly poor, shallow soil. Those trees increased diameter growth more than twice as much as the trees on the better soil. Their crown density increased 14%.

The study also gave us an idea of which age class of trees responds better to release from competition. Diameter growth increase was much more pronounced in trees under 35 years. Still, trees over 35 did show a positive response, which suggests that even trees planted in the 30s and 40s can benefit from controlling weeds and grass in the windbreak.

The increased vigor continues as long as the windbreak is kept free of competing vegetation. What's more, increases in diameter growth, height growth, and crown density became greater each year of the study.

The windbreaks in this study were in the fair to good category. It may be useless to try to save windbreaks in poorer condition.

The cost of a treatment such as ours is about $35/A, not including cost of labor or equipment. If your

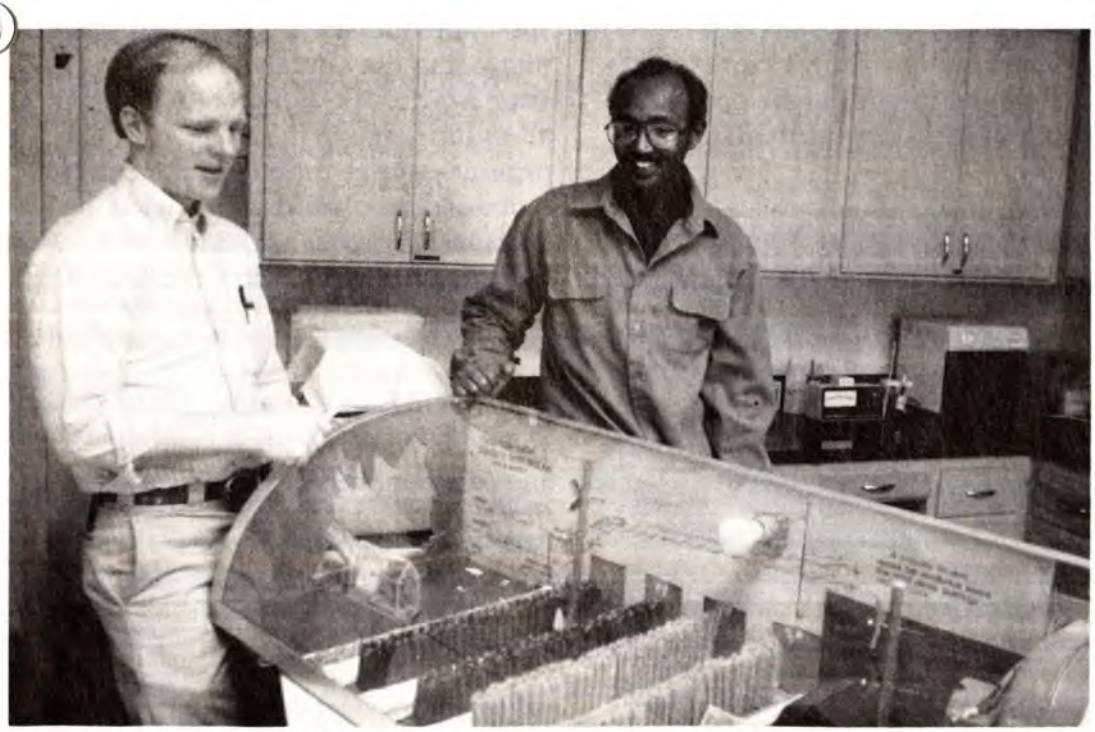


photo: M.K. McFarland

Pete Schaefer, left, can dispel doubts about the ability of a windbreak to slow down wind and snow by introducing smoke at different velocities at the end of this wind tunnel constructed in the Horticulture Forestry Department. Watching is Ismail Ahmed, also of the Horticulture Forestry Department.

What a windbreak offers

Check out the benefits a good windbreak can provide:

Erosion control. An unprotected 160-A field can lose 9 T/A/yr of topsoil to wind. Six single-row windbreaks 440 ft apart reduce that soil loss to 2.3 T/A/yr.

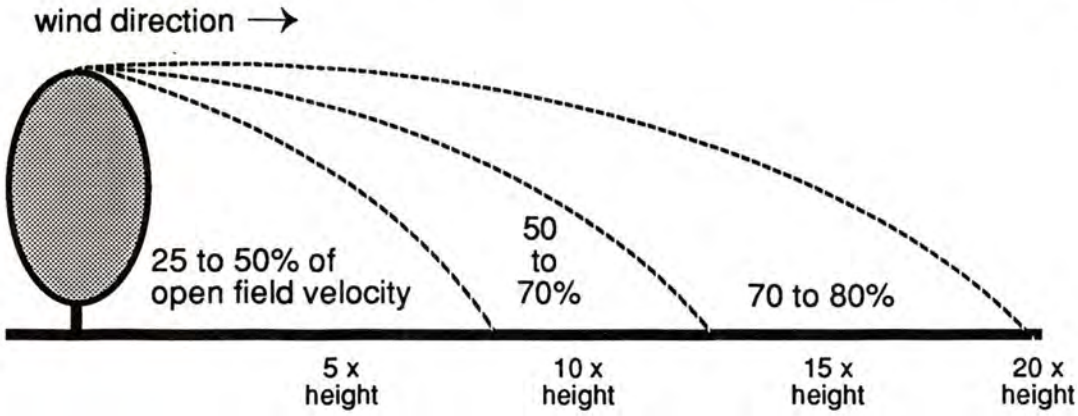
Higher crop yield. Yields from sheltered soybean fields in Nebraska were 20 to 26% higher than from soybeans with no wind protection. In North Dakota, sheltered spring-wheat yield was 21% higher than in unprotected areas.

Livestock protection. Here it helps that some wind gets through. A 20% porous barrier is better than a solid barrier. A 20% porous barrier has improved feed utilization in beef cattle by 18% and increased weight gain by 25%. Even in Canada, protected wintering beef cattle put on 12% more gain than cattle in the open. Outside of fences and feedbunks, tree windbreaks are the most common feature in South Dakota feedlots.

Snow control. "Living snow-fences" keep farmyards and highways clear and are coming back into favor with highway departments and railroads as energy and equipment costs again turn upward. It's no longer cheaper to run snowplows than to plant and maintain trees.

Home energy efficiency. No recent studies have been done in the Great Plains. In a Saskatchewan winter, however, a trailer protected by a farmstead windbreak used 22% less heating energy than an identical trailer in the open. Homeowners with trees in the Northeast saved 10% in heat bills and 80% in air conditioning bills.

Suppose a multi-row windbreak has a density of 50 to 65%. Wind speed will drop by 50 to 75% within the distance that is eight times the height of the windbreak. As far out as 20 times the height of the trees, the wind will still be 20 to 30% slower than on the windward side of the trees.



windbreaks have less canopy closure and therefore less shade, retreatment to keep competing vegetation down will naturally increase the cost.

Turning the cattle into the windbreak is not an alternative method of keeping the grass down. It is not cheaper than using herbicides. In the long run, it is much more expensive.

There are few things more detrimental to windbreak condition than domestic farm animals. Livestock compact the soil under the trees, decreasing oxygen availability to tree roots and causing water to run off instead of soak in. Domestic livestock also destroy lower-level density in a windbreak by browsing on shrubs and tree branches.

If your windbreak isn't too far gone, you should, if at all possible, spend the money to save it. Increasing the effective lifetime of your windbreak will greatly enhance all of the benefits the trees provide—prevention of soil erosion, increased crop yields, increased feed efficiency in livestock, control of blowing snow, wildlife habitat, and a more pleasant environment for people to live in.

photo: Norm Baer

The windbreak prevented this snow from becoming a nuisance in the farm yard or an outright danger on the road. That trapped moisture will also be a benefit in the spring. Note that the outer row of shrubs is in excellent condition--a sure sign the farmer knows the value of this planting and has kept the livestock out.

The authors are Dr. Norman Baer and Dr. Peter Schaefer of SDSU's Horticulture, Forestry, Landscape and Parks Department. Baer presented this information at the 2nd International Symposium on Windbreak Technology held in Harbin, China, in June 1990. If you'd like help planting or renovating a windbreak, contact the Soil Conservation Service, your Extension county agent, or the South Dakota Division of Forestry. Illustration: Duane Hanson.

No other way

We choose to treat production and research animals humanely—with care because we care

Farmers, ranchers, scientists, and many more of us from all walks of life are animal welfarists. Welfare relates to "well being," a state of comfort and health. We make the choice to provide comfort and health to our animals. We do it for economic reasons, whether the animal is a 7-lb cat or a 700-lb steer. We also do it because we have an obligation to and compassion for all living things in our care.

Animal rightists, on the other hand, believe that humans do not have the moral right to keep, use, or kill any animal. They do not believe animals should be used in research. They do not believe animals should be raised for food or even for their wool.

We use animals in research at SDSU. For those of us in animal production, for example, it seems obvious that using beef cattle for beef cattle production research is the most direct, economical, and surest way to obtain valid results that can be used by the cattle producers of South Dakota.

Scientists at SDSU also use research animals as "stand-ins" for humans. Across the nation, this has had a tremendous payoff and will continue to benefit humanity. Polio vaccine, tissue grafting, and open-heart surgery are just three examples of where animals have contributed to techniques that have saved human lives.

Animal experimentation at SDSU is closely regulated. All research proposals involving laboratory animals must pass review by the University Animal Care and Use Committee before research is initiated. The committee is chaired by a veterinarian and is made up of SDSU scientists and private citizens.

The committee must determine that animal research procedures follow guidelines mandated by the National Institute of Health (NIH) to assure the humane and proper care of animals in research. The committee continues a close oversight of animal experiments. The vast majority of lab animals are rodents.

Farm animal research at SDSU is also overseen by the Animal Care Committee. Research procedures that are not ordinary management procedures must follow the the NIH guidelines. For standard management practices, we use the "Guide for the care and use of agricultural animals in agricultural research and teaching." We make every effort to minimize stress and discomfort; the validity of our results depends on healthy, sound research animals.

We use "modeling" where we can. This is, primarily, the use of computers, and they are valuable in "what if" preliminary design of experiments. Modeling largely eliminates non-beneficial research paths, and it allows us to hold down the large investment made in livestock. Models and videos are also used in teaching. There will be cases, however, where animals must be used; there is often no substitute for an intact animal system in a research study.

Our animals are treated humanely, because we genuinely care for them and because of our various review processes. From cattle down to mice, our animals at SDSU are crucial components of the research that pays tremendous dividends to the citizens of South Dakota, the region, and the nation.

Dr. James R. Males, author, is professor and head of the Department of Animal and Range Sciences, SDSU.

" . . .we have an obligation to and compassion for all living things in our care. "

They come in all sizes

. . . but in the past 20 years, the state's 'large' feedlots

Diversification may be South Dakota cattle feeders' strongest quality. Diversification allows the farmers to use their various sets of resources in efficient ways, and it helps them control risks.

However, diversification can also cause managers to spread themselves so thin that efficiency suffers in some of their enterprises.

This is one type of finding of a 1989 survey conducted by Dr. Donald C. Taylor, SDSU agricultural economist, and Dr. John J. Wagner, SDSU ruminant nutritionist.

Taylor and Wagner surveyed 145 South Dakota feedlot managers to characterize South Dakota's feedlot industry and to document current management practices.

Respondents to the survey tended to be from above-average-size feedlots.

Surveyed feedlots ranged in design capacity from 20- to 12,000-head capacity. Average capacity per surveyed feedlot was 900 head. The average for South Dakota is 75 head.

According to Taylor, this does not necessarily mean the information derived from the survey is not helpful to the smaller feedlot manager.

"Operators of larger feedlots tend to manage their operations more intensively than smaller producers," Taylor says. "Some smaller-scale cattle producers may find some of these management techniques useful."

Although many small feedlots still remain in South Dakota, the share in production of feedlots with over 1,000-head capacity increased from 16% in 1969-70 to 64% in 1988-89.

This percentage point increase is greater than that recorded in any of the nation's 12 other major cattle feeding states, Taylor says. South Dakota usually ranks about 10th among these states, which together account for 85% of all U.S. cattle on feed.

The survey shows that large feedlots are filled closer to capacity than small feedlots, with feeder cattle

photo: Duane Hanson

have captured the lion's share of fed-cattle production

more commonly purchased (vs. home-raised) and more often placed in feedlots rather evenly throughout the year.

Managers of larger feedlots earn a higher percentage of gross farm income from the sale of slaughter cattle. They also tend to more commonly feed high moisture (vs. dry) grain, cracked (vs. ground and whole-kernel) dry grain, and ground (vs. unprocessed) hay.

Larger feedlot managers more commonly test the nutrient content of feedstuffs, use feed scales, keep detailed feed records, and use microcomputers to monitor feeding rates and cattle performance. They are also more likely than small feedlot managers to use electronic media to obtain market information, to use hedging and forward contracting for price protection, and to sell slaughter cattle directly to packers.

Managers of larger feedlots more commonly use growth promotants and feed additives. They are also more likely to hire outside professionals to help develop their nutrition, health, management, and marketing programs.

Taylor says feedlot management is complex and that the investigators did not expect to find simple answers that necessarily would apply to "everybody."

Instead, the survey results allow individual feedlot managers to see what others in the same field are doing and to learn about possible techniques for improving their own operations.

The writer is Rich Naser, Fulton, S.D., SDSU journalism major. Taylor and Wagner are preparing Agricultural Experiment Station Bulletin 709, Cattle Feedlot Management in South Dakota, on the results of their survey. Check with your county Extension office or write the ABS Bulletin Room; SDSU, Box 2231; Brookings, SD 57007 to obtain a copy.

Dr. Alfred L. Musson

A RESOLUTION OF
THE EXPERIMENT STATION SECTION

DIVISION OF AGRICULTURE
NATIONAL ASSOCIATION OF STATE
UNIVERSITIES
AND LAND-GRANT COLLEGES

WHEREAS, Dr. Alfred L. Musson, former Associate Director of the South Dakota Agricultural Experiment Station, passed away on July 21, 1990; and

WHEREAS, Dr. Musson served in the Director's Office from 1960 until 1973 when he retired; and

WHEREAS, Dr. Musson served as Professor and Head of the Animal Science Department, South Dakota State University, from 1952 to 1960; and

WHEREAS, Dr. Musson made significant, long-term, and distinguished contributions to agriculture and agricultural research in The Land-Grant System; now

THEREFORE, BE IT RESOLVED that the Experiment Station Section, Division of Agriculture, National Association of State Universities and Land-Grant Colleges, assembled in Kansas City, Mo., on November 12, 1990, wishes to express its profound sorrow over the loss of this distinguished leader, colleague, and friend and conveys a sincere expression of sympathy to his family.

Chairman

Secretary

Director's Comments

continued from page 2.

We only need to look at past civilizations that failed because they exploited their soil or water resources. Help us protect these resources. Your Ag Experiment Station is an important member of the soil and water research team.

South Dakota is one of the few states that have no assistant directors for the Experiment Station. This puts extra pressure on its director, but it does free up funds for additional research projects, assistantships, and for some capital assets. With that kind of funding base, our researchers are in a position to compete for grant funds and contracts from other sources. It is a fact that grants, whether from federal or private sources, represent the only feasible way to achieve growth in the research program.

Ground breaking for the Biostress Laboratory this coming summer is another indication of our progress here in South Dakota. I am pleased to have made some contributions toward the concept and realization of this research facility.

Readers of this magazine throughout the state: You have at your disposal here in the South Dakota Agricultural Experiment Station people, ideas, and information to improve your quality of life while earning a living.

I am pleased to recognize the many friends of the Plant Science Department who have supported our programs and who have helped me with my job.

May our paths continue to cross!

Maurice L. Horton

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Agricultural Experiment Station

South Dakota State University

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Projects

Agricultural Engineering

H-176, Irrigation management practices for efficient crop water use; DeBoer, Chu, Stange, Werner
H-179, Crop harvesters (combines) and soil compaction; Froehlich, Alcock, Durland
H-187, Conservation of water, soil, and energy by constant hold spacing trail tubes; Chu, DeBoer
H-189, Applying and recording ag chemicals simultaneously via computer control; Froehlich, Klosterman, Alcock, Durland, Stange
H-196, Management of shallow water tables under ag lands; DeBoer, Chu, Lytle, Stange
H-197, Engineering of animal housing environments; Froehlich, Anderson, Hellickson, Julson, Schipull
H-198, Tillage systems design and ag vehicle traction; Alcock, Froehlich, Kelley
H-207, Engineering in mushroom production; Julson, Froehlich, Pohl
R-239, Variables in ag weather information systems; DeBoer, Stange, Chu, Werner
H-247, Post frame ag structures; Anderson, Froehlich, Julson
H-249, Root growth and mechanical impedance of soils; Alcock, Schumacher, Froehlich
H-358, Biodegradable plastics; Julson, Krishnan, West

Animal and Range Sciences

H-038, Precooking and coating meat products: methods, palatability, physical traits; Costello
H-049, Nutritional management to minimize costs and improve reproductive performance of beef cows; Pruitt
H-059, Age-weight dependent mechanisms of skeletal muscle growth in cattle; Pritchard
R-079, Genetics of body composition in beef cattle; Marshall
H-128, Reducing breeding seasonality in the ewe; Slyter
H-217, Effects of specific feed proteins on the amino acid nutrition of growing lambs; Pritchard
H-259, Lipids in animal products: modification and control; Romans
H-268, Influence of grazing system changes on range productivity; J. Johnson
H-289, Influence of gonadotrophin releasing hormone implants on reproductive performance in beef cattle; Miller, Goehring
H-297, Grazing strategies for native and introduced rangelands; P. Johnson
R-307, Increasing prolificacy in sheep and its impact on nutritional needs; Slyter
H-308, Energy and nutrient utilization by growing swine fed various components of fiber; Hamilton, Libal
H-314, Rangeland resource improvement; Gartner
H-318, Effect of postweaning diets on intestinal function and morphology of pigs; Libal, Hamilton
H-319, Corn grain, corn silage, and alfalfa hay in cattle feeding and farming operations; Wagner
H-328, Nutrient interrelationships affecting performance, metabolism, and body composition of growing swine; Libal, Hamilton
R-329, Factors regulating protein synthesis, degradation, and growth in skeletal muscle; McFarland
H-357, Nutrient and management interrelationships affecting reproductive efficiency of swine; Libal, Wahlstrom
H-378, Energetic efficiency of beef cattle production: relationship of maintenance energy requirement to beef cow production efficiency; Birkelo
H-464, Grazing management for the mesic mixed-grass prairie of South Dakota; P. Johnson

Biology

H-029, Genetic variability in Echinacea; Reese, Kahler, Larson
H-089, Enhanced reproductive efficiency: molecular genetics of a gene controlling fertility and adiposity; Granholm
H-188, Tissue and cell culture techniques for breeding monocotyledonous species; Chen, Boe
H-228, In vitro propagation of hybrid lilies and induction of polyploids; McMullen, Chen, Spinski

Dairy Science

H-020, Milk concentration techniques in dairy processing; Mistry
H-119, Whey utilization by dairy cattle; Schingoethe
R-137, Metabolic relationships in nutrients for lactating cows; Schingoethe
R-147, Dairy herd management strategies for improved decision making and profitability; Foster
H-157, Composition, quality, and consumer acceptance of milk and dairy products; Baer
H-257, Analysis of dairy products; Parsons
H-258, Nutritional utilization of forages by dairy cattle; Harrison
H-317, Quality, microbiological safety, and profitability of dairy products; Torrey

Economics

H-076, Economics of farming systems alternatives in eastern South Dakota; Dobbs, Taylor
R-086, Determinants of farm size and structure in U.S. north-central areas; Janssen
H-087, Economic analysis of South Dakota rangeland values, lease and rental rates, grazing fees; Beutler
H-109, Simulation and risk analysis for South Dakota producers and agribusinesses; Schmeising
H-158, Alternative marketing strategies for cull beef cows; Ellingson
H-168, Crop enterprise costs and return and management practices in eastern South Dakota; Franklin
H-178, Economics of South Dakota cattle feeding; Taylor
H-219, Economic development impacts of water resource policy on selected projects in South Dakota; Franklin, Lundeen
R-226, Financing agriculture in a changing environment: macro, market, policy, and management issues; Lamberton
R-348, Impacts of transportation changes on ag marketing and local communities; Lamberton

Home Economics

R-039, Reducing pesticide exposure of applicators through improved clothing design and care; Scholten
H-108, Selenium content of triticum durum; Krishnan, Palmer
H-278, Effects of ionizing radiation on grains and vegetables; Crews, Krishnan, DeZeeuw
H-338, Human physiological responsiveness to changes in dietary cholesterol levels; Bohannon, Crews, DeZeeuw

Horticulture, Forestry, Landscape, and Parks

H-069, Vegetable breeding, evaluation, production, and cultural practices; Prashar
MS-088, Genetic improvement of tall tree species for protective forestry applications in South Dakota; Schaefer
H-169, Micropropagation of herbaceous plants; Spinski
MS-299, Superior selections of native and introduced trees and shrubs for South Dakota; Evers
R-336, Advanced generation breeding of north-central forest species; Schaefer

MS-387, Factors in the success or failure of ponderosa pine regeneration in the Black Hills; Schaefer
MS-408, Conflict use resolution between forest production and forest recreation; Stubbles

Microbiology

H-208, Soil fungi for increased ag productivity; Todd
H-218, Nitrate reduction in Azospirillum brasilense: gene cloning and sequencing and isolation of mutants; Westby
H-327, Biological nitrogen cycling in ag soils; Todd

Plant Science

R-005, Nutrient management in conservation tillage to improve productivity and environmental quality; White
H-010, Correlation, calibration, and interpretation of soil and plant tests; Gelderman
H-016, Root growth and development of corn with respect to tillage system and landscape position; Schumacher
H-017, Faba beans as an alternate crop for South Dakota; Sorensen
H-025, Effects of starter fertilization of corn under varying cultural and environmental conditions; Fixen
H-030, Crop rotation system influence on earthworm population in a no-till environment; Beck, Venner
MS-047, Understory herbage production: soil and forestry factors in the limestone uplands of the Black Hills; Lemme
H-057, Soil survey information for agrotechnology transfer and soil productivity relationships in South Dakota; Malo
H-058, Spring wheat breeding and genetics; Cholick, Buchenau
H-060, Molecular genetics of lipid and protein biosynthesis in oilseed crops; Carter
H-067, Residue management effects on nitrate and pesticide leaching and water quality; Kohl
H-077, Environmental and biological stress in wheat; Gellner
R-078, Interaction of nematode-host variability and abiotic factors on crop losses; Smolik
H-097, Oat and rye development for South Dakota; Reeves
H-098, Molecular biology of low temperature response proteins in winter barley; Kenefick, Westby, Evenson
H-107, Nutritive quality, growth, and production of forage crops; Kephart
H-117, Genetics of host-pathogen interactions of row crops in South Dakota; Carson
H-118, Amelioration of claypan or formerly cultivated clay-rich soils to increase range forage production; White
H-127, Phenotypic variation in tissue water transport during dehydration and rehydration of winter wheat; Kenefick
H-138, Corn genetics, physiology, and breeding; Wicks, Carson
R-148, Soil productivity and erosion; Schumacher, Lemme, Lindstrom
R-186, Introduction, maintenance, evaluation, and utilization of plant germplasm; Boe
H-199, Frozen soil effects of herbicide movement and weed ecology in conventional and alternative management systems; Clay
H-229, Expert systems for scheduling fungicide applications for wheat disease control; Buchenau, Gallenberg
H-267, Water quality of soil water under intensively cultivated fields; Carlson
H-269, Alternative farming systems; Smolik
H-277, Breeding evaluation of forage grasses in South Dakota; Boe
H-279, Ecology and control of western and northern corn rootworms in South Dakota; Walgenbach, Boetel
R-287, Seed production of breeding lines of insect-pollinated forage legumes; Boe
H-309, Oilseed breeding and genetics; Grady
H-316, Cropping systems in western South Dakota; Stymiest, Rickerl, Jacobson, Johnson
H-346, Economics and ecology of farm systems and conservation tillage; Rickerl, Weeldreyer, Stymiest, Sorensen, Smolik, Beck
H-356, Detection and control of soybean diseases in South Dakota; Ferguson
H-377, Soil moisture regimes: relationships to soil morphology; Lemme
H-388, Biological control of insects affecting seed production of forage legumes and grasses; McDaniel
R-398, Forage characterization and utilization for beef cattle; Kephart
S-401, Foundation seed stock; Ingemansen
S-402, Seed certification; Pollman
S-403, Seed testing; Gutormson
S-404, Variety testing; Bonnemann
S-406, Survey entomologist; Walgenbach

Rural Sociology

H-167, Census Data Center; Satterlee

Station Biochemistry

H-099, Mineral nutrition and metabolism in animals; Emerick, Kayongo-Male, Pritchard
H-145, Flow cytometry; Evenson
H-149, Selected herbicides and fungal metabolism; Matthees
H-209, Biochemistry of selenium; Palmer, Olson
H-368, Corn as a substrate for fungal polysaccharide synthesis and for degradation for xylanase; West
S-407, Analytical services; Thiex

Veterinary Science

R-066, Bovine respiratory disease: risk factors, pathogens, diagnosis, and management; Vickers
AH-129, Atypical rotavirus infections in calves; Janke, Benfield
H-139, Examination of porcine fetuses for evidence of EMC virus infection; Libal
AH-159, Virulence capacities of enterohemorrhagic E. coli of serogroup 0111; Francis
AH-227, Diagnostic panel for the diagnosis of calf diarrhea; Benfield
H-237, Antibiotics, bacteria, and bacterial toxins and the structure and function of porcine alveolar macrophages; Libal, Vickers, Zeman
AH-238, BVD in herd health; Thomson, Vickers
R-347, Prevention and control of enteric diseases of swine; Francis, Benfield, Janke

Wildlife and Fisheries Sciences

MS-018, Farmland forest cover and ring-necked pheasant wintering and use of food plots; Flake
H-019, Population dynamics of centrarchid bass and panfish in South Dakota ponds; Willis
H-026, Polyploid fishes for South Dakota waters; Scalet
M-028, Forest characteristics and landscape patterns and wild turkey populations in eastern and central South Dakota; Flake
H-048, Big-game use of cropland and crop depredation patterns in South Dakota; Jenkins
S-492, South Dakota Cooperative Fish and Wildlife Research Unit; Berry, Higgins

Articles, Publications

Agricultural Engineering

Refereed journal articles

Anderson, G.A. and D.S. Bundy. 1990. Stiffness of screw-fastened, metal-clad, timber-framed roof diaphragms with openings in the sheeting. Trans ASAE 31(1):266.

_____ and _____. 1989. Characterizing diaphragm shear stiffness for diaphragm-frame interaction analysis. Trans ASAE 32(5):1785.

_____, _____, and N.F. Meador. 1989. Force distribution method: Procedure and application to the analysis of buildings with diaphragm action. Trans ASAE 32(5):1791.

DeBoer, D.W., B.M. Ketelhut, and D.L. Beck. 1989. Corn water use in central South Dakota. Appl Engr in Agr 5(3):392.

Djakaria, R., J.L. Julson, and D.P. Froehlich. 1990. Transiometer: A method for moisture measurement in the mushroom casing layer. Mushroom News 38(1):18.

Froehlich, D.P. and P.G. Ellwein. Relationships between parameters of combine design and soil compaction. Trans ASAE (in print).

_____ and B.J. Glawe. Parametric analysis of horizontal air and liquid earth loops. Trans, Amer Soc Mech Eng (in print).

Glawe, B.J., D.P. Froehlich, M.A. Hellickson, and J.L. Julson. Comparisons of earth loops for livestock housing. Trans ASAE (in print).

Hanson, G. and R. Alcock. 1989. SDSU-NRECA battery powered skid-steer loader: Test procedures and results. App Eng in Ag 5(4):507.

Schumacher, J.A. and D.P. Froehlich. 1990. Computer controlled chemical application in controlled traffic fields. Proc, Int Off-Highway & Power Plant Congress & Exposition, session 7F27, Soc of Automotive Eng.

Shinners, K., R. Alcock, and M. Wilkes. 1990. Combining active and passive tillage elements to reduce draft requirements. Trans ASAE 33(2):400.

Other publications

Alcock, R. 1989. Prototype battery powered tractor-loaders developed at South Dakota State University. Proc, 11th Int Conf on Ag Eng 4:2497.

Anderson, G.A. 1989. Effects of fasteners on the stiffness and strength of timber-framed metal-clad roof sections. ASAE NCR 89-501.

_____. 1989. Flat grain storage bulkhead test results. ASAE 89451.

_____. 1990. What affects the strength and stiffness of diaphragms. ASAE 904028.

_____ and S. Pohl. 1990. Farm buildings and diaphragm action. Frame Building Professional 2(3):6.

Bohnhoff, D.R., G.A. Anderson, and P.A. Boor. 1989. Influence of insulation on the behavior of metal-clad wood frame diaphragms. ASAE 894507.

_____, _____, and N.F. Meador. 1990. Simplified three-dimensional analysis for post-frame buildings. ASAE 904032.

Christianson, L.L., R. Alcock, G. Jahns, and K.L. Seshasi. 1989. Electric vehicles in agriculture. Ch 11 IN (K. McFate, ed) Energy in world agriculture, vol 3. Pub. Elsevier.

Chu, S.T. and D.W. DeBoer. 1989. Development and field evaluation of a cantenary trail-tube system for reducing irrigation water losses. Final tech rpt, Project 14-08-0001-G1283, U.S. Geological Survey.

DeBoer, D.W. and D.L. Beck. 1989. Will it wash? SDAES F&HR 40(3):8.

_____ and M. Brashier. 1989. South Dakotan goes to China. SDAES F&HR 40(3):13.

_____, D.L. Beck, C.G. Carlson, and A.R. Bender. 1989. Application of drainage technology to irrigated agriculture. ABS ann rpt, SDSU:6.

Derickson, R. and J.L. Julson. 1989. Survey of 1988 stored grain management practices in South Dakota. Rpt, South Dakota Dept of Ag, Division of Regulatory Services.

Djakaria, R., J.L. Julson, and D.P. Froehlich. 1989. Transiometer: A method of moisture measurement in the mushroom casing layer. ASAE 89-6512.

Ellwein, P.G. and D.P. Froehlich. 1989. Relationships between combine design parameters and soil compaction. ASAE 89-1091.

Froehlich, D.P. et al. 1989. Performance evaluation of a mist sprayer. Rpt, Automatic Equipment Manufacturing Company Research Project, Pender, Neb.

_____ and D.L. Beck. 1989. Features and performance of the all crop no till drill. ABS Horizons:8.

_____ and J.A. Schumacher. 1990. Lap-top computer controls fertilizer rates in research. Farm and Ranch Guide 10(19)B10, Bismarck, N.D.

_____, _____, and D.G. Ollila. 1990. Farm by the foot: Change rates on the run. Farm Journal, March, p 1.

Hellickson, M.A., E.H. Schlenker, M.A. Schipull, R.R. Parry, and D.P. Froehlich. 1989. Effect of dust and gases on laborers in livestock confinement buildings. Proc, 11th Int Congress on Ag Engineering.

Schumacher, J.A. and D.P. Froehlich. 1989. Computer controlled chemical application in controlled traffic fields. ASAE 89-1606.

Wee, C.L. and G.A. Anderson. 1990. Strength and stiffness of metal-clad roof sections. ASAE 904029.

Animal and Range Sciences

Refereed journal articles

Johnson, R.C., J.R. Romans, T.S. Muller, W.J. Costello, C.M. Chen, and K.W. Jones. 1989. Estimation of beef forequarter composition by prediction equations. J Anim Sci 67:2316.

Marshall, D.M. and C.R. Hamilton. 1990. Relationships of certain performance traits to sale price of centrally tested boars. Professional Anim Scientist 6(1):21.

_____, _____, and G.L. Ambrose. 1990. Phenotypic trends over time for performance of centrally tested boars. Professional Anim Scientist 6(1):15.

Naasz, C.D. and H.L. Miller. 1990. Effects of bull exposure on postpartum interval and reproductive performance in beef cows. Can J Anim Sci 70:537.

Pritchard, R.H. and J.K. Mendez. 1990. Effects of preconditioning on pre- and post-shipment performance of feeder calves. J Anim Sci 68(1):28.

Stewart, S.R., R.J. Emerick, and R.H. Pritchard. 1990. High dietary calcium to phosphorus ratio and alkali-forming potential as factors promoting silica urolithiasis in sheep. J Anim Sci 68(2):498.

White, E.M. and F.R. Gartner. 1989. Some osmotic and pH effects on blue grama seedling establishment. Proc, SD Acad Sci 68:75.

Other publications

Boggs, D.L. 1989. Matching cattle type to nutritional resources and management. Proc Range Beef Cow Symp XI:68.

Collins, R.M. and R.H. Pritchard. 1989. Alternate day supplementation of high escape compared to low escape protein fed with corn stalks. SDAES Beef Report CATTLE 89-7:19.

Doumit, M.E and D.C. McFarland. 1989. Effects of bird age and sex on turkey satellite cell proliferation and differentiation in vitro. J Anim Sci 67(suppl 1):207.

Freking, B.A. 1989. Effects of biological traits on efficiency of beef production to weaning. SDSU MS thesis.
_____ and D.M. Marshall. 1989. Factors related to efficiency of beef production to weaning. J Anim Sci 67(suppl 1):36.
Gartner, F.R. and W.W. Thompson. 1990. Bison's answer to pine encroachment. Proc, Soc Range Mgmt Abstr 227.
Goehring, T.B. 1989. Estrous synchronization of heifers using MGA and prostaglandin: Ranch results. SDAES Beef Report CATTLE 89-13:42.
_____. 1989. Understanding statistics and evaluating research. Proc, Range Beef Cow Symp XI:11.
Hamilton, C.R. and G.W. Libal. 1989. Response of finishing swine fed diets containing various levels of added neutral detergent and acid detergent fiber. SDAES SWINE 89-2:5.
_____ and _____. 1989. Effects of source and type of fiber on finishing pig performance. J Anim Sci 67(suppl 1):265.
_____, _____, and J.U. Thomson. 1989. Evaluation of various anatomical locations for subcutaneous implantation of an electronic device in pigs during the finishing phase. SDAES SWINE 89-1:1.
_____, E.M. Weaver, M.K. Hoppe, and G.W. Libal. 1989. Evaluation of the niacin-tryptophan interaction in diets fed to young pigs. SDAES SWINE 89-5:19.
Hoppe, K.F. 1990. Effect of protein source on amino acid nutrition in ruminants using a semipurified diet. SDSU PhD thesis.
_____ and R.H. Pritchard. 1989. Effects of diet nitrogen change, day and fasting on lambs fed urea or zein in a semipurifed diet. J Anim Sci 67(suppl 1):562.
Hoppe, M.K., C.R. Hamilton, G.W. Libal, and E.M. Weaver. 1989. Effects of various lysine concentrations per Mcal of metabolizable energy on the performance of weaned pigs fed diets containing 5% soybean oil. SDAES SWINE 89-8:28.
_____, G.W. Libal, C.R. Hamilton, and D.H. Zeman. 1989. Effect of postweaning diet on early weaned pig intestinal morphology and function. J Anim Sci 67(suppl 1):238.
Johnson, B.J., P.A. Momont, and R.J. Pruitt. 1989. Effect of methionine, leucine and isovaleric acid on in vitro digestibility of corn stover. SDAES Beef Report CATTLE 89-10:34.
_____, _____, and _____. 1990. Effect of methionine, leucine and isovaleric acid on in vitro fermentation of corn stover. J Anim Sci 68(suppl 1):133.
Johnson, P.S., J.J. Wagner, M.J. Goetz, and J. Cantrell. 1989. Comparison of yearling steer gains in early summer under season-long native, season-long crested wheatgrass and June-deferred native grazing systems. SDAES Beef Report CATTLE 89-21:80.
Johnson, R.C., D.M. Wulf, and W.J. Costello. 1989. Effects of hot-fat trimming and peripheral muscle removal on the tenderness of six bovine muscles. J Anim Sci 67(suppl 1):183.
_____, _____, _____, and P.S. DeZeeuw. 1989. Effects of hot-fat trimming and peripheral muscle removal on the physical characteristics of ground beef patties. J Anim Sci 67(suppl 1):159.
Kerkaert, B.R., C.R. Hamilton, G.W. Libal, and E.M. Weaver. 1989. Supplemental niacin for growing swine provided limited space and fed diets limited or adequate in tryptophan. SDAES SWINE 89-6:22.
_____, _____, _____, _____, and M.K. Hoppe. 1990. Relationship between niacin and tryptophan in weaned pig diets. J Anim Sci 68(suppl 1):102.
Krcil, L.J. 1990. Deferred-rotation grazing on prairie pothole rangeland. SDSU MS thesis.
Libal, G.W. and C.R. Hamilton. 1989. Effect of within pen weight variation on performance of finishing pigs. SDAES SWINE 89-4:17.
_____ and _____. 1989. Effect of lysine level of the diet on performance of finishing pigs fed diets containing excess essential amino acids. SDAES SWINE 89-7:26.
_____ and _____. 1989. Effect of water flow rate from nipple drinkers on sow performance during lactation. SDAES SWINE 89-14:46.
Loesche, J.A. 1989. Characterization of composition, fermentation and antinutritional constituents of frost damaged immature soybeans for ruminants. SDSU MS thesis.
_____, R.H. Pritchard, and J.M. Reecy. 1989. Characterization of antinutritional constituents of frost-damaged, immature soybeans in corn silage diets fed to lambs. J Anim Sci 67(suppl 1):576.
_____, _____, and _____. 1989. Frost damaged, immature soybeans for ruminant diets. SDAES Beef Report CATTLE 89-6:14.
Males, J.R. 1989. Probiotics—What are they? What are the benefits? Proc, Range Beef Cow Symp XI:142.
Marshall, D.M. 1989. Interpreting experimental results. SDAES Beef Report CATTLE 89-1:1.
_____ and C.R. Hamilton. 1989. Relationships of certain performance traits with sale prices of centrally tested boars. J Anim Sci 67(suppl 1):599.
_____ and _____. 1989. Relationships among certain performance traits and sale price of centrally tested boars. SDAES SWINE 89-3:12.
_____, W. Minqiang, and B.A. Freking. 1989. Relationship of relative calving date of beef heifers to production efficiency and subsequent reproductive performance. SDAES Beef Report CATTLE 89-15:48.
_____, M.D. Monfore, W.J. Costello, and C.A. Dinkel. 1989. Characterization of Hereford and two-breed rotational crosses of Hereford with Angus and Simmental cattle: Carcass traits of steers. SDAES Beef Report CATTLE 89-17:59.
_____, _____, and C.A. Dinkel. 1989. Characterization of Hereford and two-breed rotational crosses of Hereford with Angus and Simmental cattle: Calf production through weaning. SDAES Beef Report CATTLE 89-16:53.
Miller, H.L., J.J. Wagner, and R.L. Hanson. 1989. Comparison of melengesterol acetate and prostaglandin with two injections of prostaglandin for estrous synchronization in beef heifers. SDAES Beef Report CATTLE 89-12:40.
Minshall, R.D. 1989. Interaction of insulin-like growth factor 1 with turkey satellite cells and satellite cell-derived myotubes. SDSU MS thesis.
_____ and D.C. McFarland. 1989. Interaction of insulin-like growth factor-I (IGF-I), IGF-II and insulin with turkey satellite cell-derived myotubes. J Anim Sci 67(suppl 1):205.

Momont, P.A., R.J. Pruitt, and J. Cantrell. 1989. Hydrolyzed feather meal supplementation for lactating range cows. SDAES Beef Report CATTLE 89-3:5.

_____, _____, and R.H. Pritchard. 1989. Evaluation of controlled release chromic oxide boluses and alkaline peroxide lignin as marker methods to determine forage intake of grazing ruminants. SDAES Beef Report CATTLE 89-11:37.

_____, _____, _____, B.J. Johnson, and P.S. Johnson. 1989. Effects of amino acid and branched-chain volatile fatty acid additions on in vitro fermentation of dormant range grasses. SDAES Beef Report CATTLE 89-8:23.

_____, _____, _____, _____, and _____. 1989. Effects of amino acids and branched-chain volatile fatty acids on in vitro fermentation of dormant range grasses. J Anim Sci 67(suppl 1):295.

_____, _____, _____, and P.S. Johnson. 1989. Effect of methionine addition to a urea-grain based supplement on digestibility of mature prairie grass hay. SDAES Beef Report CATTLE 89-9:30.

_____, _____, _____, and _____. 1990. Effect of methionine addition to a urea-grain supplement on digestibility of mature prairie hay. J Anim Sci 68(suppl 1):130.

Muller, T.S. 1989. Binding and storage properties of structured beef steaks produced with the algin/calcium/adipic acid gel. SDSU MS thesis.

Nantoume, H. 1990. Evaluation of the nutritive value of the whole plant faba bean silage as component of growing steer diets. SDSU MS thesis.

Peterson, K.R. and F.R. Gartner. 1990. Forage quality of selected forbs in northwestern South Dakota. Proc, Soc Range Mgmt Abstr 115.

Pritchard, R.H., D.H. Gee, and M.R. Robbins. 1989. Effects of restricting intake on carcass traits of young steers. SDAES Beef Report CATTLE 89-18:67.

Pruitt, R.J., R.H. Haigh, and K.E. Vander Wal. 1989. SDSU purebred beef herds. SDAES Beef Report CATTLE 89-2:2.

Reecy, J.R., J.A. Loesche, and R.H. Pritchard. 1990. Effects of frost-damaged, immature soybeans in corn silage diets. J Anim Sci 68(suppl 1):145.

Romans, J.R., R.C. Johnson, P.S. DeZeeuw, W.J. Costello, and G.W. Libal. 1989. Taste panel identification of omega-3 fatty acid enriched pork from pigs fed flaxseed. J Anim Sci 67(suppl 1):156.

_____, _____, _____, _____, and _____. 1990. There is a trade-off between the health effects of flaxseed in swine rations and consumer acceptability of pork. Proc, Flax Institute:25.

_____ and H.W. Norton. 1989. Consumer evaluation of fresh pork quality. Proc, 35th International Congress Meat Sci and Technol:614.

Stewart, S.R., R.J. Emerick, and R.H. Pritchard. 1989. Factors promoting formation of siliceous uroliths in sheep. J Anim Sci 67(suppl 1):480.

Taylor, D.C., J.J. Wagner, and R.D. Kappes. 1989. Feeding practices in South Dakota cattle feedlots. SDAES Beef Report CATTLE 89-20:73.

Wagner, J.J. and R. Hanson. 1989. Moderate versus high protein diets for finishing yearling steers. SDAES Beef Report CATTLE 89-5:11.

_____ and _____. 1989. Effect of Deccox and aureomycin on performance of feedlot steers during the receiving period. SDAES Beef Report CATTLE 89-19:70.

_____, P.S. Johnson, and J. Cantrell. 1989. Effect of late season protein and energy supplementation on performance of yearling steers grazing mixed native range or cool season, crested wheatgrass pastures. SDAES Beef Report CATTLE 89-4:8.

_____, D. Petersen, R. Hanson, and H.L. Miller. 1989. Economic analysis of using a mixing wagon with a scale for growing heifers. J Anim Sci 67(suppl 1):604.

_____, J.U. Thomson, and R. Hanson. 1990. Feeding programs for newly arrived calves. SD Beef Prod Handbook GPE1608.

Weaver, E.M. 1990. Effects of nutrition and management on plasma _-tocopherol concentrations in the weaned pig. SDSU MS thesis.

_____, G.W. Libal, C.R. Hamilton, and I.S. Palmer. 1989. Effects of dietary or injected vitamin E on liver and plasma _-tocopherol concentrations in the weaned pig. SDAES SWINE 89-11:39.

_____, _____, _____, and _____. 1989. Effects of an oil soluble vitamin E injectable on plasma and tissue _-tocopherol. SDAES SWINE 89-12:42.

_____, _____, _____, and _____. 1990. Effects of vitamin E supplementation through the diet or using an oil-soluble injection on plasma and liver _-tocopherol in the newly weaning pig. J Anim Sci 68(suppl 1):98.

_____, _____, _____, _____, B.S. Borg, and M.K. Hoppe. 1989. Effects of vitamin A, vitamin E and fat supplementation on the vitamin E status of the weaned pig. SDAES SWINE 89-9:32.

_____, _____, _____, _____, R.C. Thaler, and M.K. Hoppe. 1989. Effect of supplementation of newly weaned pig diets with different sources of vitamin E on plasma _-tocopherol. SDAES SWINE 89-10:35.

_____, _____, R.C. Wahlstrom, C.R. Hamilton, B.S. Borg, and M.K. Hoppe. 1989. Effects of water flow rate from nipple drinkers on weaned pig performance. SDAES SWINE 89-13:44.

Wilcox, G.A., R.J. Pruitt, P.A. Momont, and R.H. Pritchard. 1989. Effect of dietary energy source on age and weight at puberty of beef heifers. SDAES Beef Report CATTLE 89-14:45.

_____, _____, _____, and _____. 1990. Effects of source of energy on age and weight at puberty of beef heifers. J Anim Sci 68(suppl 1):76.

Biology and Microbiology

Refereed journal articles

Gibbons, W.R. 1989. Batch and continuous solid-phase fermentation of Jerusalem artichoke tubers. J Ferment Bioeng 67:260.

_____ and C.A. Westby. 1989. Confermentation of sweet sorghum juice and grain for production of fuel ethanol and distiller's wet grain. Biomass 18:43.

Granholm, N.H. and A.W. VanAmerongen. Effects of exogenous MSH on the transformation from phaeo- to eumelanogenesis within C57BL/6J-Ay/a hairbulb melanocytes. J Invest Dermatol (in press).

_____, R.A. Japs, and K.E. Kappenman. 1990. Differentiation of hairbulb pigment cell melanosomes in compound agouti and albino locus mouse mutants (A*y, a, c*2J; C57BL/6J). Pigment Cell Res 3:16.

Other publications

Bartlett, M. and C. Westby. 1990. Production of a lambda cDNA subtraction library from mRNA associated with cold acclimation in barley. ASM H-201 (abstr).

Baughman, T.L., G.A. Harvison, K.E. Kappenman, and N.H. Granholm. Dopa oxidase activities in soluble and particulate fractions of regenerating hairbulbs of agouti mice (C57BL/6J-AwJ/AwJ). Proc, SD Acad Sci 69 (abstr, in press).

Chen, C.H., F.A. Cholick, H.K. Shin, and K.S. Yao. Anther culture of spring wheat hybrids. Proc, SD Acad Sci (in press).

_____, A.A. Boe, and C.R. McMullen. 1990. Tissue culture of forage grasses. IN (K.D. Kephart, ed), Summaries of forage research. SDAES C 249.

Dybing, C.D. and R.N. Reese. 1990. Molecular attributes of soybean flower abscission. Proc, 3rd Biennial Conf Molec Cellular Biol Soybean #10.

Dvoracek, M.A., R.N. Reese, and N.H. Granholm. Glutathione concentration in regenerating hairbulbs of agouti mice (C57BL/6J-AwJ/AwJ). Proc, SD Acad Sci 69 (abstr, in press).

Gibbons, W.R., N.S. Pulscher, and E.J. Ringquist. 1989. Submerged cultivation of Pleurotus sajor caju under varying sodium meta bisulfite levels. NC Branch, Am Soc Microbiol (abstr).

Granholm, D.E., M.A. Dvoracek, R.N. Reese, and N.H. Granholm. 1990. Glutathione concentration and glutathione reductase activity in regenerating hairbulbs of Ay/a, a/a, and AwJ/AwJ mice. Proc, XIV Int Pigment Cell Conf.

_____, R.N. Reese, and N.H. Granholm. Glutathione concentration and glutathione reductase activity in regenerating hairbulb fractions of C57BL/6J black (a/a) and yellow (Ay/a) mice. Proc, SD Acad Sci 69 (abstr, in press).

Granholm, N.H., K.E. Kappenman, G.A. Harvison, and T.L. Baughman. 1990. Tyrosinase abundance and activity in hairbulb melanocytes of agouti mice (C57BL/6J-Ay/a, -a/a, and -AwJ/AwJ). Proc, XIV Int Pigment Cell Conf.

Harvison, G.A. 1990. Molecular characterization of tyrosinase (dopa oxidase activity, abundance, and synthesis) in lethal yellow mice — a mutation that affects pigmentation, fertility, and obesity. SDSU.

_____, K.E. Kappenman, and N.H. Granholm. Effect of the lethal yellow allele (Ay) on rates of tyrosinase synthesis in hairbulb melanocytes of yellow and black mice (C57BL/6J-Ay/a and -a/a). Proc, SD Acad Sci 69 (abstr, in press).

Johnson, J.R., C.E. Wolf, and W.R. Gibbons. 1989. Productivity and fermentation efficiency of Pleurotus sajor caju WC 537 under varying glucose concentrations. Abst, NC Branch, Am Soc Microbiol:607.

Kappenman, K.E. and N.H. Granholm. Tyrosinase hydroxylase (TH) activity in regenerating agouti hairbulbs (C57BL/6J-AwJ/AwJ). Proc, SD Acad Sci 69 (abstr, in press).

Pulscher, N.S. and W.R. Gibbons. 1989. Effects of substrate bale size density, and inoculum type on oyster mushroom production from wheat straw. Abst, NC Branch, Am Soc Microbiol.

_____ and _____. 1990. Effects of substrate bale size/density and inoculum type, placement, and density on oyster mushroom production from wheat straw. Abst, SD Acad Sci.

Reese, R.N. and L.W. Roberts. 1985. Effects of cadmium on whole cell and mitochondrial respiration in tobacco cell suspension cultures (N. tabacum L. var. xanthi). J Plant Physiol 120:123-30.

Roessler, P.F. and C.A. Westby. 1990. Nitrate and nitrite reductase genes of Azospirillum brasilense Sp7. ASM H-42 (abstr).

Shin, H.K. 1990. Anther culture of spring wheat (Triticum aestivum L.) in F1 hybrids. SDSU MS thesis.

Westby, C.A. 1990. Probing lambda DNA on a Southern blot with a biotinylated lambda probe. Presentation, ASM.

White, C.A. and R.N. Reese. Cadmium toxicity and the mechanism of tolerance in Euglena gracilis. SD Acad Sci 68 (in press).

Wolf, C.E. and W.R. Gibbons. 1989. Development and optimization of a bioassay for quantification of the antibiotic nisin. Abst, NC Branch, Am Soc Microbiol.

_____ and _____. 1990. Development and optimization of a bioassay for quantification of the antibiotic nisin. Abst, SD Acad Sci.

Yao, K.S. 1989. Differentiation patterns in cultured inflorescences and anthers of selected forage grasses. SDSU PhD dissertation.

Dairy Science

Refereed journal articles

Baer, R.J., K.M. Tieszen, D.J. Schingoethe, D.P. Casper, W.A. Eisenbeisz, R.D. Shaver, and R.M. Cleale. 1989. Composition and flavor of milk produced by cows injected with recombinant bovine somatotropin. JDS 72:1424.

Casper, D.P. and D.J. Schingoethe. 1989. Model to describe and alleviate milk protein depression in early lactation dairy cows fed a high fat diet. JDS 72:3327.

_____, _____, and W.A. Eisenbeisz. 1990. Response of early lactation cows to diets that vary in ruminal degradability of carbohydrates and amount of fat. JDS 73:425.

_____, _____, and _____. 1990. Response of early lactation dairy cows fed diets varying in source of nonstructional carbohydrate and crude protein. JDS 73:1039.

Eisenbeisz, W.A., D.J. Schingoethe, D.P. Casper, R.D. Shaver, and R.M. Cleale. 1990. Lactational evaluation of recombinant bovine somatotropin with corn and barley diets. JDS 73:1269.

Mistry, V.V., H.N. Hassan, and R.J. Baer. 1989. Spectrophometric method for measurement of lactose in milk and milk products. JAOAC 72:877.

Tieszen, K.M. and R.J. Baer. 1989. Composition and microbiological quality of frozen yogurts. CDPJ 24(4):11.

Other publications

Austin, C.L., D.J. Schingoethe, D.P. Casper, and R.M. Cleale. 1990. Interaction of bovine somatotropin and nutrition on milk production and composition from dairy cows. JDS 73(suppl 1):159 (abstr).

Baer, R.J. 1989. BST - Its effect on milk processors. 9th ann mtg, North Central Cheese Industries Assoc.
_____. 1990. Effect of bovine somatotropin on milk composition. Regional Dairy Processors Symposium, BST implications in the dairy industry.
_____ and D.J. Schingoethe. 1990. Production of dairy products higher in unsaturated fatty acids. ABS Horizons:22.
Casper, D.P. 1990. Can milk protein be improved? SDSU DSU-90-19.
_____, C.L. Austin, and D.J. Schingoethe. 1989. Reproductive parameters of dairy cows fed urea during early lactation. Proc, 20th Conf on Rumen Function 20:37 (abstr).
_____ and A. Boe. 1989. Laboratory evaluation of grasses and legumes as possible alternative forages for dairy cattle. JDS (suppl 1):306 (abstr).
_____ and _____. 1990. Alternative forages for dairy cattle. Proc, 1990 SD Dairy Conf:40.
_____ and _____. 1990. Can sloughgrass be a forage source? Proc, 1990 SD Dairy Conf:44.
_____ and _____. 1990. Alternative forages for dairy cattle. IN (K.D. Kephart, ed) Summaries of forage research, SDAES 249:2.
_____ and _____. 1990. Forage production and quality of American sloughgrass. IN (K.D. Kephart, ed) Summaries of forage research, SDAES 249:6.
_____ and D.J. Schingoethe. 1990. Mineral supplementation for dairy cattle. Proc, 1990 SD Dairy Conf:23.
_____ and _____. 1990. Extra fat and certain carbohydrates go together. Hoard's Dairyman 135:462.
_____, R. Wynia, and A. Boe. 1989. Productivity and nutritional quality of American sloughgrass grown for forage. JDS 72(suppl 1):307 (abstr).
Cassel, E.K. 1990. Sire evaluation and sire selection. Proc, 1990 SD Dairy Conf:15.
_____. 1990. Alternative forages for dairy cattle. Proc, 1990 SD Dairy Conf:33.
_____ and L.R. Vough. 1990. Maryland dairy herd demonstration project: Changes in nutrition and forage quality. Proc, Amer Forage and Grasslands Council:43.
_____, ed. 1990. Dairy and Animal and Range Sciences Newsletter. vols 1:1, 2, 3, 4, 5, 6.
_____, ed. 1990. South Dakota Dairy Herd Improvement Association Newsletter. September 1989-June 1990.
Dawson, K.A., G.A. Harrison, K.E. Newman, and S. Jenkins. 1989. Stimulated cellulose degradation in cocultures containing yeast and cellulolytic rumen bacteria. Conf on Rumen Function 20:48.
Foster, S.J. 1989. Cheddar cheese manufactured from condensed milk. MS thesis, SDSU.
_____, R.J. Baer, and V.V. Mistry. 1989. Cheddar cheese manufactured from whole and separated condensed milks. JDS 72(suppl 1):130 (abstr).
Foster, W.W. 1990. Response in milk yield of cows selected for yield or type. JDS 73(suppl 1):139 (abstr).
_____. 1990. Maximizing genetic improvement through sire selection. Proc, 1990 SD Dairy Conf:13.
_____. 1990. Analyzing dairy records for increased profit. Presentation, 1990 SDSU Herd Health Conference.
_____ and E.K. Cassel. 1990. Calf hutch management tips. Extension News 1(4)11.
Harrison, G.A. 1989. Microbial inoculants for corn silage. Proc, 1990 SD Dairy Conf.
_____, B.H. Kang, and W.W. Foster. 1990. In vitro examination of the efficacy of commercial microbial inoculants for corn silage. JDS 73(suppl 1):176 (abstr).
Hassan, H.N. and V.V. Mistry. 1990. High protein lactose-free milk powders. II.- Functional, chemical and physical properties. JDS 73(suppl 1):114 (abstr).
Kim, Y.K., D.J. Schingoethe, D.P. Casper, and F.C. Ludens. 1990. Lactational response of dairy cows to diets containing added fats from extruded soybeans and Megalac. JDS 73(suppl 1):243 (abstr).
McGilliard, M.L. and W.W. Foster. 1990. Herd changes in reproduction from increasing milk through genetics and management. Virginia Dairyman, March 1990:62.
Mistry, V.V. 1989. Cottage cheese made from retentate starter. JDS 72(suppl 1):168 (abstr).
_____. 1989. Future of membrane technology. SDSU-Klenzade sanitation short course for the dairy industry.
_____ and H.N. Hassan. 1990. High protein lactose-free milk powders. I.- Production and composition. JDS 73(suppl 1):113 (abstr).
_____, _____, and R.J. Baer. 1989. New method for measuring lactose in milk and milk products by dialysis. JDS 72(suppl 1):128 (abstr).
Parsons, J.G. 1990. CITE project research results in new product introduction. ABS Horizons:24.
Schingoethe, D.J. 1990. Bovine somatotropin for dairy cows. Proc, 1990 SD Dairy Conf:7.
_____. 1990. Supplemental dietary fat for dairy cows. Proc, 1990 SD Dairy Conf:27.
_____. 1990. Utilization of dairy products in animal feeds. Proc, Dairy Products Technical Conf:115.

Economics

Refereed journal articles

Edelman, M., B. Schmiesing, and D. Olson. 1990. Use of selected marketing alternatives by Iowa farm operators. Agribusiness: An Int J 6:121.
Feuz, D., N.L. Dalsted, and P.H. Gutierrez. 1990. Leasing cows-what is equitable? J Amer Soc Farm Managers and Rural Appraisers 54(1):21.
Taylor, D.C. On-farm sustainable agriculture research: Lessons from the past, direction for the future. J Sustainable Ag 1(2) (in press).

Other publications

Becker, D.L., T.L. Dobbs, and D.C. Taylor. 1990. Crop enterprise and principal rotation budgets for sustainable agriculture case farms in South Dakota. Econ Res Rpt 90.
Below, S. 1990. Feasibility of participation in the Farmer Mac secondary market for agricultural real estate mortgages by South Dakota bankers. SDU MS thesis.

Beutler, M. 1990. Determining pasture rents. S.D. Stockgrowers 44(4).
_____. 1989. Determining the value of pasture. Proc, 3rd winter mtg, South Dakota Forage and Grassland Council.
_____. 1989. Economic value of grazing public lands in western South Dakota. Econ Staff Pap 89.
_____. 1990. Economic value of public lands grazing to local communities in South Dakota. Presentation, 43rd ann mtg, Soc for Range Mgmt.
_____. 1990. Economic value of public lands grazing in western South Dakota and Montana. Econ Staff Pap 90-1 presented at 5th ann Montana Public Lands Forum.
_____. 1989. Estimated economic gain of the reduction of 14,000 acres of prairie dogs on the Buffalo Gap National Grasslands. Presentation, U.S. Forest Service mtg on revised Conata Basis Prairie Dog Management Plan.
_____. 1989. Grazing public lands in western South Dakota: What's it worth? SDAES Beef Rptort CATTLE and S.D. Stockgrowers 43(12).
_____. 1989. Value of grazing public land in western South Dakota. Econ Commentator 280.
_____. 1990. West River hay storage project. IN (K.D. Kephart, ed) 1990 Summaries of forage research, SDAES C249.
_____. 1990. What are economic multipliers? Econ Commentator 289.
_____. 1990. What is a multiplier? S.D. Stockgrower 44(2) and Montana Farmer Stockman 77(7).
Cole, J.D. 1989. Economic analysis of public and private rangeland leasing arrangements and land values in South Dakota. SDSU MS thesis.
_____, M. Beutler, and L. Janssen. 1990. Pasture/rangeland lease characteristics and rental rates. Econ Commentator 282.
_____, _____, and _____. 1990. Rangeland leases in South Dakota. Econ Commentator 281.
_____, _____, and _____. 1990. Economic analysis of rangeland lease rates in South Dakota. Presentation, 43rd ann mtg, Soc for Range Mgmt.
_____ and T.L. Dobbs. 1990. Crop enterprise and whole-farm budgets for "conventional" farming systems in five areas of South Dakota. Econ Res Rpt 90-3.
Dobbs, T.L. 1990. Presentation, hearings on 1990 farm bill, subcom on wheat, soybeans, and feed grains of Com on Ag, U.S. House of Rep, U.S. GPO 219.
_____, D.L. Becker, and D.C. Taylor. 1989. Farm program participation and policy perspectives of sustainable farmers in South Dakota. Econ Staff Paper 89-7.
_____, _____, and _____. 1990. LISA public policy: From Capitol to courthouse, debate over ag and environment continues. SDAES F&HR 41(1):3.
_____ and C. Mends. 1990. Economic comparisons of farming systems: SDSU's Northeast Station in 1989. Pl Sci Pamph 22.
_____ and _____. 1990. Profitability of alternative farming systems at South Dakota State University's Northeast Research Station: 1989 compared to previous transition years. Res Rpt 90-1.
_____, J.D. Smolik, and C. Mends. 1990. On-farm research comparing conventional and low-input/sustainable agricultural systems in the Northern Great Plains. Presentation, National Workshop on Sustainable Ag Res and Educ in the Field, USDA and and Natl Acad of Sci, Natl Res Council's Bd on Ag.
Dorn, A. 1990. Condition analysis and network strategies for rural roads in South Dakota. SDSU MS thesis.
Edelman, M.A., B.H. Schmiesing, and K. Khajasteh. 1990. Effects of disaster assistance on Multiple Peril Crop Insurance purchases by Iowa crop farmers. Presentation, 1990 ann mtg, Amer Agric Econ Assoc.
Feuz, D.M. and W.G. Kearl. 1989. On-ranch retained ownership decision—in periods of relatively low prices versus relatively high prices. Presentation, 1989 ann mtg, West Agric Econ Assoc.
_____. 1990. Analysis of Colorado typical farms using the farm optimization and financial analysis system (FOFAS). CSU PhD dissertation.
_____. 1990. Analysis of slaughter steer prices. Econ Commentator 288.
_____. 1990. Current feeder calf prices: Are they really record highs? SDSU Econ Commentator 283.
_____. 1990. Historical prices, trends, seasonal indexes, and futures basis of cattle and calves at Sioux Falls, South Dakota, 1970-1989. Econ Res Rpt 90-4.
_____. 1990. Retained ownership. Proc, Beef cattle management and marketing shortcourse, SDSU and Uni of Minnesota.
Guither, H., et al. 1989. U.S. farmers' preferences for agricultural and food policy in the 1990s. NC Reg Res Pub 321.
Janssen, L.L. 1989. Agricultural and food policy decisions: A 1989 perspective from South Dakota's agricultural producers. Econ Res Rpt 89-4.
_____. 1989. Agricultural policy decisions: Perspective of South Dakota's farmers. Econ Commentator 275.
_____, M. Beutler, and J. Cole. 1990. Economic analysis of rangeland leasing practices and rates. Econ Staff Pap 90-2 and presentation, 1990 ann mtg, Amer Agric Econ Assoc.
_____, R. Stover, and V. Clark. 1989. Structure of families and changes in farm organization and structure. Presentation, NC-181 Meeting.
Jass, L. and B. Schmiesing. 1990. Harvest States expands Crop-Sure, cooperative grain marketing program. Farmer Cooperatives (USDA, ACS) 56(11):20.
Kim, Hee Seong. 1990. Case study analysis of farm program impacts on an eastern South Dakota producer's decision to buy Multiple Peril Crop Insurance. SDSU MS thesis.
McDaniel, M. 1990. Impact of the Tax Reform Act of 1986 on a selected South Dakota farm. SDSU MS thesis.
Lamberton, C.E. 1990. South Dakota's rural road network. Econ Commentator 288.
Pflueger, B. and L. Janssen. 1990. Examination of Chapter 12 farm reorganization bankruptcy filings and approved reorganization plans. Presentation, 1990 ann mtg, Amer Agric Econ Assoc.
Powers, J. 1990. Water allocation institutions in South Dakota: An economic analysis of law and policy. SDSU MS thesis.
Qasmi, B. and B. Schmiesing. 1989. Linkages between prices of agricultural commodities and processed final products. Econ Staff Pap 89-8.
B. Schmiesing. 1989. Rolling hedges: A marketing strategy for the 1990s. SDSU Econ Commentator 276.

Taylor, D.C., T.L. Dobbs, D.L. Becker, and J.D. Smolik. 1989. Crop and livestock enterprises, risk evaluation, and management strategies on South Dakota sustainable farms. Res Rpt 89-5.

_____, _____, _____, and _____. 1989. On-farm management of sustainable agriculture. Econ Commentator 277.

_____, _____, _____, and _____. 1990. LISA in the "real world:" Veteran producers report how they farm and the risks they encounter. SDAES F&HR 41(1):10.

_____ and J.J. Wagner. 1990. What's different about larger cattle feedlots in South Dakota? Econ Commentator 285.

_____, _____, and R.D. Kappes. 1989. Feeding practices in South Dakota cattle feedlots. SDAES Beef Rptort CATTLE 1989.

Tiong, L.M. 1990. Analysis of risk in low-input/sustainable farming systems. SDSU MS thesis.

Toland, G.D., Jr., B.H. Schmiesing, and J.R. Black. 1990. Comparison of crop yield coverage plans for Multiple Peril Crop Insurance. Presentation, 1990 ann mtg, Amer Agric Econ Assoc.

Home Ecomomics

Clark, V.L., L.L. Janssen, R. Stover, P. Schlecter, and B. Quoss. 1990. Successful farming in South Dakota: Tech res rpt, Farm Enterprise Partnership, Midwest Technology Development Institute.

_____, R. Stover, and L.L. Janssen. 1990. Successful farm families and farming in South Dakota. Econ Commentator 290.

Horticulture, Forestry, Landscape, and Parks

Refereed journal articles

Johnson, W.C. and T. Webb, III. 1989. Role of blue jays (Cyanocitta cristata L.) in the postglacial dispersal of fagaceous trees in eastern North America. J Biogeography 16:561.

Poiani, K. and W.C. Johnson. 1989. Effect of hydroperiod on seed bank composition in semipermanent prairie wetlands. Can J Bot 67:856.

Schaefer, P.R. and J.W. Hanover. 1990. Investigation of sympatric populations of blue and Engelmann spruces in the Scotch Creek drainage, Colorado. Silvae Genetica 39(2):72.

_____. 1989. Trees and sustainable agriculture. Am J of Alt Agr 4(3/4):173.

Schiffman, P. and W.C. Johnson. 1989. Phytomass and detrital carbon storage during forest regrowth in the Piedmont (USA). Can J For Res 19(1):69.

Skroch, C., D.J. Gallenberg, and P.L. Spinski. Response to Erwinia inoculation in tissue culture plantlets of three potato cultivars. Phytopathology (in press).

Skroch, C., D.J. Gallenberg, and P.L. Spinski. Influence of growth medium on response of potato tissue culture plantlets to Erwinia. Phytopathology (in press).

Williams, C.E. and W.C. Johnson. Age structure and the maintenance of Pinus pungens in pine-oak forests of southwestern Virginia. Am Midl Nat (in press).

_____, M.V. Lipscomb, W.C. Johnson, and E. T. Nilsen. Influence of leaf litter and soil moisture regime on early establishment of Pinus pungens. Am Midl Nat (in press).

Other publications

Baer, N.W. 1990. Renovating windbreaks in South Dakota. IN Proc, 2nd int Symnposium on Protective Plantation Technology:286.

_____. 1989. Green death: releasing windbreaks from sod. IN Proc, Windbreak Renovation Symp, Great Plains Agriculture Council 128:29.

Evers, N.P. 1989. Homestead. SDAES F&HR 40(3):3.

French, D.A., P.L. Spinski, and C.H. Chen. 1989. In vitro shoot production by three cultivars of African violet (Saintpaulia ionantha Wendl). Proc, SD Acad Sci 68:35.

Johnson, W.C. 1989. Dams and riparian forest ecosystems. Proc, Symp, Restoration, Creation and Management of Wetland and Riparian Ecosystems in the American West. US Fish & Wildlife Ser (suppl).

Liu, G., C.R. McMullen, P.L. Spinski, and C.H. Chen. 1990. In vitro induction of hybrid tetraploid lilies by colchincine. Proc, SD Acad Sci (in press).

Prashar, P. and M. Enevoldsen. 1989. Vegetable cultivar trials research report #4. SDAES.

Sandin, T.M., P.L. Spinski, and Z.W. Wicks, III. 1989. Evaluation of three propagation techniques for the production of foliage plants. Am Soc for Hort Sci Program and Abstracts 1989:95.

Stubbles, R. 1990. Ancient Greek oracles and droughtville's new swimming pool. J South Dakota Park & Recreation Assoc XIX(4):6.

_____. 1990. Proposed interpretation plan for Kadoka Lake, South Dakota. Presentation, Nebraska National Forest, U.S.Forest Service, Wall District Station.

_____. 1990. Use of the Delphi technique in geography. Presentation, ann mtg, Assoc of Am Geographers.

_____. 1190. Scout, pioneer, or settler. Nat Rec & Park Assoc New 1:2.

Plant Science

Refereed journal articles

Boe, A., K. Robbins, and B. McDaniel. 1989. Direct effect of parasitism by Dinarmus acutus Thomson on seed predation by Acanthoscelides perforatus (Horn) in Canada milk-vetch. J Range Mgmt 42:514.

_____, _____, and _____. 1989. Spikelet characteristics and midge predation of hermaphorditic genotypes of big bluestem. Crop Sci 29:1433.

_____. 1990. Variability for seed size and yield in two tall dropseed populations. J Range Mgmt 43:195.

Cholick, F.A., G.W. Buchenau, and K.M. Sellers. 1990. Registration of prospect wheat. Crop Sci 30:233.

Clay, S.A. and W.C. Koskinen. 1990. Adsorption and desorption of atrazine, hydroxyatrazine, and s-glutathione atrazine on two soils. Weed Sci 38:26.

_____ and _____. 1990. Characterization of alachlor and atrazine desorption from soils. Weed Sci 38:74.

_____ and E.A. Oelke. 1990. Chemical control of giant burreed (Sparganium eurycarpum) in wild rice (Zizana palustris). Weed Tech 4:294.

Dobbs, T.L., J.D. Smolik, and C. Mends. 1990. On-farm research comparing conventional and/or-input/sustainable agricultural systems in the Northern Great Plains. Proc, National Workshop on Sust Ag Res and Ed USDA/Nat Acad Sci.

Dybing, C.D. and C. Lay. 1989. Daily flower production rate of seed and fiber flax cultivars as related to seed yield. Crop Sci 29:1062.

Espinasse, A., J. Volin, C.D. Dybing, and C. Lay. Embryo rescue through in ovulo culture in Helianthus. Crop Sci (in press).

Gellner, J.L., R.W. Kieckhefer, and M.W. Ferguson. 1989. Assessment of aphid damage in seedling wheat by a slant-board-absorbent technique. Cereal Res Commun 17:149.

_____. 1990. Yield comparisons between recently released and older, but contemporary, cultivars of spring wheat. Plant Var and Seeds 3:15.

_____, R.W. Kieckhefer, and B. Moreno. 1990. Effects of pot size and fertility level on assessment of aphid feeding damage in greenhouse-grown spring wheat. J Kansas Entomol Soc 63:187.

Gordon, W.B., D.H. Rickerl, and J.T. Touchton. 1990. Effects of nitrogen, dicyandiamide, and tillage on cotton N concentration and yield. Agron J 82:597.

Kephart, K.D. and D.R. Buxton. 1989. Adaptation and forage quality of grasses grown under shade. Proc, XVI Int Grassl Cong:819.

_____, _____, and R.R. Hill, Jr. 1990. Digestibility and cell-wall composition of alfalfa selected for divergent herbage lignin. Crop Sci 30:207.

_____, L.G. Higley, D.R. Buxton, and L.P. Pedigo. 1990. Cicer milkvetch forage yield, quality, and acceptability to insects. Agron J 82:477.

Kohl, R.A. 1989. Crop cover development in eastern South Dakota. Proc, SD Acad Sci 68:83.

_____ and L.J. Wrage. 1989. Small grain growth stages related to temperature. Proc, SD Acad Sci 68:91.

Malo, D.D. 1990. Soil management: A world view of conservation and production by R.L. Cook and B.G. Ellis (book review). JAE 19(1):112.

Marshall, L., R. Busch, F. Cholick, I. Edwards, and R. Frohberg. 1989. Agronomic performance of spring wheat near-isolines differing for daylength response. Crop Sci 29:752.

Miller, J.B. and D.D. Malo. Quality of the surface water and groundwater around prairie potholes in Deuel County, South Dakota. USFWLS Biological Report (in press).

Rasiah, V., G.C. Carlson, and R.A. Kohl. 1990. Variabilities in the estimates of hydraulic parameters in Richards flow equation. Soil Technology 3:145.

Rickerl, D.H., E.A. Curl, and J.T. Touchton. 1989. Tillage and rotation effects on Collembola populations, Rhizoctonia infestation and soil moisture. Soil and Tillage Res 15:41.

_____, W.B. Gordon, and J.T. Touchton. 1989. Influence of ammonia fertilization on cotton production in conservation tillage systems. Commun in Soil Sci and Plant Anal 20:2105.

_____ and J.D. Smolik. 1990. Farming systems influence on soil properties and yield. J of Soil and Water Cons 45:121.

Twidwell, E.K., N.J. Thiex, and D.T. Islam. 1989. On-site forage testing to aid drought-stricken producers. J Agron Educ 18:89.

_____, K.D. Johnson, C.E. Bracker, J.A. Patterson, and J.W. Cherney. 1989. Plant tissue degradation measurement using image analysis. Agron J 81:837.

White, E.M. 1989. Factors causing hollow-crown or ring grass patterns. Rangelands 11:154.

_____ and L.A. Hannus. 1989. Identification of phosphorus enriched soils, Mitchell Prehistoric Indian Village, South Dakota. Proc, SD Acad Sci 68:67.

_____ and F.R. Gartner. 1989. Some osmotic and pH effects on blue grama seedling establishment. Proc, SD Acad Sci 68:75.

_____. 1990. Estimates of natural soil drainage volumes in South Dakota. Soil Sci 149:235.

Van de Crommert, J., D.L. Reeves, P. Evenson, and Q. Schultz. 1989. Fluorescence of oat seed and its value as a cultivar purity indicator. J Seed Tech 13:1.

Wicks, Z.W., J.D. Smolik, and M.L. Carson. 1990. Registration of SD101, parental line of maize resistant to Pratylenchus hexincisus and P scribneri. Crop Sci 30:242.

_____, _____, and _____. 1990. Registration of SD102 and SD103, parental line of maize resistant to Pratylenchus hexincisus. Crop Sci 30:242.

Other publications

Autrique, J.E., F.A. Cholick, and K.M. Sellers. 1989. Evaluation of single, three-way and backcross crosses to introduce non-adapted germplasm into adapted spring wheat. Agron Abstr:73.

Boe, A. and B. McDaniel. 1989. Emergence patterns of chalcids associated with alfalfa seed. Proc, 21st Cent Alfalf Improve Conf:9.

_____. 1989. Species selection for southeastern South Dakota pastures. Proc, SD Forage and Grassland Council:10.

Bonnemann, J.J. 1989. 1989 South Dakota corn performance trials. SDAES Pl Sci Pamphh 20.

_____. 1989. 1989 South Dakota grain sorghum performance trials. SDAES Pl Sci Pamphh 21.

Bortnem, R., A. Boe, and F. Einhellig. 1989. Effect of previous legume crop on alfalfa production. Proc, 21st Cent Alfalf Improve Conf:11.

_____ and _____. 1990. Stand establishment and production of alfalfa cultivars in legume residues. Proc, 1990 Forage and Grassland Conf:314.

Brinkman, M.J., D.L. Reeves, and L.A. Hall. 1989. Oat seedling response to corn residue extracts. Agron Abstr:128.

Brix, K., D.L. Reeves, and G.D. Lemme. 1989. Mycorrhizal fungi in low phosphorus soils. Agron Abstr:211.

Buchenau, G.W. and D.J. Gallenberg. 1990. Wheat diseases. Ann Wheat Newsl 36:208.

_____ and J.D. Smolik. 1990. Soil microorganisms and disease suppression in farming systems studies. Pl Sci Pamphh 22:75.

_____ and S.A. Rizvi. 1990. Control of foliage diseases of wheat with fungicides at the Northeast Farm in 1989. Pl Sci Pamphh 22:42.

Cholick, F.A. and J.E. Autrique. 1989. Comparison of mean yield of early and late genotypes in spring wheat. Agron Abstr:76.

Clay, S.A. and W.C. Koskinen. 1990. Adsorption and desorption of atrazine, hydroxyatrazine, and s-glutathione atrazine on two soils. WSSA Abst 224.

_____ and _____. 1990. Alachlor movement through intact soil columns taken from two tillage systems. Agron Abstr:33.

Curran, B.S., K.D. Kephart, and E.K. Twidwell. 1990. Chemical control of companion crops in alfalfa establishment. Proc, Forage and Grassland Conf:319.

Dybing, C.D. and M.E. Westgate. 1989. Genotype, environment, and cytokinin effects on soybean flower abortion. Proc, Plant Growth Regulator Soc of Amer 16:29.

_____ and K. Grady. 1990. 1988 and 1989 studies on maximum daily flower production rate. Proc, Flax Instit of the US 53:126.

Espinasse, A., C. Lay, J.C. Volin, and C.D. Dybing. 1989. Development of in vitro techniques for sunflower improvement. Agron Abstr:175.

_____ and K. Grady. 1990. In ovulo rescue and interspecific hybridization between sunflower and other Helianthus species. Proc, Sunflower Research Forum, Nat Sunflower Assoc:29.

_____, C.R. Roseland, and T.J. Grosz. 1990. High coumarin somaclonal variants of sunflower: production and resistance to insects. Proc, Great Plains Sunflower Insect Workshop.

Foueillassar, J., A. Espinasse, and K. Grady. 1990. Ovule culture in Helianthus. Special research rpt, Pl Sci Dept.

Gallenberg, P. and A. Espinasse. 1990. In vitro production of somaclonal variants resistant to Alternaria helianthi. Proc, Sunflower Research Forum, Nat Sunflower Assoc:28.

Geise, H.A. et al. 1989. Annual Progress Report, West River Ag Res and Ext Center. Pl Sci Pamphh 19:1.

Gellner, J.L. and A. Espinasse. 1989. Callus formation from various explants of barley. Agron Abstr:176.

_____, F.A. Cholick, and J.J. Bonnemann. 1990. Use of multiple years and locations in predicting cultivar yield rankings. Genotype-by-environment interaction and plant breeding symposium.

Gordon, W.B. and D.H. Rickerl. 1989. Effects of tillage and N rate on soil nitrate-N levels and corn grain yield. 1989 ann rpt, Southeast SD Exp Farm:32.

_____ and _____. 1989. Effect of tillage and N rate on soil nitrate levels and corn grain yield. 1989 Soil Fertility Progress Reports:1.

_____ and _____. 1990. Nitrogen uptake and leaching in corn production as influenced by tillage methods. Agron Abstr:269.

Hall, L.A. and D.L. Reeves. 1989. Effects of herbicides on oats. Agron Abstr:133.

_____. 1990. Effects of herbicides on oats. SDSU MS thesis.

Hall, R.G., et al. 1989. 1990 Variety recommendations (1989 crop performance results), small grains. SDCES EC 774 (rev).

_____. 1989. 1990 Variety recommendations (1989 crop performance results), soybeans. SDCES EC 775 (rev).

Kafawin, O.M. 1989. Effects of various stresses on single seed descent in oats, Avena sativa L. SDSU PhD dissertation.

_____, J.L. Gellner, D.L. Reeves, and R.W. Kieckhefer. 1989. Use of seedling growth in determining level of resistance to BYD in spring oat. Agron Abstr:89.

Kephart, K.D., A.A. Boe, and B.S. Curran. 1989. Architecture effects on morphology and yield of alfalfa. Agron Abstr:170.

_____. 1990. Summaries of forage research. SDAES C 249.

_____, E.K. Twidwell, and R.R. Bortnem. 1990. Alfalfa seeding rate effects on forage yield components. Proc, Forage and Grassland Conf:234.

_____ and _____. 1989. How does seeding rate affect alfalfa growth? Proc, SD Forage and Grassland Council:34.

Kieckhefer, R.W., J.L. Gellner, W.E. Riedell, and C.D. Dybing. 1989. Physiologic response of spring wheat seedlings to cereal aphid feeding. Agron Abstr:115.

Kohl, R.A., P.A. Molumeli, and S.T. Chu. 1989. Infiltration rate sensitivity to surface soil water content. ASAE 89-405.

Lewis, K.K., J.D. Smolik, and D.H. Rickerl. 1990. Dagger nematode and oligochaete population on conventional and organic farming systems. NC ASA Abstr.

_____, _____, and _____. 1990. Weed populations in small grain farming systems. ASA Agron Abstr:150.

Malo, D.D. 1989. Introductory soils lecture notes. Pl Sci Dept.

_____ and G.D. Lemme. 1989. Introductory soils laboratory manual. Pl Sci Dept.

_____ et al. 1989. Report of the task force on mission and goals for the South Dakota North Central Association of College and Schools. Accreditation self study. SDSU.

_____, M.G. Holland, and D.M. Beyers. 1990. Soil productivity ratings and estimated yields for Lake County. Pl Sci Pamph 26.

_____, _____, and _____. 1990. Soil productivity ratings and estimates for Lincoln County. Pl Sci Pamph 27.

_____, _____, and _____. 1990. Soil productivity ratings and estimates for Turner County. Pl Sci Pamph 28.

_____, _____, and _____. 1990. Soil productivity ratings and estimates for Yankton County. Pl Sci Pamph 29.

_____, _____, and _____. 1990. Soil productivity ratings and estimates for Union County. Pl Sci Pamph 30.

_____, _____, and R.J. Malo. 1990. Soil productivity ratings and estimated yields for McCook County. Pl Sci Pamph 31.

_____, _____, and _____. 1990. Soil productivity ratings and estimated yields for Minnehaha County. Pl Sci Pamph 32.

_____, _____, and _____. 1990. Soil productivity ratings and estimated yields for Bon Homme County. Pl Sci Pamph 33.

_____, _____, and _____. 1990. Soil productivity ratings and estimated yields for Clay County. Pl Sci Pamph 34.

_____, _____, and _____. 1990. Soil productivity ratings and estimated yields for Hutchinson County. Pl Sci Pamph 35.

Miller, J.B. 1990. Water quality and soil genesis around native prairie potholes in Deuel County, SD. SDSU MS thesis.

Pollmann, R.J. 1989. South Dakota preliminary certified seed grower directory. South Dakota Crop Improvement Association.

Rasiah, V. and R.A. Kohl. 1989. Soybean root water uptake in two soils. Agricultural Water Mgmt 15:387.

Reeves, D.L., O.M. Kafawin, J.L. Gellner, and L.A. Hall. 1989. Effects of various stresses on single seed descent in oats Avena sativa. Agron Abstr:96.

Rickerl, D.H. and J.D. Smolik. 1989. Effects of farming systems on mycorrhizae. SD Acad of Sci 68:41.
_____ and D.R. Sorensen. 1989. Tillage and rotation for corn and soybeans. Ann rpt, Southeast SD Exp Farm:26.
_____. 1990. Agroecology - a natural progression in dimension. Agron Abstr:62.
_____. 1990. Landscape position and surface compaction effects on soil nitrate movement. Ann rpt, Eastern SD Soil and Water Res Farm:18.
_____. 1990. Rotation and tillage effects on mycorrhizae. Ann rpt, Eastern SD Soil and Water Res Farm:20.
_____. 1990. Rotation and tillage effects on nitrate movement through the soil. Ann rpt, Eastern SD Soil and Water Res Farm:82.
_____. 1990. Weed management in alternative systems research. Proc, Extending Sustainable Syst Conf Proc:1.
_____ and D. Beck. 1990. No-till rotations. Ann Wheat Newsletter 36:209.
_____, _____, and P.K. Wieland. 1990. Nitrate leaching in controlled traffic, no-till rotations. Agron Abstr:278.
_____, T. Dobbs, J.D. Smolik, and D.C. Taylor. 1990. Sustainable agriculture in South Dakota. Proc, Nat Sustainable Ag and Nat Res Conf:121.
_____, J. Gerwing, B. Farber, J.D. Smolik, P.K. Wieland, and K.K. Lewis. 1989. Farming systems studies. 1989 Soil Fert Prog Rpt:1.
_____ and J.D. Smolik. 1990. Farming systems. Annual Wheat Newsletter 36:210.
_____ and _____. 1990. Friendly fungi. SDAES F&HR 41:14.
_____ and _____. 1990. LISA: Soils and yields. SDAES F&HR 41:7.
_____ and _____. 1990. Tillage and crop residue effects on soil frost depth. Proc, Frozen Soil Symp:31.
_____, _____, and K.K. Lewis. 1990. Weed populations in three farming systems. NC ASA Abstr.
_____, W.B. Gordon, and R. Gelderman. 1990. Site and management effects on nitrate leaching. WRI Proj Synopsis.
Smolik, J.D., ed. 1990. Ann prog rpt, Northeast Research Station. Pl Sci Pamph 22.
_____, et al. 1990. Farming systems studies, 1989. Pl Sci Pamph 22:43.
_____ and L. Evjen. 1990. Legume-small grain studies. Pl Sci Pamph 22:18.
_____ and D. Rickerl. 1990. Farming systems studies, 1989. Pl Sci Pamph 22:56.
_____, _____, L. Evjen, K. Lewis, and L. Wrage. 1990. Mechanical weed control in corn. Pl Sci Pamph 22:39.
_____, _____, _____, _____, and _____. 1990. Mechanical weed control in corn. Proc, Extending Sustainable Systems Conf:7.
_____ et al. 1990. Farming systems research summary. Proc, Extending Sustainable Systems Conf:103.
Stymiest, C.E. et al. Winter wheat yields and comments: 1989. SDCES EMC 883 (rev).
Tadesse, N., C. Lay, and C.D. Dybing. 1989. Comparative performances of high-by-high and high-by-low flax crosses. Agron Abstr:102.
_____. 1990. Genetic variation of plant water relation traits in oats (Avena sativa L.). SDSU PhD dissertation.
Thompson, J.U., E.K. Twidwell, and R.D. Neiger. 1990. Feeding kochia to South Dakota livestock. SDCES Extension Extra 11002.
Twidwell, E.K. and K.D. Kephart. 1989. Forage potential of cicer milkvetch. SDCES Extension Extra 8057.
_____, _____, and R.R. Bortnem. 1990. Cultivar tests in South Dakota: Alfalfa yields. SDAES C 248.
_____, N.J. Thiex, and R.G. Hall. 1990. Forage value of spring oats and triticale. SDCES Extension Extra 8059.
Wieland, P.K., D.H. Rickerl, and J.D. Smolik. 1990. Weed populations in row crop farming systems. Agron Abstr:162.

Rural Sociology

Other publications

Satterlee, J.L. and D.E. Arwood. 1989. South Dakota counties: agricultural patterns. SDAES CDC N/L 4(6).
_____ and _____. 1989. Farm facts: ouwnership and the family farm in South Dakota. SDAES CDC N/L 4(7).
_____ and _____. 1989. County population estimates: 1988. SDAES CDC N/L 4(8).
_____ and _____. 1990. Poverty in the United States and South Dakota. SDAES CDC N/L 5(1).
_____, _____, and J. VanDenBerg. 1990. 1990 census is coming! SDAES CDC N/L 5(2).
_____, _____, and _____. 1990. Adolescent life chances. SDAES CDC N/L 5(3).

Station Biochemistry

Refereed journal articles

Chu, C. and T.P. West. 1990. Pyrimidine ribonucleoside catabolism in Pseudomonas fluorescens. Antonie van Leeuwenhoek 57:253.
_____ and _____. 1990. Pyrimidine biosynthesis in Pseudomonas fluorescens. J Gen Microbiol 136:875.
Emerick, R.J. and H. Kayongo-Male. 1990. Interactive effects of dietary silicon, copper and zinc in the rat. J Nutritional Biochem 1:35.

Evenson, D.P. and Z. Darzynkiewicz. 1990. Acridine orange induced precipitation of mouse testicular sperm cell DNA reveals new patterns of chromatin structure. Exp Cell Res 187:328.

_____, R.K. Baer, and L.K. Jost. 1989. Flow cytometric analysis of rodent epididymal spermatozoal chromatin condensation and loss of free sulfhydryl groups. Molecular Reprod and Devel 1:283.

_____, _____, and _____. 1989. Long term effects of triethylenemelamine exposure on mouse testis cells and sperm chromatin structure assayed by flow cytometry. J Environ and Molecular Mutagenesis 14:79.

_____, F.C. Janca, L.K. Jost, R.K. Baer, and D.S. Karabinus. 1989. Flow cytometric analysis of effects of l,3-Dinitrobenzene on rat spermatogenesis. J Toxicol and Environ Health 28:81.

_____, _____, R.K. Baer, L.K. Jost, and D.S. Karabinus. 1989. Effect of l,3-Dinitrobenzene on prepubertal, pubertal and adult mouse spermatogenesis. J Toxicol and Environ Health 28:67.

_____. 1989. Flow cytometric analysis of toxic chemical induced alterations in testicular cell kinetics and sperm chromatin structure. IN (G. Jolles and A. Cordier, eds) New trends in genetic risk assessment, New York: Academic Press:343.

_____ 1989. Flow cytometry evaluation of male germ cells. IN (A. Yen, ed) Flow cytometry: Advanced research and clinical applications, vol I, Boca Raton, Fla: CRC Press:217.

Ghazi, M. and D.P. Matthees. 1989. Use of ion-pairing reversed-phase liquid chromatography in the separation of solanidine and solasodine. J Chem Ecol 15(12):2661.

_____ and _____. 1990. Opposing effects of strychnine and brucine on the germination and growth of lettuce seeds. J Plant Growth Regul 9(2):95.

Gledhill, B.L., D.P. Evenson, and D. Pinkel. 1990. Flow cytometry and sorting of sperm and male germ cells. IN (M.R. Melamed, M. Mendelsohn, and T. Lindmo, eds) Flow cytometry and sorting, New York: Alan R. Liss:531.

Stewart, S.R., R.J. Emerick, and R.H. Pritchard. 1990. High dietary calcium to phosphorus ratio and alkali-forming potential as factors promoting silica urolithiasis in sheep. J Animal Sci 68:498.

West, T.P. 1989. Study of Pseudomonas testosteroni growth on pyrimidines and pyrimidine analogues. Microbios Letters 41:125.

_____. 1990. Utilization of pyrimidine bases and nucleosides by the stutzeri group of Pseudomonas. Microbios 61:71.

Wilson, T.M., P.G. Cramer, R.L. Owen, C.R. Knepp, I.S. Palmer, A. deLahunta, J.L. Rosenberger, and R.H. Hammerstedt. 1989. Porcine focal symmetrical poliomyelomalacia: Test for an interaction between dietary selenium and niacin. Can J Vet Res 53:454.

Other publications

Emerick, R.J. and H. Kayongo-Male. 1990. Silicon facilitates copper utilization in the rat. 4(3):A510 (abstr).

Evenson, D.P. 1990. DNA denaturation patterns in mammalian sperm related to environmental toxin exposure and fertility. Presentation, Int Conf on Perspectives in Primate Reproductive Biology, Indian Institute of Science.

_____ 1990. Longitudinal studies of sperm chromatin structure. Presentation, XIV int mtg, Soc of Analytical Cytology.

_____, L. Jost, R. Baer, T. Turner, and S. Schrader. 1990. Longitudinal study of sperm chromatin structure of 45 men. Am Soc of Andrology.

_____. 1990. Flow cytometry analysis of boar sperm chromatin structure as related to cryopreservation and fertility. Presentation, int conf on deep freezing of boar semen.

_____. 1989. Relative denaturability of sperm DNA. Presentation, EPA/NIOSH workshop on methods for semen studies in humans.

Karabinus, D., D. Evenson, L. Jost, R. Baer, and M. Kaproth. 1990. Semen quality of bulls at two ages: light microscope and flow cytometric studies. XIV int mtg, Soc of Analytical Cytology.

Kim, S. 1989. Reductive catabolism of pyrimidine bases by Pseudomonas aeruginosa. SDSU MS thesis.

_____ and T.P. West. 1989. Pyrimidine catabolism in Pseudomonas aeruginosa. Pseudomonas'89 Abstracts.

_____ and _____. 1989. Reductive catabolism of pyrimidine bases by Pseudomonas aeruginosa. Abst North Central Branch, ann mtg, Amer Soc Microbiol.

Matthees, D.P. 1990. Agricultural and related chemical contamination in foods: a historical perspective. Ch 1 IN (J.O. Nriagu and M.S. Simmons, eds) Food contamination from environmental sources, vol 23 in Advances in environmental science and technology. New York: John Wiley and Sons.

Stewart, S.R., R.J. Emerick, and R.H. Pritchard. 1989. Factors promoting formation of siliceous uroliths in sheep. J. Animal Sci 67(suppl 1):480 (abstr).

Weaver, E.M., G.W. Libal, C.R. Hamilton, and I.S. Palmer. 1989. Effects of dietary or injected vitamin E on liver and plasma a-tocopherol concentrations in the weaned pig. SDAES SWINE 89-11:39.

_____, _____, _____, and _____. 1989. Effects of an oil soluble vitamin E injectable on plasma and tissue a-tocopherol. SDAES SWINE 88-12:42.

_____, _____, _____, _____, B.S. Borg, and M.K. Hoppe. 1989. Effects of vitamin A, vitamin E and fat supplementation on the vitamin E status of the weaned pig. SDAES SWINE 89-9:32.

_____, _____, _____, _____, R.C. Thaler, and M.K. Hoppe. 1989. Effect of supplementation of newly weaned pig diets with different sources of vitamin E on Plasma a-tocopherol. SDAES SWINE 89-10:35.

West, T.P. 1989. Isolation of germination deficient mutants from strain Y55 of Saccharomyces cerevisiae. Cold Spring Harbor Laboratory Yeast Cell Biology Meeting Abstracts.

_____. 1989. Dihydropyrimidine dehydrogenase mutant of Pseudomonas chlororaphis. Abst North Central Branch, ann mtg, Amer Soc Microbiol.

_____ 1990. Characterization of germination deficient mutants from Saccharomyces cerevisiae. Abst, ann mtg, Amer Soc Microbiol.

_____ 1990. Corn utilization in the production of pullulan. Proc, Corn Utilization Conference III.

Xu, G. and T.P. West. 1989. Effect of carbon source upon Saccharomyces cerevisiae strain AP-3 ascospore germination. Abst North Central Branch, ann mtg, Amer Soc Microbiol.

_____ and _____. 1990. Nutritional requirements for Saccharomyces cerevisiae strain AP-3 germination. Abst, ann mtg, Amer Soc Microbiol.

Veterinary Science

Refereed journal articles

Benfield, D.A. 1990. Enteric adenoviruses of animals. IN (L.S. Saif and K.W. Theil, eds) Viral diarrheas of man and animals. Boca Raton, Fla: CRC Press.

_____ and L.J. Saif. 1990. Cell culture propagation of a coronavirus isolated from cows with winter dysentery. J Clin Microbiol 28:1454.

Collins, J.E., M.E. Bergeland, D. Bouley, A.L. Ducommun, D.H. Francis, and P. Yeske. 1989. Diarrhea associated with Clostridium perfringens type A enterotoxin in neonatal pigs. J Vet Diagn Invest 1:351.

Janke, B.H. 1989. Protecting calves from viral diarrhea. Vet Med 84:803.

_____. 1989. Selenium toxicosis in a dog. J Am Vet Med Assoc 195:1150.

_____, D.H. Francis, J.E. Collins, M.C. Libal, D.H. Zeman, D.D. Johnson, and R.D. Neiger. 1990. Attaching and effacing Escherichia coli infection as a cause of diarrhea in young calves. J Am Vet Med Assoc 196:897.

Roberts, E.D., D.H. Zeman, T. Miwa, and H. Shoje. 1989. Morphometric evaluation of rhesus articular cartilage: correlation of hexosamine and 35SO4=incorporation. Vet Pathol 26:309.

Zeman, D.H., J.U. Thomson, and D.H. Francis. 1989. Diagnosis, treatment, and management of enteric colibacillosis. Vet Med 84:794.

_____, E.D. Roberts, W.G. Henk, and E. Watson. 1989. Macroscopic, microscopic, and ultrastructural findings in experimental haemarthrosis of rhesus monkeys. J Comp Pathol 101:119.

Other publications

Bae, I., D.J. Jackwood, D.A. Benfield, L.J. Saif, and R.D. Wesley. 1989. Nucleotide sequence comparisons of virulent and attenuated strains of transmissible gastroenteritis virus. Abstr, 8th ann mtg, Amer Soc Virol.

Benfield, D.A., D.J. Jackwood, I. Bae, L.J. Saif, and R.D. Wesley. 1989. Detection of transmissible gastroenteritis virus by dot-blot hybridization using cDNA probes. Abstr, 8th ann mtg, Amer Soc Virol.

_____, _____, _____, _____, and _____. 1989. Detection of transmissible gastroenteritis virus using cDNA probes. Abstr, 70th Conf Res Workers Ani Dis.

_____ and L.J. Saif. 1989. Propagation of a coronavirus from cows with winter dysentery in a human rectal tumor cell line. Abstr, 70th Conf Res Workers Ani Dis.

Dykstra, S.A., E.A. Nelson, B.H. Janke, and D.H. Francis. 1989. Effect of shiga-like toxin I of Escherichia coli on gnotobiotic pigs. Abstr, 70th Conf Res Workers Ani Dis.

Francis, D.H. 1989. Relationship between malnutrition and enteric disease in formula-fed calves. Abstr, 70th Conf Res Workers Ani Dis.

Jackwood, D.J., I. Bae, D.A. Benfield, and L.J. Saif. 1989. Differentiation of transmissible gastroenteritis virus from antigenically related coronaviruses using DNA probes. Abstr, 70th Conf Res Workers Ani Dis.

Janke, B.H., J.K. Nelson, D.A. Benfield, I.J. Stotz, D.J. Robison, J.R. Duimstra, and E.A. Nelson. 1989. Epidemiological studies on rotavirus infection in swine. Abstr, 32nd ann mtg, AAVLD.

_____, _____, E.A. Nelson, and D.A. Benfield. 1990. Prevalence of atypical strains among rotaviruses recovered from diarrheic calves in the north central United States. Abstr, NCCVLD.

Moxley, R.A., D.H. Francis, and J.A. Willgohs. 1989. Chronic typholocolitis caused by bovine origin SLT-I-producing 0111:NM Escherichia coli in gnotobiotic piglets. Abstr, 70th Conf Res Workers Ani Dis.

Mullaney, C.D., D.H. Francis, and J.A. Willgohs. 1989. Comparison of seroagglutination, ELISA, and indirect fluorescent antibody staining for the detection of K99, K88, and 987P pilus antigens of Escherichia coli. Abstr, NCCVLD.

Overbaugh, S.A., S. McFarland, and D.H. Francis. 1989. Preliminary characterization of a porcine intestinal receptor to K88 pili of Escherichia coli. Abstr, 70th Conf Res Workers Ani Dis.

Willgohs, J.A., D. Francis, R. Moxley, and D. Hurley. 1989. Immunosuppression in gnotobiotic piglets caused by an SLT-I producing 0111:NM Escherichia coli of bovine origin. Abstr, 70th Conf Res Workers Ani Dis.

_____, _____, and D. Hurley. 1990. Immunocompromise of gnotobiotic piglets infected with a shiga-like toxin type-I producing 0111:NM strain of Escherichia coli. Abstr, 90th ann mtg, Am Soc Microbiol.

Wildlife and Fisheries Sciences

Refereed journal articles

Auforth, A.D., H. Goetz, and K.F. Higgins. 1990. Duck nesting on islands at J. Clark Salyer Refuge in North Dakota, 1983-84. Prairie Nat 22:1.

Babey, G.J. and C.R. Berry, Jr. 1989. Post-stocking performance of three strains of rainbow trout in a reservoir. N Amer J Fish Manage 9:309.

Bauer, D.L. and D.W. Willis. Effects of triploid grass carp on aquatic vegetation in two prairie lakes. Lake Reser Manage (in press).

Clark, S.W. and D.W. Willis. 1989. Size structure and catch rates of northern pike captured in trap nets with two different mesh sizes. Prairie Nat 21:157.

Dieter, C.D. and T.R. McCabe. 1989. Factors influencing beaver lodge-site selection on a prairie river. Amer Midl Nat 122:408.

Gordon, C.C., L.D. Flake, and K.F. Higgins. Aquatic invertebrates in the Rainwater Basin area of Nebraska. Prairie Nat 22 (in press).

Guy, C.S. and D.W. Willis. Evaluation of largemouth bass-yellow perch communities in small South Dakota impoundments. N Amer J Fish Manage (in press).

_____, E.A. Bettross, and D.W. Willis. 1990. Proposed standard weight (Ws) equation for sauger. Prairie Nat 22:41.

_____ and D.W. Willis. Structural relationships of largemouth bass and bluegills in South Dakota ponds. N Amer J Fish Manage (in press).

Halseth, R.A. and D.W. Willis. 1989. Unusually high condition and growth of black crappies in the Sand Lake National Wildlife Refuge, South Dakota. Prairie Nat 21:105.

Happe, P.J., K.J. Jenkins, E.E. Starkey, and S.H. Sharrow. Nutritional quality and tannin astringency of browse in clear-cuttings and old-growth forests. J Wildl Manage (in press).

Higgins, K.F., K.J. Jenkins, G. Clambey, and F. Harlow. Vegetation sampling. IN (T. Bookhout, ed) Wildlife Management Techniques Manual, 5th ed, The Wildl Soc (in press).

Hoffman, G.C., C.L. Milewski, and D.W. Willis. 1990. Population characteristics of rock bass in three northeastern South Dakota lakes. Prairie Nat 22:33.

Hop, K.D., K.F. Higgins, and D.E. Nomsen. 1989. Vertebrate wildlife use of highway borrow pit wetlands in South Dakota. Proc, SD Acad Sci 68:47.

Howe, F.P. and L.D. Flake. 1989. Mourning dove use of man-made ponds in a cold desert ecosystem in Idaho. Great Basin Nat 49:627.

_____ and _____. 1989. Nesting ecology of mourning doves in a cold desert ecosystem. Wilson Bull 101:467.

Hubbard, D.E. and A. Boe. 1988. IVDDM and chemical constituents in selected species of wetland plants. Proc, SD Acad Sci 67:44.

Jenkins, K.J. and E.E. Starkey. Foods of Roosevelt elk. Rangelands (in press).

_____, P.J. Happe, and R.G. Wright. 1990. Evaluating above-snow browse availability using non-linear regression. Wildl Soc Bull 17:49.

Lindgren, J.P. and D.W. Willis. Evaluation of a 380-mm minimum length limit for largemouth bass in Lake Alvin, South Dakota. SD Acad Sci (in press).

_____ and _____. 1990. Vulnerability of largemouth bass to angling in two small South Dakota impoundments. Prairie Nat 22:107.

Milewski, C.L. and D.W. Willis. 1989. Reproduction, recruitment, and survival of brown and rainbow trout in a prairie coteau stream. Prairie Nat 21:147.

Murphy, B.R., D.W. Willis, and T.A. Springer. The relative weight index in fisheries management: status and needs. Fisheries (in press).

Saffel, P.D., C.S. Guy, and D.W. Willis. 1990. Population structure of largemouth bass and black bullheads in South Dakota ponds. Prairie Nat 22:113.

Smith, B., H. Browers, T. Dahl, D. Nomsen, and K.F. Higgins. 1989. Indirect wetland drainage in association with federal highway projects in the prairie pothole region. Wetlands 9:27.

_____, K.F. Higgins, and C. Gritzner. 1989. Land use relationships to avian cholera outbreaks in the Nebraska Basin Area. Prairie Nat 21:125.

Wickstrom, G. and R.L. Applegate. 1989. Growth and food selection of intensively cultured largemouth bass fry. Prog Fish-Cult 51:79.

Willis, D.W. 1989. Proposed standard length-weight equation for northern pike. N Amer J Fish Manage 9:203.

_____, C.S. Guy, and B.R. Murphy. Development and evaluation of a proposed standard weight (Ws) equation for yellow perch. N Amer J Fish Manage (in press).

_____ and C.G. Scalet. 1989. Relations between proportional stock density and growth and condition of northern pike populations. N Amer J Fish Manage 9:488.

Other publications

Berry, C.R. 1989. Duck farmer blew the whistle on wetlands. SD Magazine July/Aug:42.

_____. 1989. Ready for the NPBL: field research is critical but goes just so far. SDAES F&HR 40(2):21.

_____. 1989. Wildlife tour of Brookings County. Dept Wildl Fish Sci.

_____. 1990. Water and wildlife of the upper James River. ABS Horizons:68.

_____ and K.D. Keenlyne. 1989. Fisheries management controversies on the Missouri River. 119th ann mtg, Amer Fish Soc (abstr).

_____ and L. Berg. 1990. Evaluation of an evaporation reservoir for rearing fingerling walleyes. Ann mtg, SD Acad Sci (abstr).

_____, D.W. Willis, C.D. Dieter, B.R. Koltermann, and S.W. Clark. 1990. Carp in James River waterfowl refuges and effects on submerged macrophytes. Final rpt, US Bur Rec, SD Coop Fish Wildl Res Unit.

Bettross, E.A. 1989. Evaluation of the Big Stone Power Plant cooling reservoir as a source of largemouth bass and bluegill broodstock. SDSU MS thesis.

Browers, H.W., R.R. Blank-Libra, and D.E. Hubbard. 1989. Potential sites for wetland enhancement for the Mid-Dakota water development project. Comp rpt, Mid-Dakota Water Dev Sys.

Clark, S.W. 1990. Population/biomass estimates and relative abundance indices of adult common carp in Arrowwood and Sand Lake National Wildlife Refuges. SDSU MS thesis.

_____ and D.W. Willis. 1990. Size structure and catch rates of northern pike captured in trap nets with two different mesh sizes. 51st Mid Fish Wildl Conf (abstr).

Day, K.S. and D.E. Hubbard. 1990. Creating pheasant habitat. SDCES FS 856.

Deisch, M.S., D.W. Uresk, and R.L. Linder. 1989. Effects of two prairie dog rodenticides on ground-dwelling invertebrates in western South Dakota. Proc, 9th Great Plains Wildl Dam Cont Workshop.

Dieter, C.D. 1989. Is it time to close the duck season? Waterfowl USA, Sept./Oct.

_____. 1990. Causes and effects of water turbidity: A selected annotated bibliography. Tech Bull 5, SD Coop Fish Wildl Res Unit.

_____. 1990. Conservation notes: Northern Great Plains. Waterfowl USA, Jan-Feb:36.

_____. 1990. Factors affecting duck populations in North America. Ann mtg, SD Chap TWS (abstr).

_____. 1990. Sportfishing on national wildlife refuges in the Northern Great Plains. Ann mtg, Dakota Chap Amer Fish Soc (abstr).

Dirks, B.J. 1990. Distribution and productivity of least terns and piping plovers along the Missouri and Cheyenne rivers in South Dakota. SDSU MS thesis.

_____ and K.F. Higgins. 1989. Distribution and productivity of least terns and piping plovers on the Missouri River, South Dakota. 51st Mid Fish Wildl Conf (abstr).

Duffy, W.G. and D. Clark (eds). 1989. Marsh management in coastal Louisiana: effects and issues. Biol Rpt 89 (22), US Fish Wildl Ser.

Easterly, T.G. 1989. Effects of ivermectin on lungworm infection and lamb survival of bighorn sheep in Custer State Park, South Dakota. SDSU MS thesis.

Edwards, C., P. Hudson, and W.G. Duffy. 1989. Hydrological, morphological, and biological characteristics of the connecting rivers of the international Great Lakes: a review. IN (D.P. Dodge, ed) Proc, Int Large River Symp:240.

Ewing, R.R. 1989. Production and flow cytometric identification of triploid walleyes. SDSU MS thesis.

Guy, C.S. 1990. Population dynamics of largemouth bass and panfish in South Dakota ponds. SDSU MS thesis.

_____ and D.W. Willis. 1989. Population dynamics of largemouth bass and bluegills in South Dakota ponds. 51st Mid Fish Wildl Conf (abstr).

_____ and _____. 1990. Evaluation of largemouth bass-yellow perch communities in small South Dakota impoundments. 120th ann mtg, Amer Fish Soc (abstr).

Halseth, R.A., D.W. Willis, and B.R. Murphy. 1990. Proposed standard weight (Ws) equation for inland chinook salmon. SD Dept Game, Fish and Parks, Fish Rept 90-7.
Happe, P.J., K.J. Jenkins, and E.E. Starkey. Nutritional quality of browse grown in old-growth and clearcut forests. IN Proc, 1990 West States Prov Elk Workshop (in press).
_____, _____m _____, and S.H. Sharrow. 1990. Nutritional quality and tannin astringency of browse in clear-cuttings and old-growth forests. Ann mtg, Soc Range Manage (abstr).
Haworth, M. and K.F. Higgins. 1990. Farming and waterfowl in the prairie pothole region. SDCES FS 854.
Higgins, K.F. 1990. Burning: Part II. ABS Horizons:64.
_____. 1990. Land use effects on emergent vegetation in wetlands. ND Wildl Soc Chapter (abstr).
_____. 1990. Nesting success of upland nesting waterfowl and sharp-tailed grouse in specialized grazing systems in southcentral North Dakota. Ann mtg, Soc Range Manage (abstr).
_____. 1990. Predation and habitats: management by results. Symposium: Managing predation to increase production of wetland birds (abstr).
_____, A. Kruse, and J. Piehhl. 1989. Effects of fire in the northern Great Plains. SDCES C 751.
Hubbard, D.E. 1989. Wetland values in the prairie pothole region of Minnesota and the Dakotas. Comp rpt, Contract . 14-16-0009-1549-16, U.S. Fish Wildl Serv, Regions 3 and 6.
Jenkins, K.J. 1990. Influences of adjacent forest management activities on migratory elk of Mount Rainier National Park. Oregon State University Res Rept CPSU/OSU 90-3.
_____. 1990. White-tailed deer on Conservation Reserve in eastern South Dakota. ABS Horizons:66.
_____ and E.E. Starkey. 1990. Winter diets of Roosevelt elk in managed and unmanaged Douglas-fir forests in western Washington. Ann mtg, Soc Range Manage (abstr).
Kjellsen, M., and K.F. Higgins. 1990. Grasslands: benefits of management by fire. SDCES FS 857.
Knupp, P.M. 1990. Relationship of forest characteristics and landscape patterns to wild turkey populations in eastern and central South Dakota. SDSU MS thesis.
Kolterman, B.F. 1989. Effects of common carp and black bullheads on sago pondweed. SDSU MS thesis.
_____ and C.R. Berry. 1990. Common carp in the James River waterfowl refuges and their effects on submerged macrophytes. 120th ann mtg, Amer Fish Soc (abstr).
_____ and C.R. Berry. 1990. Effects of common carp and black bullheads on submerged macrophytes. Ann mtg, Dakota Chap Amer Fish Soc (abstr).
Larson, S.V. 1990. Waterfowl breeding pair and brood usage of oxbows and riverine habitats on the James River. SDSU MS thesis.
Leslie, D.M., Jr., and K.J. Jenkins. 1989. Competition and niche relationships among resource-limited cervid populations. Ann mtg, Amer Soc Mammal (abstr).
Luttschwager, K. and K.F. Higgins. 1989. Density and fate of duck nests in hayed and idle strips and blocks of conservation reserve program (CRP) cover in South Dakota. 51st Mid Fish Wildl Conf (abstr).
Milewski, C.L. and D.W. Willis. 1990. Statewide summary of smallmouth bass sampling data from South Dakota waters. SD Dept Game, Fish and Parks, Fish Rept 90-9.
Ray, J.D. 1990. Waterfowl use and production on artificial nesting structures and hay bales in South Dakota. SDSU MS thesis.
_____. 1990. High-rise honkers. AES F&HR 40(4):6.
_____, K.F. Higgins, and I.J. Ball. 1989. Waterfowl nesting on three structure types in Montana and North and South Dakota, 1986-1989. 51st Mid Fish Wildl Conf (abstr).
_____ and C.D. Kruse. 1989. Edmunds County eared grebe colony. SD Bird Notes 41:43.
Sewell, R. 1989. Floral and faunal colonization of restored wetlands in west-central Minnesota and northeastern South Dakota. SDSU MS thesis.
Smith, B. and K.F. Higgins. 1989. Factors affecting the outbreak of avian cholera in the rainwater basin area of Nebraska. 51st Mid Fish Wildl Conf (abstr).
_____, _____, and F.L. Tucker. 1990. Weather events, waterfowl densities, and mycotoxins: Their effect on the severity of avian cholera outbreaks in the Nebraska Rainwater Basin area. N Amer Wildl Conf (abstr).
Walsh, R. and C.R. Berry. 1990. Association between game fishes and habitat types in the middle James River. Ann mtg, Dakota Chap Amer Fish Soc (abstr).
Willis, D.W., C.S. Guy, and B.R. Murphy. 1989. Development and evaluation of a proposed standard weight (Ws) equation for yellow perch. Fish Rept 89-13, SD Game, Fish and Parks.
_____, M.D. Beem, and R.L. Hanten. 1990. Managing South Dakota ponds for fish and wildlife. SD Game, Fish and Parks.

Budget

Agricultural Experiment Station
For period ending June 30, 1990

State appropriation	$5,146,343*
Federal appropriation	2,252,529
Federal restricted	1,229,503
Other restricted	4,309,280
Total	12,937,655

*includes $68,777 in one-time dollars

New Faces

Seven new faculty members have joined the Agricultural Experiment Station within the past fiscal year; all came with highest credentials.

We introduce four of them here; they have already made themselves known to many of you.

"Beef producers have 2 or 3 more years of favorable prices ahead-unless the economy really goes bad," says **Dr. Dillon Feuz**, SDSU livestock marketing economist.

His assessment comes from economic indicators on a general level and South Dakota conditions on a practical level. Feuz has been here only a year, but he knows his way around the state like an old-timer.

He focused early on preparing advice for producers wondering whether to raise replacement heifers or buy new ones.

"I remember my father and grandfather discussing and cussing this very issue," he says.

They scratched out the options on the barn door with a pencil. Feuz uses a computer to "model" different choices. The producer still has to pick the right option for himself—and live with the consequences.

"The replacements this fall will have an impact on the profitability of the cow herd for at least the next 10 years," he says.

The economist grew up in Wyoming, obtained his Ph.D. from Colorado State in 1990, and came to SDSU when a livestock marketing position "made to order because it deals primarily with range cattle" came open. In addition to research and presentations at various clinics, he teaches undergraduate economics courses.

Dr. Jerome Nietfeld heard about the South Dakota Diagnostic Lab when he was earning his DVM at Kansas State, while in general practice in Iowa, and again while at the University of Georgia for his Ph.D. The name of the South Dakota lab was brought up by a Californian at veterinary meetings in Baltimore.

When he joined the staff of the South Dakota Animal and Diagnostic Lab, he found that reality matched reputation: "one of the better diagnostic labs in the nation, especially remarkable for a university without a vet school."

His major assignment is as forensic pathologist. "It's critical that vets and producers know—accurately and quickly—what is threatening their herds. Most often, they worry about infectious and toxicologic diseases."

Five pathologists and staff in virology and bacteriology run postmortems and test for disease organisms. If they suspect a poison or other toxic agent, they work with Station Biochemistry, Nietfeld says.

Nietfeld practiced as a veterinarian in Iowa for 5 years.

Dr. Howard Woodard is learning that South Dakota ag and biostress are the same thing.

"It is a test of your patience when you have a field trial designed to help South Dakota farmers, and then the trial fails because something ate it up or it dried up because of moisture stress.

"But perhaps we can learn something even from the bad years."

The researcher points out the rewards of working at SDSU. He likes teaching. He likes having co-workers in testing labs and the Extension Service.

"My part of the work is to provide the research base to help improve the efficient use of fertilizers.

"If it doesn't rain in the spring and there's very little moisture in the soil, we're not going to tell the farmer to fertilize for maximum yield. But we need to know just what yield he can expect if it does start raining."

Woodard obtained his Ph.D. in soil fertility from Rutgers University and worked as a post-doctoral associate in soil chemistry at Texas A&M for 4 years. He had barely unpacked at SDSU before he was off to Cameroon to assist in a project in which the Plant Science Department was involved.

Kraft General Foods called them "special situations," and they meant that **Dr. David Henning** couldn't call his time his own. His 24-hour-a-day beeper could call him to any spot in the world.

In 19 years at Kraft, Henning had become worldwide director of quality assurance for the company. He was always called when a death was allegedly linked to his company's product.

When a plant supervisor died and 12 others became ill, Henning and his investigators found the salmonella poisoning came from a local bakery and not a Kraft product. "Until we knew that, shipments from a plant that supplied the entire U.S. were on hold."

When police found a cyanide-laced Kraft product beside a teenager who eventually died, Henning knew, from his knowledge of chemistry and dairy manufacturing, that the cyanide had been added just prior to eating. (The death was subsequently ruled a suicide.) He couldn't tell anybody but the FBI and FDA how he knew. "That would tell people which products they could 'safely' hide cyanide in." The company took the brunt of public opinion.

"It got to be you didn't want anybody to die anywhere."

Henning knew Dr. John Parsons, Dairy Science Department head, from midwest intercollegiate dairy product judging contests which were run in one of Kraft's facilities. "I saw the superior students from SDSU. I think I have a lot of food microbiology experience to pass on to them."

His research is in food safety. "Last year in Minnesota, the salmonella outbreak cost the dairy industry somewhere around $4.7 million. People just stopped eating cheese. I want to do what I can to keep that from happening again."

Dr. Catherine Carter and **Dr. Thomas Chase**, both of the Plant Science Department, and **Dr. David Hurley**, Biology/Microbiology Department, could not be contacted by press time. We regret this, but we assure you that they will also become familiar and respected contributors in the research and agricultural production communities.

research notes capsule updates on Experiment Station research

Read range condition more and calendar dates less

Typically, livestock are moved from introduced to native pasture in late May or early June. Conclusive evidence from an SDSU study shows that, during a drought year, crested wheatgrass pastures can be grazed well beyond early spring when cattle are usually moved off and to native grasses.

Cattle staying on crested wheatgrass gained as well as those on excellent native mixed prairie pastures until July and gained more than cattle on fair condition native mixed prairie through July. No range deterioration occurred, and native pastures were spared potentially damaging use. *Principal investigator: Dr. Patricia Johnson, Department of Animal and Range Sciences, SDSU.*

Selenium gains recognition as a beneficial element

U.S. wheats, particularly the northern durums, have significant levels of selenium. The value of this element in human diets was recognized only recently; selenium has been listed in the Recommended Daily Allowance only since 1989. Researchers suspect selenium may also protect in some way against cancer and lower the incidence of this disease.

SDSU scientists are tracing the distribution of selenium in different durums, from uptake of the mineral by the plants to mill fractions of the grain. Where the element is found and the nature of its association with other nutrients will give clues to its exact physiological role in plants and humans. Selenium uptake in durums appears to be entirely due to environmental factors—location and year—and not to variety. *Principal investigator: Dr. P.G. Krishnan, Department of Nutrition and Food Science, College of Home Economics, SDSU.*

Breeding for resistance may eliminate a critical disease

Some pigs inherit complete resistance to some forms of colibacillosis while others are highly susceptible. SDSU researchers are developing a non-invasive test to identify resistant animals. Since losses from this disease are among the highest in the swine industry, tests which lead to selective breeding for disease resistance will have significant economic impact. *Principal investigator: Dr. David H. Francis, Veterinary Science, SDSU.*

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